

Public Accounts Committee Evidence paper - Informatics Systems in Wales

When I wrote to the Committee on 20 February 2019, I reported that the Welsh Government was considering two important reviews which had been commissioned in support of the commitment under A Healthier Wales to driving forward digital innovation across Wales. I consider there has been good progress over the course of this year and I set out below an update on the key areas.

A Healthier Wales commitment to Digital

I would restate that *A Healthier Wales* acknowledges the significant challenge of driving digital change at pace and scale and sets an expectation for progress and delivery in this area. It identifies priority areas for investment, describes a new 'open platform' approach to digital innovation, and recognises the need to strengthen national leadership and delivery arrangements. This aligns with and responds to the work of the Parliamentary Review of Health and Care, and with reports and recommendations by the Wales Audit Office and the Public Accounts Committee.

A Healthier Wales also includes a commitment to significantly increase investment in digital health and care, linked to stronger leadership and delivery arrangements. You will be aware that the Minister has recently confirmed an additional £50 million of investment in digital priorities. This will be a key part of transforming our health and social care system in Wales.

Digital Architecture and Digital Governance Reviews

Following the Public Accounts Committee's report and recommendations a year ago, the Welsh Government commissioned two major reviews of digital delivery in Wales. These reviews addressed how digital systems are designed to work together ('the Digital Architecture Review'), and our delivery structures and decision making arrangements ('the Digital Governance Review'). The reviews had a whole system scope, covering local and national services, all NHS services, and the Welsh Community Care Information System (WCCIS). The two reviews were undertaken by independent consultants, who engaged very widely with all stakeholders across Wales.

The Welsh government has carefully considered the findings and recommendations from these reviews, which are attached as an annex. The reviews have informed significant changes to delivery arrangements, and the strategic allocation of additional investment in digital services and systems. These were announced by the Minister for Health and Social Services in a Written Statement on 30th September 2019.

The scope of the Digital Architecture and Digital Governance Reviews addressed most but not all of the WAO and PAC recommendations. The recommendations were wide ranging and inter-dependent, requiring a phased approach to changes. For example, the design of technical systems and the configuration of delivery organisations will have a significant influence on the workforce and programme delivery. With these key changes now confirmed, the Welsh government will commission four further strategic reviews, which will address the remaining WAO

and PAC recommendations. Further details on these reviews are set out below. Their findings and recommendations will lead next year to a digital infrastructure plan, a digital workforce plan, a digital commercial strategy, and a digital communications strategy.

WAO and PAC recommendations update

The WAO and PAC recommendations have been carefully considered. To summarise, five have been completed; seven are due to be completed shortly. A further six require further action and needed to await completion of the Governance and Architecture Reviews before considering further. I set out an update on each recommendation below.

WAO Recommendations Update

Recommendation 1 The vision for informatics of incrementally creating an electronic patient record is clear and had a clear rationale when it was first set following the 2003 strategy. However, the informatics market and community have moved on significantly since then. The Welsh Government, working with NWIS and NHS bodies, should review the informatics market to test whether it offers new opportunities to achieve the aims of the Strategy.

Update: The Digital Architecture Review considered the current configuration and capability of digital systems, including the electronic patient record, and its ability to meet the ambitions set out in A Healthier Wales. The Review recommends a target 'open architecture' model based on common standards and prioritised steps to transition systems and services from current to future state. The Digital Architecture Review considered the informatics market and its opportunities, which has informed the decision to develop a commercial strategy.

Recommendation 2 - NHS Wales has set up a task and finish group to seek to clarify the meaning of the 'Once for Wales' approach to developing and rolling out informatics systems. The Welsh Government, working with NWIS and NHS bodies, should: clearly define the balance and respective responsibilities between national systems led by NWIS and locally led systems; ensure that national and local implementation plans are updated to reflect any implications for the funding, development and roll-out of informatics systems of the clarified approach to Once for Wales; and prioritise the development of a set of common standards to ensure that systems procured or developed locally are compatible with other local systems and the national systems.

Update: All of these issues were considered in detail by the Digital Governance Review and the Digital Architecture Review, which have informed key decisions recently announced including the creation of a new Chief Digital Officer for Health and Care, and transitioning NWIS to a new Special Health Authority dedicated to delivering national digital services.

Recommendation 3 - We found that the NHS has not set clear priorities for informatics. The Welsh Government, NWIS and NHS bodies should agree a clear

and achievable set of priorities for national informatics and resist adding new priorities without either deprioritising something else or adding new resources.

Update: A Healthier Wales set out the critical role of digital as an enabler for transformation and good patient care. The Welsh Government, NWIS and NHS has worked closely through 2019 to agree common priorities for additional digital investment, alongside existing national priorities. Prioritisation will be kept under continuous review, and will be further informed by a focussed strategic review which will lead to an Infrastructure Plan next year.

Recommendation 4 - Many of the issues and concerns about barriers to progress that we found during our fieldwork have long been recognised. The Welsh Government, NHS bodies and NWIS should produce an open and honest assessment of what has worked and what has not so far and produce a clear and jointly owned plan for overcoming the known barriers to progress. These documents should be in the public domain so that NHS staff can see that their concerns have been recognised and are being addressed.

Update: The Digital Governance Review and the Digital Architecture Review engaged widely with stakeholders on an open and collaborative basis. The findings and recommendations from the Architecture Review have been widely shared through an engagement programme over the summer. The Welsh Government has set out actions in response to the two reviews in a Written Statement, which has been widely reported. A focussed review will lead to a Communications Strategy next year. Neither report has been formally published but they are attached as an annex to this document and so are in the public domain.

Recommendation 5 We found that there is considerable scope to strengthen national and local leadership on informatics across the NHS. The Welsh Government should: (a) work with NHS bodies to develop options for strengthening representation of informatics at board level, including reviewing the merits of a board level Chief Clinical Information Officer (or equivalent) role; (b) work with NHS bodies to develop a clear action plan for the development of a cadre of senior clinician-informatics staff, in line with the recommendations of the Wachter review in England; and (c) identify opportunities to strengthen the informatics voice at the most senior level in the Department for Health and Social Services, including reviewing whether and if so, how to strengthen the roles of the NHS Wales Chief Information Officer and Chief Clinical Informatics Officer in NHS Wales' strategic decision-making process.

Update: Welsh Government, NWIS, and NHS bodies have maintained their commitment to developing senior informatics leadership. The Welsh Government has recently announced its decision to create a new Chief Digital Officer for Health and Care, and to establish a new NHS Wales organisation to deliver national digital services, which will strengthen the informatics voice at the strategic and national level. A strategic review of the digital workforce will include national and local leadership capability and will address this recommendation.

Recommendation 6 - We found that the governance arrangements for overseeing and challenging NWIS are weak. While the Welsh Government has written to Velindre NHS Trust requiring it to strengthen governance arrangements for NWIS, we consider that the Welsh Government should carry out a wider appraisal of options to strengthen governance and oversight of NWIS. The final arrangements should ensure that: (a) there is independent scrutiny of performance and progress; (b) there is greater transparency, with papers and minutes of discussions placed in the public domain; and (c) there are clear lines of accountability between NWIS and the Chief Executive of NHS Wales and the Cabinet Secretary.

Update: The Welsh Government has maintained and strengthened its oversight of NWIS and has completed its appraisal of options, informed by the Digital Governance review. It has recently confirmed its decision to transition NWIS to a new independent Special Health Authority responsible for the delivery of national digital services. These arrangements will deliver independent scrutiny, greater transparency, and clear lines of accountability.

Recommendation 7. We found that the progress reports that NWIS produces for the Welsh Government and the public do not provide a complete or balanced picture. The Welsh Government should work with NWIS to improve the reporting of performance to tell a more balanced story of what is going well, where there are difficulties and why. Performance reporting should include information about progress against initial project plans, user satisfaction and concerns.

Update: The Welsh Government has maintained its oversight of NWIS during this interim period in advance of transitioning to a new Special Health Authority. New Welsh government reporting arrangements will be considered as part of the establishment of the new organisations, consistent with arrangements in place for HEIW and other existing NHS organisations. A strategic review of communications will include consideration of reporting to the public and other stakeholders.

Recommendation 8. The Welsh Government needs to decide whether and how to provide the additional funding that NHS bodies and NWIS have estimated is required to deliver the vision for an electronic patient record. The Welsh Government should carry out a full cost-benefit analysis of the proposed investment, including the extent to which financial savings from new systems may enable funding to be redirected from existing services to invest in new informatics systems.

Update: The Welsh Government has confirmed significant additional investment of £50m annually to support digital priorities, as part of its wider commitment of resources to deliver A Healthier Wales. This investment will be supported by the establishment of a Digital Business Case Delivery Unit, which will strengthen continuous consideration of value for money and benefits realisation for digital programmes and projects.

Recommendation 9 - Despite some recent progress, there remains scope for better integration of medium term financial planning of informatics across the NHS. The Welsh Government, working with NHS bodies and NWIS, should set out clear and

agreed medium term funding plans for local and national ICT programmes. This should involve NHS bodies and NWIS working together before NHS bodies complete the first draft of their rolling three-year plans. It should also take account of any future decision on funding required to deliver the strategy.

Update: Welsh Government has set out expectations for how NHS bodies and NWIS should strengthen and clarify medium term planning for informatics in a revised IMTP Framework and the National IMTP. Welsh Government has worked closely with NHS bodies and NWIS to confirm allocations and arrangements for additional investment in digital priorities. Medium term financial planning from 2020 will be informed by IMTP returns, the strategic review of digital infrastructure, and continued close engagement between all stakeholders.

Recommendation 10 - NWIS is increasingly using the Agile approach to software development. There are potential benefits to this approach in terms of timeliness and quality, but the approach relies on deep engagement with clinicians and other end users, which has often been difficult to secure. NWIS and NHS bodies should work together to: (a) strengthen the relationship between developers and clinicians, particularly in designing and testing new systems and functions, so that there is a better collective understanding of what is wanted and what is possible; and (b) engage with managers to identify their information needs as well as the needs of clinicians.

Update: This action will be considered as part of the strategic review of the digital workforce commissioned by Welsh Government, which will lead to a digital workforce plan. The role of Chief Digital officer for Health and Care includes a remit to lead the digital profession, and the CDO will be supported by a clinical leadership advisory group.

Recommendation 11. NWIS is developing but does not yet have a full workforce plan, and reports that it struggles to recruit and retain senior developer staff due to competition from the private sector. The Welsh Government, NWIS and NHS bodies should work together to explore options to secure the experienced ICT staff and developers that NWIS needs within the context of a comprehensive workforce plan for NWIS and taking account of the ICT staff available to NHS bodies.

Update: This action is still to be considered and will be addressed as part of the planned workforce review. The broader NHS Workforce Plan due to be published shortly recognises the development of specialist and general digital skills.

Recommendation 12. We found that there is a lack of clarity as to responsibility for delivering the intended benefits of national informatics systems and a lack of monitoring. The Welsh Government, NHS bodies and NWIS should work together to ensure that: (a) there is a clear allocation of responsibility for achieving the benefits; and (b) there are clear responsibilities and processes in place for monitoring and reporting progress in delivering those benefits.

Update: Welsh Government has worked closely with NHS bodies and NWIS to consider delivery arrangements for additional investment to support Digital Priorities, which will be supported by a new Digital Business Case Delivery Unit. Further work is required to extend this approach to existing national services and systems, linked to oversight on NHS bodies and NWIS for local and national digital services respectively. The role of the Chief Digital Officer will also be important in overseeing standards and outcomes.

Recommendation 13 - We found that many staff in the NHS are frustrated with some of the functionality and quality of national informatics systems. NWIS has a process for updating national systems, but there are concerns about the slow pace and lack of feedback and the Change Advisory Boards themselves could function more effectively. NWIS should review its process for managing change requests and where necessary make changes to: (a) provide clearer feedback to the service about how their requests have been dealt with and whether and when any changes can be expected; (b) remain open to minor changes that could have a significant impact in improving end users' use and perception of the systems; and (c) provide clearer agendas and work programmes for the Change Advisory Boards to make them more focussed on enabling impactful improvements to systems.

Update: There are several strands of work which have an impact on this recommendation. The Welsh government has accepted all the recommendations in the digital architecture review. This includes commitments to an open architecture, and a standards based approach, which will support improved functionality and more agile development, including in a response to change requests. The recent digital governance review has also led to the Minister announcing that there will be a Chief Digital Officer for Health and Social Care. With a position in the NHS Executive and senior ownership and responsibility for standards, they will be able to provide support and authority if any group in the ecosystem feels their voices are not being heard. Alongside a new Chief Digital Officer, NWIS will become a Special Health Authority. This reflects the recommendations of this Committee, the WAO and the recent digital architecture and governance reviews.

PAC recommendations update

Recommendation 1 – We recommend that the Committee receives six monthly updates from the Welsh Government on progress in implementing the digital recommendations in the Parliamentary Review and the Auditor General's report in order to enable us to revisit these issues at a later date.

Update: An update is set out above as agreed with the Committee.

Recommendation 2 – The Committee was also very concerned by the evidence we heard on system outages, infrastructure and resilience. Given recent evidence of further outages since we took evidence, we would like further assurance from Welsh Government that the systems are resilient. We recommend the Welsh Government set out a clear timetable for putting the digital infrastructure of NHS Wales on a stable footing.

Update: Welsh Government has continued to work closely with NWIS on the monitoring of national system outages, and has worked with NHS bodies and NWIS to agree prioritised investment in digital infrastructure and focus on system resilience. There is a monthly timetable for this prioritised investment, but a longer term timetable will be informed by a strategic review of digital infrastructure, commissioned by Welsh government, which will lead to a Digital Infrastructure Plan.

Recommendation 3 – In the discussions on the use of Cloud computing and the impact of recent outages, it was deeply concerning that, when many consumer systems appear to have very robust performance and up-time, the NHS in Wales is struggling to run its own data centres with 21 outages in the first 6 months of 2018 – one outage every 9 days. The Committee recommends a review of the senior leadership capacity in terms of skillset and governance within both NWIS and the wider NHS Digital Team.

Update: The Digital Governance Review included consideration of delivery and decision making structures, and of senior leadership capability and capacity. The Welsh Government has confirmed that it is commissioning a strategic review of the digital workforce which will include leadership skills within its remit. The transition to a new Special Health Authority will strengthen leadership capacity through new appointments, including an independent Chair and Board Members appointed by Welsh Ministers.

Recommendation 4 – NWIS is currently overstretched and improvement requires far more than simply pouring more money into the existing organisation, which is unlikely to achieve significantly different results. We recommend that any additional funding apportioned to NWIS needs to be tied to reorganisation to achieve the improvements that are required.

Update: Welsh Government has recently announced its decision to transition NWIS from its existing arrangements to a new Special Health Authority, responsible for delivering national digital services. Following this organisational change, we expect that the workforce review and other strategic reviews will inform further structural reorganisation within the new organisation, led by the Chair, board members, and Chief Executive Officer.

Recommendation 5 – We recommend that NWIS looks to increase its work with other public bodies, including those from UK Government. This approach could work on a number of levels, from the sharing of good practice on recruitment to the creation of Government Digital Service which could work across multiple agencies.

Update: NWIS works closely with other digital organisations in Wales and across the UK. We expect the new Digital Special Health Authority to build further on this work, alongside a new Chief Digital Officer, Welsh Government and wider Welsh public services.

Digital Priorities Investment Fund and the Digital Business Case Delivery Unit
A Healthier Wales committed to significantly increase investment in digital priorities. As part of the £192 million included in the 2018 budget to support delivery of A

Healthier Wales, an additional £50m for digital has been announced. This additional funding will be managed centrally by the Welsh Government to support a portfolio of transformational programmes, covering five strategic themes:

- Transforming digital services for patients and public
- Transforming digital services for professionals
- Investing in data and intelligent information
- Modernising devices and moving to cloud services
- Cyber-security and resilience

This investment as outlined in the Ministers statement will accelerate the delivery of key programmes, including the Wales Community Care Information System and a National Data Resource, both of which are key commitments in A Healthier Wales. The cross-cutting themes will support the implementation of recommendations from the two reviews, including the creation of the new CDO and SHA, as outlined above, thereby strengthening digital delivery and planning across the whole system.

Furthermore, it is intended to establish a Digital Business Case Delivery Unit to strengthen business case development and delivery. And which will be further strengthened following the recommendations arising from the planned Digital Infrastructure Review next year.

Outages

Since my last update to the Committee NWIS have provided the following information and also provided a summary of outages per quarter as set out below. As previously, this information includes all incidents logged via the NWIS Service Desk which meant that users were unable to access CaNISC, Welsh Laboratory Information Management System (WLIMS) or the National Data Centres (affecting access to WLIMS or CaNISC), for the period 1st August 2018 to 31st August 2019.

- Data Centres - There was one outage relating to Data Centres, i.e. the supplier incident that affected Blaenavon Data Centre on 29th June.
- CaNISC - There were eight outages affecting CaNISC.
- WLIMS - There were eight outages affecting WLIMS.

Summary of data across the full period of reporting: January 2018 – August 2019

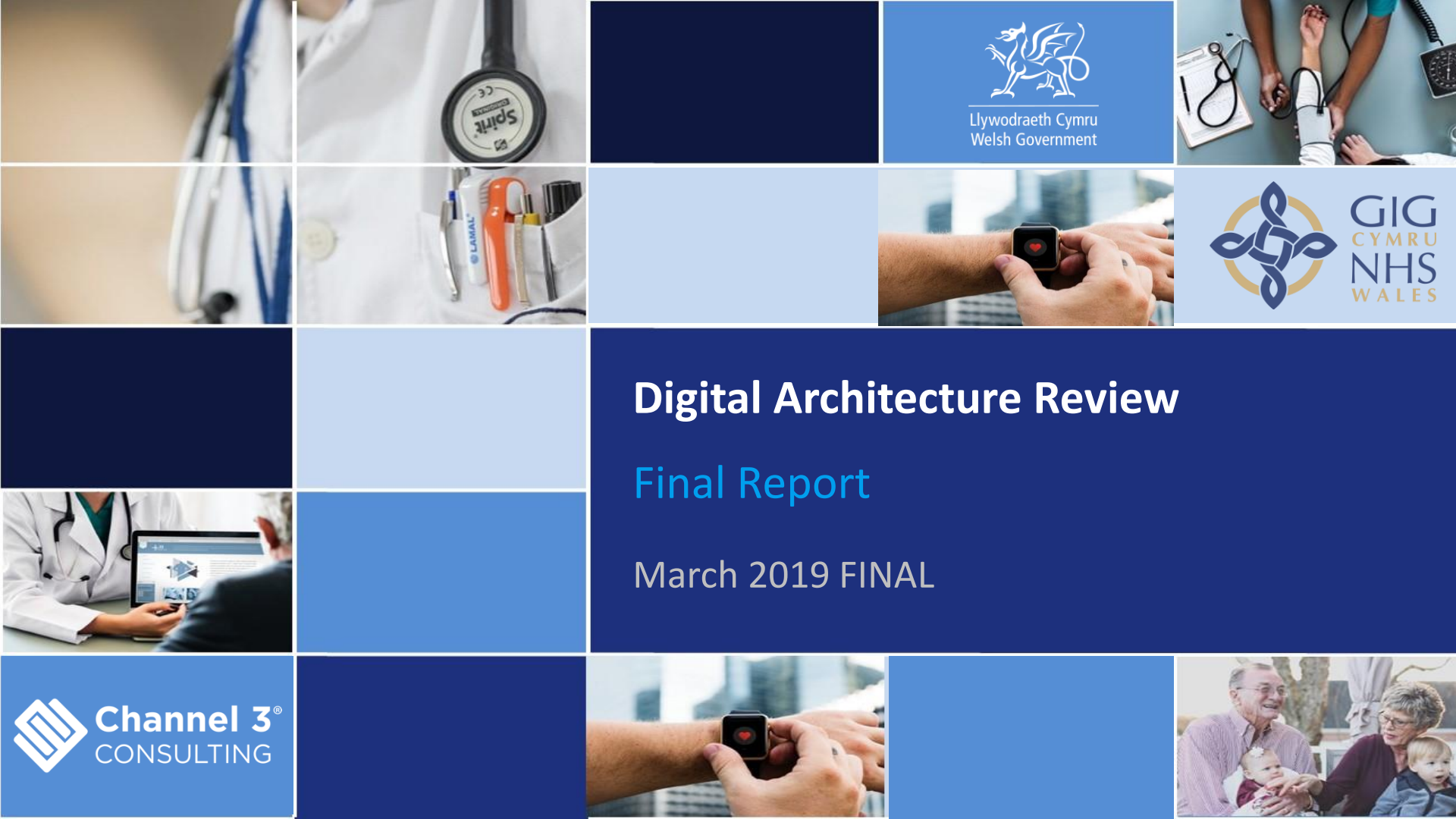
	Total	CaNISC	WLIMS	Data Centres
2017/Q4	5	2	2	1
2018/Q1	11	5	5	1
2018/Q2	7	5	2	0
2018/Q3	1	1	0	0
2018/Q4	3	1	2	0
2019/Q1	7	2	4	1
2019/Q2	2	2	0	0

Blaenavon Data Centre

The Committee will be aware of the recent data centre outage at the Blaenavon Data Centre which occurred on 29th June 2019. The incident was as a result of a failure of the data centre environment and was not as a result of any issues arising from NWIS systems. This outage affected the main services operating from the data centre and arrangements were made to maintain services from another data centre. Whilst the incident was investigated, there were some residual issues that occurred and these were resolved. Operational services resumed on 3 July. A full review has been completed to analyse cause, response, and lessons learned in order to mitigate the risk of this type of failure in the future.

Next Steps

The change approach outlined in this paper demonstrates the Welsh Government's commitment to putting in place the necessary steps required to commence and support the transformation of a future digital strategy for health and care in Wales. These actions will continue to be implemented whilst the further four reviews planned for the next year are commissioned to maintain a mechanism for external advice and challenge. This approach is intended to support our strategy to implement at pace and with the necessary governance and accountability in place to ensure effective progress continues to be made.



Digital Architecture Review

Final Report

March 2019 FINAL

Limitations of our works

This assessment is based on information provided by the Welsh Government and NHS Wales and associated stakeholders and was supported by further clarifications and confirmations.

Channel 3 Consulting have not undertaken a comprehensive audit nor have Channel 3 subjected the information upon which we have relied to verify assessments. Accordingly, Channel 3 assume no responsibility and make no representations with respect to the accuracy or completeness of the information in the report.

Channel 3 cannot guarantee that we have had sight of all relevant documentation or information that may be in existence and

as such, our assessment is based on the information Channel 3 have been provided. Any documentation or information brought to our attention subsequent to the date of the assessment may require us to adjust our assessment accordingly. Channel 3 also note that, given the sample nature of some of the testing which we have conducted, we cannot guarantee that we have identified all information that may be relevant.

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Introduction

Channel 3 Consulting was engaged by the Welsh Government and NHS Wales to undertake a review of the NHS Wales Digital Architecture, recognising the ambition for digital transformation across Wales at pace.

The focus of this review was to assess the extent to which the current Digital Architecture of NHS Wales is ready to meet the ambition set out in “A Healthier Wales”, and whether it is scalable to support digital transformation across Welsh health and social care.

The review involved technical reviews with NWIS and workshops and interviews with over 100 key stakeholders from NWIS, all Health Boards, and the universities, augmented by three “deep dives” at Aneurin Bevan and Cwm Taf Heath Boards, and Public Health Wales Trust. It involved three phases of work, the reports for which are annexed to this final report

01

Annex A - Current state assessment

Reviews the extent to which the current digital architecture is fit for purpose for delivering the Welsh ambition.

02

Annex B - Future state assessment

Provides a vision for the NHS Wales Digital Architecture that would address the longer term aims of the NHS Wales, that builds on the current state.

03

Annex C – Improvement options

Provides a set of shorter-term options to improve the current NHS Wales Digital Architecture that would provide a stepping stone towards the future vision and /or address immediate gaps or risks in the current state.

3

We have reached three major conclusions

01

Current state

The current approach to digital architecture in NHS Wales is unsustainable and will not enable the ambition set out in A Healthier Wales to be achieved as things stand

The focus on centrally led projects and platforms is now starting to limit the ambitions of the system and of individual organisations within it. This in turn is impeding advances in care and innovation in the system. There is widespread frustration in Health Boards and more widely, but an acknowledgement that a collective approach is required. There is also an acknowledgement of the scale of the task, and the commitment and skills of the teams in NWIS and locally.

02

Opportunity

There is a significant opportunity for digital transformation in health and social care in Wales and the timing is optimal

Globally, there has been recognition in the last two years, that traditional approaches to digital technology in health and social care are no longer fit for purpose. The technology vision set out in A Healthier Wales aligns with this global thinking and is achievable. The ingredients are there in terms of the digital building blocks required, and the overall commitment and capability at a system level. The challenge is more tractable in Wales than in many health economies, and could enable the nation to become a true global exemplar.

03

Approach

A digitally transformed NHS in Wales is achievable, but achieving the ambition requires a fundamental change of approach and focus

There needs to be a twin track approach so that resilience and innovation proceed in tandem, and at pace. There will need to be a keen focus on three major architectural building blocks alongside taking the opportunity to seize some immediate opportunities to make a real difference to patient care. The work should be undertaken as a collaborative, whole system approach and make use of all of the available capacity and capability.

The current approach is unsustainable

The current Digital Architecture of NHS Wales has grown organically and is now too complex, whilst the intent to develop something along open standards guidelines is clear, the reality is that insufficient progress is being made towards achieving this. There is a lack of clear standards and controls and it is becoming a constraint for the system.

The National Data Resource work is however moving in a direction that is fully aligned with Once for Wales and making progress, the challenge is likely to be on gaining early benefits from that work.

The integration layer is in need of some

work to bring to a level where a more open approach could be adopted. There are also core capabilities that need to be added to that.

There is an application level focus in the National plans that is leading to a diversion from the intent of Once for Wales to expose the systems information assets for the benefit of the population as a whole, and a considerable impediment to agility as the system develops new care models and innovates.

The underpinning infrastructure represents a risk to the system as a whole both at the level of core networks, but also at the level

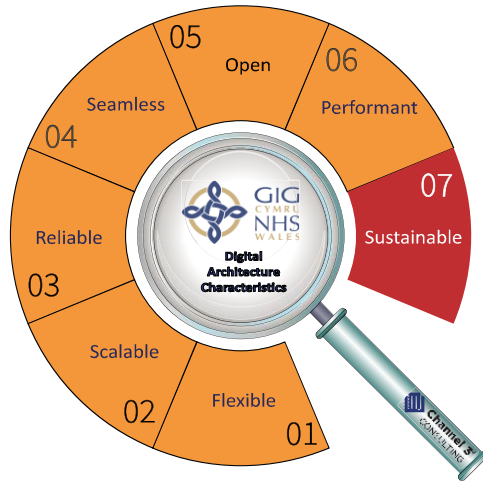
of core software and the levels of support for that – for example with respect to patching. As data volumes transmitted across the system increase, the ability of the core infrastructure to be sustainable is a considerable area of risk.

There are however many positives that would help to address these risks, including the skills and capabilities in the system, and the knowledge and understanding of the core technologies both in NWIS and in Health Boards.

The current approach is unsustainable

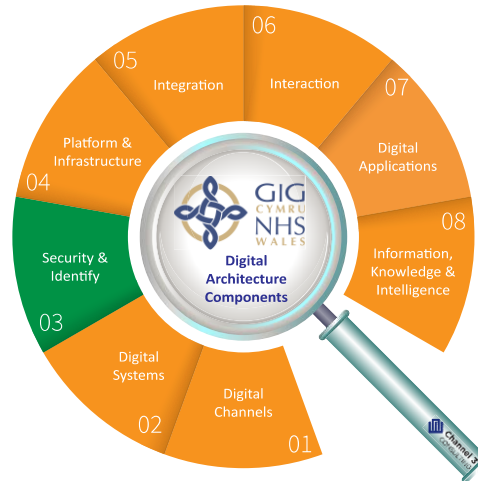
Digital Architecture Characteristics

(Derived from A Healthier Wales and discussions with stakeholders including NIMB and the Advisory Group)



Digital Architecture Components

(Derived from Channel 3 best practice model)



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

There is a significant opportunity

There is a need to recognise and accept that the approach taken to date was right at the time for Wales, but that the world has changed. Globally, there has been widespread recognition, particularly in the last two years, that more traditional approaches to digital technology in health and social care are no longer fit for purpose.

The pace of innovation in healthcare, its use of digital technology and digital innovation more generally combined with the demand for agility on the one hand, and resilience on the other is near universal. There has been a significant movement towards embracing fully open digital platforms in

response to these challenges.

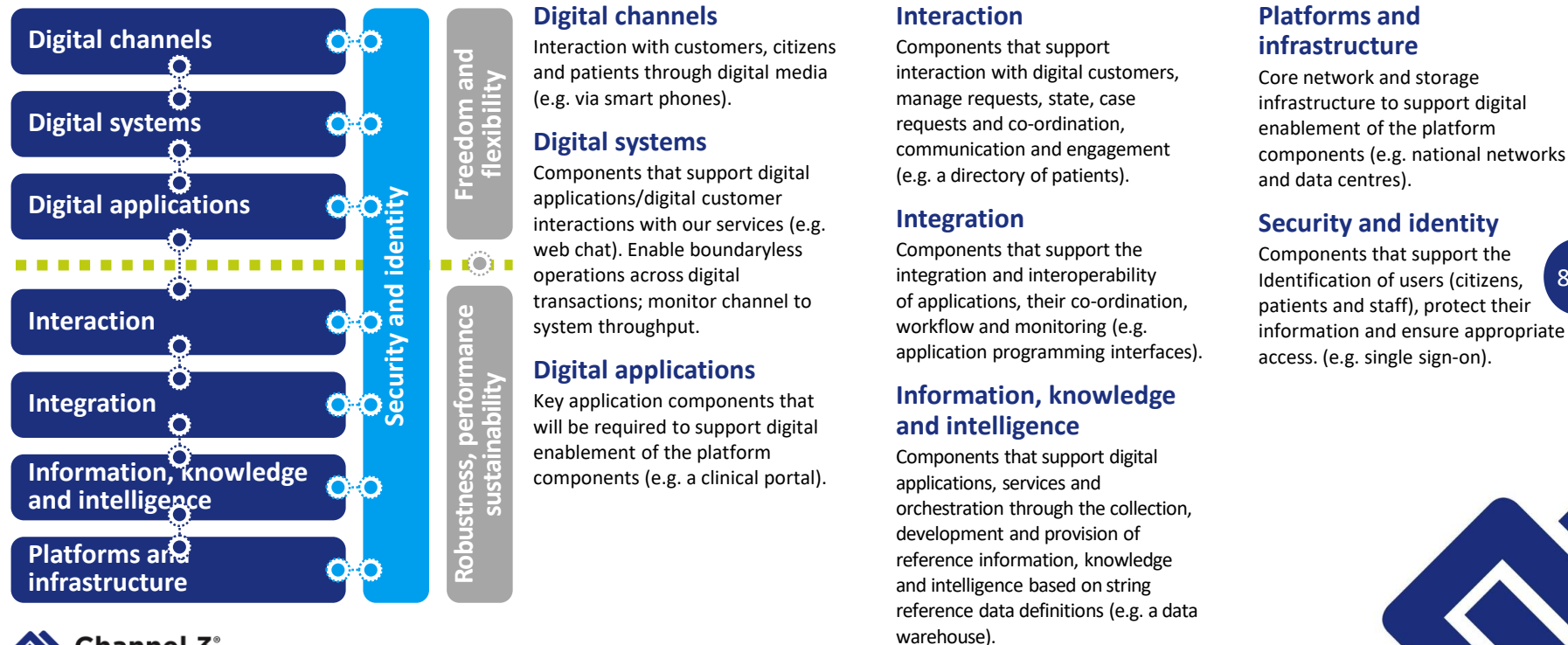
Wales is almost uniquely placed to capitalise on this shift. It is tractable in terms of size and will. It has a skilled and capable digital workforce both in the NHS and more widely. It has a number of leading universities. Economically the national focus on growth and inward investment makes it an ideal environment in which to innovate at pace.

The timing is right for a digital health and social care transformation in Wales. The technology vision set out in A Healthier Wales aligns with global thinking, and it is achievable.

The key to making this vision a reality is a clear target digital architecture and a clear focus on the components within that that need priority development.

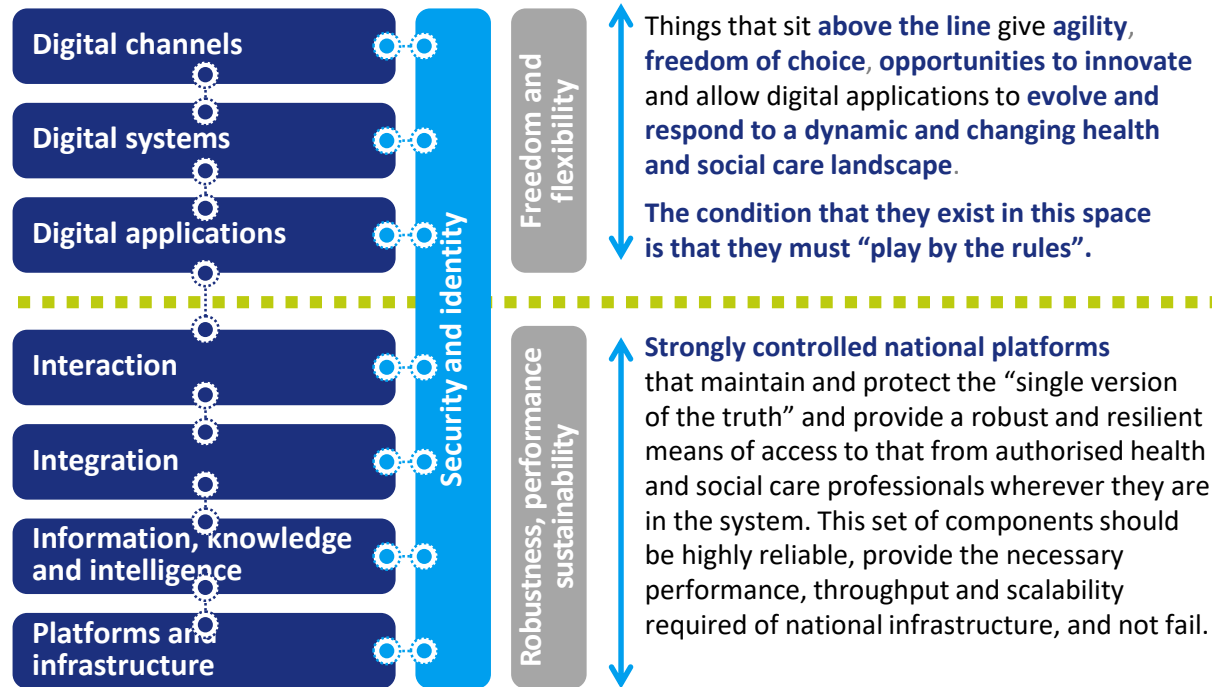
There is a significant opportunity

The model below translates the Components set out in the Current State Assessment into a high level Target Architecture that is designed to meet the requirements of a Healthier Wales and embodies open design principles.



There is a significant opportunity

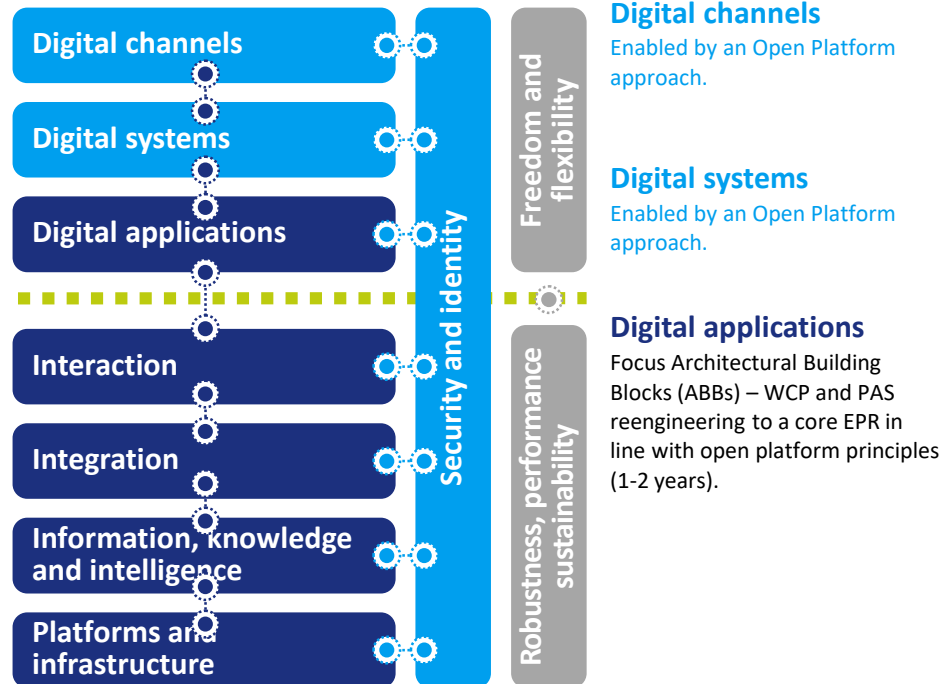
The model forces a clear separation between components “above the line” that allow for diversity, choice and agility within a set of clear rules, and those “below the line” that are defined, managed and protected.



A highly modular approach is key. It means that individual components can be stress-tested and monitored for performance independent of the whole. It would permit health boards to integrate national functionality into existing workflows and help convergence work.

There is a significant opportunity

The key Building Blocks necessary for an Open NHS Wales Platform are located in the high level Target Architecture as below:



Interaction

Focus ABB – Enhance NHS Wales EMPI along open principles to facilitate a more developed Patient/Citizen identification strategy. (1 year with early wins in 3 months).

Integration

Focus ABB – Enhance Integration and Interaction Engine (possibly including sourcing options) to provide a truly open platform for Wales (1 year target).

Information, knowledge and intelligence

Focus ABB – Clinical Data Repository. Focus the work of the National Data Resource (NDR) programme on the creation of a National Clinical Data Repository in line with open principles as a key part of the programme. (1 – 2 years).

Platforms and infrastructure

Focus ABBs – All core network and storage infrastructure, both local and national, to support digital enablement of the platform components. Build on the final recommendations of the Trustmarque review of networks to move towards a modern (possibly multi-sourced) software managed national network and storage infrastructure (3-5 years).

Security and identity

Enhance in line with other Open Platform work and national cyber security requirements.

The ambition is achievable

The high level roadmap for achieving the Target Architecture defined in the Future State Assessment is estimated to be a three year transition from financial year 19/20 to financial year 21/22. A fully open and resilient Target Architecture should be achievable in that timescale, but its development will have to be balanced against:

- Maintaining day to day service throughout the transition.
- Available capacity and funding.
- Other priorities for the system that will require functionality to be enhanced or developed.

Within that overall transition, there are however some aspects of the transition that can be achieved much more quickly than others.

We estimate that, with an appropriate focus, the majority of the transition to an open architecture could realistically be achieved within a 2 year period to the end of financial year 20/21. This will require considerable focus, along with some key priority calls, however it will enable the pace of innovation on the front line to be accelerated. The aspects that will take longer will principally relate to core infrastructure change that will be a major undertaking and require considerable investment for a resilient national platform.

In addition, the roadmap includes some much shorter term architectural adjustments that could yield shorter term benefit in 19/20 to early 20/21, along with some candidate “challenge” projects that could be accelerated to test and signal digital transformation to patients, service users and staff across the system.

Achieving the ambition requires a fundamental change of approach and focus

Underpinning our recommendations is a set of assumptions that are critical to success.

An open Digital Architecture, as described in this report, is necessary for the achievement of the ambition set out in A Healthier Wales. To deliver an open architecture is not enough on its own.

An open architecture requires a significant transformation in the ways of working within the digital community.

To ensure the benefits of an open architecture are realised a transformation programme is needed to drive the changes in operational practice, standards and collaboration across health and social care in Wales. This will require a commitment to the development of an Open Digital Platform that

can be matched by the focus required to accelerate the journey.

Delivering these changes in a relatively short timeframe will require additional, short term, resources with a focus on the planning for a programme of this scale and laying the foundations to ensure the benefits are available to all Health Boards, Trusts, Social care and ultimately the population of Wales.

An open digital architecture is equally about changing the interactions between the providers and consumers of systems and data. This change will require a new operating model, revised governance, clear responsibilities and transparent oversight.

There will need to be collaboration and different working arrangements between all parties involved in Digital to maximise the use of the expertise in the system in the short term.

There will also be a need for an adjustment to delivery priorities in the next financial year in order to make progress.

Although we make no specific recommendations on these points as they are outside the remit of this review, they are fundamental to success.

The recommended architectural steps

The prize of a digitally enabled health and social care system in Wales is within reach, but it cannot be achieved without a change in approach, focus and energy.

Digital architecture

3 - 9
months

- Adopt a core set of Digital Design Principles.
- Adopt and publish a TOGAF® (or similar) framework, locating Digital Architecture in a business context for the NHS in Wales.
- Define the all Architectural Building Blocks (ABBs) for the NHS Wales Digital Architecture.
- Define all candidate open national applications (e.g. WCP, WCCIS etc.)
- For the key ABBs required for an Open Digital Architecture (EMPI, Integration and Interaction, and CDR) develop a consistent set of core products that are agreed and published nationally.
- Start to focus on some early wins.

Open digital platform

1 - 2
years

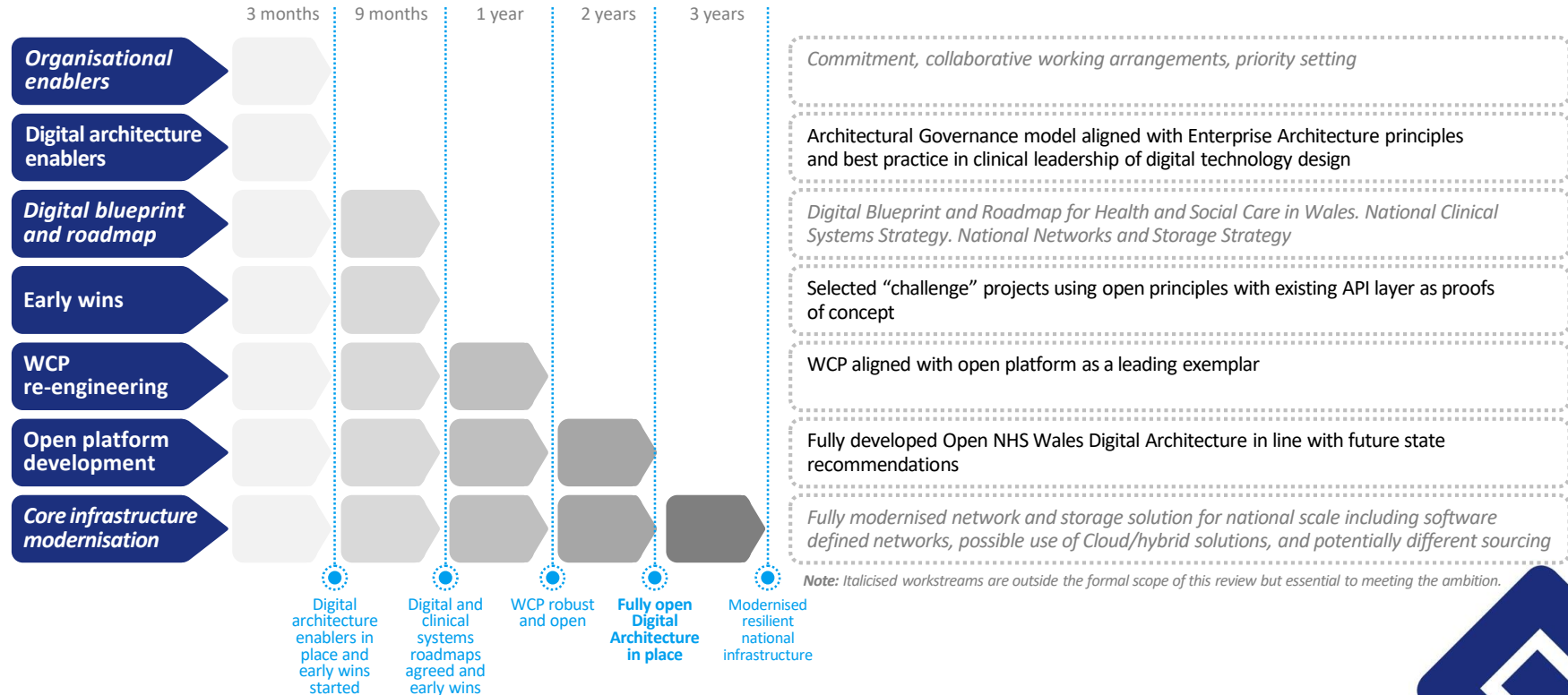
- Enhance the NHS Wales EMPI along open principles to facilitate a more developed Patient/Citizen identification strategy.
- Enhance the NHS Wales Integration and Interaction Engine to provide a truly open platform for NHS Wales.
- Focus the work of the National Data Resource (NDR) programme on the creation of a National Clinical Data Repository in line with open principles whilst progressing the programme as a whole.
- Make migrating the WCP to an open architecture the highest priority for the product in the next 12 months. This will need to address any impacts on the current work programme.

Stabilisation and resilience

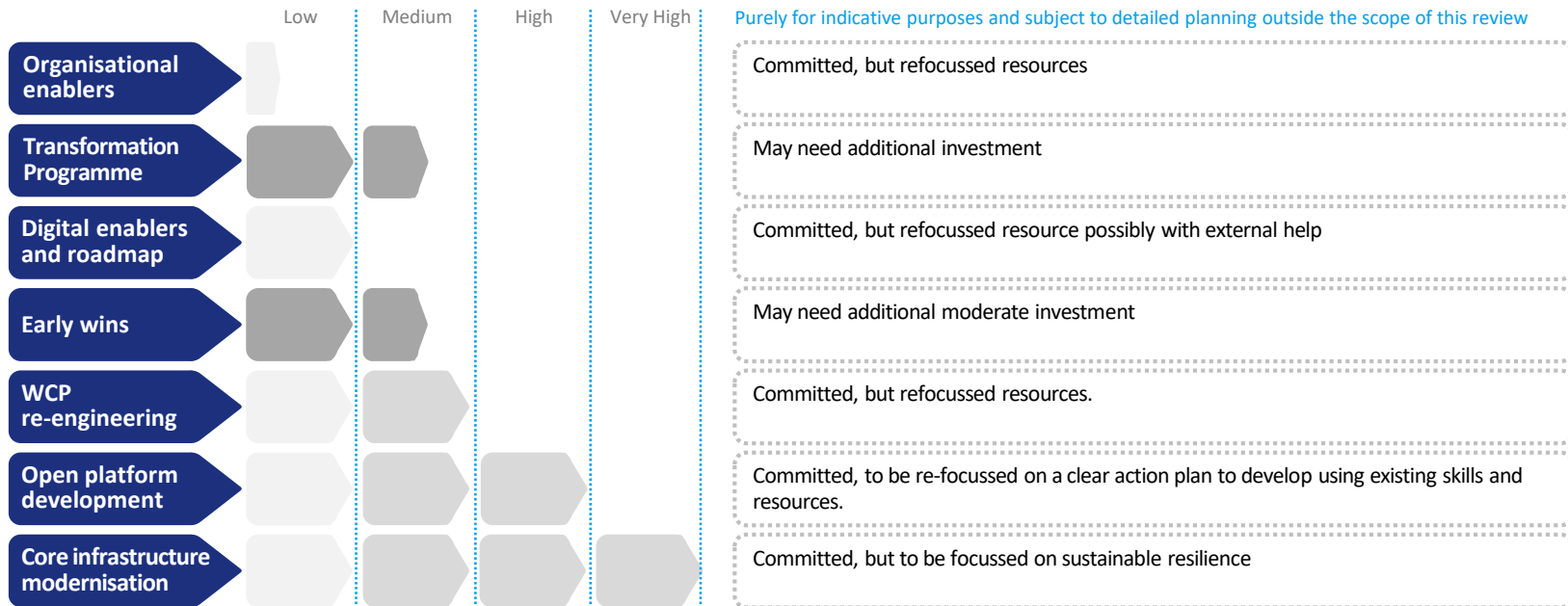
2 - 3
years

- Build on the final recommendations of the Trustmarque review of networks to move towards a modern (possibly multi-sourced) software managed national network and storage infrastructure.

Achieving the ambition requires more



Indicative resourcing implications



Whilst there may be some incremental additional funds needed for early wins and transformation, we would recommend a refocussing of existing plans, resources and funding to achieve the goals of A Healthier Wales

Target “challenge” projects

We have identified a small number of projects where a different approach could start the journey towards an open digital platform for Wales. The purpose of these projects is to challenge the NHS in Wales and its supply chain to work in a different way around a national architecture, at the same time delivering short and medium term patient benefits. There will need to be a level of resolve and commitment to making these work for all parties involved.

Patient Knows Best (PKB) and Dr Doctor

Patient facing solutions such as Dr Doctor (proposed in Aneurin Bevan University Health Board) and PKB (in Cardiff and Vale University and Hwyswel Dda Health Boards, and Swansea but with different implementations) have significant advantages in term

of patient engagement and care. They are largely proven products and can co-exist. The challenge we are setting is to align all instances of PKB and Dr Doctor with the open principles outlined in this report, and to focus on them accessing the same, national, patient record rather than local instances. This will test the concept of working with suppliers in a new, open, digital architecture and test the progression of local solutions with national potential.

ABUHB Portal

Discussions on portal convergence between NWIS and Aneurin Bevan University Health Board have struggled to progress. Our proposal is to challenge the acceleration of the convergence by moving to an open systems approach for the ABUHB Portal (CWS) that would facilitate user pull to convergence rather than supply side push. It would focus on making sure that CWS is able to access the “single version of the truth” for the patient record,

and align with the approach outlined in the “innovation pyramid” in A Healthier Wales. We know that this represents a significant challenge to all parties, but the current approach does not appear to be working. There is an opportunity to develop the CWS into a truly open platform alongside the WCP to test the concept of this approach, and to build a resilient “plug and play” open environment. Similar to the recommendation for the WCP, ABUHB would need to align the portal with the open architecture recommended in this report.

Target “challenge” projects

WCCIS (in ABUHB)

The WCCIS implementation in ABUHB represents a significant opportunity to test the pathways and use of shared information between health and social care in Gwent. However, the project is experiencing some difficulty in progressing because of architectural concerns around differing views on how the implementation could be delivered. Some of this is related to the issues mentioned above around convergence of the different portal estates. The prize of a test of the new ways of working across health and social care in Gwent is potentially being impeded by this and we suggest that all parties involved work towards an open systems approach as the end game with a possible tactical stepping stone towards

that which maximises the likelihood of success for patients and the front line. We are aware of the options being considered and that would suggest that the challenge is set to resolve the short term issues to the benefit of the system, with a longer term game plan towards a truly open implementation of WCCIS that can be adopted nationally.

This will not be an exhaustive list, but represents a few early examples where a task and finish approach that examines the options in an accelerated timescale using a more agile approach could yield early benefits, some as early as three months.

Action plan

Recommendation		Suggested timing	Suggested ownership
Digital architecture	Commit to the development of an NHS Wales Open Digital Architecture.	Immediate	Welsh Government
	Adopt a core set of Digital Design Principles.	3 months	NHS Wales
	Adopt and publish TOGAF ® (or similar) framework to locating Digital Architecture in a business context for the NHS in Wales.	3 months	NHS Wales
	Define all Architectural Building Blocks (ABBs) for the NHS Wales Digital Architecture.	3 months	NHS Wales
	For the key ABBs required for an Open Digital Architecture (EMPI, Integration and Interaction, and CDR) develop, publish a consistent product set of core products that are agreed across Wales and published nationally.	3 months	NHS Wales
	Start work to focus on some early wins in line with open architecture principles.	3 months	NHS Wales

Action plan

Recommendation		Suggested timing	Suggested ownership
Open digital platform	Enhance the NHS Wales EMPI along open principles to facilitate a more developed Patient/Citizen identification.	1 year with early wins in 3 months	NHS Wales
	Enhance the NHS Wales Integration and Interaction Engine (possibly including sourcing options) to provide a truly open platform for Wales.	1 year target	NHS Wales
	Focus the work of the National Data Resource (NDR) programme on the creation of a National Clinical Data Repository in line with open principles in a balanced way that ensures that the programme as a whole is progressed but the CDR is given priority.	1-2 years with a series of shorter term transition architectures	NHS Wales
Stabilisation and resilience	Make resolving the performance problems of the WCP and migrating to an open architecture that can take advantage of the architecture proposed in the Future State the highest priority for the product in the next 12 months.	1 year	NHS Wales
	Build on the final recommendations of the Trustmarque review of networks to move towards a modern (possibly multi-sourced) software managed national network and storage infrastructure.	2 - 3 years	NHS Wales

Action plan

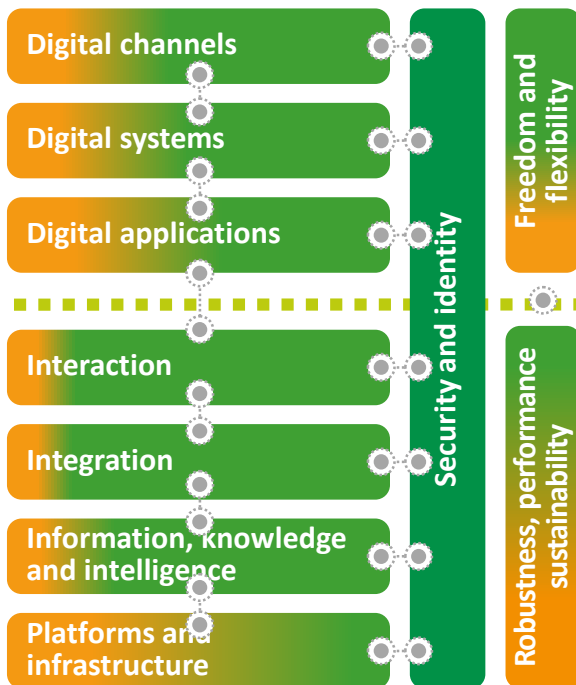
Recommendation		Suggested timing	Suggested ownership
Digital health and social blueprint and roadmap	Develop and publish an end to end Digital Blueprint and Roadmap for Health and Social Care in Wales that develops the high level ambition articulated in “A Healthier Wales” into an actionable roadmap setting out the evolution of the digital architecture and how will deliver on the ambition for the system.	6-9 months	NHS Wales
National clinical systems strategy	As observed in the Current and Future State Assessments, the Welsh Clinical Portal and other national systems sit within a complex landscape of other clinical systems used at the level of Health Boards. The ability to maintain a direction that relies on scarce national capacity to develop all clinical solutions is one that is likely to be unsustainable. In addition, some of these platforms are regarded as being in direct competition and the focus is on convergence rather than openness. An open platform approach would enable more freedom and flexibility to meet Health Boards’ local needs in addition to innovation, whilst taking advantage of shared records across Wales. We strongly recommend the development of a national clinical systems strategy that takes account of the full range of clinical systems across Wales and charts an agreed roadmap for their development against an Open Platform model.	6-9 months	NHS Wales

Action plan

Recommendation		Suggested timing	Suggested ownership
Architectural controls	There is a need for Architectural Governance mechanisms to be built into the wider Governance of Digital technology in Wales including clinical and non-clinical design authorities, and a leadership model for collective clinical leadership of the Digital Architecture in Wales. We therefore recommend the development and implementation of an Architectural Governance model aligned with Enterprise Architecture principles and best practice in clinical leadership of digital technology design. In this there need to be decision making mechanisms that are inclusive but binding.	6-9 months	NHS Wales
Market relationships	Whilst we have seen strong contract management skills evident in the NHS in Wales, a digital model against an open architecture requires amore commercial mindset that will enable the NHS in Wales to partner with the market in more innovative and collaborative ways whilst still observing the necessary legal and contractual frameworks. NHS Wales should consider approaches to building relationships with the market in a way that works towards mutual alignment behind the ambition and outcomes set out by A Healthier Wales, as opposed to contracting for digital outputs and products.	6-9 months	NHS Wales

Future State

With the right focus a target digital architecture that supports the ambition for A Healthier Wales could be achievable.



Digital channels

Multi-channel working environment for clinicians and non-clinicians in most Health Boards. Patient access on line to a variety of services.

Digital systems

Supporting infrastructure to orchestrate channels and use modern customer interaction technologies such as web chat.

Digital applications

Majority of national platforms use open principles. Multiple examples of clinical, non-clinical and patient applications in use that comply with the Welsh

Key

Capable of supporting ambition:

Now In <2 years In >2 years

standards and make use of the open platform. Acceleration of pace towards an eco-system of suppliers, innovators and academic institutions driving innovation.

Interaction

Fully open architecture with supporting published standards and available test and accreditation environments and developer support in place.

Integration

Significant progress towards integrated working across health and social care through the digital architecture in place. Strong digital workflow.

Information, knowledge and intelligence.

National Clinical Data Repository with associated intelligence and research capability. Strong data standards. Advanced business intelligence.

Platforms and infrastructure

Significant progress towards a modernised network and storage infrastructure providing resilience and stability nationally and making appropriate use of software defined network and clouds technologies.

Security and identity

Ongoing development in line with threat levels and capabilities required.

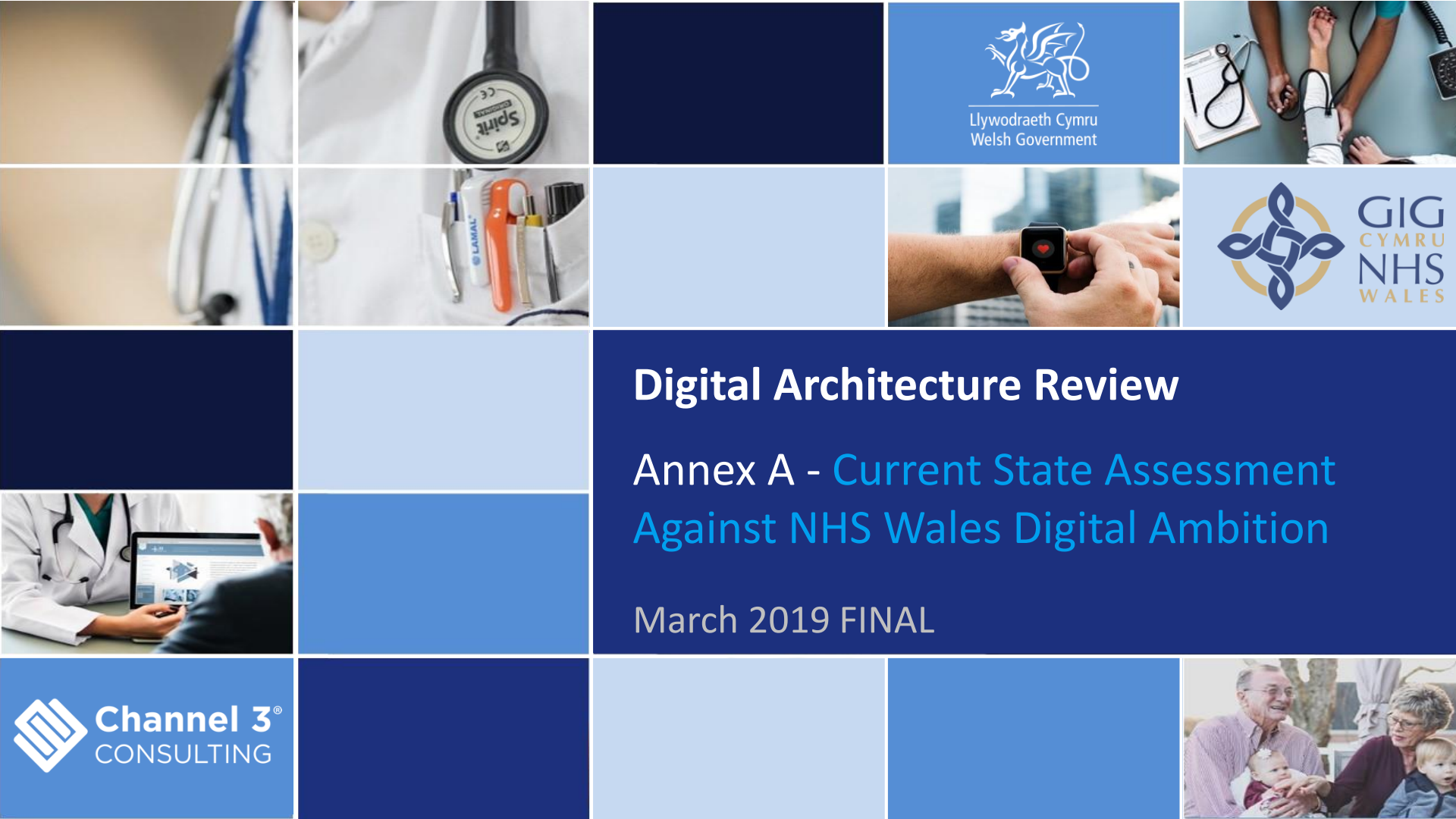
Conclusions

The recommendations set out in this document build on the current digital architecture of the NHS in Wales. They set out a clear and achievable plan to deliver an architecture that will fully enable Wales to embrace a digital future, support innovative practices in front line care, to plan services, and facilitate research and public health.

An open architecture as recommended in this report will provide the flexibility and pace for innovation using local, national and commercial resources, thus accelerating pace. The digital teams in Wales will be able to respond to changes in front line care delivery and organisational structures rapidly, without changes to underlying systems or data. This model protects against supplier lock-in, preventing constraints, and providing freedom to select the best solution to meet the needs of the Welsh people.

The immediate recommendations set out in the Improvement Options also suggest real demonstrable examples that will engage directly with patients and support clinicians in their delivery of high quality care. These will help set the tone for the future of digital service in Wales.

It is also recognised that to deliver a transformation as impactful as this requires resources to support the programme of change and deliver an infrastructure that will ensure reliability resilience and sustainability for the health and social care services for Wales.



Llywodraeth Cymru
Welsh Government



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WALES



Digital Architecture Review

Annex A - Current State Assessment Against NHS Wales Digital Ambition

March 2019 FINAL



Channel 3[®]
CONSULTING



Current state assessment

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Background

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Current state assessment

- Qualitative – what you said
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Assessment conclusion

Appendices

Limitations of our works

This assessment is based on information provided by NHS Wales and associated stakeholders and was supported by further clarifications and confirmations.

Channel 3 Consulting have not undertaken a comprehensive audit nor have Channel 3 subjected the information upon which we have relied to verify assessments. Accordingly, Channel 3 assume no responsibility and make no representations with respect to the accuracy or completeness of the information in the report.

Channel 3 cannot guarantee that we have had sight of all relevant documentation or information that may be in existence and as such, our assessment is based on the information Channel 3 have been provided.

Any documentation or information brought to our attention subsequent to the date of the assessment may require us to adjust our assessment accordingly. Channel 3 also note that, given the sample nature of some of the testing which we have conducted, we cannot guarantee that we have identified all information that may be relevant.

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Background to the review

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Background

A Healthier Wales (2018), sets out the Welsh Government's ambition to bring health and care services together, so that they are designed and delivered around the needs and preferences of individuals, with a much greater emphasis on keeping people healthy and well and adopting a seamless whole system approach to health and social care.

Digital is a key enabler of transformational change, with the potential to provide a shared platform for safe and effective joint working between different organisations, and with citizens directly. There are examples of digital systems sharing information across and between primary

care, secondary care and social care in Wales, however, more needs to be done to support the transformation of the health and care system. Specifically, A Healthier Wales requires the Health and Social Care System in Wales to:

- Accelerate progress towards a fully integrated national digital architecture, and create an online digital platform for citizens, alongside other nationally mandated services.
- Establish a national data resource which allows large scale information to be shared securely and appropriately.
- Develop an “open platform” approach to digital innovation, through publishing national standards for how software and technologies work together, and how

external partners can work with the national digital platform and national data resource.

- Significantly increase investment in digital infrastructure, technologies and workforce capacity, supported by stronger national digital leadership and delivery arrangements.

As part of a wider programme of work to deliver the strategy, the Welsh Government has commissioned a review of the NHS Wales digital architecture, recognising the ambition for digital transformation across Wales at pace. NHS Wales Informatics Service (NWIS) has, on behalf of the Welsh Government, commissioned Channel 3 Consulting to undertake this review of the NHS Wales Digital Architecture.

Background

The Welsh Government has commissioned a review of the NHS Wales digital architecture, recognising the ambition for digital transformation across Wales at pace. NHS Wales Informatics Service (NWIS) has, on behalf of the Welsh Government commissioned Channel 3 Consulting to undertake this review of the NHS Wales Digital Architecture.

The focus of this review is to assess the extent to which the current Digital Architecture of NHS Wales is ready to meet the ambition set out in A Healthier Wales and whether it is scalable to support digital transformation across Wales.

To achieve this, the review will consist of three core phases:

01

Current state assessment

Review the extent to which the current digital architecture is fit for purpose for delivering the Welsh ambition.

02

Future state assessment

Provide a vision for the NHS Wales Digital Architecture that would address the longer term aims of the NHS Wales, that builds on the current state.

03

Improvement options

Provide a set of shorter-term options to improve the current NHS Wales Digital Architecture that would provide a stepping stone towards the future vision and/or address immediate gaps or risks in the current state.

This document summarises the first of these phases.

Executive summary

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Executive summary

Our review has focussed on the Current State of the NHS Wales Digital Architecture. It has focussed on locating Digital Architecture as the core technology “stack” – channels, software applications, integration technology, information and data, and core technology (Infrastructure) – that would enable a Digital Strategy for the Health and Social Care in Wales to be enacted and for Digital Transformation for the benefit of patients, cohorts of patients and population of Wales as a whole to happen.

To do this we have developed a statement capturing what stakeholders in the Health

and Social Care need that Digital Architecture to do, and we have also applied a high level Architectural Reference Model to organise our assessment.

That need is for:

- On the one hand a Digital Architecture that is open, seamless across boundaries, flexible and responsive, and consistently scalable from the local to the national as set out in A Healthier Wales.
- On the other hand, it needs to provide resilience, performance and sustainability at its core.
- And the Digital Architecture needs to align with the agreed definition of Once for Wales.

“Once for Wales is about all parties involved in health and care in Wales working

collaboratively to add value and deliver the strategy of a single electronic patient record, ensuring that information is entered once and is made available to all those who need it, at the time and place they need it.”

The assessments undertaken as part of this review appraise the current architecture against a future state. Our assessment shows a relatively strong position from which Wales can make progress. This is in no small part due to the work that has gone before, building and shaping the current architecture. Many of the base components are in place and some elements have great strengths. The work to progress will be about the final yards, sometimes the hardest yards, as the digital enterprise across Wales aligns with a single, defined, strategic architecture.

Executive summary

These sets of aims are mutually supportive with the right approach.

Our current assessment of the Digital Architecture has identified a number of major findings against this backdrop:

- There are many positives, including the skills and capabilities in the system, and the knowledge and understanding of the core technologies both in NWIS and in Health Boards.
- There is a strong alignment across the system in terms of what a good digital architecture could look like and many of the basic building blocks of an open architecture exist in some form.
- However, the current Digital Architecture of NHS Wales* has grown organically and

is now too complex, whilst the intent to develop something along open standards guidelines is clear, the reality is that insufficient progress is being made towards achieving this, there is a lack of clear standards and controls and it is becoming a constraint for the system.

- The National Data Resource work is moving in a direction that is fully aligned with Once for Wales and making progress, the challenge is likely to be how to gain early benefits from that work.
- The integration layer is in need of some work to bring it to a level where a more open approach could be adopted. There are also core capabilities that need to be added to that.

* See Appendix C ** See Appendix D

- There is an application level** focus in the National plans that is leading to a diversion from the intent of Once for Wales to expose the systems information assets for the benefit of the population as a whole, and a considerable impediment to agility as the system develops new care models and innovates.
- The underpinning infrastructure represents a risk to the system as a whole both at the level of core networks, but also at the level of core software and the levels of support for that – for example with respect to patching. As data volumes transmitted across the system increase, the ability of the core infrastructure to be sustainable is a considerable area of risk.

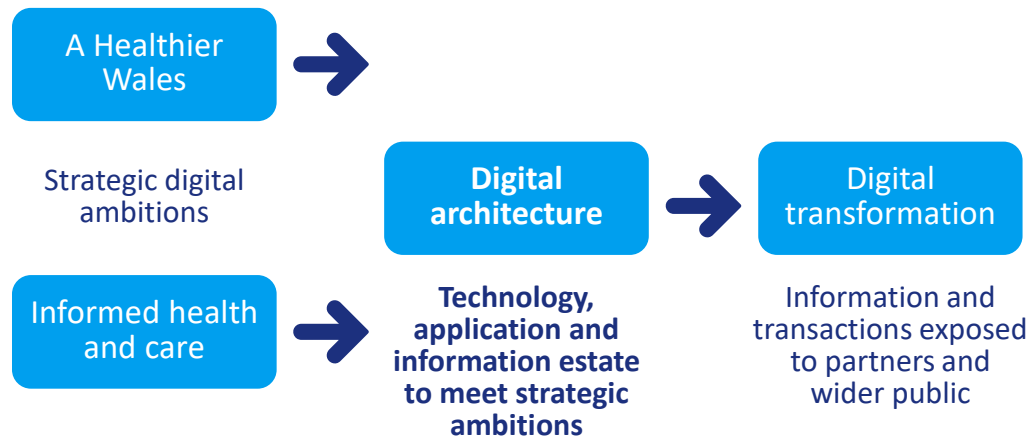
Context and approach

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Context – strategy to transformation

The digital ambition for Wales is clearly articulated through 'A Healthier Wales' and 'Informed Health and Care'.

That ambition is enabled by NHS Wales Digital architecture and delivered through new ways of working and service delivery through digital transformation.



NHS Wales' digital ambition

Ambition

Patient and service user focussed

Genuinely open

Aligns with once for Wales

Enables innovation

Reflects the "fast breeder" transformation approach in 'A Healthier Wales'

Agile and responsive

World class national resilience, reliability and performance

Once for Wales is about all parties involved in health and care in Wales working collaboratively to add value and deliver the strategy of a single electronic patient record, ensuring that information is entered once and is made available to all those who need it, at the time and place they need it.

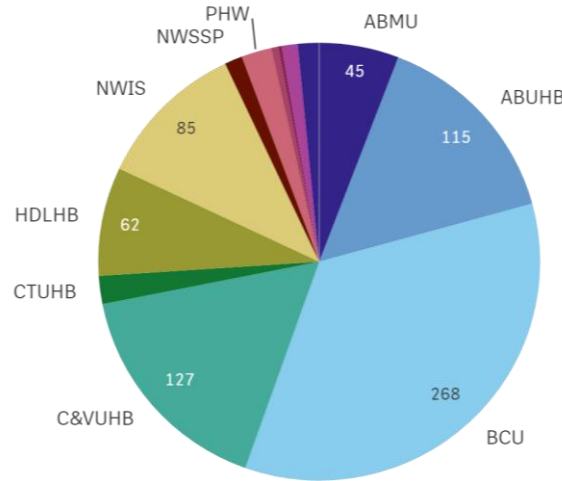
The complexity of the current digital landscape

When reviewing the architecture for NHS Wales it is important to gain a perspective of the entire landscape.

As can be seen from the chart view below, National Applications (provided by NWIS) comprise only 11% of all clinical applications identified in the NHS Wales landscape.

The national applications are significant in size and scope however it is important that all clinical systems can share data across Wales and that the architecture addresses that challenge.

Out of a total of 780 systems, 85 are nationally supported



...with 5 PASs, 3 LIMS, 2 PACS, at least 2 portals, 2 digital dictation solutions...

Current state assessment

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Qualitative – what you said

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Engagement feedback

Through engagement with stakeholders and boards, the following is a reflection on feedback on the current state of the Digital architecture:

Applications

Health Boards feel constrained in their ability to get the best application for the job. There are a number of examples where highly functional applications used locally have been replaced by national solutions that are seen as a step backwards.

There is concern that national applications sometimes over promise and under deliver. There is a reported reluctance to consider applications that would benefit patients that are already commodity in other geographies (an example would be a simple patient portal – for appointment booking, results, repeats prescriptions etc. and PROMS technology widely in use elsewhere). Barriers to taking advantage of these technologies are reported as being related to interfacing challenges to the national data repositories, and also Information Governance, consenting and GDPR concerns.

Some of the national applications are viewed as functionally rich but (locally) slow, “buggy” and with a need for improvement at the user interface level to meet the standards set by open market solutions.

Feedback from Health Boards is that the process to develop and enhance applications is far from agile. The need for a consensus approach nationally inevitably takes time, and a failure to meet recognised needs in specialist areas by both restricting alternative options and deprioritising them from national solutions has a real impact on patient services and their ability to innovate. Development at national level isn’t typically focussed on the things that would provide high national benefit.

Engagement feedback

Through engagement with stakeholders and boards, the following is a reflection on feedback on the current state of the Digital architecture:

General

Digital is seen as a blocker rather than an enabler – for service change it frequently becomes the critical path and impedes agile service change. There are many local pockets of innovative use of technology that are not being explored as having national capability – examples include early work with IBM Watson at Velindre, and a number of examples of co-working with the nation's universities. But there is a feeling that in general, the NHS in Wales has stagnated in digital terms and has lost its ability to innovate.

Data

A range of national and local data repositories and a lack of an ability to access that data easily (because it is largely unstructured), makes it almost impossible to unlock the data the NHS in Wales uses to provide benefit to patients, cohorts and the population of Wales as a whole. This is a particular frustration for clinicians.

Authentication

The lack of a national Single Sign On (SSO) capability and associated identification regimes is considered to be a significant issues to working in different contexts and locations across the system.

Channels*

Digital communication channels – Skype, e-mail, call centre, chat bots and instant messaging apps for clinical users – is under explored and under developed at all levels of the system in Wales. Mobile working is at a very early stage of development.

**Channels – Ways though which users, staff and citizens, access NHS Wales digital systems.*

Engagement feedback

Through engagement with stakeholders and boards, the following is a reflection on feedback on the current state of the Digital architecture:

Infrastructure

The ability to keep core software up to date and in line with patching regimes to maintain resilience and cyber security is a wide spread challenge (not just in Wales), however with a relatively large Windows Server 2003 estate and legacy versions of SQL Server underpinning many core clinical systems including the national ones (unsupported by Microsoft since 2015) and extensive use of Windows 7 (due to end extended support next year), this represents a significant threat to the system.

Specific concerns were raised around the desktop estate. The enterprise agreement for Office and applications expires at the end of June this year, with a move to Office 365, envisaged. There is a concern as to whether this switch is actually achievable, whether discount thresholds can be achieved, and whether there is a risk to parts of the estate being unlicensed and unsupported when the current agreement runs out.

Whilst there is a 2 year old policy for the use of Cloud technologies, there is no clear strategy as to what role Cloud technologies could play in the NHS Wales infrastructure vs on premise or locally hosted Cloud solutions.

There is concern that balance has to be struck to ensure that the core infrastructure remains resilient, secure and performant.

Whilst largely invisible, there is a fear within the NHSW technology community that investment here, given the pace of change associated with core technologies (networks etc), may be overlooked in funding decisions.

The volume of data transacted across Wales as a result of the increased use of electronic means, for example – images, will rapidly outstrip the levels of throughput, storage and performance which the core infrastructure in Wales can currently cope with.

Engagement feedback – suppliers

A small number of key suppliers were also consulted. The key messages on this page are a reflection on feedback on the current state of the Digital architecture and have raised a number of general concerns.

There is an absence of transparent/obvious strategy and direction, which makes it very difficult for suppliers to add value and support the NHS in Wales in planning for the future.

There is an opportunity to further improve knowledge of modern technology / technology direction and how to implement it. There appears to be some resistance to the adoption of new technology / newer technology approaches.

The NHS Wales IT organisations appear to be quite insular in their thinking. Better collaboration, awareness and joint strategy development and planning would allow them to utilise the technology and people available more fully.

There are strong deep vertical (local technical) skills in the system with a wealth of knowledge, but currently that is not being harnessed effectively. There also needs to be more done to innovate and motivate the teams available to the system.

Whilst all of these messages have to be viewed from the standpoint that they come from suppliers, they none the less resonate strongly with perspectives from within the health system.

Quantitative – what we found

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Assessing the architecture

The digital architecture to support and enable digital transformation is appraised on two key aspects:

Architectural characteristics

An assessment of the architecture features (quantitative and qualitative aspects) are needed to enable new ways of working and service design – e.g. is the architecture ‘Open’ to all members of the public, software developers and information analysts to support innovation and advancement on scale?

Architectural components

An assessment of each of the architecture components/building blocks (quantitative and qualitative aspects) that enables the functioning of all digital components e.g. secure access to the environment?

Architecture characteristics – method



Each characteristic is RAG rated. These ratings are a high level rating summarising the more detailed assessments provided in the appendix.

Method and approach

The architecture characteristics review is focused on the major attributes of the architecture to test its alignment to the vision for a digital service for NHS Wales.

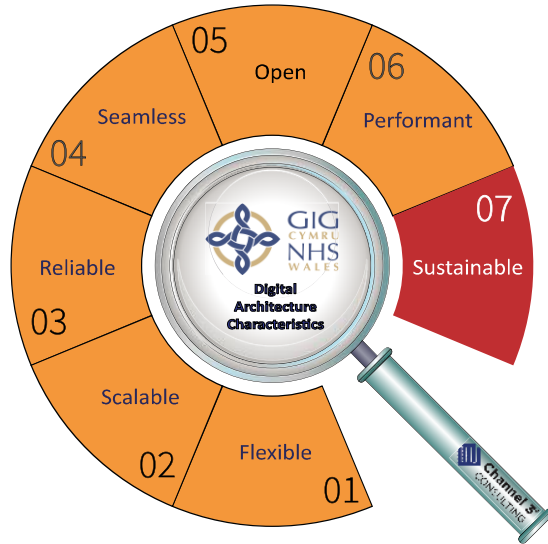
The review method is based on Channel 3 digital architecture assessment methodologies (aligned to digital architecture best practice and TOGAF (The Open Group Architecture Framework)).

We have reviewed the key characteristics of the NHS Wales Digital Architecture necessary for the architecture to meet the ambitions of Digital Care for NHS Wales. These characteristics have been developed as part of the review process.

The architecture is reviewed against expected/best practice characteristics that we would expect to find in a digital architecture of this scale and ambition.

An appendix of digital architecture characteristics assessed is provided in Appendix A.

Architecture characteristics – findings



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Key findings

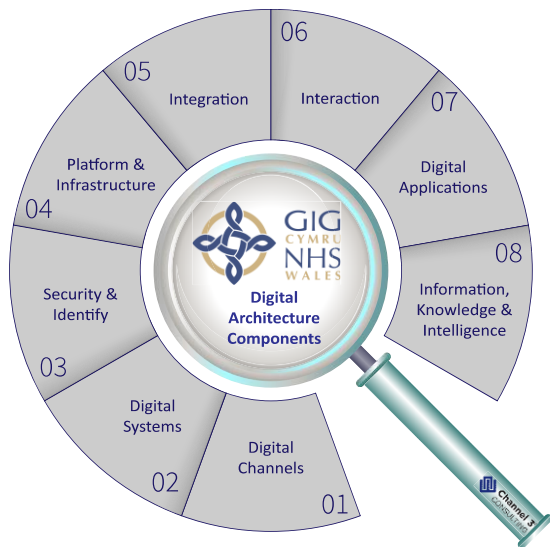
The assessment shows clear attributes of a robust architecture, however, these are aligned to the principle of establishing a single solution and component set across the NHS Wales care economy rather than an architecture aligned to the agreed definition of 'Once for Wales', i.e. facilitation, integration and standards.

Whilst awaiting the completion of the current architecture, the wider care system is stifled in many areas (e.g. mobile and agile working) and cannot transform to meet their service and population needs.

Specific aspects of the architecture can be adapted to the ambition (e.g. exposing interfaces to underlying applications, transactions, API's and information), but, many components of the architecture have not been designed to decouple interfaces, applications and information.

Details on assessment can be found in Appendix A.

Architecture components – method



Method and approach

The component review is focused on solutions and capabilities necessary to provide digital services for NHS Wales.

The review method is based on Channel 3 digital architecture assessment methodologies (aligned to digital architecture best practice).

We have reviewed the key components of the NHS Wales Digital Architecture (solutions) necessary for the architecture to met the ambitions of Digital Care for NHS Wales.

Each component area is sub divided into expected/best practice components that we would expect to find in a digital architecture.

An appendix of digital architecture components assessed is provided in Appendix B.

Each component is RAG rated. These ratings are a high level rating summarising the more detailed assessments provided in the appendix.

Architecture components – findings



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Key findings

The assessment shows clear development of architectural components (building blocks), however, typically designed/configured to support the delivery of a centralised solution and component set across NHS Wales rather than components required to support the agreed definition of 'Once for Wales', i.e. facilitation, integration and standards.

Developing these solutions and components against this centralised architecture has been a major undertaking and whilst good progress has been made, significant work remains with associated cost, time and effort.

There is inherent value in the components and solutions (e.g. Security and Identity), but, there is a significant and necessary undertaking required to re-configure/develop these components aligned to the strategic ambition, a move to centralised information, integration and standards.

The market and local health boards will ultimately bring solutions and components to meet their specific needs (aligned to a centralised digital architecture). In all cases, more consideration should be given to centralised/federated models and buy/build.

Details on assessment can be found in Appendix B.

Assessment conclusions

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Assessment conclusion

Assessment question

As a key element to the brief, Channel 3 have been asked to assess the existing NHS Wales architecture (national and local systems and services deployed across NHS Wales) to determine whether it is fit for purpose for delivering the ambitions set out in both 'Informed Health and Care – A digital health and care strategy for Wales' and 'A Healthier Wales' The Long-term Plan for Health and Social Care and is “future proofed” as far as possible.

Assessment conclusion

The assessment of architecture characteristics and supporting digital components highlights a reasonably well considered architecture that has evolved rather than followed a clear architectural strategy. This has been focused on the provision of centralised solutions and services rather than the facilitation of digital transformation (the ambition).

As many components have been developed for internal consumption (NHS applications, staff and organisations), the architecture is not easily able to support a digital ecosystem to quickly embrace rapid changes in technology, clinical care

or information analysis (e.g. public health/research) and this is seen as a blocker to transformation of front line care, care system configuration and digital innovation.

Scope and focus of national and regional/ local services needs to be re-visited to ensure optimal pace and innovation with all parties providing best capability to meet the challenge, aligned to the ambition.

In its current form, it is the conclusion of this assessment that the Digital ambitions will not be achieved in a reasonable timeframe.

Assessment conclusion

Phases 2 & 3

This Phase 1 evaluated the current architecture. The future phases now look at a proposed future state and recommended steps to make effective progress to support the digital vision.

Remaining questions

As a key element to the brief, Channel 3 have been asked to make recommendations on how the NHS Wales architecture could be improved to support delivery at pace of the ambitions set out in 'Informed Health and Care' and the digital vision outlined in 'A Healthier Wales'. Key aspects of this are:

- Achievement of the electronic health record.
- Delivery of the roadmaps under each of the four workstreams of informed health and care.
- Delivery of the commitments within the informatics statement of intent.

- Ambition of an open architecture.
- Ensuring NHS Wales is data driven.

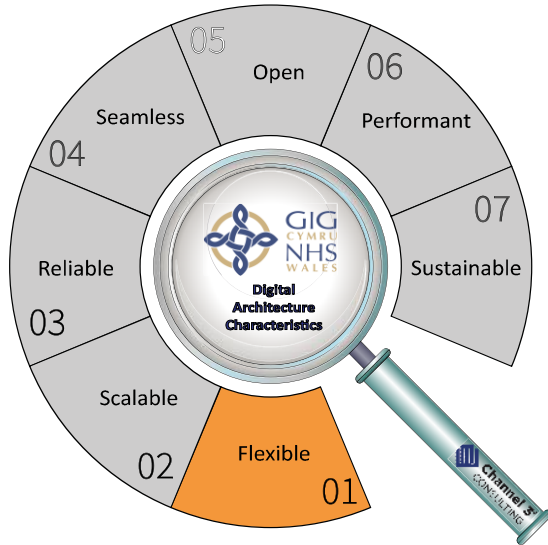
As a key element to the brief, Channel 3 have been asked to assess the health and care informatics market and recommend how recent developments could be considered in developing the NHS Wales architecture.



Appendix A – Characteristics assessment

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Architecture characteristics – flexible



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Assessment on the current architecture as to flexibility to support changes in models of care and the structures that support them, multiple channels for patients and staff and accommodate new technologies with ease.

Assessment conclusion

The architecture is not yet founded on the definition of “Once for Wales”, seeking to establish a single solution and product set across the care economy rather than facilitating innovation, integration and information.

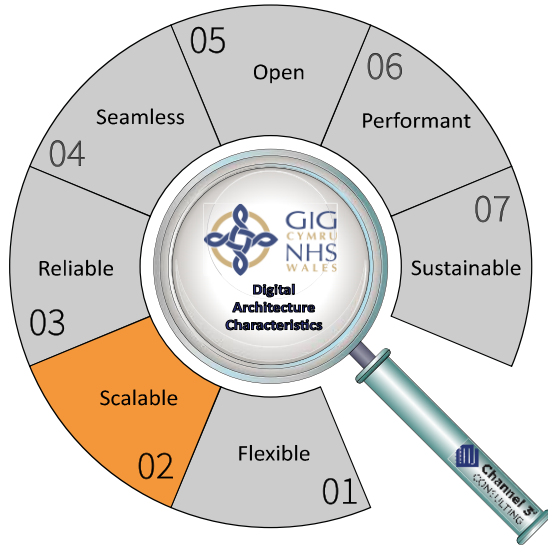
Assessment

The architecture does yet not easily accommodate organisational and system reconfigurations or avoid re-engineering to cope with inevitable adjustments in models of care (e.g. transition from acute to primary care, need for mobile and agile systems, specialist systems, etc.).

The architecture does not easily support health-board/supplier/citizen/patient solutions, innovations or interactions (e.g. new specialist clinical systems, integration of patient monitoring devices, internet of things, etc.).

Whilst there has been good work in developing solutions and components, these are typically not yet aligned to the strategic ambition although with some work that alignment could be achieved.

Architecture characteristics – scalable



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Assessment on the current architecture as to scalability to support local, regional and national solutions and innovations, scale from local to national seamlessly, and cope with the diversity and complexity of the Welsh Health and Social Care system.

Assessment conclusion

The architecture has components of scale designed in areas, but, there are clear point of performance and demand challenge/issues. The demands of data and processing as clinical and technology innovation coincide will significantly stretch existing scale capabilities (for example in terms of network throughput and storage as the demands of service based approaches

such as Office 365, image sizes in pathology, genomics and many other examples make escalating demands on core and local infrastructure).

Assessment

The architecture will not scale to meet the demands of a truly digital Welsh Health and Social Care system that aims to allow all citizens to manage their own health through digital channels.

The architecture will not be able to scale to meet the emerging demands of data (e.g. genomics) and transaction challenges posed by the “Internet of Things”, where devices (portable; wearable; implanted) will be integrated into the digital care economy.

Architecture characteristics – reliable



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Assessment on the current architecture as to reliability to provide the appropriate levels of day to day resilience possible for the public, and for those working in the Health and Social Care system.

Assessment conclusion

Specific components have reliable designs in isolation, but, over all performance and outages have shown issues in resilience across several digital components.

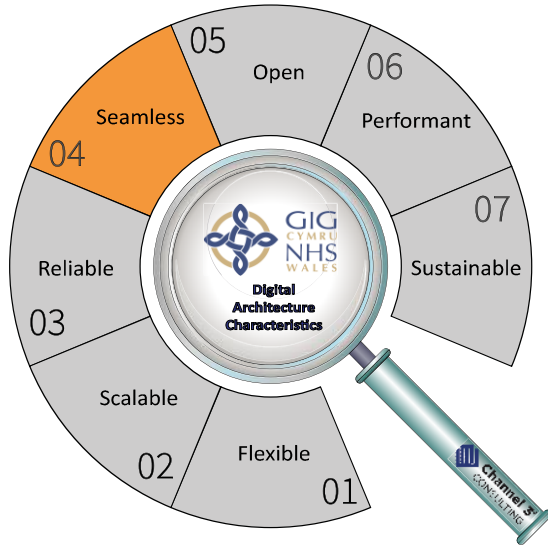
Assessment

End to end resilience needs to be designed in all components of the digital architecture from inception. Components need to be natively modular and where possible, containerised with workloads being distributed and orchestrated.

The architecture needs to be able to cope with multiple point failures without impact on service availability or end user experience. Otherwise the risk of reputational damage to NHS Wales is substantial.

As the digital landscape across NHS Wales matures and becomes the norm, the loss of service, even a short interruption, will have an increasingly significant impact on patient care.

Architecture characteristics – seamless



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Assessment on the current architecture as to the extent to which it is seamless facilitating interworking within Wales and with other health economies such as those in England, other parts of Government, and potentially internationally to enhance the supply options for core clinical and non-clinical services.

Assessment conclusion

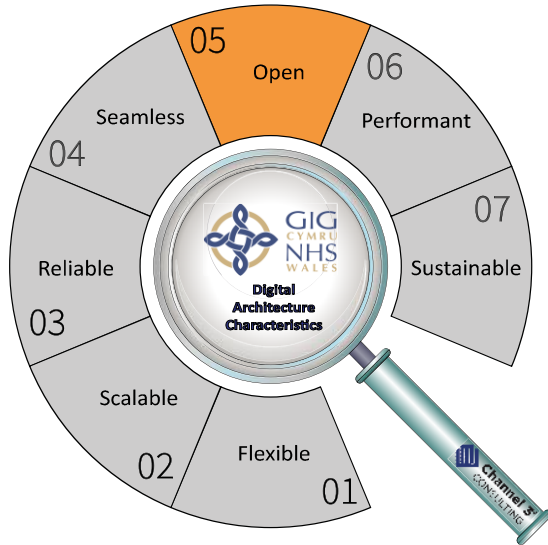
The architecture is aligned to the principle of developing centralised components and solutions for NHS Wales rather than facilitating seamless integration and transactional co-ordination across multiple systems. This presents barriers to seamless integrated working and processing transactions and information across national and local boundaries.

Assessment

The challenges will require the architecture to work across the system and other health economies as well as parts of Government and wider.

Increasingly the demand for interoperability across traditional boundaries to support the digital landscape of clinical and non-clinical services will drive the requirement for seamless integration of workflows and processes.

Architecture characteristics – open



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Assessment on the current architecture as to openness with the supporting services available to developers and innovators, ensuring that innovation can proceed at pace, choices for solutions required by the Health and Social Care system in Wales are maximised, but that they are delivered with appropriate controls to ensure the safety and confidence of the public can be maintained.

Assessment conclusion

Whilst many components of the architecture are based on open standards (e.g. XDS-I for image sharing), the architecture is not genuinely open, actually providing open services and interfaces (APIs) to developers and innovators whether internal or external with visible results for front line care.

Assessment

A successful Open Architecture would strike the right balance between standards and controls, ensuring innovation can proceed at pace, choices for solutions required by the Health and Social Care system in Wales are maximised, while solutions are delivered with appropriate controls and accreditations to ensure safety and the confidence of the public can be maintained

Standard and controls should be published and open to developers and innovators and they should be supported and enabled to make use of the digital architecture to support their aims.

Architecture characteristics – performant



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Assessment on the current architecture as to its ability to provide the responsiveness and performance in line with that we expect of consumer products – irrespective of the loading that is placed on it by the system as we become more and more digitally enabled.

Assessment conclusion

Whilst many components have been designed to perform for the needs of a centralised set of applications and components, the service is not inherently designed to perform at digital/public scale in many aspects.

Point performance issues lead to a need for wider architectural principles on volumetric design, scale and performance.

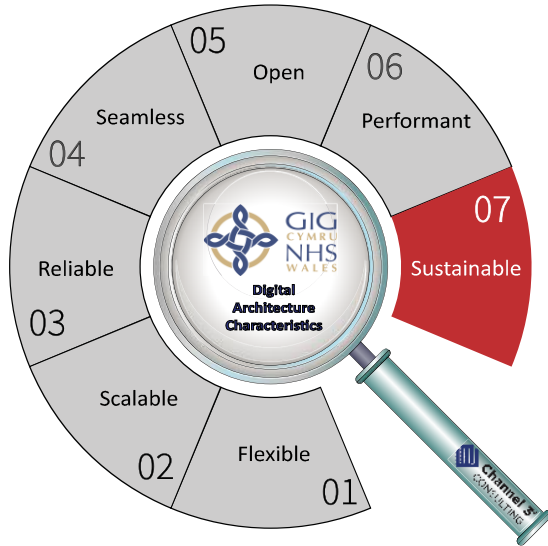
Assessment

The architecture has not been designed for the step change in demand that will inevitably come with the advance of digital ways of working and technology. A fundamentally different approach is needed to the infrastructure architectural approach to ensure capacity and thus performance.

The architecture needs to include elements that proactively monitor and react to changes in demand in an automated, programmable fashion.

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Architecture characteristics – sustainable



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Assessment on the current architecture as to its ability to take advantage of the latest developments in technology without the need to redesign the architecture to accommodate this.

Assessment conclusion

The architecture has evolved over time, seeking to establish a single solution and component set across the care economy, the demands for digital health, innovation from clinical care and technology and changes to care service delivery and configuration will place unsustainable demands on the architecture in terms of required systems, functionality, cost and capability.

Assessment

Even today, the pipeline of proposed changes to applications like the Welsh Clinical Portal pose significant bandwidth issues and the demand pipeline for new projects and initiatives is ever growing.

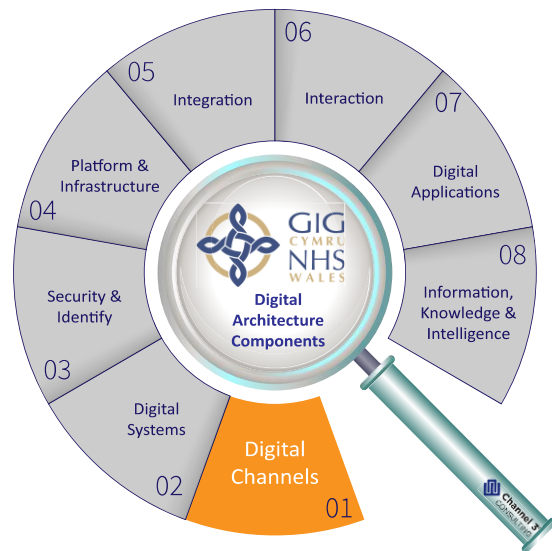
Changes in provision of commodity computing (e.g. cloud) are significantly changing the cost base of commodity services, and although there are challenges that needs to be addressed, the benefits of new deployment models should be leveraged.



Appendix B – Component assessment

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Components – digital channels



Architecture components required to support our interaction with customers, citizens and patients through digital media. The components required for a front door to Digital NHS Wales.

● Web pages and forms

In use for several use cases; established

● Mobile capability

No live capability; some apps in beta deployment

● Product/service catalogue

Limited capability evidenced

● Web chat/video

Some internal capability; skype, no external

● Search/guidance

Capability exists for single patient record

● Content management

Pending assessment

● Preferences

Some limited capability in some applications

● Social networks/groups

No capability to integrate or provide social networking

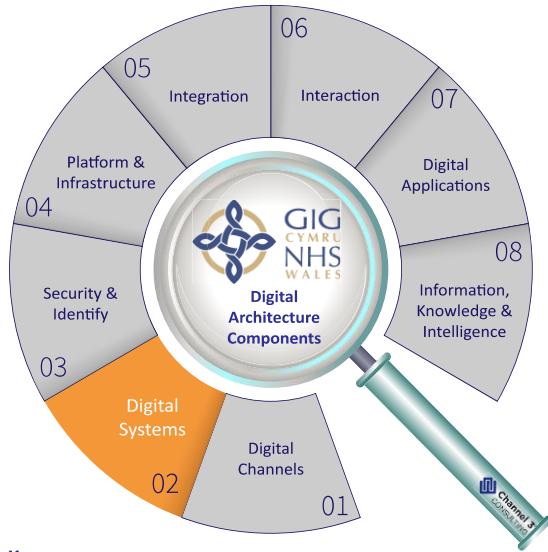
● SMS/texting

Some limited capability in some applications

● Style/presentation

Some capability, but, limited. accessibility needs

Components – digital systems



Key

Capable of supporting ambition:

Now

In <2 years

In <5 years

Architectural components that support digital applications/digital customer interactions with our services. Enable stateless operations across digital transactions and workflow; monitor channel to system throughput.

● Multi-channel analytics

No capability in place or in use

● Database processing

Some capability, not at big data/digital scale

● Device connectivity

Limited capability for IoT or digital device connectivity

● State management

Application specific; not at digital scale

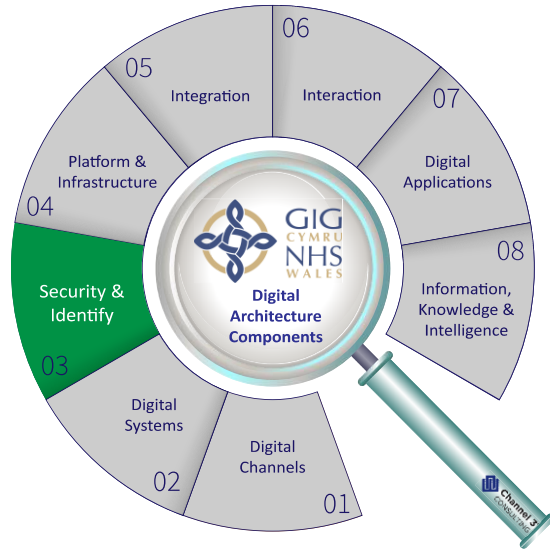
● Document management

Capability exists; not at digital scale

● Synchronisation

No offline working capability/synchronisation

Components – security and identity



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Components that support the identification of users (citizens, patients and staff), protect their information and ensure appropriate access.

● User directory

Capability exists and could be extended to digital scale

● Single sign-on

No capability in place currently

● Personalisation

Capability exists in some applications

● Certificate management

Capability exists and could be extended to digital scale

● Identity and access

Capability exists and could be extended to digital scale

● Authentication

Capability exists and could be extended to digital scale

● Logging

Capability exists and could be extended to digital scale

● Access controls

Capability exists and could be extended to digital scale

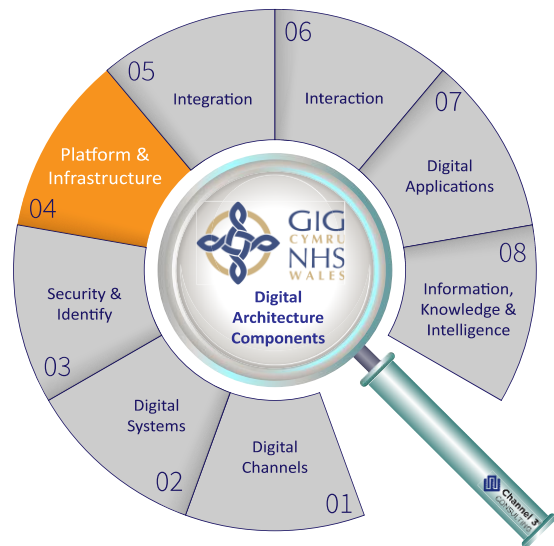
● Monitoring/alerting

Capability exists with constraints

● Consent/authority

Some capability but require development

Components – platform and infrastructure



Whilst not the purpose of this review to appraise the technology architecture, specific focus is required on key elements to support digital enablement of the platform components.

● Scalable firewalls

Capability exists and could be extended to digital scale

● Scalable load balancers

Capability exists and could be extended to digital scale

● Scalable traffic mgt.

Limited capability evidenced

● Scalable web servers

Capability exists and could be extended to digital scale

● Scalable application servers

Capability exists; not at digital scale

● Scalable data storage

Pending assessment

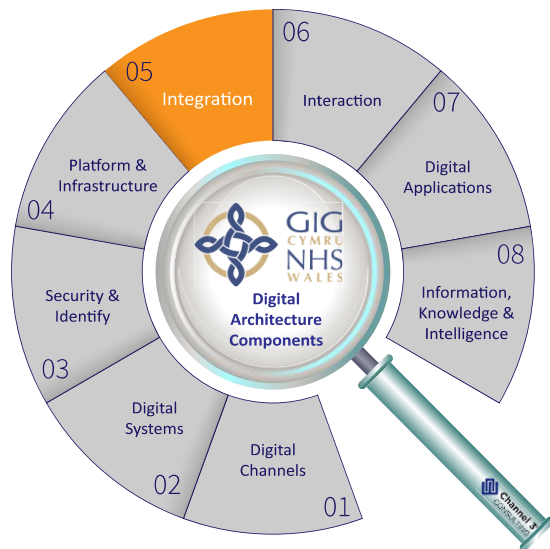
● Data security/encryption

Capability exists and could be extended to digital scale

● Usage/performance

Limited capability in place

Components – integration



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Architectural components that support the integration and interoperability of applications, their co-ordination, workflow and monitoring.

● Service orchestration

Capability exists, some limitations exist

● Application integration

Capability exists and could be extended to digital scale

● Security

Capability exists, limited exposure to digital services

● Integration configuration

Capability exists, some limitations exist

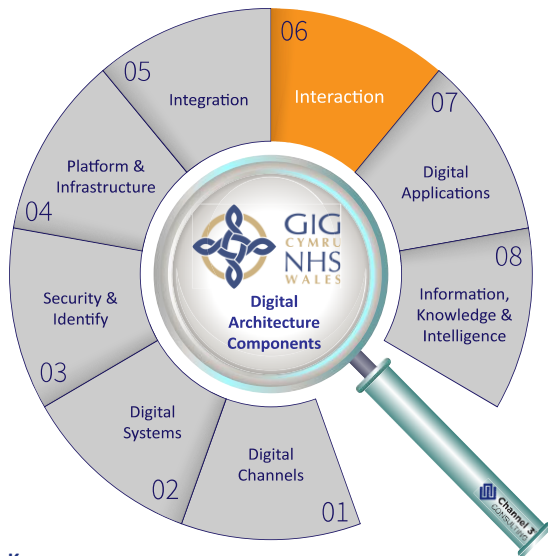
● Data management

Capability exists, some limitations exist

● Monitoring management

Capability exists, some limitations exist

Components – interaction



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Architectural components that support interaction with digital customers, manage requests, state, case requests and co-ordination, communication and engagement.

● **Business process management**

No capability exists

● **Case management**

Capability exists; not at digital scale

● **Service management**

Capability exists; not at digital scale

● **Resource management**

Pending assessment

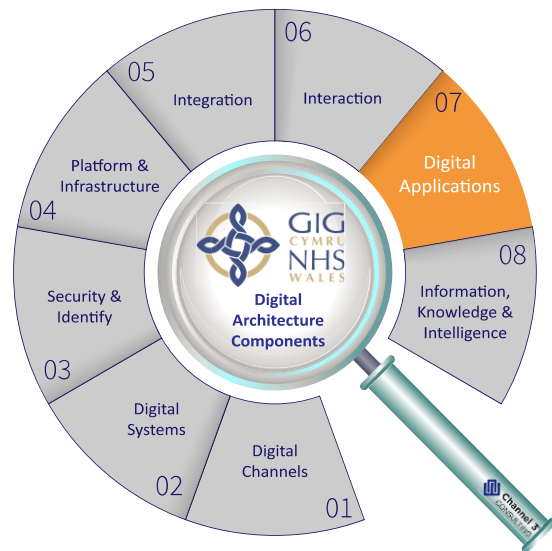
● **Product management**

Capability exists and could be extended to digital scale

● **Communications/engagement**

Some capability exists

Components – digital applications



Whilst not the purpose of this review to appraise the applications or application architecture, specific focus is required on key application components that will be required to support digital enablement of the platform components.

● Identification

Capability established; not adopted holistically

● Demographics

Capability established; not adopted holistically

● Portals

Portal, significant capability, insufficient traction with users

● eForms

Capability established; not at digital scale

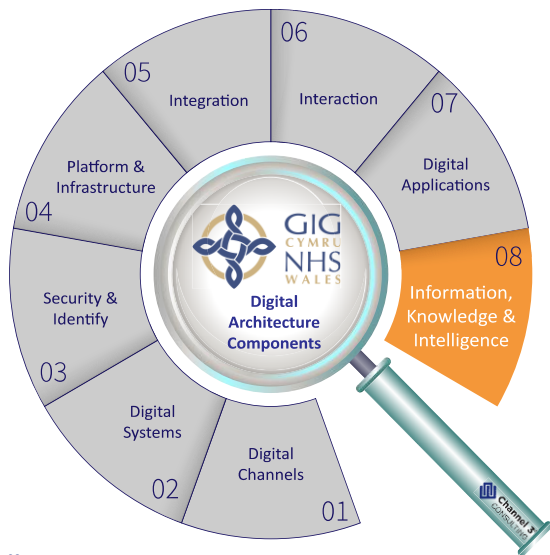
● Single patient record

Some capability; not at digital scale

● Administration

Some capability; not at digital scale

Components – information, knowledge/intelligence



Key

Capable of supporting ambition:

Now

In <2 years

In >2 years

Whilst not the purpose of this review to appraise the information architecture, key components that support digital applications, services and orchestration through the collection, development and provision of reference Information, knowledge and intelligence are assessed.

● Transitory storage

Capability exists and could be extended to digital scale

● Persistent storage

Capability exists and could be extended to digital scale

● Audit/archive

Capability exists and could be extended to digital scale

● Reporting service

Capability established; not at digital scale

● Taxonomy/classification

Capability exists and could be extended to digital scale

● Analytics/scenario

Some capability; plans in place to develop

● Artificial intelligence

No capability; plans in place to develop

● Big data/research

No capability; plans in place to develop

Architectural component conclusions

Implications of the findings and alignment to next steps

Through the assessment, it is evident that there are significant digital capabilities and architectural components established, in development or planned across the NHS Wales digital landscape. The findings (and associated RAG) demonstrate diverse capabilities, but without delivering the expected benefits to support digital transformation.

Whilst most decisions and investments are sound (in their own right) and most digital capabilities are robust in nature, the pipeline and demand for digital components lacks a clear over-arching programme of digital works that will optimise investment, returns, outcomes and pace.

The second phase of this project (concluding March 2019) will result in a clear definition of a recommended programme of works that will seek to optimise the digital architecture (components and characteristics) in the most efficient and expeditious manner.

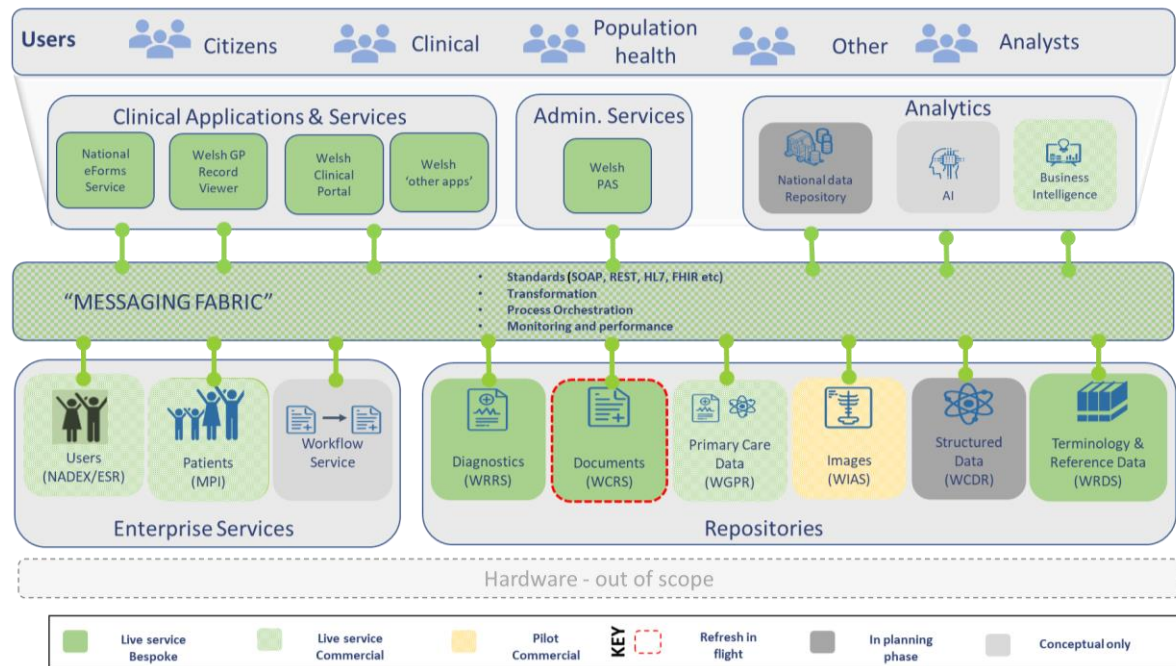
Few impending risks were identified in the core digital components (albeit, reliant on underpinning technologies). Equally, architectural components have not typically been designed for internet/digital/mobile scale, e.g. growth predictions in healthcare data (scale), the move from acute centric care to care in the community/home (mobile) and the processing challenges of Internet of Things (performance) are a step change (cost, performance) from architectural capabilities developed primarily for internal consumption.



Appendix C – Wales current architecture

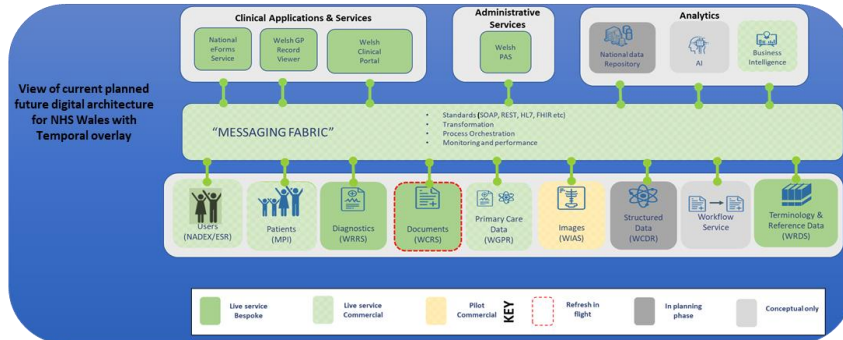
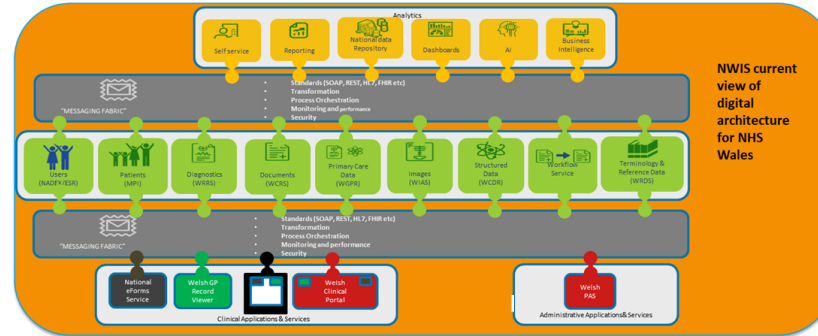
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High level NHS Wales digital architecture view



Digital architecture temporal view

The Current NWIS architecture view reflects an aspirational position.





Appendix D – Architectural layers

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Application architecture – business logic layer

High level example application architecture

Application user interface
presentation layer

Business logic layer

Messaging fabric data access layer

Repositories data layer

In this example of a high level application architecture there are several layers that are dedicated to performing discrete functions. The advantage of such a model is that one layer, e.g. the Presentation layer, could be replaced or modified without the other layers being impacted. This leads to a much more flexible architecture that allows changes to be made to a layer in isolation, increasing efficiency and simplicity.

In this example model, to replace the Presentation layer the Business Logic must be extracted and relocated first. As the Business Logic could exist across all other layers, they are all impacted and the process becomes much more burdensome, complex and expensive.

NHS Wales application architecture

Application user interface
presentation layer

Messaging fabric data access layer

Repositories data layer

Business logic

Many of the current NHS Wales applications have organically evolved over time rather than being designed and architected in line with best practice from inception. This is not uncommon for software development organisations to face this issue as they transition from small start-up to SME scale. Although the layers all exist the boundaries have not always been maintained.



Appendix E – Stakeholders, workshops and meetings

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Wider stakeholder engagement



- One to one interviews
- Key groups
- Deep dives – 2 days each



- Interviews / group discussions with over **75** individual stakeholders across Health Boards not involved in Deep Dives and **6** key suppliers



- **3** Deep Dives
- Aneurin Bevan Health Board, Cwm Taf Health Board, and Public Health Wales Trust
- Over **30** stakeholders involved.



Other key meetings including:

- Assistant Medical Directors
- Primary Care

Stakeholders consulted - interviews

Name	Role
Welsh Government	
Peter Jones	Deputy Director Digital Health and Care
Jeremy Evas	Welsh Language Policy
Karin Phillips	Deputy Director, Primary Care
Andrew Evans	Chief Pharmacist
NWIS	
Andrew Griffiths	Chief Information Officer
Gary Bullock	Director of Applications Development And Support
Helen Thomas	Director of Information
Carwyn Jones	Director of Information and Communication Technology
Rhidian Hurle	Medical Director
Anne-Marie Cunningham	GP and Primary Care Clinical Director at Aneurin Bevan University Health Board
Martin Dickinson	Programme Director Primary Care
Paul Howells	Innovation Manager

Name	Role
BCU HB	
Evan Moore	Medical Director
Dylan Williams	CIO
Markus Hesseling	CCIO
C&V UHB	
David Thomas	Director of Digital And Health Intelligence
Sharon Hopkins	Director of Transformation, Deputy CEO
Nigel Lewis	Associate Director of Informatics ICT
Allan Wardaugh	AMD Informatics
Phil Clee	IM&T
Mark Wardle	Chair Wales Technical Standards Board

Stakeholders consulted - interviews

Name	Role
Powys HB	
Ian Ruse	IT
Hywel Dda HB	
Anthony Tracey	Associate Director of Informatics
Karen Miles	Director of Planning
Sarah Brain	Informatics Business Manager
Gareth Collier	CCIO
Paul Solloway	Head Of ICT
John Hackett	Infrastructure Manager
ABM UHB	
Matt John	CIO
James Chess	CCIO

Name	Role
Cwm Taf HB	
Richard Cahn	Associate Director of Informatics, Technology
John Palmer	COO
Steve Webster	Director of Finance
Rob Bleasdale	CCIO
Lesley Jones	Head of Clinical Training
Paul Chilcot	ICT
Karen Winder	ICT
Liam Morrissey	ICT
Liam Diamond	ICT
Valentin Anismov	ICT
Chris Ball	ICT

Stakeholders consulted – interviews and groups

Name	Role
Velindre University NHS Trust	
Stuart Morris	Associate Director of Informatics
Mark Osland	Director of Finance
Jake Tanguay	CCIO
Daniel Rainbird	Technical Services Manager Welsh Blood Service
Jonathan Jones	Technical Services Manager, Velindre Cancer Centre
David Mason-Hawes	Head of Business Systems, Welsh Blood Service
Ann Marie Stockdale,	Head of IM&T, Velindre Cancer Centre
WAST	
Chris Turley	Director of Finance
Claire Bevan	Director of Quality: Lead Nurse Director for Informatics
Aled Williams	Head of ICT

Name	Role
Other Groups	
National Informatics Management Board	Various
Primary Care Healthboard	Asst. Medical Directors All HBs
Primary Care Gvt.	Karin Philips Andrew Havers Colette Bridgman David O'sullivan

Stakeholders consulted – deep dives

Name	Role
Cwm Taf HB	
Richard Cahn	Associate Director of Informatics
John Palmer	COO
Steve Webster	Director of Finance
Rob Bleasdale	CCIO
Lesley Jones	Head of Clinical Training
Chris Ball	ICT
Paul Chilcot	ICT
Karen Winder	ICT
Liam Morrissey	ICT
Liam Diamond	ICT
Valentin Anismov	ICT

Name	Role
AB UHB	
Mike Ogonovsky	Associate Director of Informatics
Helen Dinham	Lead Nurse Clinical Informatics
Robin Rice	CCIO
Ann Wrightson	Head of Information Architecture
Andy Warburton	Software Dev & Enterprise Design Architect
Helen Hughes-Tait	Head of Clinical Futures (ICT)
Cynthia Anderson	ICT
Lee Price	ICT
Matthew Mahoney	ICT
Sara Khali-Moore	ICT
John Frankish	ICT
Richard Howells	ICT

Stakeholders consulted – deep dives

Name	Role
PHWT	
Phil Walters	Head of IM&T, Informatics
Simon Thomas	IT Operations' Lead, Informatics
Helen Clayton	Lead Informatics And Data Services Manager, Informatics
Kate Mckenzie	1000 Lives-senior Improvement Measurement Manager,
Stuart Silcox	Head Of Business Planning (1000 Lives)
Ciarán Humphreys	Director Of Health Intelligence
Sharon Hillier	Director Of Screening Division
Michael Clayton	Deputy IT Operations Manager

Stakeholders consulted – Advisory Group

Name	Role
NHS Wales Digital Architecture Review Advisory Group	
Ifan Evans	Director – Technology & Transformation, Health & Social Services Group, Welsh Government
Caren Fullerton	Chief Digital Officer, Welsh Government
Peter Jones	Deputy Director, Digital Health & Care, Welsh Government
Eric Gregory	Independent advisor
Jan Jones	Deputy Director Strategy & Architecture, Digital Services and Technology Office for National Statistics
Richard Cahn	ADI representative, Assistant Director of Informatics, Cwm Taf UHB
Helen Thomas	Director of Information, NWIS
Dr Mark Wardle	Chair of Welsh Technical Standards Board
Carol Shillabeer	Chief Executive representative, Chief Executive, Powys HB
Daniel Phillips	Director of Informatics Planning Development
Paul Cunningham	Welsh Audit Office (Observer)



Appendix F – Materials reviewed

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Materials reviewed

- Documents provided via NHS Wales Informatics architecture review share
- A healthier Wales
- Informed health and care
- Doc 3 – Delivering informed health and care
- Definition of Once for Wales agreed by NIMB Sept 2017
- Once for Wales Task and Finish group NIMB paper 20180215
- Informatics – Statement of intent
- NHS Wales guidance_ Cloud services Final v1.0
- Welsh technical standards board (WTSB) TOR – Final v1.0
- 20110722 WISB Final TOR FINAL
- Overview of the Technology Enabled Care Programme
- ToR Ecosystem Board 1.3
- Welsh Government – Digital service Standard – July 2017
- GDS Digital Design Standards
- WTSB Statement of Intent 2018-12-28
- NDR documents for National Architecture review
- Connecting systems applications to the mandated services functions – combined responses MASTER
- 181023-welsh-language-technology-action-plan
- OSM2016 05 10 with WTSB
- National architecture introduction 2018 v1.0
- Single record overview
- NWIS datacentre network report 1.0
- National infrastructure strategy for NHS Wales 2009 v1_6
- National Application strategy 2010
- National Architecture standards v3-0
- PLN-NWIS Annual Corporate Plan 2018-19 V5
- PLN-NWIS IMTP 3 year plan 2018-2021 v3



Appendix G – Self assessed risk assessment

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Operational relative risk – self assessments

Example service risk assessments against standard Channel 3 assessment framework conducted by NWIS in order to provide a more detailed technical backdrop as part of the current state assessment.

The example shown uses comparative RAG rating showing the relative risk services relative to each other.

Critical System	Risk by Critical System		Critical System	Risk by Critical System
Welsh Care Records Service (WCRS)			Welsh Laboratory Information Management System (WLIMS)	
National Intelligent Integrated Audit System (NIIAS)			Hospital Pharmacy	
Active Directory (NADEX)			Master Patient Index (MPI)	
Welsh GP Record (WGPR)			Integration Services - Fiorano	
Welsh Demographics Service (WDS)			Canisc	
Welsh Results Reporting Service (WRRS)			Welsh Clinical Portal (WCP)	
Welsh Reference Data Service (WRDS)			Welsh Patient Administration System (WPAS)	
Welsh Clinical Communications Gateway (WCCG)			GP Links/Data Transfer Service	

Operational relative risk – self assessments

Example service risk assessments against standard Channel 3 assessment framework conducted by NWIS in order to provide a more detailed technical backdrop as part of the current state assessment.

The example shown is for the WCP and shows the highest risk areas for that service, when considered in isolation.

Application System Purpose	Welsh Clinical Portal (WCP) Applications The WCP is a secure webpage uniting key patient information from numerous computer systems and databases used in NHS Wales. It provides an immediate view of important data that is required to support vital clinical decisions. Supplier: NWIS # of Users: Peak of 3 homepage calls by 3 clinical user per second across Wales.				
Business Continuity	0%				
Emergency Contact No	Named Lead No	Documented Plan No	Comms Plan No	Operational Recovery No	Tested No
Business Impact Assessment - an incident would cause:					
System Outage Impacts	Loss of clinical service Yes	Patients placed at harm	Reputational damage Potentially	Loss of Revenue No	Exposure to financial penalties No
Risk to Service	Likelihood	Implications	Risk to Service	Likelihood	Implications
Data Backup		Loss of Significant Data (Single)	Capacity Planning		Loss of IT Service (Short Term)
Data Restore		Loss of Significant Data (Single)	Performance Management		Impaired Performance
Data Replication		Loss of Some Data (Single System)	Infrastructure Monitoring		Loss of IT Service (Short Term)
High Availability		Loss of IT Service (Short Term)	Application Monitoring		Loss of IT Service (Short Term)
Fallover		Loss of IT Service (Short Term)	Service Readiness		Loss of IT Service (Short Term)
Disaster Recovery		Loss of IT Service (Long Term)	Information Lifecycle		Loss of Some Data (Single System)
Security Maintenance		Security Breach	Supporting Technology		Loss of IT Service (Short Term)
Secure Hosting		Security Breach	Improvement		Loss of IT Service (Short Term)
Access Controls		Security Breach	Roadmap		Loss of IT Service (Short Term)
Alerts and Audit		Security Breach	Maintenance		Loss of IT Service (Short Term)

Note: Channel 3 would not normally undertake these reviews as a self assessment and they therefore do not represent our final opinion on absolute risk. There is a risk that the results may be optimistic.



Digital Architecture Review

Annex B — Future State Assessment

March 2019 FINAL



Future state assessment

Table of contents

Introduction

Executive summary

Core elements of a successful digital architecture

Key digital architecture domains

Detailed changes by target architectural building block

Summary future state

Appendices

2

Limitations of our works

This assessment is based on information provided by the Welsh Government and NHS Wales and associated stakeholders and was supported by further clarifications and confirmations.

Channel 3 Consulting have not undertaken a comprehensive audit nor have Channel 3 subjected the information upon which we have relied to verify assessments. Accordingly, Channel 3 assume no responsibility and make no representations with respect to the accuracy or completeness of the information in the report.

Channel 3 cannot guarantee that we have had sight of all relevant documentation or information that may be in existence and

as such, our assessment is based on the information Channel 3 have been provided. Any documentation or information brought to our attention subsequent to the date of the assessment may require us to adjust our assessment accordingly. Channel 3 also note that, given the sample nature of some of the testing which we have conducted, we cannot guarantee that we have identified all information that may be relevant.

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Introduction

4

Background

The Welsh Government has commissioned a review of the NHS Wales digital architecture, recognising the ambition for digital transformation across the Welsh Health and Social Care System at pace. NHS Wales Informatics Service (NWIS) has, on behalf of the Welsh Government engaged Channel 3 Consulting to undertake this review of the NHS Wales Digital Architecture.

The focus of this review is to assess the extent to which the current Digital Architecture of NHS Wales is ready to meet the ambition set out in A Healthier Wales and whether it is scalable to support digital transformation across Wales.

To achieve this, the review consists of three core phases:

01

Current state assessment

Review the extent to which the current digital architecture is fit for purpose for delivering the Welsh ambition.

02

Future state assessment

Provide a vision for the NHS Wales Digital Architecture that would address the longer term aims of the NHS Wales, that builds on the current state.

03

Improvement options

Provide a set of shorter-term options to improve the current NHS Wales Digital Architecture that would provide a stepping stone towards the future vision and/or address immediate gaps or risks in the current state.

This document summarises the second of these phases. It is assumed that readers are familiar with the Current State Assessment which provides essential context.

Approach to future state

The Current State Assessment of the NHS Wales Digital Architecture examined the readiness of today's digital architecture and its readiness to support the delivery of the ambition for Health and Social Care in Wales as described in "A Healthier Wales" (2018).

It is acknowledged that Wales is in a relatively strong starting position due to the efforts invested in the current architecture, with many components in place and some elements ready to support the future state.

The findings of the Current State Assessment are summarised in the following pages. The approach to defining the NHS Wales Future State Digital Architecture builds on the Current State to provide a blueprint that can be delivered at national scale by:

- Translating the components described above in the Architecture Reference Model, developed during the Current State Assessment, into essential Architectural Building Blocks.
- Identifying the core building blocks for work that would most effectively enable the ambition to be achieved.
- Describing in headline terms, the changes to capability recommended.
- Summarising a realistic end state, stepping stones towards that, and demonstrating the extent to which it will enable the characteristics required by the ambition for Health and Social Care in Wales, and development beyond that.

Executive summary

7

The context for the future Digital Architecture

A Healthier Wales (2018), sets out the Welsh Government's ambition to bring health and care services together, so that they are designed and delivered around the needs and preferences of individuals, cohorts of patients or the population as a whole. This enables a much greater emphasis on keeping people healthy and well and adopting a seamless whole system approach to health and social care change. It unlocks the potential to provide a shared platform for safe and effective joint working between different organisations, and with citizens directly.

Digital is a key enabler of transformation. There are examples of digital systems sharing information across and between primary care, secondary care and social care in Wales, however, more needs to be done to support the transformation of the health and care system. Specifically, A Healthier Wales requires the Health and Social Care System in Wales to:

- “Accelerate progress towards a fully integrated national digital architecture, and create an online digital platform for citizens, alongside other nationally mandated services.”
- “Establish a national data resource which allows large scale information to be shared securely and appropriately for care to be better targeted at individual, cohort or population level.”
- “Develop an “open platform” approach to digital innovation, through publishing national standards for how software and technologies work together, and how external partners can work with the national digital platform and national data resource.”
- “Significantly increase investment in digital infrastructure, technologies and workforce capacity, supported by stronger national digital leadership and delivery arrangements.”

Why an open architecture is the right choice

An open architecture provides the strategic context in which IT systems can respond to the constantly changing needs of the organisation and across a complex healthcare system. Many of the foundations are already laid for this in the NHS in Wales and a lot of investment has been made. The key to success will be to capitalise on that ground work.

An open architecture carefully delineates the key components, keeping the data and applications separate and linking them with an interfacing layer centered around a common index that ensures a patients' data, no matter where it is collected. It links

back to the right patient, and allows focus on individual patients, cohorts of patients or the population of Wales as a whole.

This separation ensures that the data can be stored once, and reused when and wherever it is needed. This prevents supplier dependencies and also avoids bottlenecks developing with one supplier.

Applications can be replaced more easily, and with less interruption to the front line operations. Multiple applications can share the same data and contribute to the data without disadvantaging other systems or process.

Innovation at pace can be delivered locally, with local resources or commercial partners, within a clear and secure framework.

Successful innovations can be scaled rapidly to a national footprint due to the common architecture.

Creating applications that cross organisational boundaries and flex with the changing needs of the service becomes a reality.

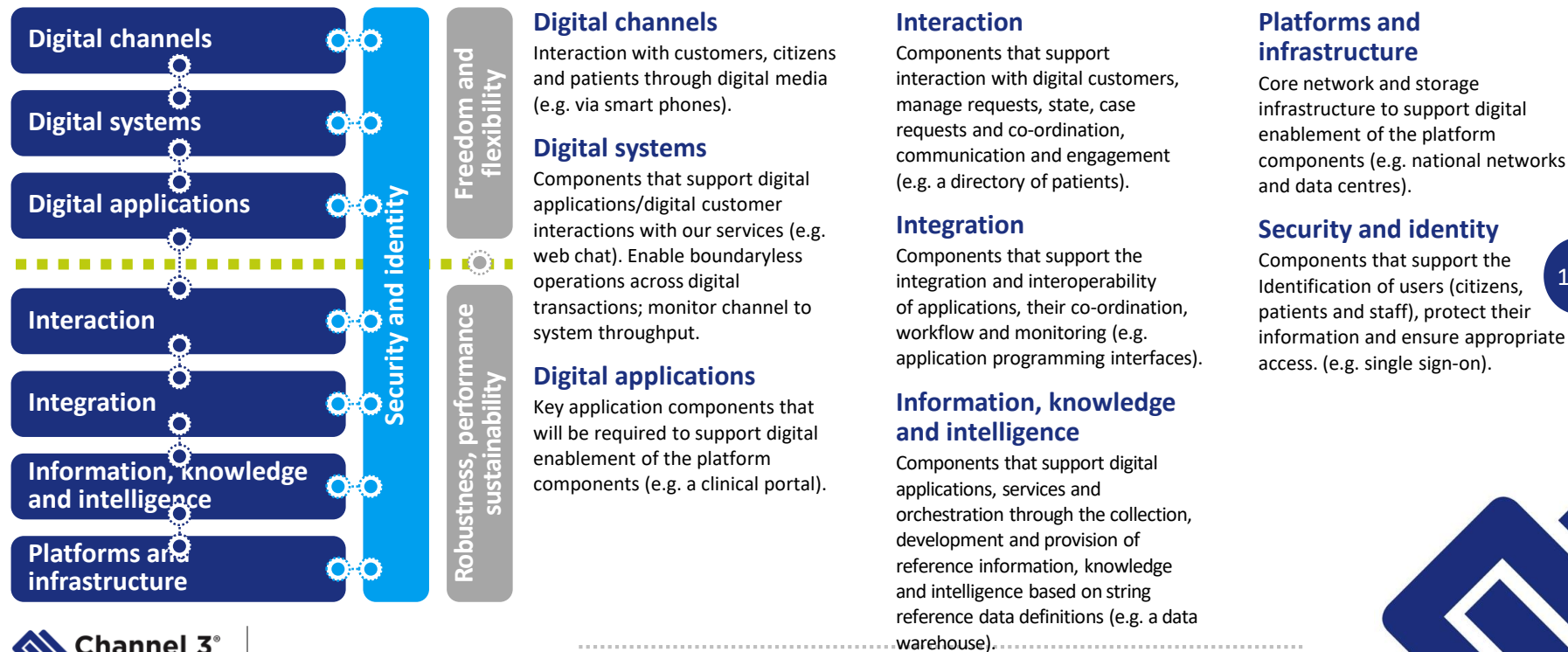
These characteristics have led to the development of open Digital Architecture as an approach in Healthcare systems globally.

This approach meets all of the requirements of A Healthier Wales, and is the basis on which the Future State has been developed.

It is an approach for which many foundations exists in NHS Wales. The challenge now is to make it a reality and deliver it at pace.

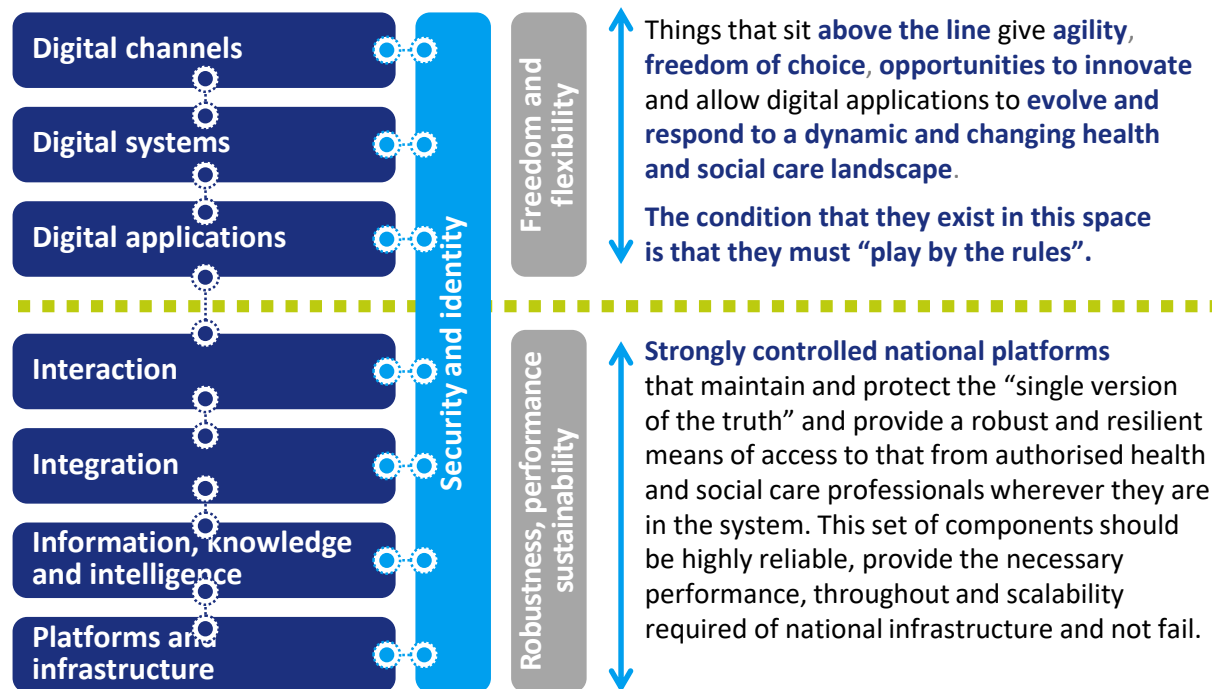
The target digital architecture for NHS Wales

The model below translates the Components set out in the Current State Assessment into a high level Target Architecture that is designed to meet the requirements of a Healthier Wales and embodies open design principles.



The target digital architecture for NHS Wales

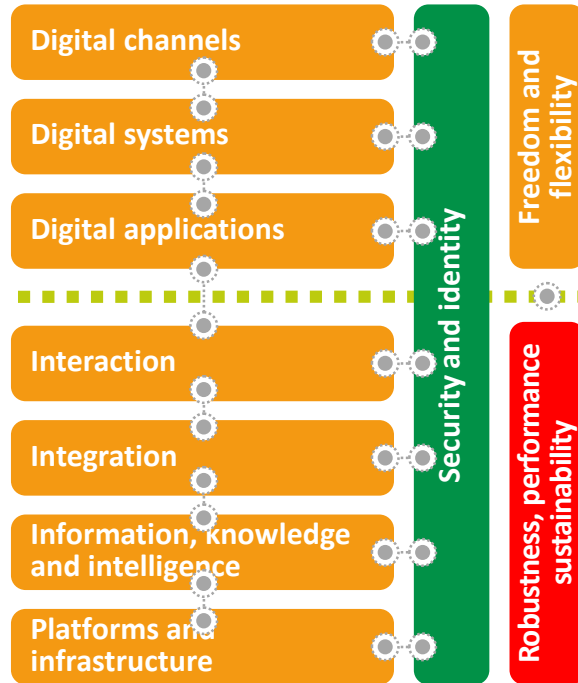
The model forces a clear separation between components “above the line” that allow for diversity, choice and agility within a set of clear rules, and those “below the line” that are defined, managed and protected.



A highly modular approach is key. It means that individual components can be stress-tested and monitored for performance independent of the whole. It would permit Health Boards to integrate national functionality into existing workflows and help our convergence work.

The current position

The Current State Assessment indicates a current digital architecture that is not yet capable of meeting the ambition set out in A Healthier Wales.



Digital channels

Limited use of multi-channel and mobile technology – some pilots. No patient access channels.

Digital systems

Limited use of products that are capable of supporting digital applications/digital customer interactions with services.

Digital applications

Some application components available or in development but as yet to align with open principles. Largely siloed/local systems and/or local implementations of national products.

Key

Capable of supporting ambition:

Now

In <2 years

In >2years

Interaction

Foundations for a national open API layer and EMPI in place but capable of enhancement and exposure beyond the national development team.

Integration

Foundations for integration exist but as yet to be fully exploited with many system and data siloes.

Information, knowledge and intelligence

Plans developing for a National Data Resource and national Clinical Data Repository.

Platforms and infrastructure

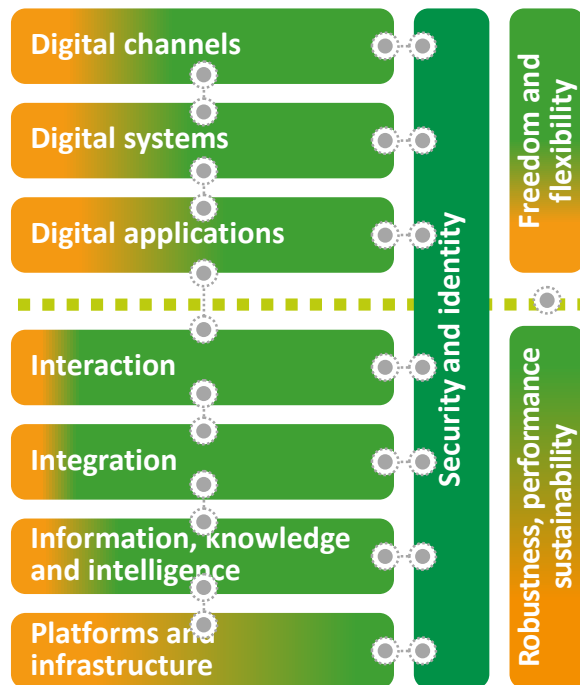
Infrastructure not architected along modern lines and remains fragile and requiring ongoing tactical investment.

Security and identity

Security infrastructure capable of providing required support in place including staff directory but will need to continue to upgrade in line with threat levels and needs of the system (e.g. Single Sign On).

The position achievable in 3 years

With the right focus a target digital architecture that supports the ambition for A Healthier Wales could be achievable.



Digital channels

Multi-channel working environment for clinicians and non-clinicians in most Health Boards. Patient access on line to a variety of services.

Digital systems

Supporting infrastructure to orchestrate channels and use modern customer interaction technologies such as web chat.

Digital applications

Majority of national platforms use open principles. Multiple examples of clinical, non-clinical and patient applications in use that comply with the Welsh standards and make use of the open platform. Acceleration of pace towards an eco-system of suppliers, innovators and academic institutions driving innovation.

Interaction

Fully open architecture with supporting published standards and available test and accreditation environments and developer support in place.

Integration

Significant progress towards integrated working across health and social care through the digital architecture in place. Strong digital workflow.

Information, knowledge and intelligence.

National Clinical Data Repository with associated intelligence and research capability. Strong data standards. Advanced business intelligence.

Platforms and infrastructure

Significant progress towards a modernised network and storage infrastructure providing resilience and stability nationally and making appropriate use of software defined network and clouds technologies.

Security and identity

Ongoing development in line with threat levels and capabilities required.

Key

Capable of supporting ambition:



Recommendations

These recommendations are summarised below. The detail is found in the body of this report. Further shorter term actions and the overall roadmap – particularly with respect to shorter term potential wins at a project level – are provided in the Improvement Options.

Digital architecture

3 - 9
months

- Adopt a core set of Digital Design Principles.
- Adopt and publish a TOGAF® (or similar) framework, locating Digital Architecture in a business context for the NHS in Wales.
- Define the all Architectural Building Blocks (ABBs) for the NHS Wales Digital Architecture.
- Define all candidate open national applications (e.g. WCP, WCCIS etc.)
- For the key ABBs required for an Open Digital Architecture (EMPI, Integration and Interaction, and CDR) develop a consistent set of core products that are agreed and published nationally.
- Start to focus on some early wins.

Open digital platform

1 - 2
years

- Enhance the NHS Wales EMPI along open principles to facilitate a more developed Patient/Citizen identification strategy.
- Enhance the NHS Wales Integration and Interaction Engine to provide a truly open platform for NHS Wales.
- Focus the work of the National Data Resource (NDR) programme on the creation of a National Clinical Data Repository in line with open principles whilst progressing the programme as a whole.
- Make migrating the WCP to an open architecture the highest priority for the product in the next 12 months. This will need to address any impacts on the current work programme.

Stabilisation and resilience

2 - 3
years

- Build on the final recommendations of the Trustmarque review of networks to move towards a modern (possibly multi-sourced) software managed national network and storage infrastructure.

What else is needed for success

This report makes a number of recommendations for the Future State of the NHS Wales Digital Architecture. Underpinning these recommendations is a set of assumptions that are critical to success.

An open Digital Architecture, as described in this report, is necessary for the achievement of the ambition set out in A Healthier Wales. To deliver an open architecture is not enough on its own. An open architecture requires a significant transformation in the ways of working within the digital community, and strong articulation of what is required of it from a system perspective.

To ensure the benefits of an open architecture are realised a transformation programme is needed to drive the changes in operational practice, standards and collaboration across health and social care in Wales. This will require a commitment to the development of an Open Digital Platform that can be matched by the focus required to accelerate the journey.

Delivering these changes in a relatively short timeframe will require additional, short term, resources with a focus on the planning for a programme of this scale and laying the foundations to ensure the benefits are available to all Health Boards, Trusts, Social care and ultimately the population of Wales.

An open digital architecture is equally about changing the interactions between the providers and consumers of systems and

data. This change will require a new operating model, revised governance, clear responsibilities and transparent oversight.

There will need to be collaboration and different working arrangements between all parties involved in Digital to maximise the use of the expertise and grow capability in the system in the short term. Longer term this will need to grow a cooperative digital culture.

There will also be a need for an adjustment to delivery priorities in the next financial year in order to make progress.

Although we make no specific recommendations on these points as they are outside the remit of this review, they are fundamental to success.

Conclusions

The Future State set out in this document builds on the current digital architecture of the NHS in Wales. It sets out a clear and achievable plan to deliver an architecture that will fully enable Wales to embrace a digital future, support innovative practices in front line care, to plan services, and facilitate research and public health.

An open architecture as recommended in this report will provide the flexibility and pace for innovation using local, national and commercial resources, thus accelerating pace. The digital teams in Wales will be able to respond to changes in front line care delivery and organisation structures rapidly without changes to underlying systems or data. This model protects against supplier lock-in, preventing constraints, and providing freedom to select the best solution to meet the needs of the Welsh people.

The immediate recommendations set out in the Improvement Options also suggest real demonstrable examples that will engage directly with patients and support clinicians in their delivery of high quality care. These will help set the tone for the future of digital service in Wales.

It is also recognised that to deliver a transformation as impactful as this requires resources to support the programme of change and deliver an infrastructure that will ensure reliability resilience and sustainability for the health and social care services for Wales.



Core elements of a successful digital architecture

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Overview

A national scale, resilient digital architecture that aligns with international current best practice, needs to be built on sound architectural principles and use clearly defined components and design principles. This section lays the ground work for the Future state by setting out those principles and the approach used to develop the proposed Target Architecture. It:

- Provides examples of Digital Architectures and approaches used in healthcare internationally, including approaches to open platform solutions.
- Establishes overall design terminology and a set of design principles for an open digital architecture drawing upon best practice, the comparators elsewhere, and TOGAF® to enable the foundations for an effective open platform for NHS Wales to align with best practice and to be constructed in the context of a solid approach to enterprise and business architecture.
- Introduces a common design language.
- Introduces the concept of Architectural Building Blocks as a way of focusing on the architectural aspects that are most critical for the NHS Wales Digital Architecture to be successful.
- Sets out the actions that need to be taken to specify the detailed technical architecture for any identified Architectural Building Block.

Context – international comparators – open platform approaches

“Develop an “Open Platform” approach to digital innovation, through publishing National Standards for how technologies work together, and how external partners can work with the national digital platform and national data resource.”

A Healthier Wales

The evolution of the required technology has made Open Platform approaches a reality for many industries. In healthcare the approach is now being widely adopted at a national level. No-one has yet to complete the full journey, but many comparators to Wales are having considerable success.

NHS Scotland

We will begin work now to deliver a Scottish health and care ‘national digital platform’ through which relevant real-time data and information from health and care records, and the tools and services they use, is available to those who need it, when they need, wherever they are, in a secure and safe way.

[Scotland’s Digital Health & Care Strategy](#)

Apperta Foundation

An open platform is based on open standards. So any application built for an open platform, will operate on any open platform. The open platforms approach is vendor and technology neutral, eliminates lock-in, facilitates innovation and competition, and forces vendors to compete on quality, value, and service.

[Apperta Foundation – Defining an Open Platform](#)

HiGHmed

By providing such an open platform, HiGHmed avoids any mandatory procurement of proprietary solutions that would cause vendor lock-in. Instead, participants in HiGHmed are able to acquire relevant components from different vendors, open source initiatives or by self-development. This architecture will foster an ecosystem, based on open service interfaces and clinical models.

[Medical Informatics Consortium, Germany](#)

Wider international comparators

Examples of health economies at similar scale to Wales that are using digital technologies to good effect:

Norway

Have true eMPI, and have grown their systems steadily and now have a robust solution. They used a phased approach based on an open architecture following IHE standards. They initially focused on quick wins. Good innovation seen but slow to deliver overall, long lead time to success as building blocks took time to put in place. Infrastructure issues encountered, network in particular.

New South Wales, Australia

Developed on an open architecture, define standards upfront. They engaged with the IHE to help develop care pathways etc. They do not deliver applications, just the core platform.

HCA

A global healthcare company. Standardised their cancer care model across globe. Now moving to a single global infrastructure to enable standardisation and mapping of all clinical processes.

British Columbia, Canada

Started by defining common standards and coding across organisations and across borders, also focused on information governance.

They defined own standards where there were no existing standards. Central repository built first and rest built more slowly over years. Cross domain transfer of data and interoperability was key strength.

Wider international comparators

Ireland (HSE)

The 'national system' is not used by one group of hospitals due to original funding model. They recently revisited the solution and are pushing a digital strategy. Their BI and analytics are now mature and delivering real benefits, the key to enabling this was defining coding standards at the beginning. Keeping projects small and attainable, broken down regionally but with central management. National workflows used but flexed if required. Local support teams deployed with range of skills.

Infrastructure issues caused problems, local hospital estate issues and national data centre space were problems. Many issues down to communication and politics. Some network issues encountered around bandwidth. Funding for improving or refreshing hardware not budgeted. Governance not as strong as it could have been which led to lack of testing thoroughness.

Key enablers and challenges globally

Key building blocks of open digital healthcare architectures

- Electronic Master Patient Index (EMPI).
- Integration engine.
- Patient Administration System (PAS).
- Electronic Patient Record (EPR).
- RIS (Radiology Information System).
- Picture Archiving and Communication System (PACS).
- Laboratory Information Management System (LIMS).
- Business Intelligence (BI) (rather than Artificial Intelligence – AI - initially).

Key digital healthcare technologies

- BI/AI (inc. trend analysis/alerting).
- Digital pathology.
- Cloud architecture (containerisation).

Key challenges

- Establish standard ways of working and care pathways across nation.
- Establish standard coding across nation.
- Establish standard communication protocols across nation.
- Data Centre space in region, even Microsoft Azure/Amazon Web Services (AWS).
- Network infrastructure – regional and local.

Top tips

- Engage with IHE to help develop standards and pathways etc at NHS Wales, Welsh Government level.
- Make more use of BI, there are many opportunities here – BI can be leveraged now to great benefit. AI will be useful going forward.
- Continuous communication and training. Issuing surveys, garnering feedback help keep people engaged. Regular retraining to help users keep up with new functionality and refresh knowledge.
- Look to introduce new technologies as they become available and keep up with changes in and new working practices.

Lessons from international comparators

- The initial focus should be on putting in place the required infrastructure, building blocks, standards for coding and standards for communication.
- Agreement on the standardisation of healthcare processes and patient care pathways nationally is essential. Deviations from these standards is acceptable if justified and formally document it.
- Do not develop bespoke solutions where there are established commercial or open source offerings available. It is not a sustainable approach and will cost far more in the long run and creates a bottleneck to innovation.
- Innovation needs to be actively encouraged and funded. Not all initiatives will succeed, be prepared to fail fast and move on without blame.
- Do not take on too much initially, use a phased approach to the programme with realistic milestones. Focus on building a robust core and then bring in other elements.
- Training has to be properly planned, phased and ongoing. Ensure people are reused and people with knowledge and experience are not lost.
- Ensure high quality documentation and good governance around systems and integrations. Establishing proven methods and tools such as formal Agile using Jira.
- Test processes must be robust and informed by domain specialists with sector and technology expertise.
- Communication is essential to help people understand what is being done and why but also to publicise and celebrate successes.
- Define strategy in advance to make clear what will be delivered and when, clearly communicate direction and some quick, easy wins.

Design terminology

Our Future State Recommendation defines an Open Platform in Terms of Target Architecture, Transition Architecture(s) and most importantly Architecture Building Blocks (ABBs). We also recommend the adoption of a framework that positions digital architecture in a well defined business context using a well recognised enterprise architecture framework such as TOGAF®

(TOGAF® definitions – adapted from the Open Group Architecture Framework).

Target architecture

The description of a future state of the architecture being developed for an organisation. There may be several future states developed as a roadmap to the evolution of the architecture to a future state.

Transition architecture

A formal description of the enterprise architecture showing an “island of stability” between the starting position and the target. Transition Architectures are used to help individual work packages and projects to be grouped into managed portfolios and programmes.

Architectural building block

A constituent of the architecture model that describes a single aspect of the overall model – ABBs are reusable components that work together to provide the overall information system. This is the most important component of the design approach. ABBs have a long term persistence as elements of the architecture, even if they are provided over time by different software solutions.

- The building blocks are enablers of the NHS Wales Digital ecosystem/platform.
- Building blocks are technical rather than clinical software components.
- Building blocks are reused by several clinical applications to enhance integration, storage of and access to information.

Design principles

The following are recommended design principles for the future state drawn from best practice:

Make information available to whomever needs it

Including: Clinicians, Patients, Health and Social Care, 3rd Sector, Carers, Public Health and research, to facilitate joined up care and improve outcomes.

Liberate data

Remove data silos and vendor lock-in; making data accessible to legacy and new applications.

Use open standards for interaction

Define how internal and external consumers interact with the platform (standards include openEHR, FHIR, IHE, HL7, REST, SOA, OAuth, SAML).

Use open standards for data exchange

This will facilitate Innovation and competition; lower barriers to entry for 3rd sector via shared Information model (Data stored in a proprietary database is not really open).

Adopt an open service model

Specifications of APIs are available to everyone.

Design for national scale

All components that may have a regional or national scale at some point in their development should be designed with national levels of resilience, reliability and performance in mind.

Consider appropriate use of cloud technologies

Cloud computing is referred to by many other open platform initiatives as an enabler – this needs to feature in NHS Wales' longer term thinking.

Build services for re-use

The digital system component could exploit APIs lower level to provide reusable service components, accelerating pace and standardisation across applications (e.g. a single web chat capability).

Adopt agile design principles – prototype, test, learn

The aim should be to shorten cycle times and improve evaluation, innovation and learning.

Focus on Architecture Building Blocks (ABBS)

Features of architecture building blocks

- A building block is a package of functionality designed to meet the business needs across an organisation – build once use often.
- A building block interoperates with other, inter-dependent, building blocks e.g. EMPI and Integration Platform.
- A building block is re-usable, replaceable and well specified.
- Building blocks that support the development of applications and capability. Digital clinical and non-clinical Applications are either built on them or interact with the platform via defined interfaces or Application Programming Interfaces (APIs).

Candidate Architectural Building Blocks for an NHS Wales – Open Platform

- Enterprise Master Patient Index (EMPI) – currently IBM Initiate/NWIS EMPI.
- Integration and Interoperability Platform – currently Fiorano in NHS Wales.
- Clinical Data Repository(ies).
- Vendor Neutral Archive (VNA).
- Electronic Document Management Systems (EDMS).
- Identity and Access Management (IAM).
- Security, certification services, biometrics, Single Sign On (SSO), two factor authentication.
- Business Process Modelling, Business Rules and Workflow.

(This is not an exhaustive list and will need developing).

Focus on Architecture Building Blocks (ABBs)

For each of the focus ABBs the following should be established

- **Scope** there should be a clearly defined area of functionality (i.e. what the component does and what is out of scope).
- **Strategy** there should be a strategy document behind each ABB that clearly outlines the options considered and the direction of travel agreed upon by stakeholders/technical team. Each of the key focus ABBs for the Future State to maximise it's effectiveness as an Open Platform will need this.
- A **target technical architecture** should be established that clearly defines how the ABBs interact.

- **Product requirements** (buy, build or hybrid) should be derived from the Strategy requirements, non-functional requirements and ABB interaction requirements.
- **Operating model should be defined**, this includes outsourcing and internal capability.
- **Use cases should be modelled** against the above to test the capability, extensibility and flexibility of the platform.
- **Hosting options should be considered** for each ABB including Cloud, On-Premise or Hybrid (some may lend themselves to the cloud easier than others).

Whilst high level documentation exists for the many of the ABBs – or they are referred to in context of wider initiatives – the Current State Assessment identified that the level of detail required for the focussed development for the ABBs necessary for an open platform does not as yet exist to the necessary level of detail.

The following sections provide specific detail on the considerations for the core building blocks of the Target Architecture.

Key digital architecture domains

28

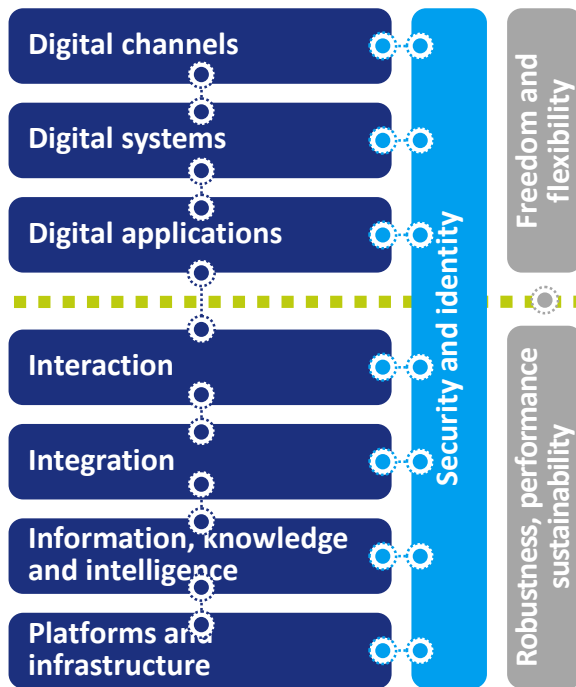
Overview

A national scale Target Architecture that follows open principles is built around a number of Architectural Building Blocks. This section sets out those building blocks for Wales and how they relate to each other. Within that architecture three building blocks in particular – the Electronic Master Patient Index, the Integration engine, and the Clinical Data Repository - are key to provide a flexible and reliable platform around the national electronic patient record. This section therefore:

- Translates the Architectural Components from the Current State Assessment into a high level Target Architecture for NHS Wales.
- Sets out the core critical Architectural Building Blocks that are required for a robust open, national health and social care Target Architecture.
- Provides a recommended set of focus ABBs for the Target Architecture in Wales that reflects the position identified in the Current State Assessment.
- Illustrates the net benefit of a focus on those Architectural Building Blocks for the Architectural Characteristics required by the needs of the Welsh Health and Social Care System.

High level target architecture

The model below translates the Components set out in the Current State Assessment into a high level Target Architecture within which individual ABBs can be located:



Digital channels

Interaction with customers, citizens and patients through digital media (e.g. via smart phones).

Digital systems

Components that support digital applications/digital customer interactions with our services (e.g. web chat). Enable boundaryless operations across digital transactions; monitor channel to system throughput.

Digital applications

Key application components that will be required to support digital enablement of the platform components (e.g. a clinical portal).

Interaction

Components that support interaction with digital customers, manage requests, state, case requests and co-ordination, communication and engagement (e.g. a directory of patients).

Integration

Components that support the integration and interoperability of applications, their co-ordination, workflow and monitoring (e.g. application programming interfaces).

Information, knowledge and intelligence

Components that support digital applications, services and orchestration through the collection, development and provision of reference information, knowledge and intelligence based on string reference data definitions (e.g. a data warehouse).

Platforms and infrastructure

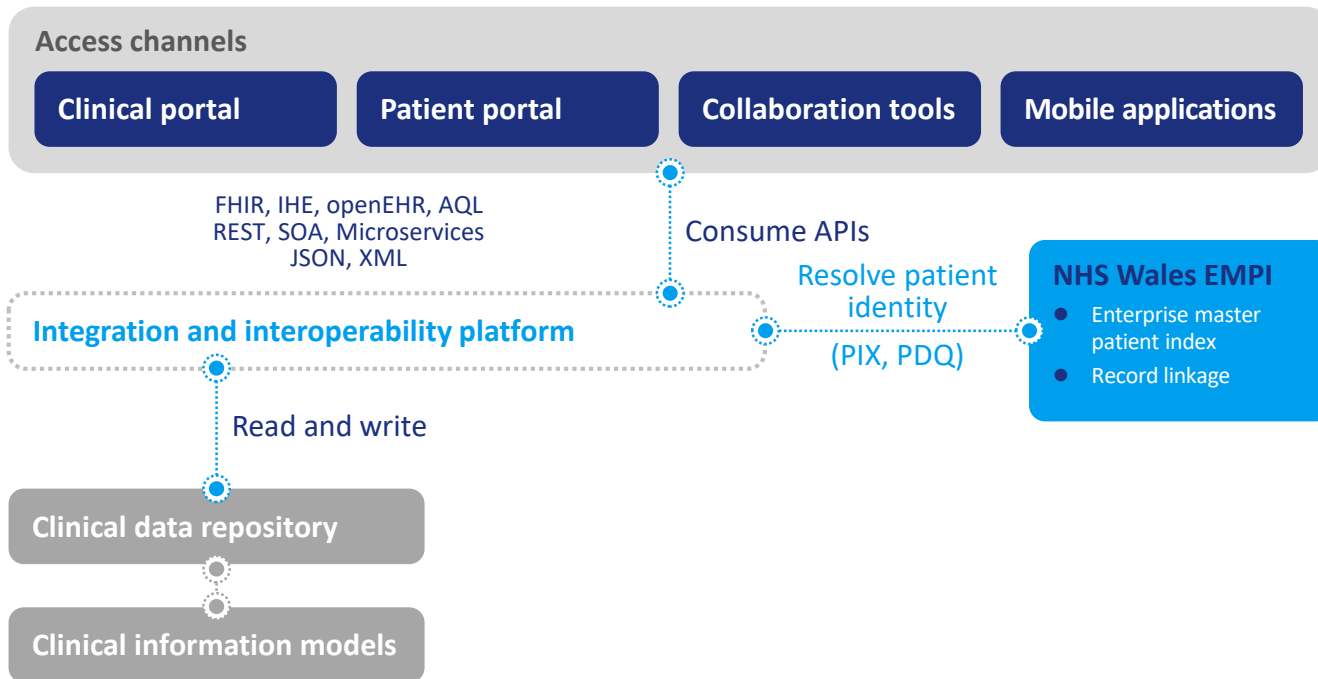
Core network and storage infrastructure to support digital enablement of the platform components (e.g. national networks and data centres).

Security and identity

Components that support the Identification of users (citizens, patients and staff), protect their information and ensure appropriate access. (e.g. single sign-on).

Foundation for an open platform

The model shows the essential Technical Target Architecture of an open platform



Recommended focus for the future state

The focus work for the development of the Future State needs to be targeted on those components that will have the highest net benefit with respect to the Architectural characteristics required by the Welsh Health and Social Care system. These correspond to the foundations on the previous page:

Using this we have identified three Architectural Building Blocks that need to be developed in the more focused way needed to achieve a truly open platform. These core products underpinning these ABBs exist in part but they need enhancing to achieve the ambition set out in A Healthier Wales. They are:

- **Interaction** – Enterprise Master Patient Index (EMPI) – currently IBM Initiate/NWIS EMPI.
- **Integration** – Integration and Interoperability Platform – currently Fiorano.
- **Information, knowledge and intelligence** – Clinical Data Repository(ies).

Development in two further architectural areas is required to stabilise the performance and resilience of the NHS Wales platforms. These are:

- **Digital Applications** – specifically the Welsh Clinical Portal (WCP) and Welsh PAS.
- **Platforms and Infrastructure** – Networks and Storage Infrastructure (this was not part of the detailed scope of this review, but is essential to any future open platform in Wales).

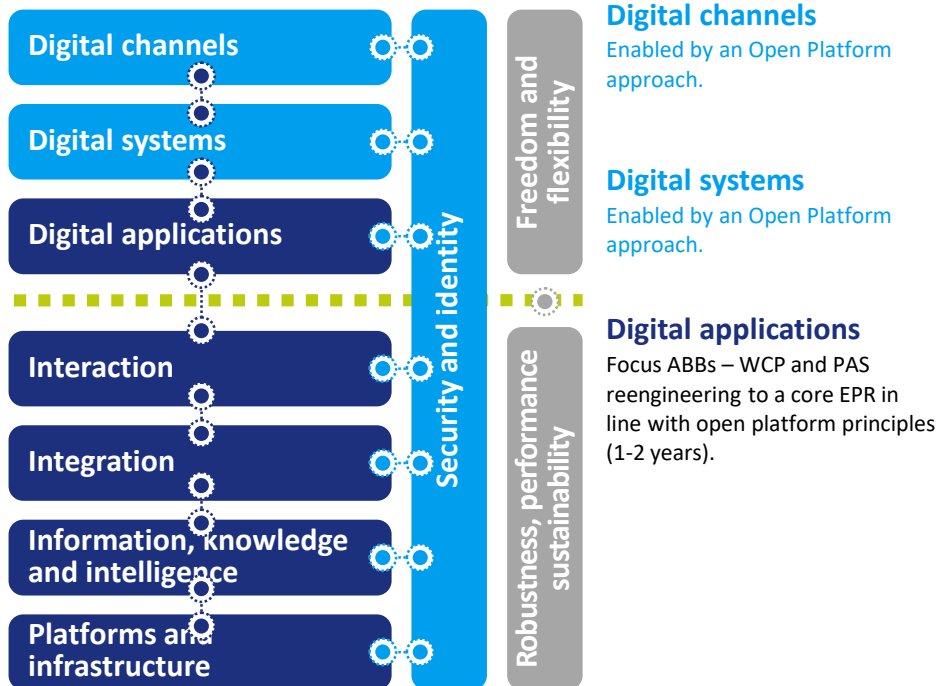
Each of these has a clear starting point from which to develop already in existence. The following pages show respectively:

- Work that would need to be done at the highest level, and how the Target Architecture would change overall in terms of its status identified in the Current State Assessment.
- What the consequential benefit for the characteristics of the NHS Wales Architecture would be given the this focus.

The next section then details the changes that would be envisaged for each of the selected priority building blocks.

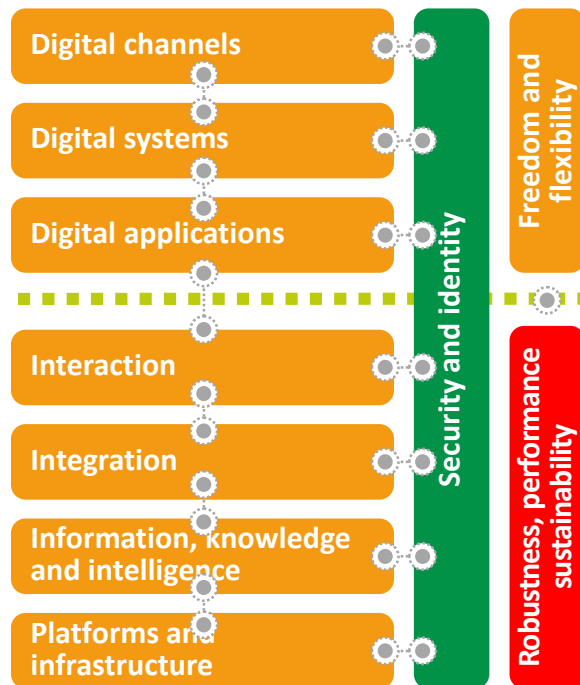
Locating focus ABBs within reference components

The key ABBs necessary for an Open NHS Wales Platform are located in the high level Target Architecture as below:



The current position

The Current State Assessment indicates a current digital architecture that is not yet capable of meeting the ambition set out in A Healthier Wales.



Digital channels

Limited use of multi-channel and mobile technology – some pilots. No patient access channels.

Digital systems

Limited use of products that are capable of supporting digital applications/digital customer interactions with services.

Digital applications

Some application components available or in development but as yet to align with open principles. Largely siloed/local systems and/or local implementations of national products.

Key

Capable of supporting ambition:

Now In <2 years In >2 years

Interaction

Foundations for a national open API layer and EMPI in place but capable of enhancement and exposure beyond the national development team.

Integration

Foundations for integration exist but as yet to be fully exploited with many system and data siloes.

Information, knowledge and intelligence

Plans developing for a National Data Resource and national Clinical Data Repository.

Platforms and infrastructure

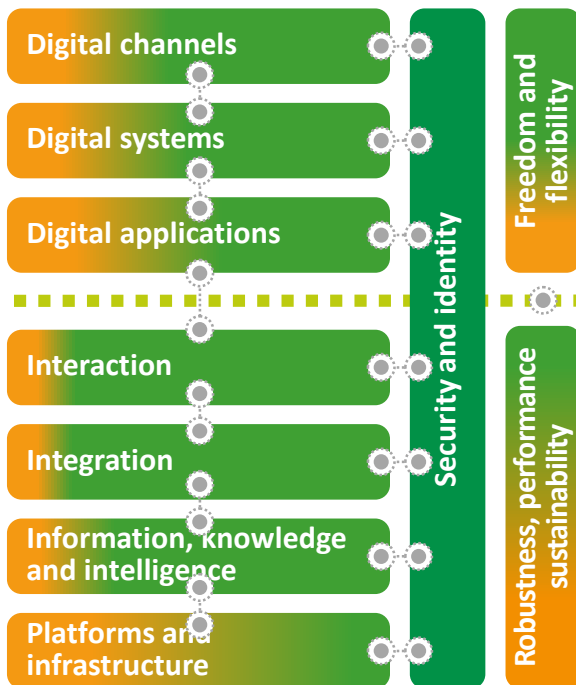
Infrastructure not architected along modern lines and remains fragile. Requires ongoing tactical investment.

Security and identity

Security infrastructure capable of providing required support in place but will need to continue to upgrade in line with threat levels and needs of the system (e.g. Single Sign On).

Benefits of changes to target ABBs

With the right focus a target digital architecture that supports the ambition for A Healthier Wales could be achievable in 3 years.



Digital channels

Multi-channel working environment for clinicians and non-clinicians in most Health Boards. Patient access on line to a variety of services.

Digital systems

Supporting infrastructure to orchestrate channels and use modern customer interaction technologies such as web chat.

Digital applications

Majority of national platforms use open principles. Multiple examples of clinical, non-clinical and patient applications in use that comply with the Welsh.

Key

Capable of supporting ambition:

Now In <2 years In >2 years

standards and make use of the open platform. Acceleration of pace towards an eco-system of suppliers, innovators and academic institutions driving innovation.

Interaction

Fully open architecture with supporting published standards and available test and accreditation environments and developer support in place.

Integration

Significant progress towards integrated working across health and social care through the digital architecture in place. Strong digital workflow.

Information, knowledge and intelligence.

National Clinical Data Repository with associated intelligence and research capability. Strong data standards. Advanced business intelligence.

Platforms and infrastructure

Significant progress towards a modernised network and storage infrastructure providing resilience and stability nationally and making appropriate use of software defined network and clouds technologies.

Security and identity

Ongoing development in line with threat levels and capabilities required.



Detailed changes by target architectural building block

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Overview

The core of the Target Architecture for Wales relies upon a number of key Architectural Building Blocks that deliver the integrated platform and electronic patient record required by the national ambition. Each of these should follow the common approach set out earlier in this report. This will require a level of investment and detailed work not within the scope of this review. With that as a base assumption, this section:

Outlines the key recommended changes needed for each of the critical Architectural Building Blocks for an Open Platform identified in this Future State Assessment, namely:

- **Interaction** – Enterprise Master Patient Index (EMPI) – currently IBM Initiate/NWIS EMPI.
- **Integration** – Integration and Interoperability Platform – currently Fiorano.
- **Information, knowledge and intelligence** – Clinical Data Repository(ies).

Provides an overview of the next steps for the two architectural areas to stabilise the performance and resilience of the NHS Wales platforms, namely:

- **Digital Applications** – specifically the Welsh Clinical Portal (WCP) and Welsh PAS.
- **Platforms and Infrastructure** – Networks and Storage Infrastructure.

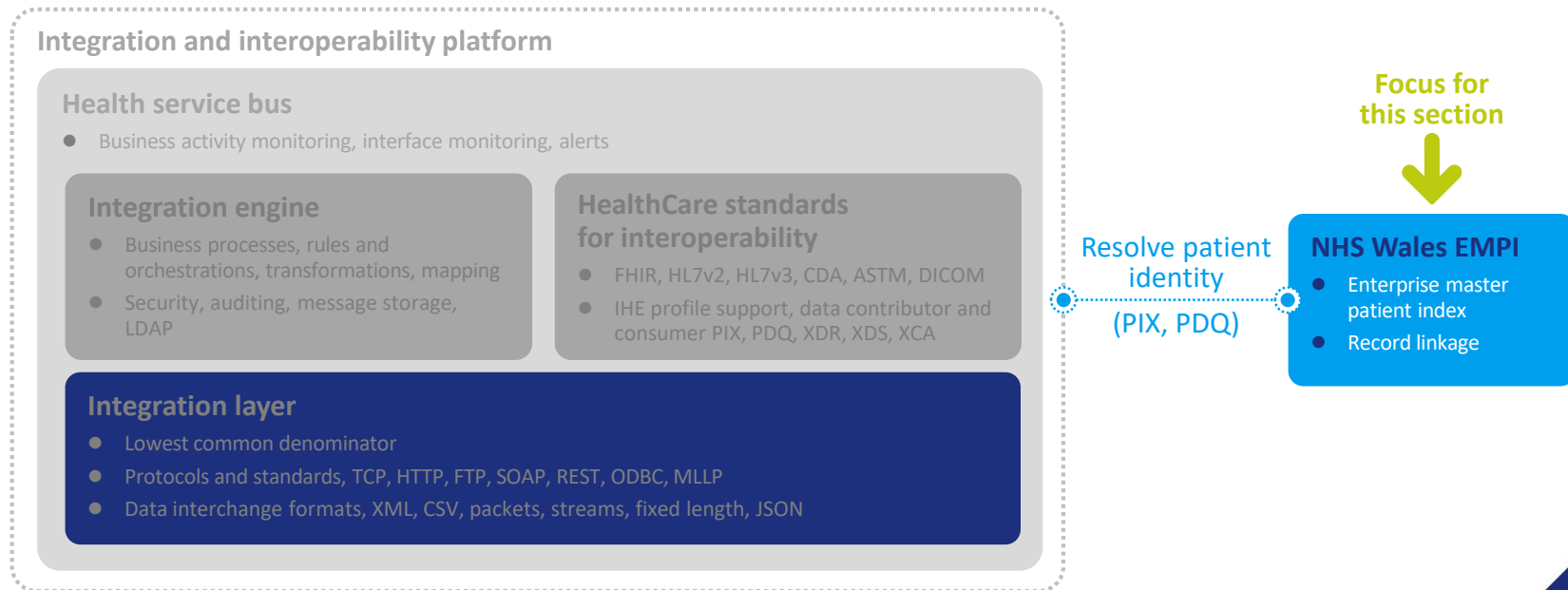


Interaction – Enterprise Master Patient Index (EMPI)

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Target Architecture context

The EMPI and the Integration and Operability Platform and are inter-dependent building blocks



What problem are we trying to address?

Problem statement

How can we correctly identify and manage patients across boundaries (with different demographics/identifiers in different systems) to accommodate the exchange of health information using a standards-based approach with a high degree of assurance that the information is about the correct patient? (IHE).

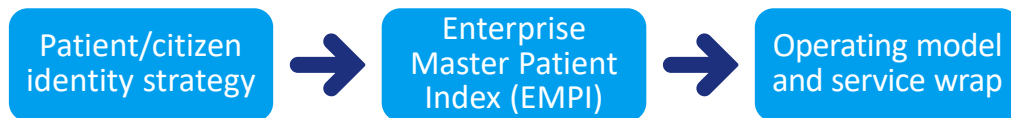
Risks

Linking the wrong clinical information to a person can not only cause great personal harm to the patient, but can also incur huge costs to the healthcare provider in correcting and mitigating the error. Incorrect information impacts patient safety and compromises quality of care. Good clinical decisions based on bad data become bad clinical outcomes. (HIMMS).

Examples include:

- **Overlay** – when information from different patients are incorrectly linked, thus presenting the wrong clinical information to a decision maker, which can lead to a catastrophic patient event.
- **Partial information** – When information from all systems in context is not displayed then this can also introduce significant clinical risk.

Resolution



What does the approach need to consider?

Patient/citizen identity strategy: statement of problem, consider options available and selected strategy for Wales:

- **Option 1** – Seed ***every*** system in scope with unique identifier for the patient/citizen. Examples elsewhere have included: NHS England and NHS Number, old Community Health Index (CHI) – NHSS.
- **Option 2** – Use record linkage to link identifiers from different systems together. Examples elsewhere have included: New CHI, IHI – Ireland, regional implementations – LHCRE – NHS England.

Note: We can provide a sample patient identity strategy that goes into this in much more detail

Enterprise Master Patient Index: set function and use, scope, boundaries/APIs

Function

Identify and match patient records stored across multiple IT systems, help prevent duplicate data and ensures all patient records are accurate, complete and up-to-date. Provide an interface for users of the platform to search for patient records, and to assist in locating data held in other system.

Use

EMPI software solutions play an important enabling role in enabling data to be exchanged (via messaging) between systems in a particular domain or pathway. They are also a fundamental component of applications that present a longitudinal patient record.

Scope

Master source of demographics, can also be used as a provider directory and to store relationships between patients, providers, organisations and carers. Flag for Welsh language speakers, mobile number and email.

Boundary

Most common APIs are based on Internationally recognised standard(s) – The PIX and PDQ IHE profiles that allow search by demographics and to retrieve a list of linked identifiers. Emerging standards include FHIR resources and profiles, and mobile support, such as PDQ (REST based implementation of PDQ).

What does the approach need to consider?

Enterprise Master Patient Index: typical features and functionality

- Data quality reporting (finding duplicates or missing records).
 - Record linkage (golden record) using various algorithms for matching e.g. probabilistic and deterministic.
 - Data stewardship with UI for (un)matching of records, automatic (un)matching thresholds, identification of duplicate records.
 - Provider Directory (organisation and individual).
 - Ability to define and maintain relationships between entities.
- IHE profile support (PIX, PDQ), other native APIs.
 - Extensibility and flexibility e.g. multiple addresses, custom tables.
 - Architecture – Performance, High availability, cloud support, typical infrastructure requirements.
 - Security – RBAC, LDAP support, certificates etc.
 - Additional features/modules – e.g. visualisation, analytics, workflow.
 - Native APIs.

Operating model and service wrap:

- Enterprise needs to stand up Data stewardship and matching function.
- Service wrap defined around the EMPI to detail how to consume services and how services are secured.
- Information governance function around access to data e.g. cross-organisation.

What are the key delivery considerations

The IBM Initiate product currently used by NHS Wales is a good product and up-to-date.

The following actions are needed:

1. **Clarify, publish and communicate** a detailed NHS Wales Patient/Citizen Identity Strategy (see following slides).
2. **Define the existing functionality** in Initiate.
3. **Evaluate the other functionality that could be put into EMPI** which could include:
 - Provider directory
 - Relationship management
 - Extensible model
 (see following slides)
4. Communicate the existing and new functionality widely.
5. Migrate to use of the EMPI as the trusted source of demographics across NHS

Wales (other applications should be using only this and will need changing over time to ensure that this is the case):

- Specifically the Welsh Clinical Portal should be developed to move away from direct link to the Welsh PAS and use the EMPI for demographics.
- Data repositories should also use the EMPI for demographics.

The effort required to bring all systems to the required level will be considerable.

6. Develop and communicate a new Open Operating Model.
7. Consider the role of the EMPI vs that of the Welsh Demographics Service – is this duplication of function.

What are the key delivery considerations?

“Clarify, publish and communicate a detailed NHS Wales Patient/Citizen Identity Strategy.”

Current position

NWIS has adopted what we believe to be a sound Patient/Citizen Identity Strategy. They have also selected a market leading EMPI product to enable this strategy, which is up-to-date and fit for purpose. This forms the basis of a key architectural building block that should be used across the Enterprise.

Recommendation

NWIS should capture and clearly document their Patient/Citizen Identity Strategy.

Rationale

The strategy adopted is sound, it needs to be captured correctly and communicated to other stakeholders. The EMPI should become a key architecture building block for the Enterprise; used across the estate by all users of the system to help identity patients and correctly link together clinical information stored across the estate in disparate systems.

Actions

- Review the sample Patient/Citizen Identity Strategy supplied by Channel 3 which clearly captures the problem statement, the options available and recommended strategy.
- Capture and document the strategy adopted by NWIS.
- Publish and communicate this strategy with key stakeholders – get buy-in from all stakeholders.

What are the key delivery considerations?

“Evaluate the other functionality that could be put into EMPI.”

Recommendation

Review and publish the current functionality used in the product, make this available to stakeholders. Evaluate the other functionality available in the product that is not currently used.

Rationale

The product selected is a market leading EMPI product. This could enable innovations at pace and underpin some of the early deliverables.

The Enterprise should clearly understand the functionality in the product and consider the other candidate areas where it could add value.

Actions

- Review and publish the current functionality and implementation, make this available to stakeholders.
- Evaluate the other functionality that could be put into EMPI e.g.
 - Provider directory – Directory of care providers and organisation across the estate.
 - Relationship management – Manage relationships between individuals, providers and carers.
 - Storage of flags against patients/citizen – e.g. Welsh language, dementia, frail, child protection, care-plan in place.



Integration – Integration and Interoperability Platform (I&I)

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Target architecture context

The EMPI and the Integration and Operability Platform and are inter-dependent building blocks

Integration and interoperability platform

Health service bus

- Business activity monitoring, interface monitoring, alerts

Integration engine

- Business processes, rules and orchestrations, transformations, mapping
- Security, auditing, message storage, LDAP

HealthCare standards for interoperability

- FHIR, HL7v2, HL7v3, CDA, ASTM, DICOM
- IHE profile support, data contributor and consumer PIX, PDQ, XDR, XDS, XCA

Integration layer

- Lowest common denominator
- Protocols and standards, TCP, HTTP, FTP, SOAP, REST, ODBC, MLLP
- Data interchange formats, XML, CSV, packets, streams, fixed length, JSON

← Focus for this section

Resolve patient identity
(PIX, PDQ)

NHS Wales EMPI

- Enterprise master patient index
- Record linkage

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What problem are we trying to address?

Problem statement

The fundamental goal of HealthCare Integration and Interoperability is to ensure the correct information is made available, to the correct person, at the correct time and place, securely, safely, reliably and in the correct context.

HealthCare integration and interoperability is hard

There are lots of systems in scope from various vendors, including proprietary and legacy.

There is a lot of variation, particularly around messaging capability and standards support.

Vendor strategy over the years has been lock-in rather than Interoperability; the industry has suffered from low governance around standards and implementation often varies.

Integration solutions are often reliant on the lowest common denominator of the systems in scope, this could be ODBC calls, flat-file, proprietary API, HL7.

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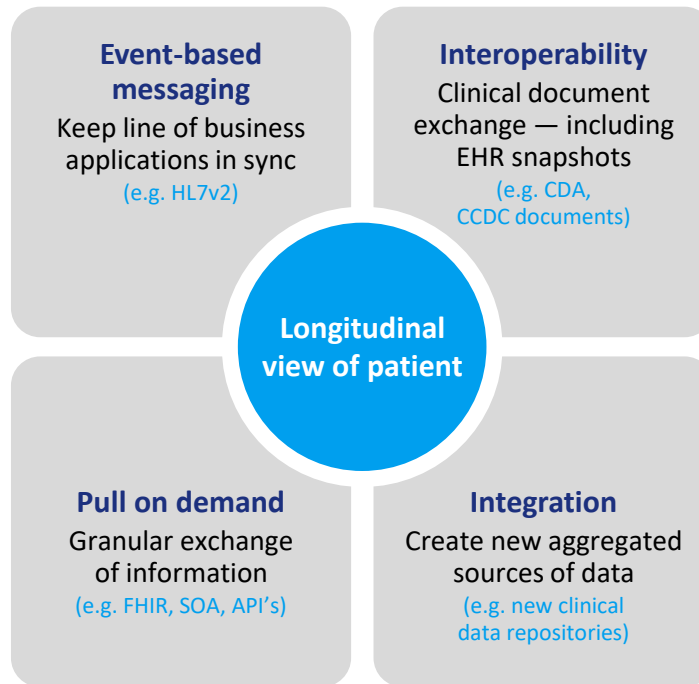
Resolution



What does the approach need to consider?

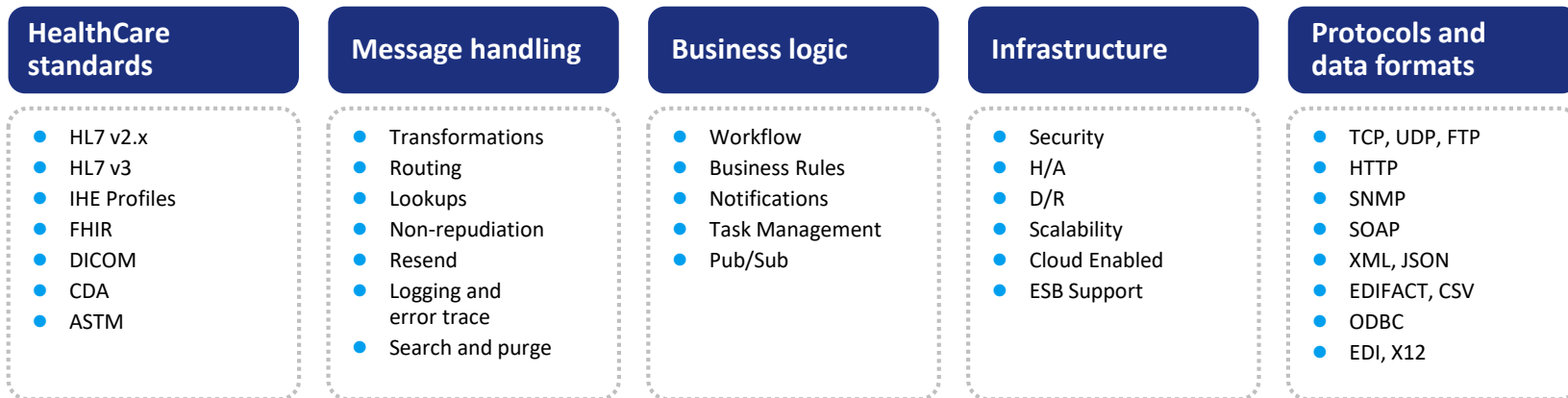
Integration and interoperability strategy:

- Integration and Interoperability are not the same, recognise the difference in the strategy.
 - **Interoperability** – systems work together unchanged.
 - **Integration** – custom coding is required.
- Structure the strategy around different message types available across the estate (there is no silver bullet).
- Define the standards that will adopted and architecture principles for I&I
e.g. FHIR, HL7, openEHR, CDA.



What does the approach need to consider?

High-level template functional requirements of an integration and interoperability platform:



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Operating model and service wrap:


- Enterprise needs to stand up Integration development and support teams, could be internal, outsourced or hybrid.
- Service wrap defined around the Integration platform to detail how to consume services and how services are secured.
- Integration capability will be required across the Enterprise, not just a central function.

What are the key delivery considerations

The product currently used by NHS Wales is Fiorano. The suitability of this product at a national level should be considered as part of the ongoing strategy.

The following actions are needed:

- Clarify, publish and communicate a detailed Integration Strategy.
- Define the existing functionality in Fiorano.
- Evaluate the other functionality that could be put into the integration platform against the models outlined in this section and/or gaps in the current platform's capability.
- Communicate the existing and new functionality widely.
- Migrate to the Open Architecture model outlined in the report with the Welsh Technical Standards Board (WTSB) as an oversight body.

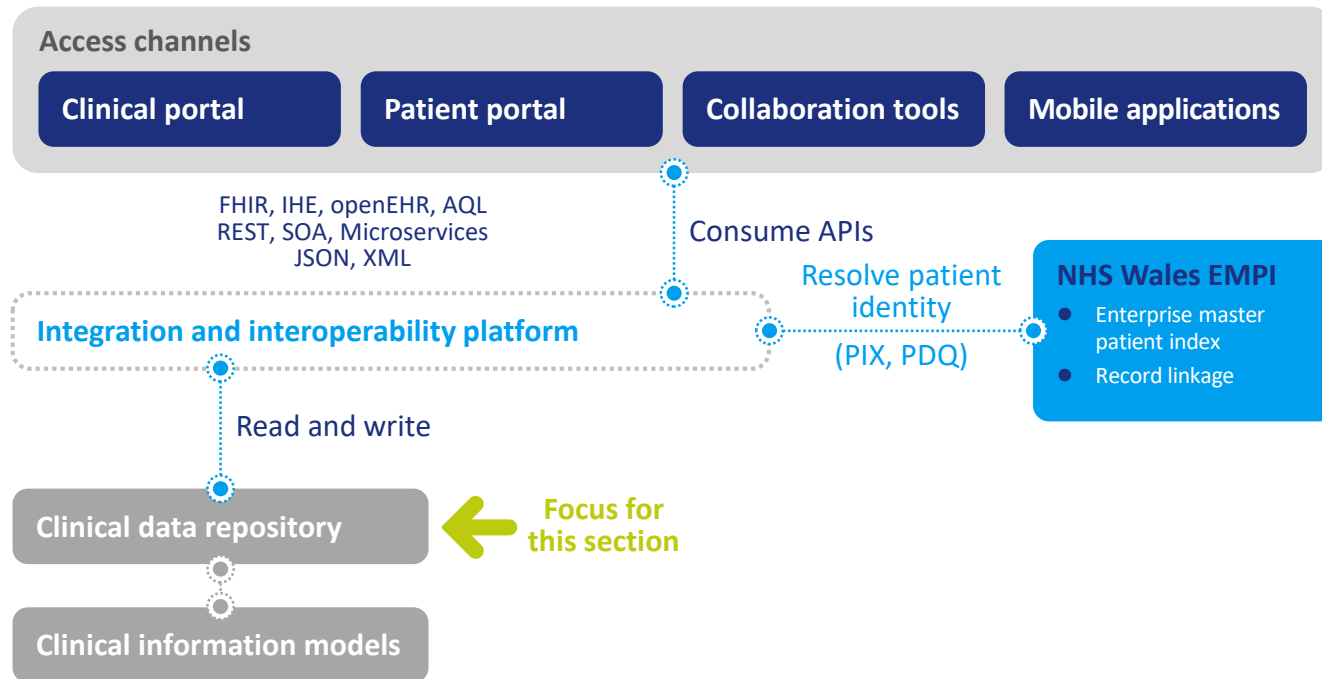


Information – clinical data repository(ies)

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Target architecture context

The model shows the essential Technical Target Architecture of an open platform



What problem are we trying to address?

“An open ecosystem is vendor and technology neutral and eliminates lock-in, facilitates innovation and forces vendors to compete on quality, value, and service.”

Apperta Foundation – Defining an Open Platform

“Gartner believes that truly effective and sustainable open architectures will need a capability for vendor-neutral data persistence, such as utilising a common scheme or set of archetypes and rules for managing structured and unstructured data (for example, a VNA, openEHR or IHE XDS repository in combination with services for trust/consent, ecosystem governance

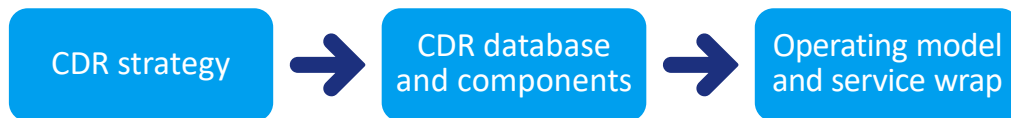
and oversight, and reuse of data and processes for secondary purposes, such as research and population health).

Providing open messaging standards (for example, FHIR, HL7) for data exchange in specific use cases will only go so far in meeting the architectural challenges of digital citizen-centric care delivery.”

Mike Jones – Gartner, 7 February 2017

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Resolution



What does the approach need to consider?

The National Data Resource programme is making a good start on examining the creation of a Clinical Data Repository (CDR) for NHS Wales. This aspect of the programme should be given priority along side the integration platform and the EMPI as it is the key enabler for targeting care at the individual, cohort and population levels.

A fundamental Building Block of an Open Platform is to hold your own CDR with the following benefits when viewed against the problem statement for this ABB:

- Vendor Neutral Data Persistence.
- Eliminates Vendor Lock-in.
- Consolidates data from a variety of clinical sources to present a unified view of a single patient record.

The Principal Options

- “Roll your own” – largely the current situation across NHS Wales.
- Adopt an agreed set of standards for access to the CDR – this is the approach being adopted more widely e.g. in NHS Scotland, Apperta Foundation, Salford RFT, Leeds PHR, Plymouth NHS Trust, Pilot in NWIS.

What are the key delivery considerations

CDR strategy

It is not possible to simply switch to owning own CDR at the expense of business continuity:

- There is a need to “keep the lights on” whilst fostering innovation and adding new capability.
- There is an opportunity to leverage the existing estate and information as part of transition plan and foundation of Target Architecture.

Recommended approach

Adopt a “Bimodal IT” approach.

“Bimodal IT is the practice of managing two separate but coherent styles of work – one focused on predictability and the other on exploration” (Gartner).

This approach has been widely adopted by many industries – examples including financial services where security and reliability have to co-exist with market agility.

There are examples in Wales – for example in the Universities such as Swansea who combine the day to day management of large data farm estates with a large innovation agenda.

- **Mode 1** is renovating the legacy environment into a state that is fit for the digital world.
- **Mode 2** is exploratory, looking to take advantage of Innovation and advances in Technology.

This second mode is missing in the current approach, and is fundamental if NHS Wales is going to keep pace with the opportunities that are now opening up in areas such as digital patient engagement, the “internet of things”, genomics, personalised medicine, big data analytics, and artificial intelligence.



Other target architecture focus areas

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Welsh Clinical Portal (WCP)



Current state

The functionality of the Welsh Clinical Portal (WCP) goes beyond what we would see in a typical Clinical Portal. The bi-directional nature and ability for subscriptions, notifications and sign off of forms, request results, review results etc are features not normally available in the majority of clinical portals. The mobile application, in trial at the moment, seems to have benefited from external design input is efficient and user friendly. It is not dissimilar in many respects to a core EPR product.

There is a substantial product roadmap for the Welsh Clinical Portal that further down the line does consider a technology refresh of the application.

Challenges

In developing and maintaining a product as complex and functionally rich as the WCP that operates at a national scale, the NHS in Wales will increasingly have to operate in a similar way to large EPR providers (such as Epic, Cerner, DXC, System C, or All Scripts). This brings with it a considerable overhead that requires considerable resource and development effort. It also requires the product to be underpinned by an extremely robust technical architecture – and investment commensurate with that of a product development company.

NWIS already report that 90%* of their resources are committed to pre-existing services.

This is a challenge typical in the software industry where finding resource to innovate and develop at pace is unachievable without a transformational step change and also rebalancing of focus to make that change.

We also understand that the uptake and clinical buy-in is not as strong as it should be for such a powerful component. Problems largely relate to performance and lack of collaboration and selling to the wider Clinical Community. We would be concerned that the NHS in Wales may lose some of the user base for the WCP, mainly due to performance issues which may be related to Network, Infrastructure, Browser or Application Architecture across the NHS in Wales.

**WAO report – Informatics Systems in NHS Wales – Jan 2018*

Welsh Clinical Portal (WCP)



Recommendations

Our overall recommendation – highlighted elsewhere in the report – is that the NHS in Wales should make resolving the architectural weaknesses of the WCP and migrating to an open architecture that can take advantage of the architecture proposed in the Future State the highest priority, at the expense of adding any new functionality in the short-term.

This will need to be impacted against the committed work plan (an open architecture would help mitigate the risks associated with that by offering alternate strategies).

This work should accelerate the refresh of the technology stack in the product roadmap. This refresh should be done in conjunction with greater level of collaboration with the Clinical Community in terms of usability and look and feel of the WCP.

In concert with that, we recommend the development of a national EPR strategy that takes account of the full range of clinical system across Wales. This strategy should clarify the purpose and capability required from portals, PAS' and other elements that be considered national components of an EPR.

Core national infrastructure



Current state

Core network and storage infrastructure for the NHS in Wales was not included in the scope of this review. However, as a part of our review we were asked to signpost any relevant concerns. Wales has been experiencing outages and performance issues highlighted in the recent review by Trustmarque (now Capita). It is also important to note that the core infrastructure is the foundation on which the digital architecture of the NHS in Wales operates and is a key part of any Digital Architecture. If this is not resilient at a national scale, the digital architecture that relies on it will also fail.

Challenges

Capita noted in their report, that, whilst the data centre and network infrastructure used by the NHS in Wales, and the associated operating and service models supporting it can be improved through a series of shorter term fixes, strategically it is not in line with current best practice. Current best practice shows all of the major providers are moving towards a software defined network approach that addresses many of the weakness that are inherent in the more traditional approach in Wales. We support that conclusion and it underpins our overall conclusion in the Current State Assessment that the overall architecture is not sustainable.

Recommendation

The NHS in Wales should rapidly develop a Network and Storage Strategy around a modern architectural approach, and follow the approach for other Architectural Building Blocks suggest earlier in this report. This is likely to involve the development of a substantial programme that considers a software defined network approach, Cloud vs other storage approaches, and a range of sourcing options for the core technology and their management.

Although outside our brief, an holistic strategy that builds a more resilient architecture has to be a priority. The current more tactical approach will not achieve that.

Lessons from international comparators

- The initial focus should be on putting in place the required infrastructure, building blocks, standards for coding and standards for communication.
- Agreement on the standardisation of healthcare processes and patient care pathways nationally is essential. Deviations from these standards is acceptable if justified and formally document it.
- Do not develop bespoke solutions where there are established commercial or open source offerings available. It is not a sustainable approach and will cost far more in the long run and creates a bottleneck to innovation.
- Innovation needs to be actively encouraged and funded. Not all initiatives will succeed, be prepared to fail fast and move on without blame.
- Do not take on too much initially, use a phased approach to the programme with realistic milestones. Focus on building a robust core and then bring in other elements.
- Training has to be properly planned, phased and ongoing. Ensure people are reused and people with knowledge and experience are not lost.
- Ensure high quality documentation and good governance around systems and integrations. Establishing proven methods and tools such as formal Agile using Jira.
- Test processes must be robust and informed by domain specialists with sector and technology expertise.
- Communication is essential to help people understand what is being done and why but also to publicise and celebrate successes.
- Define strategy in advance to make clear what will be delivered and when, clearly communicate direction and some quick, easy wins.

Design principles

The following are recommended design principles for the future state drawn from best practice:

Make information available to whomever needs it

Including: Clinicians, Patients, Health and Social Care, 3rd Sector, Carers, Public Health and research, to facilitate joined up care and improve outcomes.

Liberate data

Remove data silos and vendor lock-in; making data accessible to legacy and new applications.

Use open standards for interaction

Define how internal and external consumers interact with the platform (standards include openEHR, FHIR, IHE, HL7, REST, SOA, OAuth, SAML).

Use open standards for data exchange

This will facilitate Innovation and competition; lower barriers to entry for 3rd sector via shared Information model (Data stored in a proprietary database is not really open).

Adopt an open service model

Specifications of APIs are available to everyone.

Design for national scale

All components that may have a regional or national scale at some point in their development should be designed with national levels of resilience, reliability and performance in mind.

Consider appropriate use of cloud technologies

Cloud computing is referred to by many other open platform initiatives as an enabler – this needs to feature in NHS Wales' longer term thinking.

Build services for re-use

The digital system component could exploit APIs lower level to provide reusable service components, accelerating pace and standardisation across applications (e.g. a single web chat capability).

Adopt agile design principles – prototype, test, learn

The aim should be to shorten cycle times and improve evaluation, innovation and learning.

Focus on Architecture Building Blocks (ABBS)

For each of the focus ABBS the following should be established

- **Scope** there should be a clearly defined area of functionality (i.e. what the component does and what is out of scope).
- **Strategy** there should be a strategy document behind each ABB that clearly outlines the options considered and the direction of travel agreed upon by stakeholders/technical team. Each of the key focus ABBS for the Future State to maximise it's effectiveness as an Open Platform will need this.
- A **target technical architecture** should be established that clearly defines how the ABBS interact.

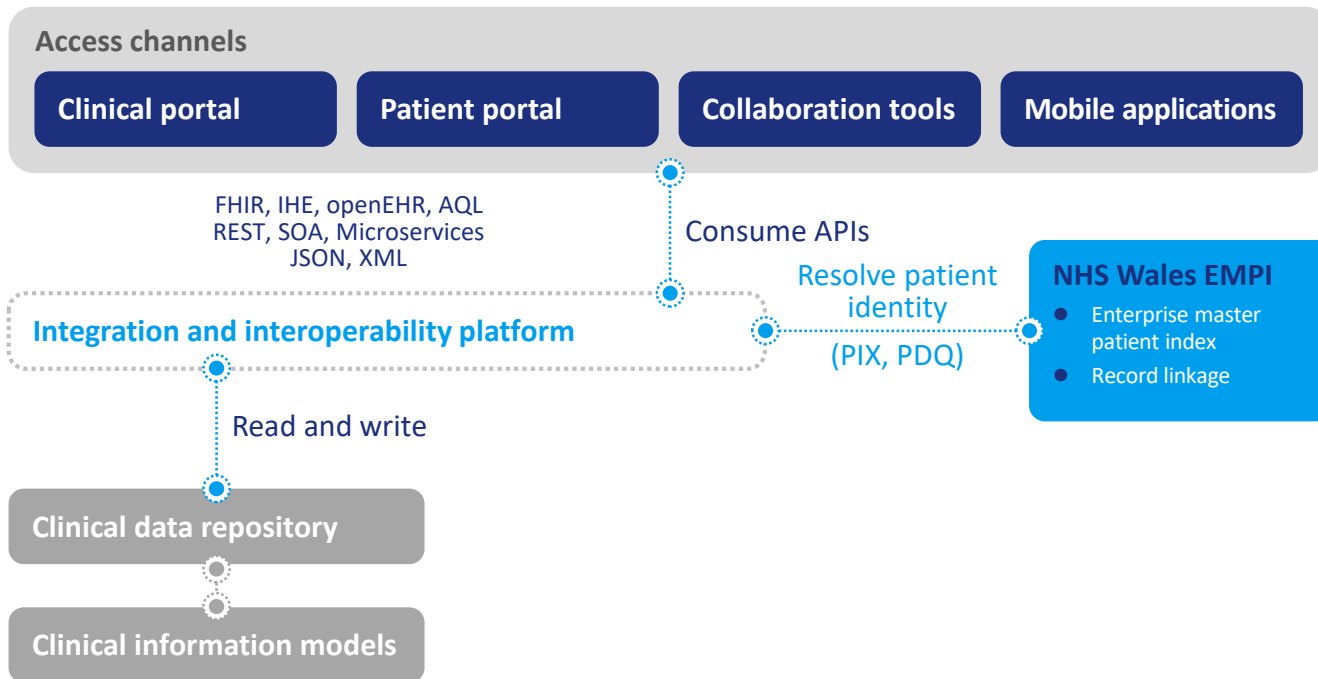
- **Product requirements** (buy, build or hybrid) should be derived from the Strategy requirements, non-functional requirements and ABB interaction requirements.
- **Operating model should be defined**, this includes outsourcing and internal capability.
- **Use cases should be modelled** against the above to test the capability, extensibility and flexibility of the platform.
- **Hosting options should be considered** for each ABB including Cloud, On-Premise or Hybrid (some may lend themselves to the cloud easier than others).

Whilst high level documentation exists for the many of the ABBS – or they are referred to in context of wider initiatives – the Current State Assessment identified that the level of detail required for the focussed development for the ABBS necessary for an open platform does not as yet exist to the necessary level of detail.

The following sections provide specific detail on the considerations for the core building blocks of the Target Architecture.

Foundation for an open platform

The model shows the essential Technical Target Architecture of an open platform



Welsh Clinical Portal (WCP)



Recommendations

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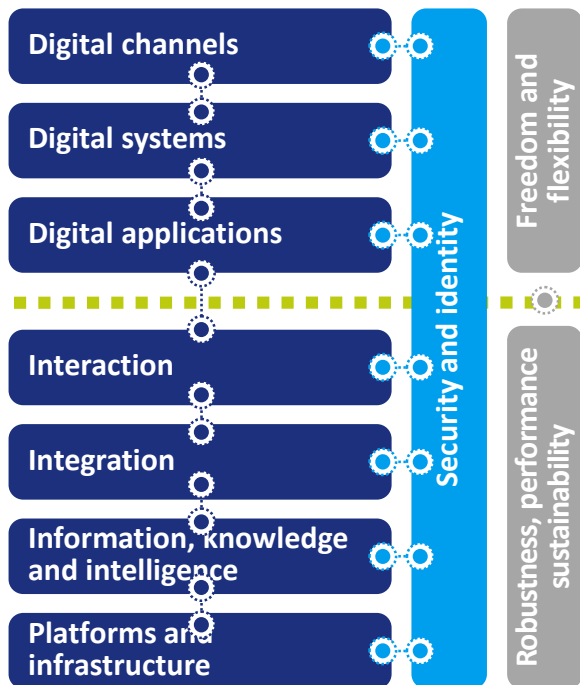
Although outside of our brief, an holistic strategy that builds a more resilient architecture has to be a priority. The current more tactical approach will not achieve that.

Summary future state

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The target digital architecture for NHS Wales

The model below translates the components set out in the Current State Assessment into a high level Target Architecture that is designed to meet the requirements of a Healthier Wales and embodies open design principles.



Digital channels

Interaction with customers, citizens and patients through digital media (e.g. via smart phones).

Digital systems

Components that support digital applications/digital customer interactions with our services (e.g. web chat). Enable boundaryless operations across digital transactions; monitor channel to system throughput.

Digital applications

Key application components that will be required to support digital enablement of the platform components (e.g. a clinical portal).

Interaction

Components that support interaction with digital customers, manage requests, state, case requests and co-ordination, communication and engagement (e.g. a directory of patients).

Integration

Components that support the integration and interoperability of applications, their co-ordination, workflow and monitoring (e.g. application programming interfaces).

Information, knowledge and intelligence

Components that support digital applications, services and orchestration through the collection, development and provision of reference information, knowledge and intelligence based on string reference data definitions (e.g. a data warehouse).

Platforms and infrastructure

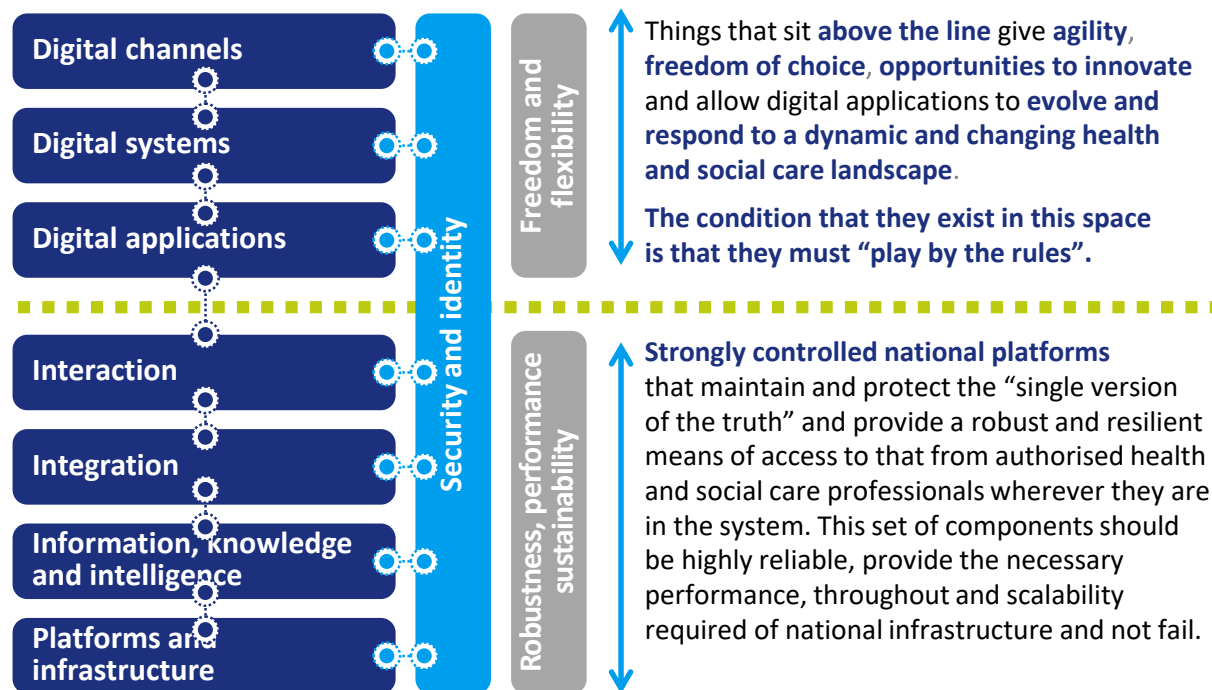
Core network and storage infrastructure to support digital enablement of the platform components (e.g. national networks and data centres).

Security and identity

Components that support the Identification of users (citizens, patients and staff), protect their information and ensure appropriate access. (e.g. single sign-on).

The target digital architecture for NHS Wales

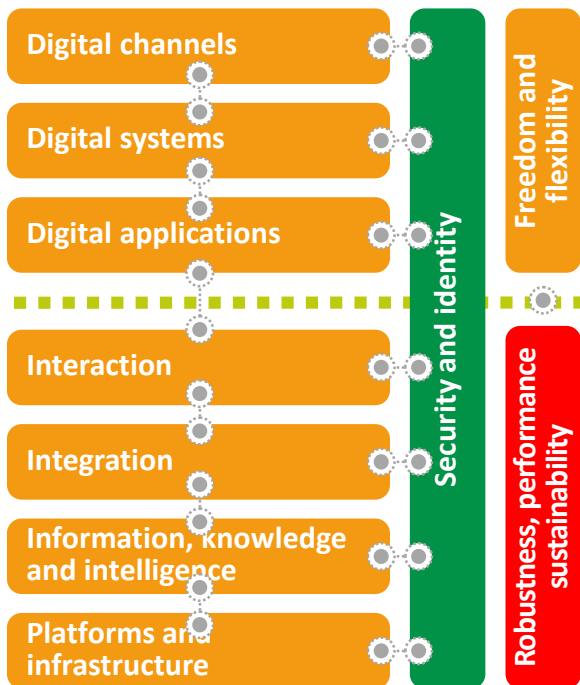
The model forces a clear separation between components “above the line” that allow for diversity, choice and agility within a set of clear rules, and those “below the line” that are defined, managed and protected.



A highly modular approach is key. It means that individual components can be stress-tested and monitored for performance independent of the whole. It would permit health boards to integrate national functionality into existing workflows and help our convergence work.

Roadmap – the current position

The Current State Assessment indicates a current digital architecture that is not yet capable of meeting the ambition set out in A Healthier Wales.



Digital channels

Limited use of multi-channel and mobile technology – some pilots. No patient access channels.

Digital systems

Limited use of products that are capable of supporting digital applications/digital customer interactions with services. Largely siloed/local systems and/or local implementations of national products.

Digital applications

Some application components available or in development but as yet to align with open principles.

Key

Capable of supporting ambition:

Now In <2 years In >2 years

Interaction

Foundations for a national open API layer and EMPI in place but capable of enhancement and exposure beyond the national development team.

Integration

Foundations for integration exist but as yet to be fully exploited with many system and data siloes.

Information, knowledge and intelligence

Plans developing for a National Data Resource and national Clinical Data Repository.

Platforms and infrastructure

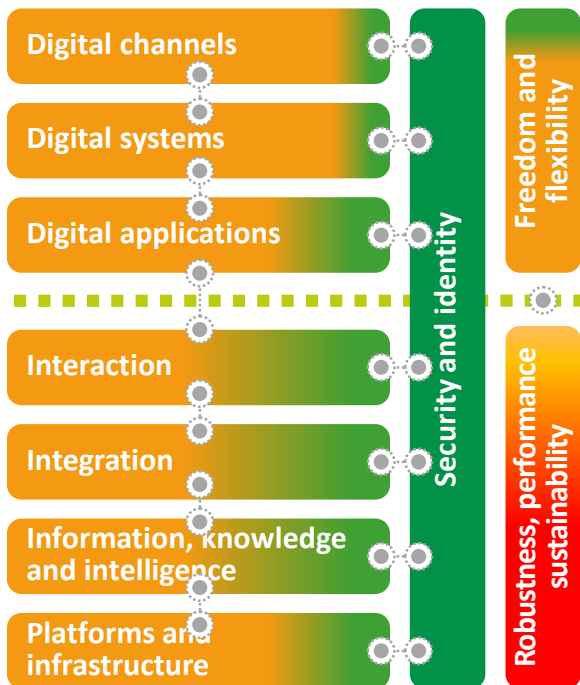
Infrastructure not architected along modern lines and remains fragile and requiring ongoing tactical investment.

Security and identity

Security infrastructure capable of providing required support in place but will need to continue to upgrade in line with threat levels and needs of the system (e.g. Single Sign On).

Roadmap - position achievable in 1 year

The approach set out in the Future State Assessment targets a transition architecture that provides a stepping stone towards a fit for purpose digital target architecture.



Digital channels

Movement beyond pilot stages for some applications. Early pilots of patient integration through new channels as exemplars.

Digital systems

Some progress with early exemplars such as PKB and move to open principles.

Digital applications

Movement of some products to an open model – e.g. WCCIS, WCP.

Key

Capable of supporting ambition:

Now In <2 years In >2 years

Interaction

Some early exposure of APIs to Health Boards and wider development community. Enhanced EMPI to provide wider range of patient flags and access mechanisms. Strategies and plans for development of the EMPI in place.

Integration

Strategies and plans for development of the Integration and Interoperability layer in place. Early examples developed to use open principles.

Information, knowledge and intelligence

Early development of a national Clinical Data Repository.

Platforms and infrastructure

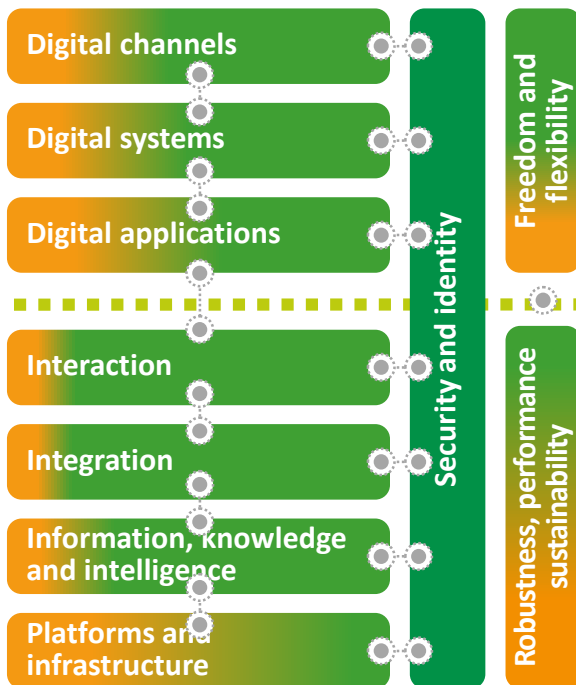
Strategies and plans for development of the core infrastructure in place. Early steps towards implementation.

Security and identity

Ongoing development in line with threat levels and capabilities required.

Roadmap – position achievable in 3 years

With the right focus a target digital architecture that supports the ambition for A Healthier Wales could be achievable.



Digital channels

Multi-channel working environment for clinicians and non-clinicians in most Health Boards. Patient access on line to a variety of services.

Digital systems

Supporting infrastructure to orchestrate channels and use modern customer interaction technologies such as web chat.

Digital applications

Majority of national platforms use open principles. Multiple examples of clinical, non-clinical and patient applications in use that comply with the Welsh

standards and make use of the open platform. Acceleration of pace towards an eco-system of suppliers, innovators and academic institutions driving innovation.

Interaction

Fully open architecture with supporting published standards and available test and accreditation environments and developer support in place.

Integration

Significant progress towards integrated working across health and social care through the digital architecture in place. Strong digital workflow.

Information, knowledge and intelligence.

National Clinical Data Repository with associated intelligence and research capability. Strong data standards. Advanced business intelligence.

Platforms and infrastructure

Significant progress towards a modernised network and storage infrastructure providing resilience and stability nationally and making appropriate use of software defined network and clouds technologies.

Security and identity

Ongoing development in line with threat levels and capabilities required.

Key

Capable of supporting ambition:



Recommendations

(Developed further in improvement options)

Recommendation		Suggested timing	Suggested ownership
Digital architecture	Commit to the development of an NHS Wales Open Digital Architecture	Immediate	Welsh Government
	Adopt a core set of Digital Design Principles (p25)	3 months	NHS Wales
	Adopt and publish TOGAF® (or similar) framework to locating Digital Architecture in a business context for the NHS in Wales (p24)	3 months	NHS Wales
	Define all Architectural Building Blocks (ABBs) for the NHS Wales Digital Architecture (p26)	3 months	NHS Wales
	For the key ABBs required for an Open Digital Architecture (EMPI, Integration and Interaction, and CDR) develop, publish a consistent product set of core products that are agreed across Wales and published nationally (p27)	3 months	NHS Wales
	Start work to focus on some early wins in line with open architecture principles (see Improvement Options)	3 months	NHS Wales

Recommendations

Recommendation		Suggested timing	Suggested ownership
Open digital platform	Enhance the NHS Wales EMPI along open principles to facilitate a more developed Patient/Citizen identification strategy (p38 - 45)	1 year with early wins in 3 months	NHS Wales
	Enhance the NHS Wales Integration and Interaction Engine (possibly including sourcing options) to provide a truly open platform for Wales (p46 - 51)	1 year target	NHS Wales
	Focus the work of the National Data Resource (NDR) programme on the creation of a National Clinical Data Repository in line with open principles in a balanced way that ensures that the programme as a whole is progressed but the CDR is given priority (p52 - 56)	1-2 years with a series of shorter term transition architectures	NHS Wales
Stabilisation and resilience	Make resolving the performance problems of the WCP and migrating to an open architecture that can take advantage of the architecture proposed in the Future State the highest priority for the product in the next 12 months. (p58 - 59)	1 year	NHS Wales
	Build on the final recommendations of the Trustmarque review of networks to move towards a modern (possibly multi-sourced) software managed national network and storage infrastructure (p60)	2 - 3 years	NHS Wales

Conclusions

The Future State set out in this document builds on the current digital architecture of the NHS in Wales. It sets out a clear and achievable plan to deliver an architecture that will fully enable Wales to embrace a digital future, support innovative practices in front line care, to plan services, and facilitate research and public health.

An open architecture as recommended in this report will provide the flexibility and pace for innovation using local, national and commercial resources, thus accelerating pace. The digital teams in Wales will be able to respond to changes in front line care delivery and organisation structures rapidly without changes to underlying systems or data. This model protects against supplier lock-in, preventing constraints, and providing freedom to select the best solution to meet the needs of the Welsh people.

The immediate recommendations set out in the Improvement Options also suggest real demonstrable examples that will engage directly with patients and support clinicians in their delivery of high quality care. These will help set the tone for the future of digital service in Wales.

It is also recognised that to deliver a transformation as impactful as this requires resources to support the programme of change and deliver an infrastructure that will ensure reliability resilience and sustainability for the health and social care services for Wales.

Appendix A – Glossary

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Glossary

Term/acronym	Meaning
ABB	Architectural Building Block a constituent of the architecture model that describes a single aspect of the overall model.
API	Application Programming Interface a software application or service that allows one service to request a specific service of another piece of software in a standard way.
AQL	The IBM Ariel Query Language (AQL) is a structured query language that you use to communicate with the Ariel databases.
ASTM	One of the earliest interfaces was the ASTM (American Society for Testing and Materials) interface, which is a bidirectional protocol that has been largely used to connect clinical devices.
CANiSC	CANiSC is a clinical information system which allows NHS Wales organisations to record assessments, treatments and follow-up care (inpatients, day cases, procedures) into a common patient case note, which any health care professional caring for a patient can access, thus giving a full picture of each individual's care wherever that person happens to be treated e.g. secondary care, palliative care.
CDA	Clinical Document Architecture (CDA) is a popular, flexible mark-up standard developed by Health Level 7 International (HL7) that defines the structure of certain medical records, such as discharge summaries and progress notes, as a way to better exchange this information between providers and patients.
CDR	Clinical Data Repository an accessible database of all clinical information for a population of patients including letters, clinical notes, scans etc.

Glossary

Term/acronym	Meaning
CHI	The Community Health Index is a register of all patients in NHS Scotland. CHI Index contains details of all Scottish residents and exists to ensure that patients can be correctly identified, and that relevant information pertaining to a patient's health is available to providers of care.
Cloud	Services and information hosted outside the domain of an organisations systems either using a bespoke arrangement or a large Cloud supplier such as Amazon (Amazon Web Services), Microsoft (Microsoft Azure) or Google (various services).
CSV	CSV is a simple file format used to store tabular data, such as a spreadsheet or database. Files in the CSV format can be imported to and exported from programs that store data in tables, such as Microsoft Excel or OpenOffice Calc. CSV stands for " comma-separated values ".
DICOM	Digital Imaging and Communications in Medicine (DICOM) is a standard for handling, storing, printing, and transmitting information in medical imaging. It includes a file format definition and a network communications protocol.
EDI	Electronic Data Interchange (EDI) is the computer-to-computer exchange of business documents in a standard electronic format between business partners.
EDIFACT	EDIFACT (ISO 9735) is the international standard for electronic data interchange (EDI). The term stands for Electronic Data Interchange For Administration, Commerce and Transport .
EDMS	Electronic Document Management System a system that allows documents to be stored and interrogated using intelligent search facilities.

Glossary

Term/acronym	Meaning
EMPI	Enterprise Master Patient Index .
FHIR	FHIR is the latest standard to be developed under the HL7 organisation. Pronounced 'Fire' , FHIR stands for Fast Healthcare Interoperability Resources .
FTP	File Transfer Protocol (FTP) is a standard Internet protocol for transmitting files between computers on the Internet over TCP/IP connections.
GP Links/Transfer Service	The National GP Links solution is a centrally hosted solution for processing pathology and radiology test results from the national WLIMS and RadIS solutions through to all GP Practices in Wales via the national Messaging Exchange for Social care and Health (MESH). This replaces existing local and interim national GP Links solution. Bowel Screening messages are also sent via national GP Links. The solution that is being implemented nationally is provided by IUVO Ltd. and is called Clin-eConnect. EDAL messages from Myrddin are also being sent to GP Practices but for Cwm Taf only.
HIMMS	The Healthcare Information and Management Systems Society (HIMSS) is an American not-for-profit organisation dedicated to improving health care in quality, safety, cost-effectiveness, and access through the best use of information technology and management systems.
HL7	Health Level-7 or HL7 refers to a set of international standards for transfer of clinical and administrative data between software applications used by various healthcare providers. These standards focus on the application layer, which is "layer 7" in the OSI (Open Systems Interconnection) model.

Glossary

Term/acronym	Meaning
Hospital Pharmacy System in Wales	The Hospital Pharmacy allows stock to be ordered and invoiced electronically, it records and labels all medication, downloads details automatically from the hospital's patient administration system (PAS), links to various robots to pick the medicines to be dispensed and delivers them to the stock room.
HTTP	HTTP means HyperText Transfer Protocol . HTTP is the underlying protocol used by the World Wide Web and this protocol defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands.
Hybrid (Cloud)	Services and information hosted partly inside and partly outside the domain of an organisations systems, often driven by access and economic considerations.
IAM	Identity and Access Management a set of services that manages the identity of users and manages their access to systems.
IHE	IHE is an initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information. IHE promotes the coordinated use of established standards such as DICOM and HL7 to address specific clinical needs in support of optimal patient care.
JSON	JavaScript Object Notation (JSON) is a text-based, human-readable data interchange format used for representing simple data structures and objects in Web browser-based code.

Glossary

Term/acronym	Meaning
LDAP	Lightweight Directory Access Protocol (LDAP) is a software protocol for enabling anyone to locate organisations, individuals, and other resources such as files and devices in a network, whether on the public Internet or on a corporate intranet.
MLLP	Minimal Lower Layer Protocol (MLLP) is any protocol residing in OSI layers one to four, as defined by Health Level 7 (HL7).
NADEX	Authentication Services enables authorised users to log on to an NHS Wales computer regardless of their location.
NDR	NHS Wales National Data Resource programme.
NHS Wales MPI	MPI is a system to aid the identification of patients and minimise the number of duplicate health records held for each patient. It achieves this by collecting key data from NHS Wales clinical systems, including name, address, date of birth and sex, from across NHS Wales Health Boards. This then creates one “gold standard” patient identity record that is intended to best represent the individual.
NIIAS	The National Intelligent Integrated Audit System (NIIAS) receives daily audit logs from WCP, WPAS, CANISC (Weekly feeds), WDS, AAA/BS, and working towards integrating ICNet, RADIS2, WCCIS, WEDS, WLIMS.
NWIS	NHS Wales Informatics Service.

Glossary

Term/acronym	Meaning
OAuth	Open Authorisation (OAuth) is an open standard for token-based authentication and authorisation on the Internet. OAuth, which is pronounced "oh-auth," allows an end user's account information to be used by third-party services, such as Facebook, without exposing the user's password.
ODBC	Open Database Connectivity (ODBC) is a standard application programming interface (API) for accessing database management systems (DBMS). The designers of ODBC aimed to make it independent of database systems and operating systems.
On-Premise	Services and information hosted inside the domain of an organisations systems.
openEHR	openEHR is an open standard specification in health informatics that describes the management and storage, retrieval and exchange of health data in electronic health records (EHRs). In openEHR, all health data for a person is stored in a "one lifetime", vendor-independent, person-centred EHR.
PDQ	Patient Demographics Query (PDQ) profile provides ways for multiple distributed applications to query a patient information server for a list of patients, based on user-defined search criteria, and retrieve a patient's demographic (and, optionally, visit or visit-related) information directly into the application.

Glossary

Term/acronym	Meaning
PIX	Patient Identity Cross-referencing (PIX) profile supports the cross-referencing of patient identifiers from multiple Patient Identifier Domains. These cross-referenced patient identifiers can then be used by “identity consumer” systems to correlate information about a single patient from sources that “know” the patient by different identifiers. This allows a clinician to have more complete view of the patient information.
RBAC	Role-based-access-control (RBAC) is a policy neutral access control mechanism defined around roles and privileges. The components of RBAC such as role-permissions, user-role and role-role relationships make it simple to perform user assignments.
REST	Representational State Transfer (REST) is an architectural style for developing web services.
SAML	Security Assertion Markup Language (SAML, pronounced sam-el) is an open standard for exchanging authentication and authorisation data between parties, in particular, between an identity provider and a service provider.
SOA	Service-oriented architecture (SOA) is a style of software design where services are provided to the other components by application components, through a communication protocol over a network. The basic principles of service-oriented architecture are independent of vendors, products and technologies.
SSO	Single Sign On the ability to sign simultaneously on to multiple systems with one set of credentials – often using smart card technology.

Glossary

Term/acronym	Meaning
TCP	Transmission Control Protocol (TCP) is a standard that defines how to establish and maintain a network conversation via which application programs can exchange data. TCP works with the Internet Protocol (IP), which defines how computers send packets of data to each other.
TOGAF®	The Open Group Architecture Framework a de-facto standard framework for Enterprise Architecture development.
UDP	User Datagram Protocol (UDP) is an alternative communications protocol to Transmission Control Protocol (TCP) used primarily for establishing low-latency and loss-tolerating connections between applications on the internet.
VNA	A Vendor Neutral Archive (VNA) is a medical imaging technology in which images and documents (and potentially any file of clinical relevance) are stored (archived) in a standard format with a standard interface, such that they can be accessed in a vendor-neutral manner by other systems.
WCCG	The Welsh Clinical Communications Gateway (WCCG) allows outpatient referral messages to be transmitted electronically from the GP Practice to the Secondary Care environment, replacing paper referral letters.
WCP	The Welsh Clinical Portal is a secure webpage uniting key patient information from numerous computer systems and databases used in NHS Wales. It provides an immediate view of important data that is required to support vital clinical decisions.

Glossary

Term/acronym	Meaning
WCRS	The Welsh Clinical Records Service provides a single place to go to find out what records exist for a patient. WCRS enables clinical applications like Welsh Clinical Portal (WCP) to navigate and present the record, so that clinicians can find the information they need quickly.
WDS	Welsh Demographic Service describes a number of information systems and services that manage demographic information for Welsh residents, with controlled access to some of the new English demographic services necessary for cross-border exchanges of information.
WG	Welsh Government .
WGPR	The Welsh GP Record (WGPR) is a summary of a patient's GP record which allows GPs and hospital staff working in an Out of Hours service to view basic information fed from the patient's GP medical record.
WLIMS	The Welsh Laboratory Information Management System (WLIMS) is based on the TrakCare LAB application and provides the computing facilities to assist a pathology laboratory with the management of accurate results reporting, laboratory efficiency, business management, with the objective of improving patient care.
WPAS (PAS)	The Welsh Patient Administration System is a suite of applications to support patient administration, maternity, theatres and emergency department.

Glossary

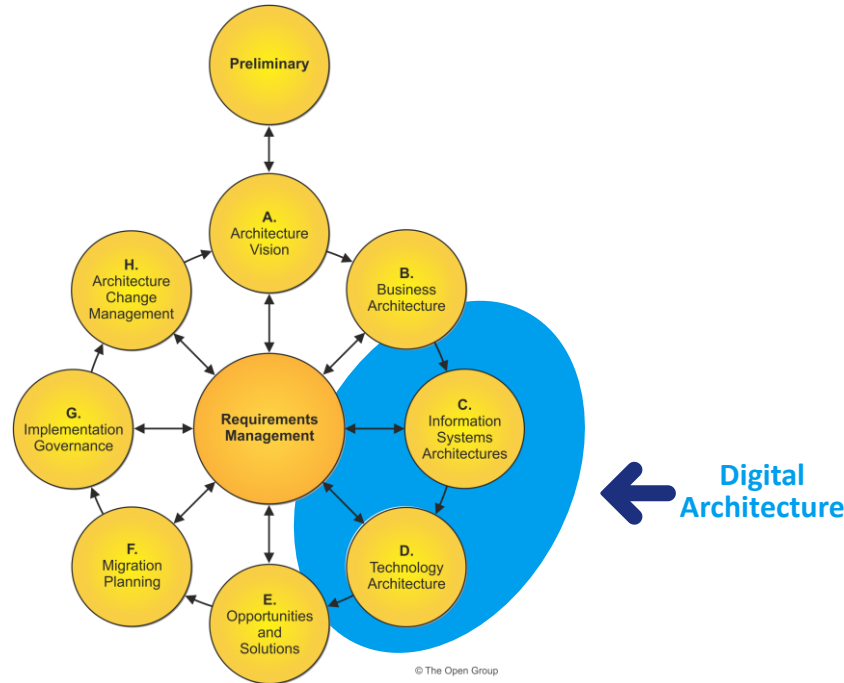
Term/acronym	Meaning
WRDS	The Welsh Reference Data Service acts as a 'hub' bringing together different Reference Data, some of which are already available in different forms and ensures that Reference Data is available on demand, via a variety of means. This reference data is used for a variety of purposes including validation, derivation of new values, the supply of nationally recognised codes in clinical IT systems and the labelling of outputs for reporting purposes. The reference data sets managed cover a wide variety of codes used within primary and secondary care.
WRRS	The Welsh Results Reporting Service is a single diagnostic repository providing WCP & GPTR users with the ability to view diagnostic reports and requests for their patient, regardless of where in Wales they were produced.
X12	X12 is a standard for Electronic Data Interchange (EDI) from the American National Standards Institute (ANSI) Accredited Standards Committee (ASC).
XCA	External Communication Adapter .
XDR	Cross-Enterprise Document Reliable Interchange (XDR) provides document interchange using a reliable messaging system.
XDS	Cross Enterprise Document Sharing (XDS) is a system of standards for cataloguing and sharing patient records across health institutions. XDS provides a registry for querying which patient records are in an EHR repository and methods for retrieving the documents.
XML	Extensible Markup Language (XML) is a mark-up language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.

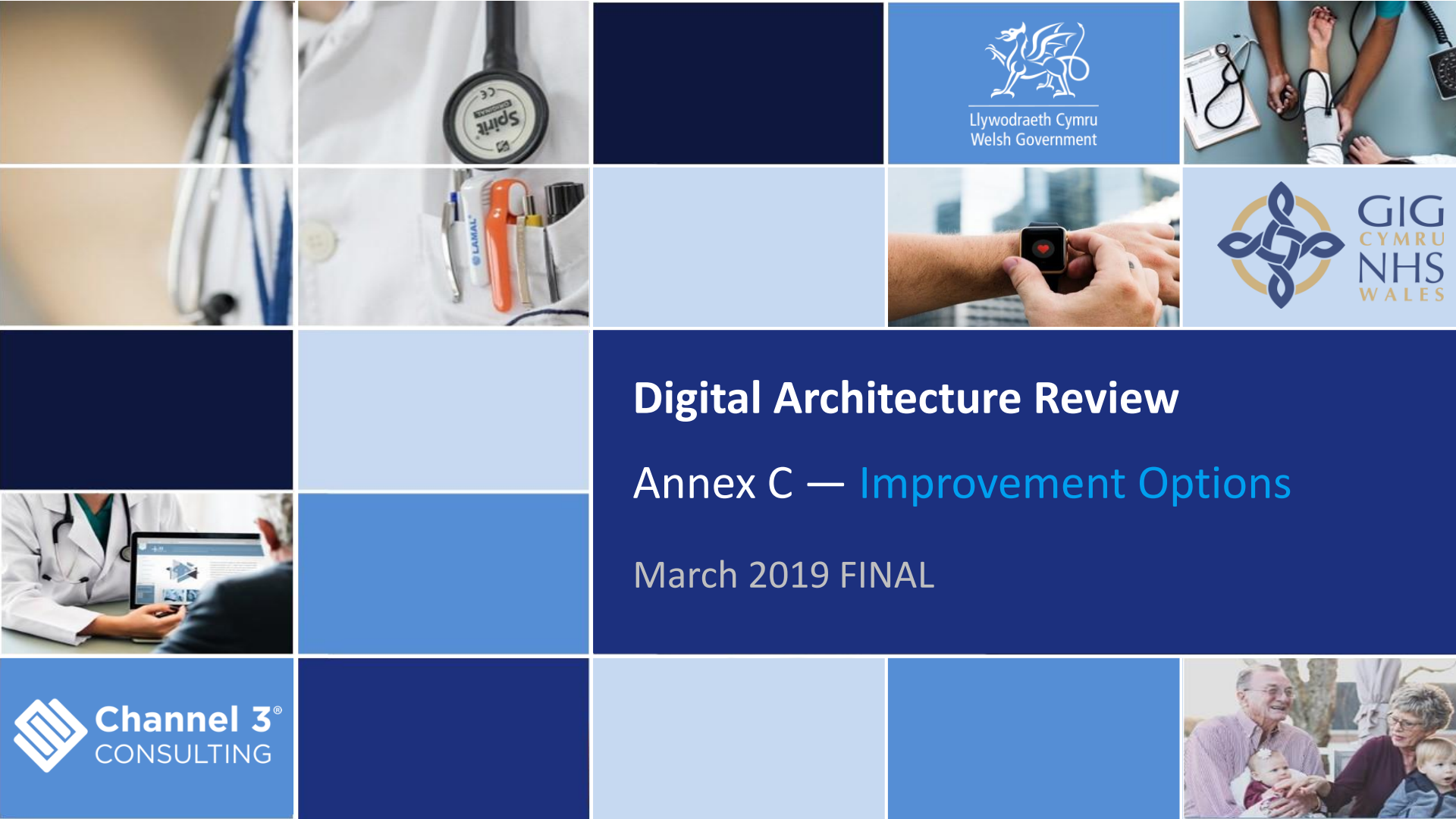
Appendix B – TOGAF® overview

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Digital architecture in a TOGAF® context

We recommend the adoption of a framework that positions digital architecture in a well defined business context using a well recognised enterprise architecture framework such as TOGAF® (The Open Group Architecture Framework).





Digital Architecture Review

Annex C — Improvement Options

March 2019 FINAL



Improvement options

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Limitations of our works

This assessment is based on information provided by the Welsh Government and NHS Wales and associated stakeholders and was supported by further clarifications and confirmations.

Channel 3 Consulting have not undertaken a comprehensive audit nor have Channel 3 subjected the information upon which we have relied to verify assessments. Accordingly, Channel 3 assume no responsibility and make no representations with respect to the accuracy or completeness of the information in the report.

Channel 3 cannot guarantee that we have had sight of all relevant documentation or information that may be in existence and

as such, our assessment is based on the information Channel 3 have been provided. Any documentation or information brought to our attention subsequent to the date of the assessment may require us to adjust our assessment accordingly. Channel 3 also note that, given the sample nature of some of the testing which we have conducted, we cannot guarantee that we have identified all information that may be relevant.

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Background

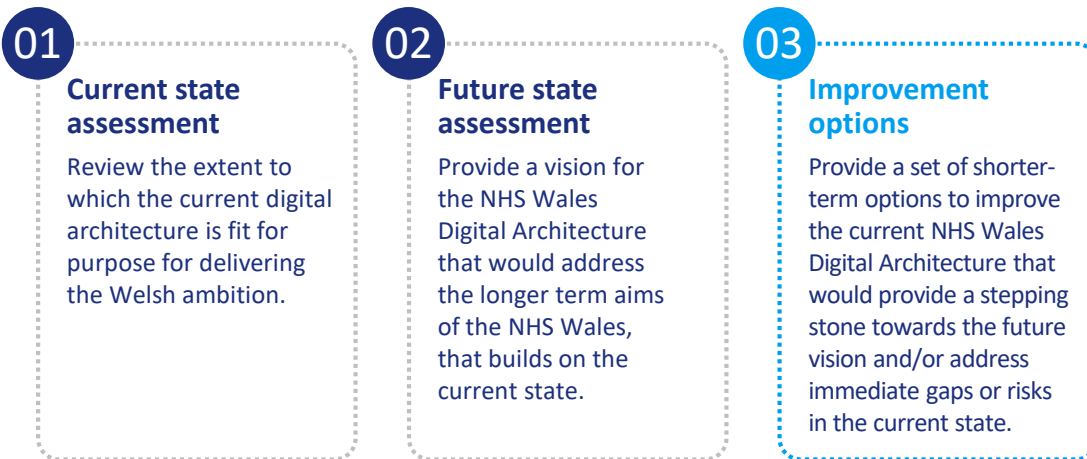
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Background

The Welsh Government has commissioned a review of the NHS Wales digital architecture, recognising the ambition for digital transformation across the Welsh Health and Social Care System at pace. NHS Wales Informatics Service (NWIS) has, on behalf of the Welsh Government engaged Channel 3 Consulting to undertake this review of the NHS Wales Digital Architecture.

The focus of this review is to assess the extent to which the current Digital Architecture of NHS Wales is ready to meet the ambition set out in A Healthier Wales and whether it is scalable to support digital transformation across Wales.

To achieve this, the review will consist of three core phases:



This document summarises the third of these phases. It is assumed that readers are familiar with the Current and Future State Assessments which provide essential context.



Executive summary

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Executive summary

This report sets out a high level three year roadmap for progressing to a digital health and social care architecture in Wales and a set of shorter term actions aligned with the Target Architecture defined in the Future State Assessment. The aim of this report is to set out the first steps towards a digital architecture that is genuinely open for the whole of the NHS in Wales. It recommends:

- A short term 18 month action plan building on the recommendations in the future state assessment, focused on the core architectural building blocks that will be central to an open architecture for the longer term – EMPI, integration engine, and clinical data repository.
 - Addressing other considerations that are essential to making progress – notably developing a Digital Health and Social Care Strategy for Wales; adopting an Enterprise Architecture approach to the wider business architecture development, and; introducing appropriate system wide architectural controls and Governance. Exploring external support to accelerate progress.
 - A set of candidate “challenge” projects that could be used to robustly test the architectural concept and accelerate the pace of transition to a digital future.
 - Mitigations for the key risks that will materially impact any transition to a digital future with a key focus on a more collaborative system wide approach to digital architecture, harnessing the available capacity, capability and funding across Wales.
- It also notes that the digital priorities for NHS Wales identified in December 2018 and ratified at NIMB align well with the recommendations in this review and suggest some targeting of those priorities to make immediate progress.



Overall roadmap to future state

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Overall roadmap

The high level roadmap for achieving the Target Architecture defined in the Future State Assessment is estimated to be a three year transition from financial year 19/20 to financial year 21/22. A fully open and resilient Target Architecture should be achievable in that timescale, but its development will have to be balanced against:

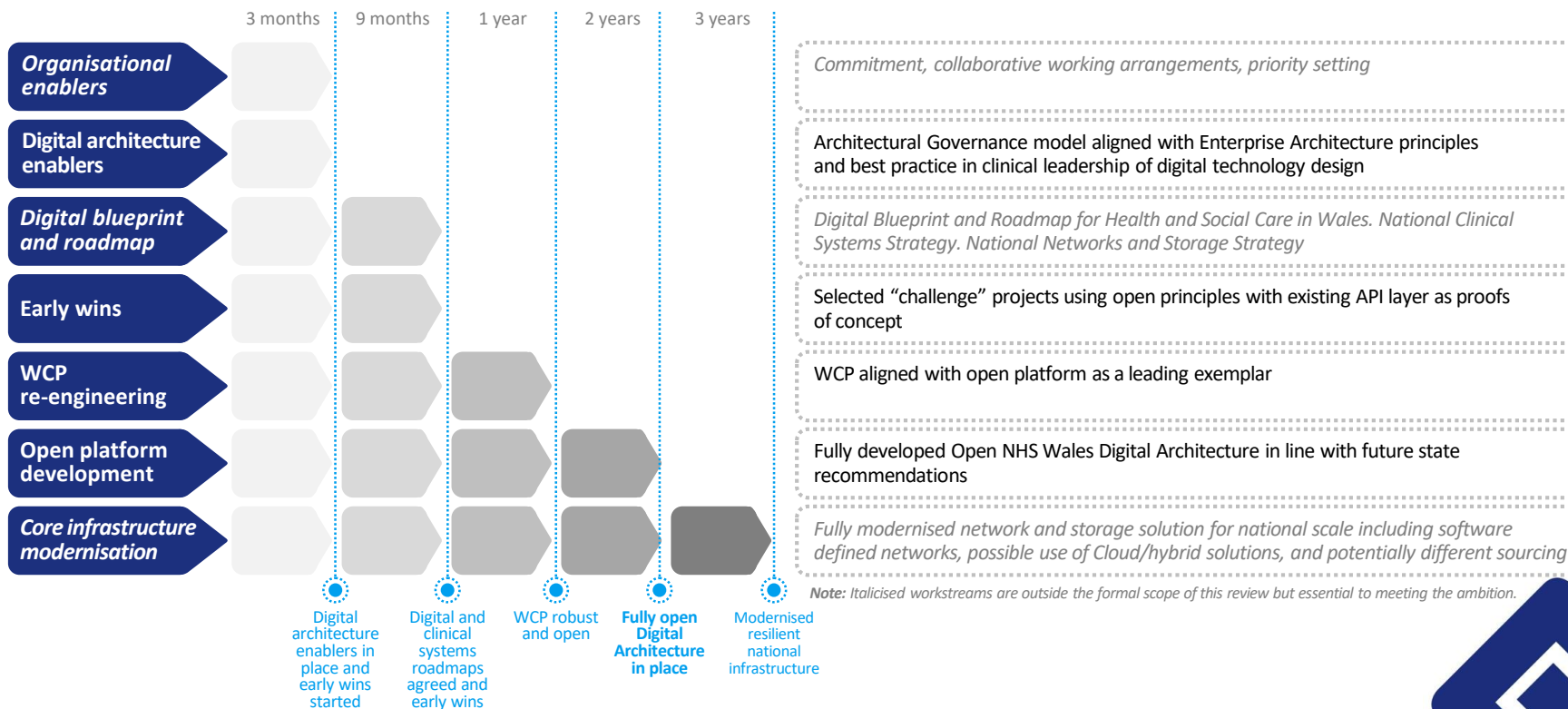
- Maintaining day to day service to throughout the transition.
- Available capacity and funding.
- Other priorities for the system that will require functionality to be enhanced or developed.

Within that overall transition, there are however some aspects of the transition that can be achieved much more quickly than others.

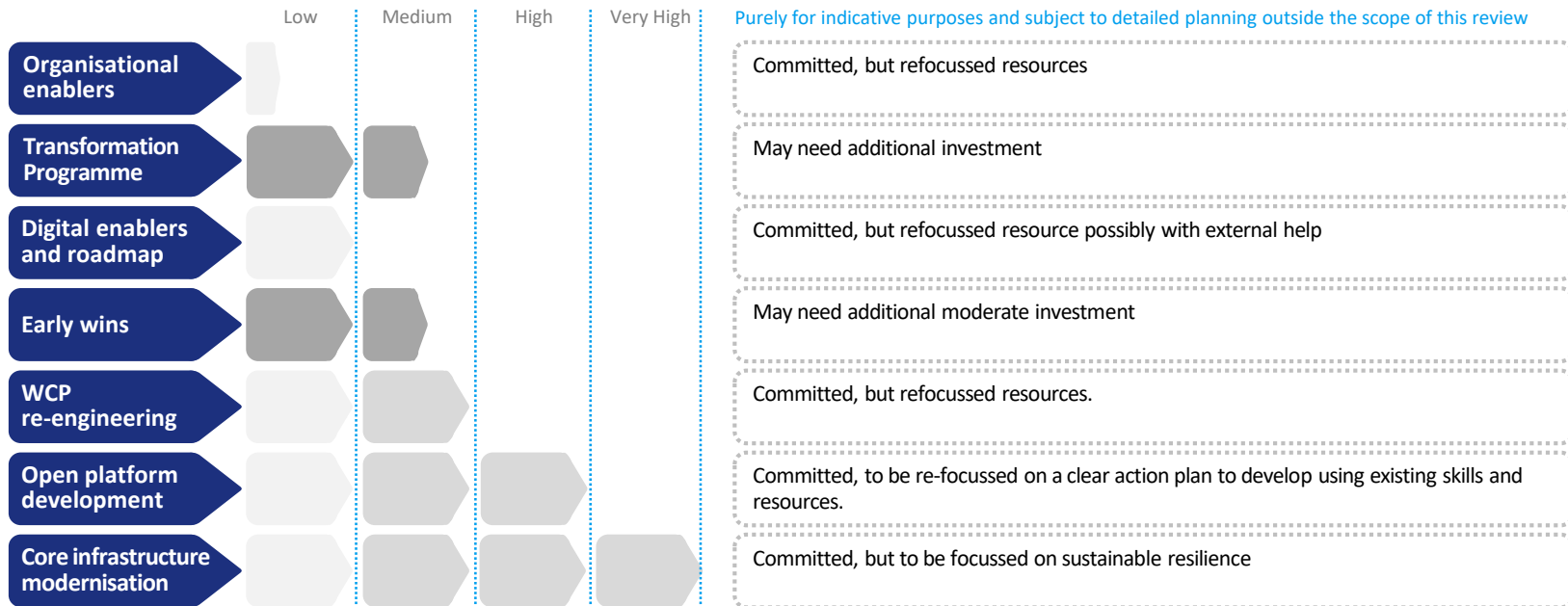
Given the existing foundations built by NWIS, we estimate that with an appropriate focus the majority of the transition to an open architecture could realistically be achieved within a 2 year period to the end of financial year 20/21. This will be challenging but achievable. It will require considerable focus, along with some key priority calls, however it will enable the pace of innovation on the front line to be accelerated. The aspects that will take longer will principally relate to core infrastructure changes that will be a major undertaking and require considerable investment for a resilient national platform.

In addition, the roadmap includes some shorter term architectural adjustments that could yield shorter term benefit in 19/20 to early 20/21, along with some candidate “challenge” projects that could be accelerated to test and signal digital transformation to patients, service users and staff across the system.

Overall roadmap



Indicative resourcing implications



Whilst there may be some incremental additional funds needed for early wins and transformation, we would recommend a refocussing of existing plans, resources and funding to achieve the goals of A Healthier Wales

18 month action plan

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18 month action plan

Our recommendations for the short term break down into three groups:

Digital architecture

Actions required to build an open Digital Architecture platform for Health and Social Care in Wales.

These are set out in the future state Assessment and replicated below for clarity.

Other enablers

Actions required to create an enabling environment in which the necessary focus for the development of the Digital Architecture can be achieved. Whilst these are not strictly within the scope of this review, they are signposted as they are necessary for the a successful Digital Architecture to be developed.

These are set out below.

Early targets

Actions that would accelerate innovation and pace based on existing work that we have discussed with Health Boards and others.

These are set out in the next section.

Digital architecture

Recommendation		Suggested timing	Suggested ownership
Digital architecture	Commit to the development of an NHS Wales Open Digital Architecture.	Immediate	Welsh Government
	Adopt a core set of Digital Design Principles.	3 months	NHS Wales
	Adopt and publish TOGAF® (or similar) framework to locating Digital Architecture in a business context for the NHS in Wales.	3 months	NHS Wales
	Define all Architectural Building Blocks (ABBs) for the NHS Wales Digital Architecture.	3 months	NHS Wales
	For the key ABBs required for an Open Digital Architecture (EMPI, Integration and Interaction, and CDR) develop, publish a consistent product set of core products that are agreed across Wales and published nationally (p26).	3 months	NHS Wales
	Start work to focus on some early wins in line with open architecture principles.	3 months	NHS Wales

Digital architecture

Recommendation		Suggested timing	Suggested ownership
Open digital platform	Enhance the NHS Wales EMPI along open principles to facilitate a more developed Patient/Citizen identification.	1 year with early wins in 3 months	NHS Wales
	Enhance the NHS Wales Integration and Interaction Engine (possibly including sourcing options) to provide a truly open platform for Wales.	1 year target	NHS Wales
	Focus the work of the National Data Resource (NDR) programme on the creation of a National Clinical Data Repository in line with open principles in a balanced way that ensures that the programme as a whole is progressed but the CDR is given priority.	1-2 years with a series of shorter term transition architectures	NHS Wales
Stabilisation and resilience	Make resolving the performance problems of the WCP and migrating to an open architecture that can take advantage of the architecture proposed in the Future State the highest priority for the product in the next 12 months.	1 year	NHS Wales
	Build on the final recommendations of the Trustmarque review of networks to move towards a modern (possibly multi-sourced) software managed national network and storage infrastructure.	2 - 3 years	NHS Wales

Other enablers

Recommendation		Suggested timing	Suggested ownership
Digital health and social blueprint and roadmap	Develop and publish an end to end Digital Blueprint and Roadmap for Health and Social Care in Wales that develops the high level ambition articulated in “A Healthier Wales” into an actionable roadmap setting out the evolution of the digital architecture and how will deliver on the ambition for the system.	6-9 months	NHS Wales
National clinical systems strategy	As observed in the Current and Future State Assessments, the Welsh Clinical Portal and other national systems sit within a complex landscape of other clinical systems used at the level of Health Boards. The ability to maintain a direction that relies on scarce national capacity to develop all clinical solutions is one that is likely to be unsustainable. In addition, some of these platforms are regarded as being in direct competition and the focus is on convergence rather than openness. An open platform approach would enable more freedom and flexibility to meet Health Boards’ local needs in addition to innovation, whilst taking advantage of shared records across Wales. We strongly recommend the development of a national clinical systems strategy that takes account of the full range of clinical systems across Wales and charts an agreed roadmap for their development against an Open Platform model.	6-9 months	NHS Wales

Other enablers

Recommendation		Suggested timing	Suggested ownership
Architectural controls	There is a need for Architectural Governance mechanisms to be built into the wider Governance of Digital technology in Wales including clinical and non-clinical design authorities, and a leadership model for collective clinical leadership of the Digital Architecture in Wales. We therefore recommend the development and implementation of an Architectural Governance model aligned with Enterprise Architecture principles and best practice in clinical leadership of digital technology design. In this there need to be decision making mechanisms that are inclusive but binding.	6-9 months	NHS Wales
Market relationships	Whilst we have seen strong contract management skills evident in the NHS in Wales, a digital model against an open architecture requires a more commercial mindset that will enable the NHS in Wales to partner with the market in more innovative and collaborative ways whilst still observing the necessary legal and contractual frameworks. NHS Wales should consider approaches to building relationships with the market in a way that works towards mutual alignment behind the ambition and outcomes set out by A Healthier Wales, as opposed to contracting for digital outputs and products.	6-9 months	NHS Wales

Target “challenge” projects

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Target “challenge” projects

In addition to the core Digital Architecture development, it is critical to the longer term development of a digital delivery culture in Health and Social Care in Wales to build an early track record of success.

This will “set the tone” of a Digital NHS Wales and also enable consistent templates to be built for using the architecture and testing its componentry as it is developed. Critically, it will enable some early visible successes with the right level of control.

This section therefore identifies a number of existing projects that could, with the right focus and joint working between NWIS, Health Boards and other stakeholders, be taken forward quickly and used to start the transition.

Our engagement work with Health Boards has indicated that with some adjustments to approach – principally around adopting open principals and working towards the Future State outlined in this review – early success (we estimate in a 12 month timeframe) is within reach. Our thinking is based on the following rationale:

- The prize of a shared patient records and interoperation across Wales, in line with the definition of Once for Wales agreed by the NIMB remains a primary goal.
- It will not be possible for the significant latent demand in the Welsh Health and Social Care system to be satisfied through centrally developed platforms. Health Boards are unable to progress operational initiatives through delays in the supply chain, and NWIS have indicated that capacity is major constraint.

- An open environment explicitly allows multiple solutions to co-exist around the same clinical data repository.
- There are opportunities to accelerate the benefit to patients through a number of projects that have been stalled.
- It is important to make a tangible start and find different ways of working if progress is to be made in any real sense.
- Whilst these suggested projects will be very challenging propositions to different stakeholders, we believe that they can be used as real tests of, not just the technical aspects, but also the adjustment in collaboration and behaviors that a truly open digital approach implies.

Target “challenge” projects

We have identified a small number of projects where a different approach could start the journey towards an open digital platform for Wales. The purpose of these projects is to challenge the NHS in Wales and its supply chain to work in a different way around a national architecture, at the same time delivering short and medium term patient benefits. There will need to be a level of resolve and commitment to making these work for all parties involved.

Patient Knows Best (PKB) and Dr Doctor

Patient facing solutions such as Dr Doctor (proposed in Aneurin Bevin University Health Board) and PKB (in Cardiff and Vale University and Hwylwel Dda Health Boards, and Swansea

but with different implementations) have significant advantages in term of patient engagement and care. They are largely proven products and can co-exist. The challenge we are setting is to align all instances of PKB and Dr Doctor with the open principles outlined in this report, and to focus on them accessing the same, national, patient record rather than local instances. This will test the concept of working with suppliers in a new, open, digital architecture and test the progression of local solutions with national potential.

ABUHB Portal

Discussions on portal convergence between NWIS and Aneurin Bevin University Health Board have struggled to progress. Our proposal is to challenge the acceleration of the convergence by moving to an open systems approach for the ABUHB Portal (CWS) that

would facilitate user pull to convergence rather than supply side push. It would focus on making sure that CWS is able to access the “single version of the truth” for the patient record, and align with the approach outlined in the “innovation pyramid” in A Healthier Wales. We know that this represents a significant challenge to all parties, but the current approach does not appear to be working. There is an opportunity to develop the CWS into a truly open platform alongside the WCP to test the concept of this approach, and to build a resilient “plug and play” open environment. Similar to the recommendation for the WCP, ABUHB would need to align the portal with the open architecture recommended in this report.

Target “challenge” projects

WCCIS (in ABUHB)

The WCCIS implementation in ABUHB represents a significant opportunity to test the pathways and use of shared information between health and social care in Gwent. However, the project is experiencing some difficulty in progressing because of architectural concerns around differing views on how the implementation could be delivered. Some of this is related to the issues mentioned above around convergence of the different portal estates. The prize of a test of the new ways of working across health and social care in Gwent is potentially being impeded by this, and we suggest that all parties involved work towards an open systems approach as the end game with a possible tactical stepping stone towards

that that maximises the likelihood of success for patients and the front line. We are aware of the technical options being considered, and would suggest that using a “challenge project” to resolve the short term issues to the benefit of the system will align with a longer term plan towards a truly open implementation of WCCIS that can be adopted nationally. This might involve a short term tactical stepping stone in ABUHB, but have the benefit of helping to accelerate the benefits of the project to patients and learning around health and social care integration.

This will not be an exhaustive list, but represents a few early examples where a task and finish approach that examines the options in an accelerated timescale using a more agile approach could yield early benefits, some as early as three months.

Impacts on existing plans

22

Impacts on 19/20 development priorities

In assessing the next steps we have reviewed the proposed priorities for investment through the Welsh Government for the NHS in Wales and agreed at Decembers NIMB.

The majority of the high level priorities for digital investment align with the recommended approach in this review and are set out below, cross referenced to the recommendations of this report.

Digital priority	Impact/suggested action
Maintaining the resilience and security of the infrastructure.	Aligns. To be incorporated into a 5 year infrastructure strategy.
Replacing existing functionality before services/applications reach their end-of-life.	Aligns. To be developed into a 5 year retirement plan using an open architecture approach to replacement and upgrade.
Accelerating the sharing of more structured clinical data.	Aligns. CDR Strategy is the first step aligned with the NDR.
Developing clear plans for digital services to support citizen engagement and interactions.	Aligns. Early challenge projects and exemplars as the first step. A 2-3 year roadmap along open principles to be developed.

Impacts on 19/20 development priorities

Digital priority	Impact/suggested action
Completing current commitments re core EHR functionality (EHR maturity HIMSS level 2/3) - WCCIS, e-requesting and reporting, e-observations/charting and flow, e-Prescribing and medicines management).	Aligns. Strategy should be developed along open sourcing lines to make the best of the market opportunity to accelerate progress towards HIMMS levels 2/3 and beyond.
Clinical mobilisation.	Aligns. Channels Strategy required to expedite this against the Target Architecture.
Digitising records or increasing storage to meet revised guidance for record retention.	Partial alignment. Focus on the CDR will reduce the live paper load.



Risks

25

Top 5 risks to a digital future for NHS Wales

Risk	Likelihood	Impacts	Mitigation
01 Failure to align to a digital future	High	High	Focus on the 3 core priorities identified in this assessment to create an Open Architecture.
02 Failure to collaborate	High	High	Open and constructive dialogue is needed between those responsible for the national architecture and Health Boards – both clinical and on-clinical – possibly through a joint design authority and/or business partnering arrangements to bridge the local to national gaps evident today. Architectural Governance should be jointly managed and lead to binding decisions.

Top 5 risks to a digital future for NHS Wales

Risk		Likelihood	Impacts	Mitigation
03 Failure to progress	There may be a failure to make any tangible difference in the coming 12 months.	High	High	Focus on “challenge” projects and detailed plans for the core architectural components where a real difference can be made (Interaction, Integration and Information). Agree what can be dropped and/or slowed down. Agree, mobilise and drive a well structured transformation programme to expedite and focus the change.
04 Funding	There may be insufficient funding to make progress.	Medium	High	There is a strong alignment between the national digital priorities and the recommendations of this review. Detailed plans to refine the priorities in line with the recommendations of this review will align already available funding with those recommendations.
05 Capacity and capability	There may be insufficient capability and capacity in the system to support the transition to a digital future.	Medium	Medium	Increased collaboration. Explore External support to accelerate progress. A focus on shared enterprise through specific projects and leveraging the shared capacity and capability across Health Boards and the national team. Strong prioritisation. Consideration of other supply options as the architecture becomes more open.



WELSH GOVERNMENT REVIEW:

Future Structure and Governance for
Health Informatics in Wales

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1 EXECUTIVE SUMMARY

1.1 KEY FINDINGS

This report is the key deliverable from the Welsh Government review *“to identify the most appropriate and effective future structure and governance arrangements for health informatics in Wales,”* commissioned on the 31st August 2018.

This Review has found that the case for change to the current system of health informatics is very strong. This echoes the findings of a number of recent reports and reviews that the system is not “fit for the future,” presenting as it currently does too many constraints to deliver the Welsh Government’s ambitions. We found evidence that there are multiple issues across all of the organisations that make up the system and for which simple, point solutions will not work. Rather more radical, multiple and co-ordinated actions are required across all parts of the system. We also heard that there is widespread support for change and a recognition that now is an opportunity to create a more resilient and responsive system that is fit for the future.

The Review therefore makes a series of integrated recommendations for both the short and medium term, designed to address the issues identified across the whole system. These recommendations distribute functions in a more coherent and efficient way and repurpose structures and governance arrangements, so they support the effective discharge of these functions by members of the health informatics community in Wales. In doing so, a new, longer-term vision for health informatics in Wales is put forward, one that dismantles existing structures and reconfigures the roles and responsibilities of all parties involved.

In identifying the most effective future structure and governance arrangements the key messages for immediate action on the part of Welsh Government are as follows:

1. Strengthen national digital leadership for health

Establish a new digital leadership team led by a ‘Chief Digital Officer’¹ (‘CDO’) for health in Wales within Welsh Government or within the

¹ Throughout this report, job titles are shown in inverted commas as these will need to be agreed upon when the job descriptions are finalised. The critical aspect of each role

is that the accountabilities shown are matched by the appropriate authority to undertake them.

redefined NHS Executive function (currently under review²) and supported by a 'Chief Clinical Digital Officer' and a 'Chief Digital Technology Officer'. The 'CDO' will be accountable for: digital health strategy. This includes setting the framework and technical roadmap within which the system operates, monitoring reporting and independent assurance of delivery, and open and transparent relationships across the system. The 'CDO' will establish new and transparent governance structures to discharge their accountabilities, such that existing discredited committees and structures are swept away.

2. Establish an Informatics Standards authority (ISa)

This authority will set national standards for all aspects of health informatics – data and infrastructure. It will also hold responsibility for policing their compliance. The ISa will remain independent of/separate from other roles so that conflicts of interest do not arise. Ultimately, this authority could certify that systems and applications meet those standards and could therefore be safely “plugged into” the wider informatics system

3. Establish shared services arrangements for data, infrastructure and commercial delivery

The informatics services that are currently dispersed across several delivery partner organisations will be brought together into a shared service arrangement. This will mean that NHS Wales Informatics

Service (NWIS) will be reconfigured and its core business (comprising around 90% of its current functions) will move to a national shared services arrangement. This will therefore include data, infrastructure and commercial services. Planning for Health Boards to transfer their data and infrastructure services to this arrangement will follow.

4. Establish a new central health digital development team

Establish an application systems development function and a delivery team set up with direct report to the 'CDO'. Priorities for systems development will be set nationally and fully align with strategic direction. It will include the current development applications function within NWIS and the staff that deliver this. In the short-term, this team is likely to include existing monolithic systems, such as (Laboratory Information Management System (LIMS), as well as the apps development.

1.2 SUMMARY OF THE REPORT

Welsh Government health informatics has been the subject of a series of critical reviews³ over the last 18 months. These highlighted, clearly and unambiguously, the serious threats posed to the Welsh Government's ambitions by the lack of “fitness-for-future-purpose” of the culture, structure and governance of health informatics in Wales.

² Again, as for the roles themselves, the critical aspect is to ensure that the accountabilities are matched by appropriate levels of authority.

³ “A Revolution from Within: Transforming Health and Care in Wales”, The Parliamentary Review of Health and Social Care in Wales, January 2018; “Informatics

systems in NHS Wales”, Auditor General for Wales, January 2018; and “Informatics Systems in NHS Wales”, National Assembly for Wales, Public Accounts Committee, November 2018. “System Reboot: transforming public services through better use of digital” Expert Panel report for Welsh Government.

This Review covers the structure and governance of the whole health informatics “system” in Wales, which comprises all the organisations involved and is described below.

- strategic direction and governance are provided by Welsh Government, creating the operating environment within which health informatics are delivered
- management and delivery of all aspects of informatics (services, data, infrastructure and procurement) are provided by a community of organisations that should work collaboratively together under the direction of Welsh Government. These include NWIS, the Health Boards, Trusts and others. The current arrangements are highly complex. All organisations currently play roles in all aspects of delivery (from the patient / clinician user interface through the “back-end systems” including data and infrastructure). This also makes the governance arrangements between and within organisations complicated with lack of clarity and transparency over accountabilities and authority
- the system is enabled to deliver the desired health outcomes for the citizens of Wales through a common set of processes, procedures and standards set by Welsh Government

This Review echoes many of the findings of the earlier reports. The current “system” of health informatics must change. There are multiple issues across all the organisations that make up that system – Welsh

Government, NHS Wales Informatics Service (NWIS), Health Boards and Trusts.

However, this is a “wicked”⁴ problem, systemic in nature, for which simple, point solutions will not work. Instead, more radical, multiple and co-ordinated actions are required across all parts of the system.

This Review therefore puts forward a new, longer-term vision for health informatics in Wales, one that dismantles existing structures and reconfigures the roles and responsibilities of all parties involved. This vision is for:

- an **Informatics Standards authority** (ISa) that both sets and polices standards across all aspects of informatics. A critical aspect of this function is the need for independence⁵ from other roles, including the systems integrator, so that conflicts of interest do not arise. Ultimately, this could certify that systems and applications meet the standards and could therefore be safely “plugged into” the wider informatics system
- a national **shared service Infrastructure** based on open architecture principles that provides standard Application Programme Interfaces (**APIs**)⁶ for applications / services to plug into. Once mature this would be responsible for **all** health informatics infrastructure across Wales (currently provided by NWIS, Health Boards and Trusts)

⁴ A wicked problem has “... *innumerable causes, is tough to describe, and doesn’t have a right answer* ... *Not only do conventional processes fail to tackle wicked problems, but they may exacerbate situations by generating undesirable consequences*” - John C. Camillus, *Harvard Business Review*, May 2008

⁵ “Independence” in this context is that it should remain independent of / separate from those organisations for which it sets and polices standards

⁶ See Appendix 10.

- a national **shared service for data** capable of being used across the health informatics system - by infrastructure and apps. Again, once mature, this would be responsible for **all** health informatics data across Wales (currently provided by NWIS, Health Boards and Trusts)
- a national **shared commercial service** engaging with the broadest range of digital providers, providing market intelligence guidance and support to commissioners. This could be modelled along the lines of an authorised Centre of Procurement Expertise which controls procurement in different parts of the public sector in Northern Ireland
- **health informatics apps / services** delivered by groupings of application/service providers across a range of types of organisation (“ecosystems”). These are likely to be regionally, locally or collaboratively owned, though there will still be the need for some all-Wales single system implementations which would remain national
- mature **system integration functions** – both technical (inter-operability of ICT components through Systems Integration and Management - **SIAM**) and **organisational integration management** (inter-operability / collaboration / policing governance between organisations)

The Review also note that, at some stage in the future, any health system structure should maintain the options for closer digital working and services across other services in Wales, especially for standards and common data and infrastructure.

Alongside this reconfiguration, the new delivery system requires strong, centralised strategic leadership and a common set of underlying enablers – processes, procedures and approaches.

The Review recognises that change of this magnitude will take time to deliver, yet it is important to start making changes now. The Review therefore makes 26 integrated **recommendations** for both the short and medium term, which address the issues identified across the **whole system**.

1.2.1 Short-Term (year one) Recommendations

Recommendations are made to strengthen the strategic leadership and direction-setting of Welsh Government by:

- creating new arrangements for leadership of the system through a major overhaul and strengthening of the Welsh Government / new NHS Executive Digital Health team. This will be through creating, and appointing to three new digital leadership roles (titles to be confirmed) – ‘Chief Digital Officer’ (‘CDO’), ‘Chief Clinical Digital Officer’ (‘CCDO’) and ‘Chief Digital Technology Officer’ (‘CDTO’)
- under the auspices of a newly appointed ‘Chief Digital Officer’ (‘CDO’) for health in Wales, providing clear leadership, accountability and governance structures for each of the following (separating the different functions that each of these represents):
 - investment/prioritisation
 - advice
 - portfolio management
 - whole system delivery management (including market and strategic supplier management)
 - national (linked to UK-wide) open standards
 - informatics skills, capabilities and innovation

Recommendations are made to distribute functions in a more coherent and efficient way and repurpose **structures** and **governance** arrangements so they support the effective discharge of these functions by members of the health informatics community in Wales, by:

- redistributing the informatics functions that are currently dispersed across several Delivery Partner Organisations (DPOs) (including NWIS, Health Boards and NHS Wales Shared Services Partnership (NWSSP)),
- concentrating resources for supporting / back-office informatics functions in a shared service, introducing new organisations (such as the new Informatics Standards authority) and
- establishing formal whole-system management mechanisms (such as the SIAM)

In addition, **recommendations are made to develop and maintain effective enablers** that permit the system to operate successfully through the following steps:

- implementing effective digital portfolio management, balancing the portfolio between “business as usual” and transformation, ensuring transparent monitoring and reporting of business as usual, and introducing robust, independent challenge and assurance into all projects and programmes
- strengthening digital project planning and execution, securing meaningful clinical and user engagement throughout the life-cycle of delivery and operation, deploying sufficient change management capability and introducing independent assurance of delivery

- ensuring better application of appropriate Programme and Project Management (PPM) disciplines by connecting system delivery project boards with accountable programme boards, improving change control and placing a stronger focus on benefits management and realisation
- improving digital competence, capability and capacity across all staff groups in the system

The **consequences** of these structural changes will mean that:

- NWIS will be reconfigured and some of its functions moved to become a national shared service (data, infrastructure and commercial/procurement). The remainder - services / applications - will work directly to the ‘CDO’. Current NWIS staff will need to be split between these different functional elements (teams) and there will need to be new leadership arrangements put in place to reflect the new structures
- Health Boards must comply with the standards set by the ISa and prepare to transfer data and infrastructure to the shared service arrangements from year two (see below)

The key actions for year one and expected system outcomes are tabulated below.

Key Actions	System Outcomes
<ul style="list-style-type: none"> • appoint to new roles • establish and mature over time independent ISa • establish over-arching governance, separating key functions • establish programme to implement recommendations • identification and separation of NWIS staff teams • transfer infrastructure / data and commercial staff teams to shared services • establish new leadership arrangements for each element in national shared services • transfer informatics apps / services team under CDO management 	<ul style="list-style-type: none"> • digital leadership strengthened and no longer dispersed across system • nationally defined 'Once for Wales' systems and priorities • compliance compulsory and policed - All digital services and IT systems must meet clear set of standards • new and transparent governance structures to meet new accountabilities (existing discredited committees and structures swept away) • improved, transparent investment between change and Business as Usual (BAU) • more transparent monitoring and reporting • integral part of a whole system "reboot" • clearer accountabilities for each area of service delivery

Key Actions	System Outcomes
<ul style="list-style-type: none"> • in consultation, develop and publish approaches to digital project implementation, PPM • undertake skills assessment, identify gaps and invest to address areas of concern 	<ul style="list-style-type: none"> • moving system towards best practice – national / international and current thinking • more effective management of the digital market-place • more transparent monitoring and reporting • more effective, controlled implementation of projects and programmes • faster delivery • greater digital competence across all staff groups

1.2.2 Medium-Term Recommendations (years two and three)

In the medium term, **further structural changes are recommended** to move towards the longer-term vision involving, amongst other things, extracting Infrastructure and Data delivery responsibility from Health Boards whilst enhancing their freedoms to sponsor innovation of systems / applications and to exercise system choice.

As indicated above, the **consequences** of these structural changes will mean that:

- Health Boards no longer manage data or infrastructure but can innovate in developing (and sourcing) applications that “plug in to” the standard national data and infrastructure services to better deliver patient outcomes
- data and infrastructure are increasingly standardised
- service elements – data, infrastructure and applications – are increasingly separate, with the first two provided as national shared services⁷

1.3 SUGGESTED GOVERNANCE STRUCTURE

The overall governance of the system needs to follow the functional and structural changes described above. Overall governance will be provided by Welsh Government and the new NHS Executive function, exercised through the committees and boards set up by the new ‘CDO’ and ‘CDTO’ to discharge their accountabilities. As such, the new role-

holders will want to be involved in the precise structures involved. However, the review makes the following suggestions, based on the following principles.

- sweep away existing committees and structures as they have become discredited by association with a system that is seen as “broken”. The one exception is the CCIO Council although this will be chaired by the new ‘CCDO’ and have an advisory role (see below for more details)
- establish separate and independent functions with their own governance arrangements to include advisory, standards, prioritisation, monitoring and reporting, and change portfolio management
- clarify relationships between the elements within the governance structure and the governance precedence rules which apply in the system
- provide checks and balances so that individual personalities are less able to dominate

As stated above, the roles of committees and boards will be to support the ‘CDO’ and ‘CDTO’ in discharging their accountabilities to govern and be involved in all aspects of the informatics system in Wales (including management and delivery). They may, therefore, be subject to review /change by the new role-holders in due course. The suggested structure and primary roles are:

- CCIO Council – advisory (non-decision making)

⁷ Subject to, and timing to be confirmed by, the recently commissioned technical architecture review

- Investment / prioritisation committee – decision-making (strategic fit of business cases, significant changes, etc.)
- Standards Board – setting and policing standards for data, infrastructure, apps etc. (and a precursor to the Informatics Standards authority)
- Portfolio Management Board – decision-making (changes within agreed authority levels, providing steers) and monitoring/reporting (delivery of both change and business as usual)
- Skills Committee – may be provided by the ‘CDO’ team rather than a committee – supporting ‘CDO’ in identifying and filling gaps in capability and capacity (particularly of future needs)

1.4 OUTCOMES AND BENEFITS

The changes suggested in this Review are intended to enable an effective informatics system that supports the outcomes identified in “**A Healthier Wales**” and should also allow more decisive strategic

intervention as and when required. The main headings across which benefits are expected are:

- transparency
- integration
- capability
- collaboration
- efficiency
- equity
- innovation

Over time, these changes should support a step improvement in health outcomes and a corresponding rise in the health and well-being of the people of Wales.

2 INTRODUCTION

2.1 BACKGROUND AND COMMISSION

This report is the key deliverable from the Welsh Government review *“to identify the most appropriate and effective future structure and governance arrangements for health informatics in Wales”*, commissioned on the 31st August 2018. The full text of the commissioning letter for the work is included for reference as Appendix 1.

Key requirements of the review were to:

- consider the requirements of the whole system and how these functions are best organised and discharged through the various partners and stakeholder organisations
- identify the most appropriate and effective structure and governance arrangements for health informatics in Wales
- identify how future effective leadership, design and delivery of the digital and informatics requirements for service transformation can be ensured
- ensure that changes to the most appropriate digital, technological and infrastructure developments take place at pace and are effective

- ensure that Welsh Government has a system of health informatics that is capable of delivering the aspirations of ‘Informed Health and Care: a digital health and social care strategy for Wales’
- clarify the function, responsibility and accountability of each partner and stakeholder organisations
- align with the Auditor General’s report, particularly Recommendation 6: to strengthen governance and oversight of all NHS partners and stakeholders involved in providing access to information and introducing new ways of delivering care with digital technologies. Specifically, this includes arrangements that support:
 - independent scrutiny and greater transparency of performance and progress
 - clear lines of accountability between the new structures, the Chief Executive of NHS Wales and the Cabinet Secretary for Health and Social Services

Appendix 2 provides Local Partnerships response to that letter in the form of a Project Brief. This describes four key stages of the work:

- | | |
|---------|--|
| Stage 1 | Review of current informatics governance |
| Stage 2 | Engagement with delivery partner organisations |

Stage 3	Options development based on analysis of the issues identified through engagement with the delivery partner organisations and research of best practice elsewhere (national and international)
Stage 4	Development of proposed system structure and governance and recommendations

The appendices (in a separate volume) provide more detailed information to support the sections described above and are cross-referenced from the body of the report.

2.2 STRUCTURE OF THIS REPORT

This report is structured as follows:

- section 1 provides the Executive Summary
- section 2 is this introduction
- section 3 sets out the findings from stages one and two above
- section 4 explores the high-level structure of the system and makes system-wide recommendations
- section 5 sets out how possible options were developed and provides a future vision for health informatics in Wales
- section 6 provides a roadmap towards implementing the vision and makes a number of short and medium-term delivery recommendations
- sections 7 explores the governance implications of the options and recommendations in more detail

3 THE CASE FOR CHANGE

3.1 BACKGROUND - THE STRATEGIC CONTEXT

3.1.1 Definition of “Health Informatics”

There is no definition of health informatics in NHS Wales. A working definition was therefore tested and confirmed with each individual and group involved in the Review.

The following very broad definition emerged:

Health Informatics is the technological and business/change management support required to shift services to deliver improvement and value in health interventions to benefit patients. Ultimately, it's about patients/people/improvement. This therefore encompasses:

- the move from paper to digital
- the enabling data and infrastructure requirements (and networks)
- systems and applications (development and care / maintenance), recognising that agile digital solutions aim to join development and operations together (“devops”)
- clinical and non-clinical (back-office) business systems

- commercial aspects of procurement / management of digital and IT solutions
- business intelligence / use of health information to drive improvement at all levels of the system

The “digital agenda” extends beyond this and supports greater engagement of the population and patients in health services, including apps to encourage health promotion and illness prevention and to support self-managed care.

It should be noted that there has been a shift of definitions/vocabulary that reflects the journey development: IT/ICT/IMT/informatics and digital. Health informatics is understood to encompass transformation underpinning service and business change and supporting improved outcomes, including value and greater efficiency.

3.1.2 The National Context for Health and Social Care

Wales is a devolved administration of the UK government covering an area of over 8000 square miles. The population of Wales is 3.1 million but is projected to increase by almost 9%, to over 3.3 million by 2036. The 65 to 84 and 85+ age groups are projected to have the largest increase by 2036, when an estimated one in four people in Wales will be aged 65 and over. More than a third of the population of Wales is

expected to be over the age of 60 by 2055 and by 2069, those aged over 75 will be the largest proportion of all age groups.

The population faces significant health challenges in the future because of this changing demography and the continued high level of behaviours which increase the risk of future ill health and disease.

As the population grows older, the number of people living with long term health conditions will continue to increase. The most common health problems amongst older people and causes of hospital admission and mortality are respiratory and heart disease, cancer, stroke, diabetes and fractures.

There are also significant public health challenges facing the population of Wales with implications for the profile and cost of future disease. This includes high levels of drinking, smoking and obesity combined with poor diets and lack of exercise. For example, a majority of people (58%) are either overweight or obese, smoking causes 18% of adult deaths and alcohol misuse directly leads to over 1,500 deaths each year at a cost of £100 million.⁸

The generation facing these potential health risks and challenges in the future is the generation that has grown up with the internet, smart phones and social media. They will expect health care to fit into this mould and to be offered modern ways of engaging with health and care (and indeed all public) services. They are comfortable with collecting and sharing data, organising and conducting the business of their daily lives through technology and are keen to adopt new

technologies in support of this. The challenge for the provision of health services – both prevention and intervention – is therefore to ensure that they can respond to the needs of this generation and maximise the opportunities that new technologies and digitalisation represent in reducing ill health and improving health outcomes. This will, for example, include on-line access to personal records and information, the use of digital applications to help with self-management of health and relationships with health care professionals through telemedicine. Health informatics in Wales needs to understand and support these changes in clinical practices, including greater patient self-management.

Seven Local Health Boards (LHBs) in Wales plan, secure and deliver healthcare services in their areas. The population is served by around 440 GP practices, over 80 hospitals and 22 local authorities (within Wales)⁹. Around £7 billion annually is spent on health services in Wales. This includes:¹⁰

- 19m GP and Primary care appointments
- 4m outpatient appointments
- 1m A&E attendances
- 750,000 hospital admissions
- 400,000 emergency admissions
- 700,000 visits to the opticians

⁸ *The Public Health Challenges Facing NHS Wales*, The Welsh NHS Confederation, 15/11/2016.

⁹ It should be noted that whilst the bulk of secondary care is delivered within Wales, some patient flows on the border include English hospitals.

¹⁰ Welsh Government, 2016.

- 70m prescriptions.

Of the c 70,000 staff within the NHS in Wales around 1,000 are directly involved in health informatics and ICT spend accounts for c 1.6% of spend¹¹ (compared to a recommended spend of 4%¹²).

“A Healthier Wales: our Plan for Health and Social Care” (referred from here on as A Healthier Wales) published in June 2018 sets out a long-term future vision for health and social care in Wales. The plan was published in response to the Parliamentary Review which made its recommendations at the beginning of 2018. A Healthier Wales sets out what health and care services need to look like in the future in Wales. It describes a whole system approach which will:

- ensure longer, healthier and happier lives and allow people to remain independent in their own homes for as long as possible
- focus on “wellness” which aims to support and anticipate health needs, to prevent illness and to reduce the impact of poor health
- be equitable delivering the same high quality of care and achieve more equal health outcomes for everyone
- provide access to a range of seamless and person-centred services delivered as close to home as possible
- use technology to support high quality services

Digital is recognised as a key enabler of the transformational change required to deliver this ambitious agenda. It is essential that the

structure and governance of health informatics in Wales is fit for purpose to support that transformation.

The plan emphasises the need for all organisations to work more effectively and efficiently together to develop this vision. Ways to ensure this is achieved include:

- new ways of working that start locally and scale up nationally
- the use of a single digital record
- shifting services out of hospital to communities
- helping people to manage their own health and long-term illnesses
- measure the health and wellbeing outcomes which matter to people
- investing in new technology
- investing in training and skills

3.1.3 The Context for Health Informatics in NHS Wales

Health informatics / the digital agenda is seen as a key enabler to delivering the future vision of health and social care set out above, as articulated in A Healthier Wales. It recognises that “*digital is a key enabler of transformational change*” and that “*making better use of digital, data and communication technologies will help us to raise the quality and value of health and care services so that they are cost-effective and sustainable and also bring our offer in line with increasing expectations of technology in people’s daily lives.*”

¹¹ WAO Report “Informatics Systems in NHS Wales”, January 2018

¹² The Report of the Project Team advised by Derek Wanless, “The Review of Health and Social Care in Wales”, June 2003

A Healthier Wales sets out an action plan for the digital agenda to achieve what is required to enable change. This includes:

- accelerating progress towards a fully integrated national digital architecture and the roll-out of the Welsh Community Care Information System (from 2018)
- investing in future skills (from 2018)
- developing an “open platform” approach to digital innovation (from 2018)
- significantly increasing investment in digital infrastructure, technologies and workforce capacity, supported by stronger national leaderships and delivery arrangements (from 2019)
- establishing a national data resource (from 2020)

A digital strategy covering health and care in Wales has been evolving over the past several years. First published as “Informing Healthcare” (December 2003), it was refreshed in December 2015 as “Informed Health and Care: a digital health and social care strategy for Wales,” which built upon the foundations already established. It includes creating an electronic patient record by bringing together information that is held on multiple systems (more details of key elements of the strategy that provided the context for this review are provided in Appendix 4).

Three reports issued in 2018 have also clearly highlighted and strongly emphasised a number of significant issues that need to be urgently addressed in relation to the current structure and governance arrangements for health informatics and the digital agenda. These reports are:

- “A Revolution from Within: Transforming Health and Care in Wales,” The Parliamentary Review of Health and Social Care in Wales, January 2018
- “Informatics systems in NHS Wales,” Auditor General for Wales, January 2018
- “Informatics Systems in NHS Wales,” National Assembly for Wales, Public Accounts Committee, November 2018

Despite the different lenses through which these reports have viewed health informatics and the digital agenda, a common set of themes emerges from them. These themes include where and how change needs to be focused to galvanise the health and care system into a future that is led by digital technologies and delivers the benefits in quality, experience, and efficiency required to improve health outcomes. The collective view from these reports is that the system is not “fit for the future” presenting as it currently does far too many constraints to deliver the Welsh Government’s ambitions. Further details of the specific recommendations most relevant to this review (also included in the Project Brief in Appendix 2) are provided in Appendix 4.

Part of the Welsh Government’s response to the first two of these reports was to commission this Review.

3.1.4 Strategic Influences

In addition to the factors set out above, there is a general acceptance that the way in which digitalisation is developing and extending its reach into all areas of life will exert influence on the environment within which informatics is delivered in Wales. These influences are commonly identified as relating to:

- the continuing acceleration of technology innovation

- the growing disparity between the technology that patients and clinicians use in other aspects of their lives and what is available within the health service
- (coupled to the previous bullet) a growing desire for – and availability of – technology / apps that can support self-management of health promotion, illness prevention and treatment of conditions
- a growing desire for patients to have access to and manage their data, their patient record
- the ability to access increasing volumes of data to support health, care, service, business and national planning
- linking all the above, a need to increase significantly the current pace of delivery of informatics / digital within the NHS Wales “system”¹³
- external scrutiny and challenge indicate that both the public and government have an expectation that more should be done digitally in health and care in Wales

In addition, the Review undertook research into the approach to health informatics and governance in England and the other devolved administrations in the UK and further afield. Key elements from these are included in the next section of this report.

3.2 CONCEPTUAL FRAMEWORK FOR ORGANISING THIS REVIEW

To organise thinking and ensure that an “organisationally-agnostic” view is taken of the current environment, a conceptual framework has been developed. This is based on systems thinking and brings together the factors that could affect the desired outcome of health informatics / digital as stated in the project brief, which is:

“Effective informatics that support the outcomes identified in ‘A Healthier Wales’”

The factors and the main high-level relationships are shown in the schematic below, which is not intended as an exhaustive illustration of all the connections across the system.

¹³ Unless stated otherwise, “system” in this report refers to the whole, that is: all organisations, bodies, boards and committees involved in setting strategic direction,

planning, development, delivery and maintenance (including infrastructure) of health informatics / digital within Wales.

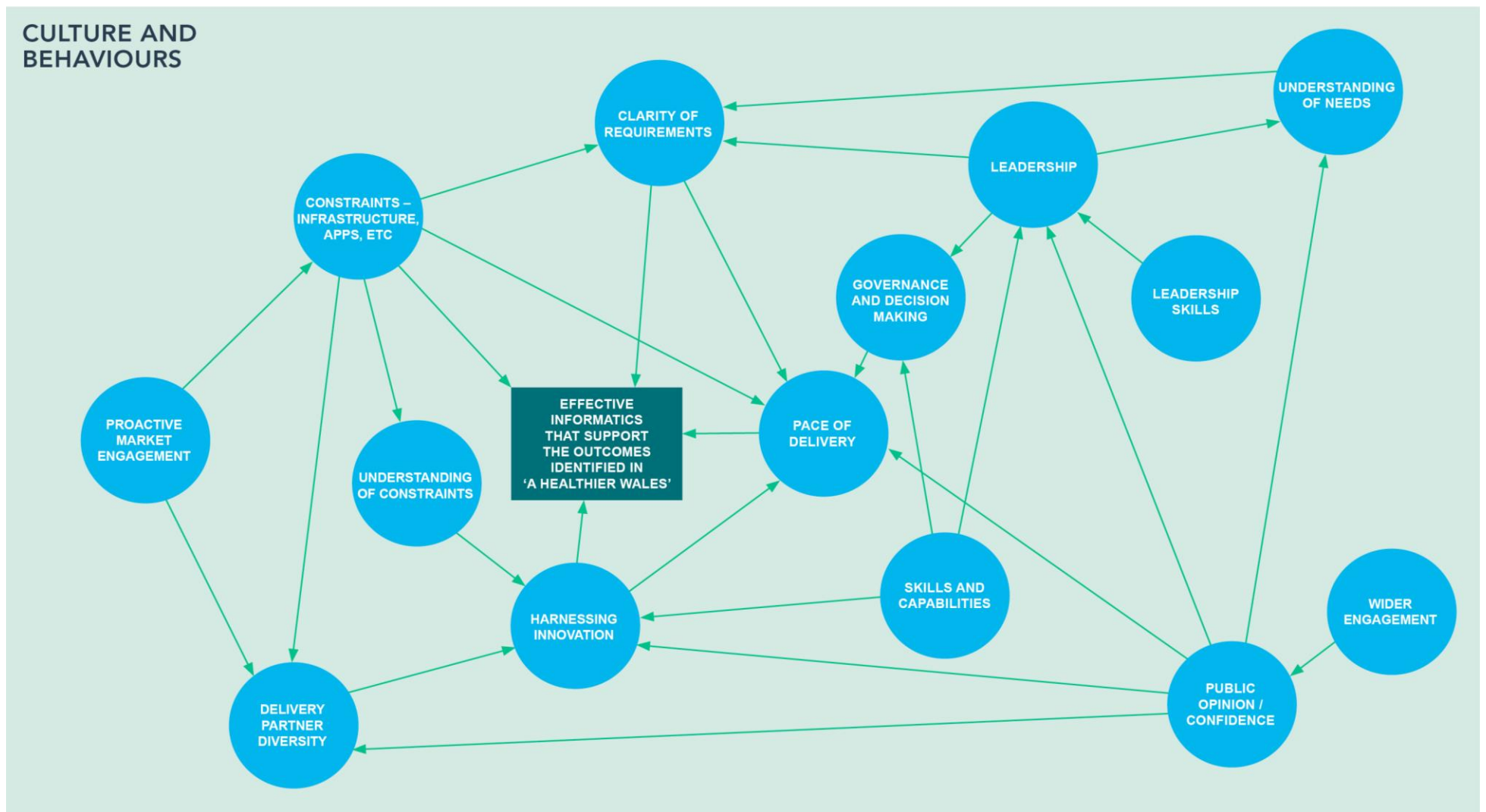


Figure 1: conceptual framework

Note that “culture and behaviours” and the background colour is intended to show that these are also recognised as key (environmental) factors that affect the whole system.

These factors are used as headings to help organise a common thinking and logic approach in subsequent sections below and were also used to develop a questionnaire, also described below.

3.3 THE CURRENT LANDSCAPE OF INFORMATICS ACROSS WALES

The current system for health informatics across Wales is complex and includes the following organisations:

- Welsh Government (WG) – providing leadership and strategic direction
- NHS Wales – providing leadership and strategic direction
- Delivery Partner Organisations (DPOs) – currently delivering all aspects of health informatics (both the clinical / patient user interface and the underlying systems). The c 1,000 staff¹⁴ resources are dispersed across the various delivery partners:
 - seven Health Boards (estimated as c 400 informatics staff¹²):
 - Abertawe Bro Morgannwg University Health Board
 - Aneurin Bevan University Health Board
 - Betsi Cadwaladr University Health Board
 - Cardiff and Vale University Health Board
 - Cwm Taf University Health Board
 - Hywel Dda University Health Board
 - Powys Teaching Health Board
 - three Trusts:
 - Welsh Ambulance Service
 - Public Health Wales
 - Velindre
 - Special Health Authority:
 - Health Education and Improvement Wales (HEIW) (newly formed)
 - NHS Wales Informatics Service (NWIS), the main provider of health informatics services across Wales, it maintains and supports the national systems for primary and secondary care. NWIS has c 600 staff, with an estimated up to 90%¹¹ dedicated to “business as usual” care and maintenance of existing systems.
 - NHS Wales Shared Services Partnership (NWSSP), providing “back office services” for the whole of NHS Wales (payroll, finance systems, HR etc.) and a shared procurement service.
- Primary care: e.g. general practitioners, pharmacists, dentists, optometrists, allied healthcare professions

The governance arrangements for strategic direction setting, commissioning, planning, delivery and maintenance of Welsh health

¹⁴ Precise figure unknown as the services are configured /described differently within each of the partner organisations.

informatics is shown schematically in the chart in Appendix 5, alongside other boards that were identified during the Review. How these work in practice was explored with the DPOs / stakeholders as described below.

3.4 THE EVIDENCE BASE FOR THIS REVIEW

As set out in the project brief, as well as meetings with key stakeholders, the methodology for this Review included a two-stage engagement with DPOs (see Appendix 6 for details of these).

1. the first involved a request to complete and return a short questionnaire largely comprising “closed” questions. The latter were derived from the initial analysis of desk research using the conceptual framework described above. The final set of questions is provided in Appendix 7 and was signed off by the Project Assurance Group
2. the second involved an up to two hour workshop with up to five individuals from each DPO using the response to the questionnaire as a broad agenda for discussion

Additionally, discussions were held with a range of other stakeholders, a full list of which appears in Appendix 8.

There was a high level of openness and willingness to share ideas and issues demonstrated by all those groups and individuals with whom the Review team engaged and a strong collective sense that this was now the time and opportunity to bring about system change.

From this two-stage engagement, the Review has therefore assembled both quantitative and qualitative evidence. These two “types” of information have enabled an important level of detail and perspective

to be assembled as evidence to inform our understanding of the key issues with the current system.

The anonymised cumulative responses to the questionnaires are provided in Appendix 9.

3.5 KEY ISSUES WITH THE CURRENT DELIVERY MODEL

The Review noted a number of successes and improvements in health informatics across Wales including:

- notable successes in terms of delivering the need for a single view of the patient across Wales including the GP portal and the Clinical portal
- development of a three-year plan to better support prioritisation
- some very capable individuals and teams (though perceived to be thinly spread and too dispersed at present) and collaborations between NWIS, Health Boards and universities to try and address specific skills shortfalls
- building relationships with universities to harness and grow the informatics skills base including, where appropriate, the use of apprenticeships
- recent improvements in addressing change / culture change management issues

However, the Review also identified several thematic issues that echoed the findings of earlier reports. The conceptual framework set out in Figure 1 has been used to organise these, summarised in the table below. Each key issue shown has been derived from analysis of both the quantitative and qualitative research undertaken. These

represent the key issues which any options for change must seek to address.

In summary, the analysis shows clearly that the issues are systemic. These issues:

- are located across the whole system and are not confined to any single part of it (see Figure 2 below for a mapping of issues to the conceptual framework)
- impact upon all the organisations within the system including Welsh Government, NWIS and Health Boards

Systems map “component”	(Summarised) Key issues
Governance and decision making	<ul style="list-style-type: none"> • NWIS not properly constituted, that is to say, the current governance structure is not well defined (partly as a result of the original, unusual way in which it was established) • Welsh Government acting as a referee between Health Boards and NWIS as well as having other roles • many boards, accountabilities unclear • inadequate level of external challenge and scrutiny

Systems map “component”	(Summarised) Key issues
	<ul style="list-style-type: none"> • insufficient transparency in both decision making and processes • unable to hold NWIS to account
Leadership	<ul style="list-style-type: none"> • Welsh Government wearing too many hats • insufficient national standards and guidance
Leadership skills	<ul style="list-style-type: none"> • inadequate capacity and capability
Understanding of needs	<ul style="list-style-type: none"> • insufficient co-production especially with clinicians • large gaps in clinical representation
Clarity of requirements	<ul style="list-style-type: none"> • scope creep, inadequate change control • doing too many things, lack of focus and prioritisation
Skills and capabilities	<ul style="list-style-type: none"> • shortage of capacity and capability • workforce development requires greater co-ordination

Systems map "component"	(Summarised) Key issues
Harnessing Innovation	<ul style="list-style-type: none"> • risk appetite unclear – not prepared to "fail fast"
Constraints and understanding of constraints	<ul style="list-style-type: none"> • informatics is bundled in with digital and applications • resource inputs and allocations unclear • whole Life Costs not routinely assessed
Pace of delivery	<ul style="list-style-type: none"> • insufficient monitoring/independence, external challenge
Proactive market engagement and delivery partner diversity	<ul style="list-style-type: none"> • build versus buy decisions unclear • risk averse interpretation of procurement rules
Wider engagement and public opinion/confidence	<ul style="list-style-type: none"> • insufficient involvement of patients and consideration of the patient perspective

Systems map "component"	(Summarised) Key issues
Effective informatics that support health care in Wales and "Informed Health and Care"	<ul style="list-style-type: none"> • outcomes for health and care strategy not clear • no agreed definition of "informatics" • inadequate benefits management
Culture and Behaviours	<ul style="list-style-type: none"> • lack of change management / culture change • NWIS provides a convenient scape-goat, which suggests a culture of blame • Health Boards are able to "go their own way" • perceived lack of engagement/listening by NWIS to other NHS Organisations and partners

This set of issues have been mapped against the conceptual framework (Figure 1) in Figure 2 below.

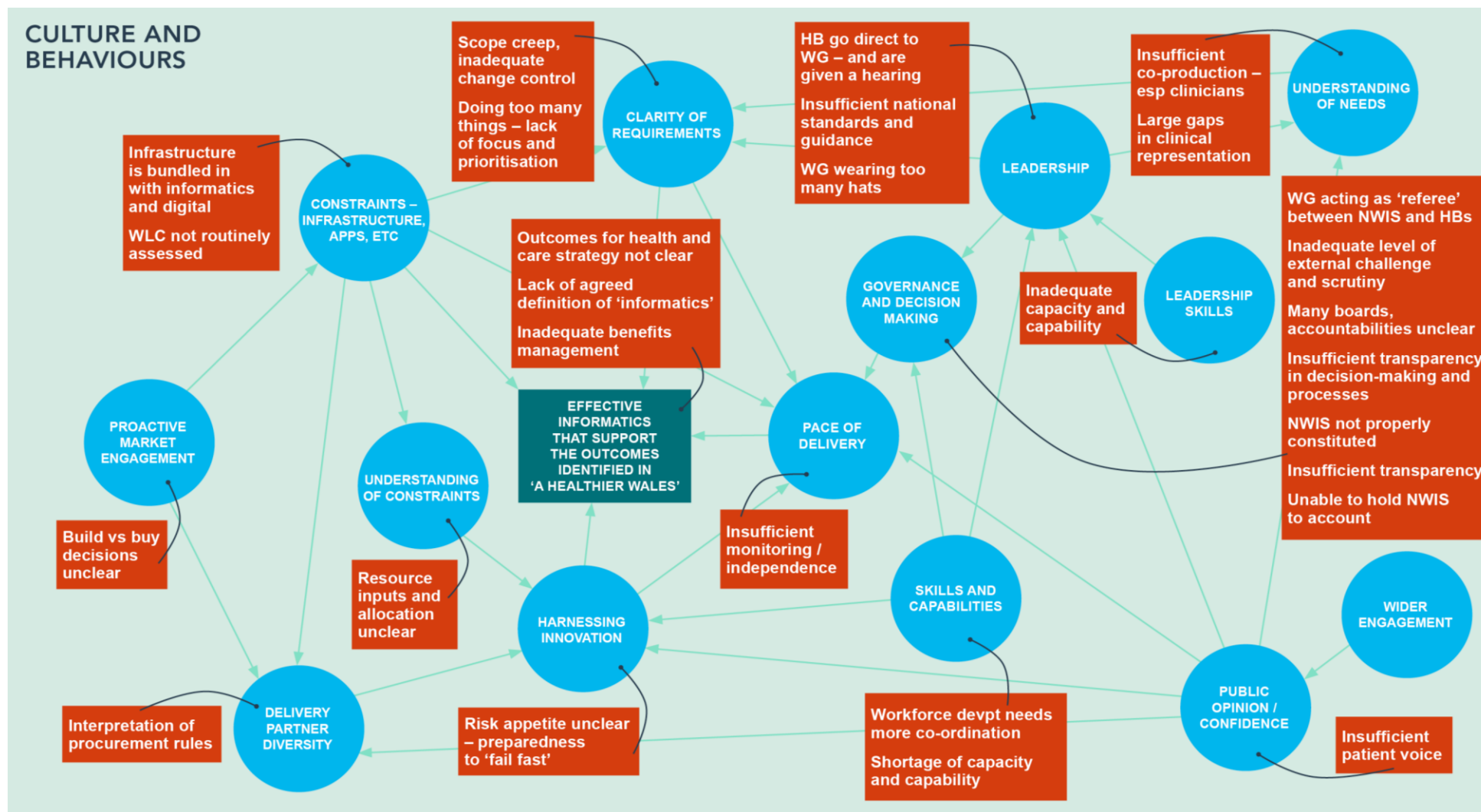


Figure 2: mapping the issues against the systems map

“Cultures and behaviours” (the last set of issues tabulated above) are included in the background to the systems map above as a contextual factor that affects each of the other elements.



Figure 3: example comments from stakeholders and DPOs

3.5.1 Example Comments made to the Review Team

To provide some “colour” to the findings in Figure 2, the Figure shown above provides examples of anonymised comments that were made to the Review team during the information and data gathering phase.

3.6 CONCLUSION

The overall case for change is very strong. There is also widespread support for such change and a recognition that now is an opportunity to create a more resilient and responsive system that is fit for the future.

The next section explores what might be done to address the issues identified, linking them back to the conceptual framework and developing an approach to the evaluation of the proposed options.

4 SYSTEM-WIDE RECOMMENDATIONS

4.1 CONTEXT AND DEFINITIONS

This Review covers the structure and system wide governance (governance structures, processes and relationships), including the management and leadership of digital health informatics in Wales. The issues identified in the Case for Change also encompass strategy, finance, programme and project management (PPM) (including benefits realisation), digital competence, capability / capacity / resourcing and the impact of rapidly changing digital technology. These are fundamental foundational elements to the smooth functioning of the whole system. Interventions in respect of some of these are set out below.

There is no common definition or shared understanding of “digital” or “informatics” in Wales. For this Review, the scope is taken to include the elements described in section 3.1.1 above. All of these components are found at national, local Delivery Partner level and each component may have a different structure for delivery within the whole system. One of our recommendations below is that common

definitions of key terms are agreed upon and put in place and widely shared. This will support better delivery strategic outcomes.

4.2 THE NATURE OF THE “PROBLEM”

As described in the preceding section, health informatics in Wales is a complex system. In addition, as shown in Figure 2, there are multiple issues across the *whole* system. Improving the governance of the system is therefore:

- not a “simple” or technical problem – it is a so-called “wicked problem”. Wicked problems were first described by Horst W.J. Rittel and Melvin M. Webber, in a 1973 article in Policy Sciences magazine. The Harvard Business Review describes a wicked problem “... *[as having] innumerable causes, is tough to describe, and doesn’t have a right answer* ... *Not only do conventional processes fail to tackle wicked problems, but they may exacerbate situations by generating undesirable consequences*”¹⁵. Wicked problems generally need multiple points of intervention across the system

¹⁵ John C. Camillus, *Harvard Business Review*, May 2008

- only partly a structural issue (in that it relates to the various governance groups, committees and boards which operate within the system). For example, as indicated in section 3, there are also issues of culture and behaviour that need to be addressed. A simple re-structuring will not, by itself, resolve all the issues

Both of these points suggest that any approach to addressing the issues identified across the health informatics system in Wales will require a combination of interventions (to address particular areas, such as leadership) and organisational changes (for example, to the formal governance arrangements currently in place). The Review team have therefore set out both a set of **whole system recommendations** (this section) and **options** for structural change (including a proposed road-map for change – next two sections). These need to be taken forward together.

4.3 THE STRUCTURE OF THE SYSTEM

In structural terms, the health informatics system can be thought of as comprising three broad blocks, as shown in the schematic and paragraphs below.

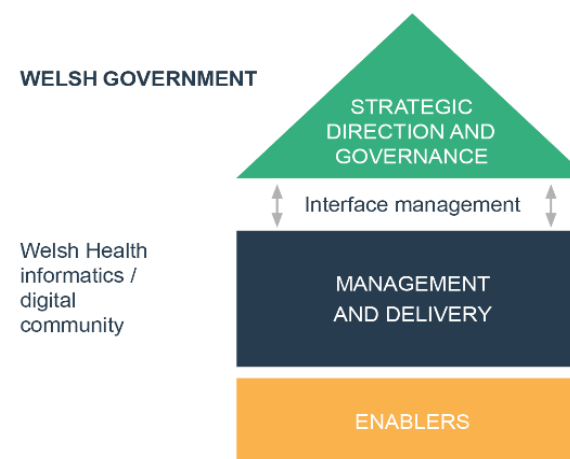


Figure 4: structural components of Welsh health informatics

The ultimate authority directing the system is Welsh Government (although it can choose to delegate that authority to nominated organisations). They should provide the strategic direction for health informatics in Wales, ensure prioritisation and make decisions (or delegate decision-making). These are common roles for the Welsh Government at the political, policy, senior executive and working level and are fundamental and consistent across all structural options, creating the overall framework / “operating environment” within which the system works.

The “black box” is the Welsh informatics / digital community, which comprises all those organisations identified in this report as Delivery Partner Organisations: NWIS, the Health Boards, the Trusts, NWSSP, etc. This community works within the framework and “operating environment” created by the Welsh Government to manage and deliver the health informatics system. These organisations currently all play

roles in all aspects of delivery (from the patient / clinician user interface through the “back-end systems” including data and infrastructure). Many of these systems are themselves “black boxes.” that is to say, in modern ICT terms they are “closed”, often monolithic systems which tend to make change and innovation difficult, slow and expensive. Appendix 10 provides a brief description of the various system components used to describe elements of such “black box” systems, which are referred to later in this Review. Lastly, there are multiple possible configurations of these partners and the associated governance arrangements.

Given the extent of the issues identified in the preceding section, change needs to happen in all organisations in the system: Welsh Government, NWIS and all the other DPOs.

The Enablers indicated above are the systems and processes that underpin the smooth running of the overall system, such as approaches to portfolio, programme and project management and ways in which clinical and user participation is included throughout the whole life-cycle of development, implementation and improvement.

The “interface management / integration” shown in the schematic is also critical and refers to the way in which the various parties work together, rather than any form of technology integration. As well as operating between the formal governance structures and management / delivery community, given that the latter comprises many different partners, it also needs to operate effectively between those partners.

The rest of this section and the subsequent two sections explore:

- **System-wide Recommendations** for addressing issues around strategic direction/overall governance and enablers, as these are common to all the structural options considered (this section)
- **Options** for structural changes with a suggested preferred migration path (sections five and six)
- **Interface management / Integration** is covered in the recommendations for formal governance and in the options for the delivery community (as the nature of that role and how it operates will vary depending on the structural option adopted)

4.4 PRINCIPLES, OUTCOMES AND WIDER COMPARATORS FOR HEALTH INFORMATICS IN WALES

The following key principles and outcomes expected of a well-functioning health informatics system within Wales were identified and discussed with the Project Assurance Group.

- the ability to transform the quality of Health and Social Care using Digital Technology through:
 - co-Production
 - standardised Clinical Practices
 - digital services
 - use of data for supporting effective care, population health improvement, research and innovation
- the establishment of common standards for digital services for the NHS in Wales

- clear governance arrangements to hold leaders, decision makers, clinicians, staff and organisations accountable for Digital Health and Social Care
- investment in Staff to produce the best digitally enabled services
- investment in Innovation Technology to produce the best digitally enabled services
- excellent and timely delivery of appropriate and new technologies

In addition, the Review team undertook external research, summarised in Appendix 11, to inform the expectations of how the system might be configured. The key common themes that emerged from that research included:

- strong government control and leadership
- separate properly constituted Arm's Length Organisations (ALOs) for delivery
- strong business management processes
- healthtech ecosystems
- separation of different informatics and digital activities
- centralised standard setting for data and infrastructure
- clinical and user advisory bodies

¹⁶ Throughout this report, job titles are shown in inverted commas as these will need to be agreed as the job descriptions are finalised. The critical aspect of each role is that the accountabilities shown are matched by the appropriate authority to undertake them.

- separation of commercial and procurement services from digital and informatics services
- digital competence, capability and capacity

The principles, outcomes and national / international comparators have been used to inform the recommendations made below.

4.5 SYSTEM-WIDE RECOMMENDATIONS

4.5.1 Leadership and Strategic Direction

Recommendation 1: appoint a 'Chief Digital Officer'¹⁶ ('CDO') for health in Wales within Welsh Government or within the redefined NHS Executive function (currently under review¹⁷) who is accountable for developing the "Intelligent / Active Investor" role, including:

- working with the Welsh Government policy leads for health and care as well as digital
- strategy, including setting the framework within which the system operates
- a technical roadmap
- governance (see next recommendation)
- monitoring, reporting and independent assurance of delivery

¹⁷ Again, as for the roles themselves, the critical aspect is to ensure that the accountabilities are matched by appropriate levels of authority.

- establishing open and transparent relationships across the system

Recommendation 2: under the auspices of the 'CDO', provide clear leadership, accountability and governance structures for each of the following (separating the different functions – such as advice, decision-making etc. - that each of these represents):

- investment / prioritisation – accountable to the 'CDO'
- advice (the existing Chief Clinical Informatics Officers (CCIO Council) - led by the new 'CCDO' (see below), accountable to the 'CDO'
- Portfolio Management Board (working title) – accountable to the 'CDO' (though this may fulfil its functions through separate sub-boards – see section seven)
- whole system delivery management (including market and strategic supplier management)
- National Open Standards (including for – data, system and application interoperability, accreditation and compliance, delivery (PPM approach, use of WLC etc.), etc.) – accountable to the health 'Chief Digital Technical Officer' ('DTO') – see below
- informatics skills, capabilities and innovation (including NHS, academic and private sector developers and data analytics and future-facing capabilities).

The Review team recognise that the 'CDO' will want to develop / agree the precise structure and configuration of the boards and committees that will enable them to discharge their accountabilities. However, an initial suggestion for these is provided in section seven below.

Recommendation 3: appoint a 'Chief Clinical Digital Officer' ('CCDO') within Welsh Government (likely to be a part-time role) who should:

- report to the 'CDO'
- be accountable for the clinical advice provided to the 'CDO'
- chair the CCIO Council, which should be the source of the advice that the 'CCDO' provides to the 'CDO' and other 'boards'

Recommendation 4: appoint a health 'Chief Digital Technology Officer' ('CDTO') who is accountable to the 'CDO' for both setting and policing standards and developing and maintaining the technical roadmap.

Recommendation 5: recommendations one, three and four above are new roles and, as such, represent an opportunity to inject new talent and leadership into the system.

Recommendation 6: continue to develop and update the strategy (Informed Health and Care) and the supporting technical roadmap (see recommendation one above), ensuring that:

- it is outcome focused.
- it includes clear, binding definitions provided for key terms (for example, informatics, digital, infrastructure, commercial etc.)
- it is informed by best and emerging digital practice elsewhere.
- future developments are considered and understood, including the skills and capabilities required
- future delivery/project execution approaches are considered and their implications for Welsh digital services is understood

- the impact that ongoing innovation in health digital technology (including for example, cloud-based technologies, artificial intelligence, intelligent robots) has on future services, system / organisation design and informatics is not considered in isolation

4.5.2 Enablers

This set of recommendations addresses the processes and approaches that help the operating environment to work smoothly and in a consistent way. Whilst this area is led by Welsh Government, the processes and approaches should be adopted and implemented by the delivery community.

Digital portfolio, programme, project and change management

Recommendation 7: implement appropriate digital Portfolio Management, encompassing:

- balancing the portfolio between BAU and delivery of change
- ensuring transparent monitoring and reporting of BAU and delivery of change
- independent assurance of projects and programmes

Recommendation 8: develop digital project planning and execution, including:

- clinical and user engagement throughout the life-cycle; in design, testing and implementation
- change management / culture change management
- ensuring sufficient resource time is available for individuals to fulfil both engagement and change management roles (for example, at

leadership level for CCIOs and at implementation level for junior doctors, other clinical roles and administrative staff)

- independent delivery assurance

Recommendation 9: ensure better application of appropriate Programme and Project Management (PPM) disciplines including, in particular, whole system improvements in:

- governance through the connection of system delivery project boards to accountable programme boards which in turn are accountable to national care boards
- change control
- benefits realisation and management (including accountability and hand over from delivery to business as usual)

Recommendation 10: invest in IT commercial services that looks beyond the buying decision (traditional “procurement”) to the full life-cycle of understanding needs, understanding / managing the market (for example early and open engagement with digital partners), ensuring compliant fulfilment of needs, contract management.

Digital competence, capability and capacity

Recommendation 11: further develop the digital competence, capability and capacity across all staff groups in the system, building on the Statement of Intent published in March 2018 and the ambitions of the newly formed HEIW, including:

- executive and non-executive board and senior management digital awareness
- clinical practitioners at all levels (leadership through to “front-line”)

- the role of senior digital directors and their interface with Directors of Finance, Planning and Strategy

4.5.3 The Impact of the Recommendations

The Review team have (re)assessed the issues identified in the systems map in Figure 2 of the Case for Change on the assumption

that the recommendations 1 to 11 above are fully implemented. The results are shown in Figure 5 below, the key being as follows:

- red: the issue remains unresolved
- amber: the issue has been partially resolved, further work is required
- green: the issue is largely or wholly resolved

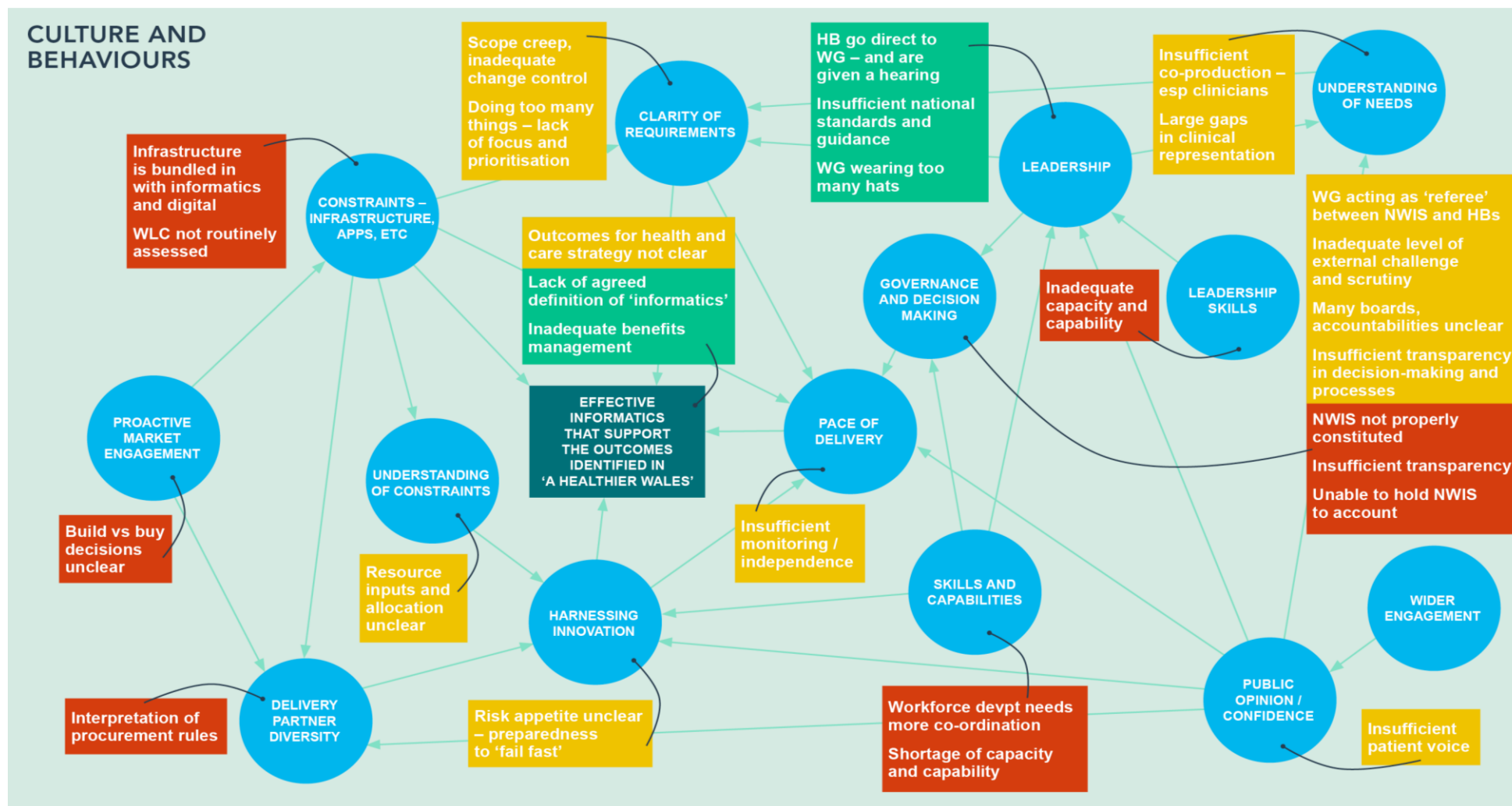


Figure 5: impact on the issues if recommendations 1 to 11 are fully implemented

As can be seen and as discussed above, implementing these recommendations alone does not fully address the current system-wide issues. Further interventions in the form of structural changes are needed and are explored as options in sections five and six below. Those structural changes in turn have implications for the governance aspects of the recommendations made in this section. These are explored in more detail in section seven.

5 OPTIONS AND VISION FOR THE FUTURE

5.1 APPROACH TO SIFTING AND EVALUATION OF OPTIONS

5.1.1 Evaluation Framework

At the same Project Assurance Group workshop, a high-level strategic framework both for evaluating similar packages of systems options and evaluating more detailed options within packages, was presented and discussed under the following four headings:

- **governance:** for example, roles, responsibilities, accountabilities and transparency
- **benefits / value add:** for example, contribution to “Informed Health and Care,” additionality to whole system, PPM, digital capability/capacity/innovation
- **stakeholder value add:** multiple perspectives – patients and the public, clinicians, digital / NHS / WG staff
- **pace of deliverability (including acceptability):** for example, stakeholder acceptance, timeline, likely cost, change management challenge and appetite for risk.

Packages of systems options and individual options can be “scored,” by reference to the following scale, as part of a process of both explicit and intuitive assessment, to establish clear differences between the packages and options:

1. very small overall impact
2. minor impact
3. moderate impact
4. significant impact
5. fully addresses the identified problems

5.2 STRUCTURAL OPTIONS - INTRODUCTION, DEFINITIONS AND SCOPE

This section explores the structural options for the “management and delivery” block shown in Figure 4 above.”¹⁸

The Institute on Governance¹⁹, provides the following very broad definitions:

“Governance determines who has power, who makes decisions, how other players make their voice heard and how account is rendered.

Governance is how society or groups within it, organize to make decisions.”

Throughout this Review, and the reports and reviews that preceded it, the governance of Welsh health informatics and NWIS within that are seen as “broken.” The options that follow, go beyond “governance” even in the broad definition provided. They explore the structure, relationships and accountabilities of the informatics delivery community including individual organisations within that community. The primary reason for this is that one of the key players within the community - NWIS – when it was created in 2010, had different governance arrangements from other similar “hosted” national functions. It is in effect an extended part of Welsh Government with “pay and rations” serviced by Velindre NHS Trust.

¹⁸ Options for all Wales solutions, including other parts of Welsh Government and agencies, (for example, a Welsh Government Digital Services structure or an all Wales shared services structure) are outside the scope of our review.

5.3 EXPLORING A POTENTIAL LONG-LIST OF OPTIONS

As a “do minimum” option the Review team believe that NWIS must be properly and formally constituted, which will mean that the relationship with their “host” local health trust (Velindre) is either fundamentally redefined or replaced by a different arrangement. Exploring that (re)constitution provides an opportunity to reflect on, and potentially change, what NWIS currently deliver. At present they provide contribution to strategic direction, development of systems, infrastructure, support and maintenance and procurement (of IT systems). Their annual report identifies the provision of some 70 different services. In simple terms they provide, at a national level, both care / maintenance and development of:

- services
- data
- infrastructure
- commercial services

The Health Boards also, at a local level, work across most if not all of these headings.

There are therefore at least three dimensions over which system delivery options and hence system structures should be considered:

¹⁹ See <https://iog.ca/what-is-governance/>

- the element of informatics services provided (as defined above)
- the care/maintenance and / or development of each of those elements
- whether those elements are delivered locally or nationally or both

These are illustrated in the diagram below.

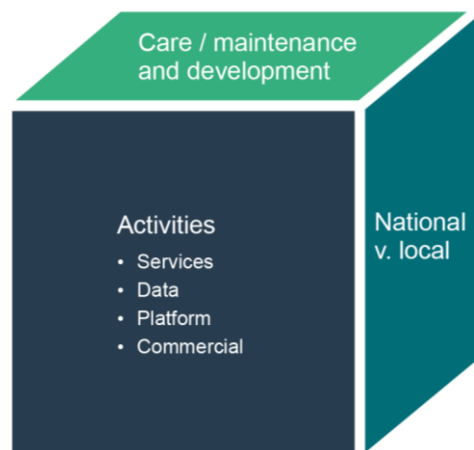


Figure 6: dimensions for consideration in the options available

Given the multiplicity of possible options, they have been grouped together into four broad strategic “packages” (A to D) moving from “do minimum” through to the most radical; these are described below.

A Do Minimum

This option looks solely at NWIS (retaining all its existing functions) and seeks to constitute it formally through two sub-options as:

- a division within Velindre reporting to the Velindre Board
- an arms-length organisation, still hosted by Velindre (similar to NWSSP), with integrated single organisation formal governance arrangements in place

B Move NWIS into another structure

This option looks solely at NWIS (retaining all its existing functions). However, here, in constituting it formally, the options are to move the organisation out of Velindre. There are two sub-options:

- move the whole of NWIS into NWSSP as an additional shared service (for informatics) and ensure that appropriate changes are made to the governance of NWSSP to reflect the broader responsibilities
- move the whole of NWIS into a new standalone Shared Service entity with new and separate governance arrangements (which could take a number of legal forms)

C Re-configure the health informatics delivery community in Wales

Whilst A and B above propose leaving all the current functions that NWIS provide together, this group contains multiple options which explore different ways in which the three dimensions set out in Figure 6 might be configured – not only the current NWIS functions, but also those of all the other DPOs. For example:

- a single national shared service health infrastructure organisation separate from the other services
- a single national provider of health data for health in Wales

- a single provider of health informatics commercial services in Wales
- an “ecosystem” of services / applications that could be local by default, national by agreement
- a mix and match of all the above
- options on the providers of each of services above – for example in the public sector or out sourced
- separation of care / maintenance from development for any or all of the activities

For all of these options, it was recognised that two additional new functions will be required to effectively operate the system:

- technical: Systems Integration and Management (SIAM) – ensuring inter-operability between the various technical elements – services / data / infrastructure (potentially under the ‘CDTO’)
- broader systemic integration – supporting the inter-operability between the various delivery organisations and ensuring that they are able to work together smoothly (potentially under the ‘CDO’)

D A new single organisation

At the most radical end of the spectrum, a new pan-Wales entity could be created absorbing the health informatics functions of both NWIS and other DPOs. For example:

- an all Wales Health Digital organisation
- an all Wales Digital organisation, of which health is just one sector

An additional option in this group includes merging with NHS Digital for England, but this was dismissed as failing to address the specific needs of the citizens of Wales and Welsh Government ambitions, for example, as encapsulated in the Wellbeing of Future Generations Act 2015.

5.3.1 Short-List of Options

A high-level Review of the above options was undertaken by the Review team following the Project Assurance Group meeting on 26th November 2018 using the guiding principles / outcomes and evaluation framework set out in section 5.1.1 and 5.1.2 above. Whilst not formally “scoring” the option groups above, reflecting on the discussions at the meeting and how these aligned with the strategic framework, the Review team concluded that:

- groups A and B did not go far enough in delivering the guiding principles (see section 5.1.1 above), particularly in terms of governance, benefits and value added and in “re-booting the system” (as referenced in the PAC report)
- group D involved substantial change and cultural challenges, calling deliverability within an acceptable time-frame into question (which assumes that some immediate actions are required). One of the sub-options, (an all Wales Health Digital organisation) runs the risk of creating a new monolithic structure (effectively a supra ‘NWIS’ with total responsibility for all health information in Wales). The internal working of such an organisation risks repeating the accountability and transparency issues identified in the PAC report. Adding this onto as a yet unidentified potential all Wales Digital organisation at this stage is likely to compound this further. The Review did note however, that, at some stage in the future, any

health system structure should maintain the options for closer digital working and services across other services in Wales, especially for standards and common data and infrastructure.

The Review team therefore considered a short-list of options in package C ranging from the more radical end of B through to the less radical end of D. These are explored in the next section.

5.4 A VISION FOR THE FUTURE AND IMPLEMENTATION APPROACH

5.4.1 A Possible Longer-Term Vision for the Structure of Health Informatics in Wales

Following presentation and discussion at the Project Assurance Group workshop on 26th November and subsequent analysis, a number of common features in relation to the design of the future structure of health informatics in Wales were identified.

A move towards both national / international emerging best practices (see section 4.4 above) and current thinking on modern ICT delivery (breaking up the “black box” – see Appendix 10), suggest the following delivery elements:

- an **Informatics Standards authority** (ISa). Whilst the precise role and function needs to be decided and then the appropriate structure put in place, a critical aspect of this function is the need for independence²⁰ from other roles, including the systems

integrator, so that conflicts of interest do not arise. One international example that could provide a model is Catalonia, where the standards authority both sets and polices standards (technical and data). Ultimately, this could certify that systems and applications met those standards and could be “plugged into” the wider informatics system. Such approval would be a pre-cursor for business case approvals and subsequent procurement processes. (As discussed below, the degree of independence of such a standards organisation can be decided over time as the standards themselves are established)

- a national **shared service Infrastructure** based on open architecture principles that provides standard Application Programme Interfaces (**APIs**)²¹ for applications / services to plug into. Once mature this would be responsible for **all** health informatics infrastructure across Wales (currently provided by NWIS, Health Boards and Trusts)
- a national **shared service for data**¹⁸ capable of being used across the health informatics system – by infrastructure and apps. Again, once mature, this would be responsible for **all** health informatics data across Wales (currently provided by NWIS, Health Boards and Trusts).
- a national **shared commercial service** engaging with the broadest range of digital providers, providing market intelligence guidance and support to commissioners. Such a commercial service would also have authority and responsibility for all IT procurement. This could be modelled along the lines of an authorised Centre of

²⁰ As stated earlier, “independence” in this context is that it should remain independent of / separate from those organisations for which it sets and polices standards

²¹ See Appendix 10

Procurement Expertise, which controls procurement in different parts of the public sector in Northern Ireland

- thriving health **informatics ecosystems** (that is, collaborations of application/service providers across a range of types of organisation, able to innovate to better deliver clinical and patient pathways using the standard data and infrastructure provided through the shared services). These could be regional, local or national, though there will still be the need for some all Wales single system implementations which would remain wholly national. Whole country implementations would need to be exactly that – a single implementation to national standards of clinically agreed, commonly designed specifications and requirements to which all parts of / parties within the informatics system subscribe. (This would include commercial procurement considerations so that any new solution being piloted by these “innovation collaborations” is capable of being provided across Wales)
- mature system **integration functions** – both technical (inter-operability of ICT components through a **SIAM**) and **integration management** (inter-operability / collaboration / policing governance between organisations)

This longer-term structural vision can be shown schematically as shown in Figure 7 below.

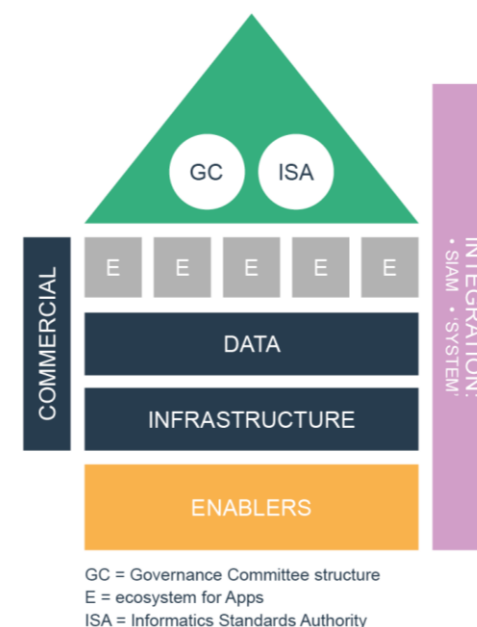


Figure 7: longer-term vision for health informatics structure

5.4.2 Evaluation of Longer-term Vision

Alongside the recommendations already made on strategic leadership, direction-setting and enablers, this longer-term structural vision could provide a direction of travel for the whole of the Welsh informatics system²². A high-level evaluation of the proposed structure has been

²² The vision itself may never be fully delivered; for example, given the pace of technology innovation, the future vision may change before it is delivered.

undertaken against both the principles / outcomes and the evaluation framework set out in section 4.4 and 5.1.1 (respectively) above.

I Principles, Outcomes and national/international comparators

Principle / Outcome	Assessment / comment
<p>The ability to transform the quality of Health and Social Care using Digital Technology through:</p> <ul style="list-style-type: none"> • co-production • standardised Clinical Practices • digital services • use of data for supporting effective care, population health improvement, research and innovation 	<p>The proposed vision, combined with the recommendations on roles, staffing enablers, should provide this capability. It is noted that transformation and standardisation of clinical practices will still require ongoing engagement / involvement of clinicians and patients.</p>
<p>The establishment of common standards of digital services for the NHS in Wales</p>	<p>The proposed ISa should provide the ability to meet this outcome.</p>

Principle / Outcome	Assessment / comment
<p>Clear governance arrangement to hold leaders, decision makers, clinicians, staff and organisations accountable for Digital Health and Social Services.</p>	<p>The proposed structure, combined with the other recommendations in this report should provide for this outcome.</p>
<p>Investment in Staff to produce the best digitally enabled services.</p>	<p>The recommendations on skills address this point although investment will remain dependent on the availability of resources.</p>
<p>Investment in Innovation Technology to produce the best digitally enabled services.</p>	<p>The separation of the services is intended to allow appropriate and transparent levels of investment in the different aspects of health informatics. However, investment will remain dependent on the availability of resources.</p>
<p>Excellent and timely delivery of appropriate and new technologies.</p>	<p>The separation of services and proposed structure ought to increase the pace of delivery; for example, of new informatics-enabled clinical practices that make use of standardised data on a common, open IT infrastructure.</p>

This vision also meets a number of the national / international common themes identified in section 4.4 above, namely:

- separate properly constituted Arm's Length Organisations (ALOs) for delivery
- healthtech ecosystems
- separation of different informatics and digital activities
- centralised standard setting for data and infrastructure
- separation of commercial and procurement services from digital and informatics services

II Evaluation Framework

A high-level scoring against the evaluation framework suggests the following scores. This also assumes that the enabling recommendations 1 to 11 are implemented in full.

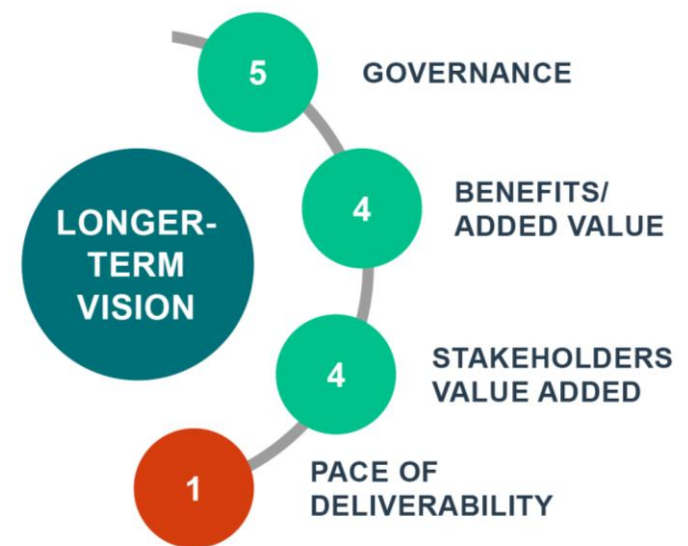


Figure 8: evaluation of longer-term vision against the agreed framework

Where:

1. Very small overall impact
2. Minor impact
3. Moderate impact
4. Significant impact
5. Fully addresses the identified problem

As shown, the outcomes of our process of explicit and intuitive assessment produced high impact scores for governance, benefits/added value and stakeholders added value. This is further illustrated in Figure 9 below.

The low score for pace of deliverability reflects the complexity of the system and the “wicked” problem to be addressed for which, as indicated earlier, there are unlikely to be any quick or easy fixes. The likelihood is that it will take a considerable time to deliver given the challenges of, for example:

- establishing a fully arm’s length ISa (if that form best meets the functional need, which may require legislation)
- disaggregating and reconstituting the service components in all the DPOs including staff transfers, particularly of NWIS and Health Boards
- stimulating the creation of the applications development collaborations (the “ecosystems”), though this could build on existing initiatives such as the innovation hubs
- The current technical maturity or otherwise of the patient stack of apps/systems, data and infrastructure (a question to be addressed by the architecture review)

III Systems Map and Addressing Issues

In addition, the Review team have revisited the updated systems map provided in Figure 5 which shows the impact of recommendations 1 to 11 (if fully implemented), to provide an assessment of the impact of the vision (again, once fully implemented). The results are shown in Figure 9 below (key as for Figure 5).

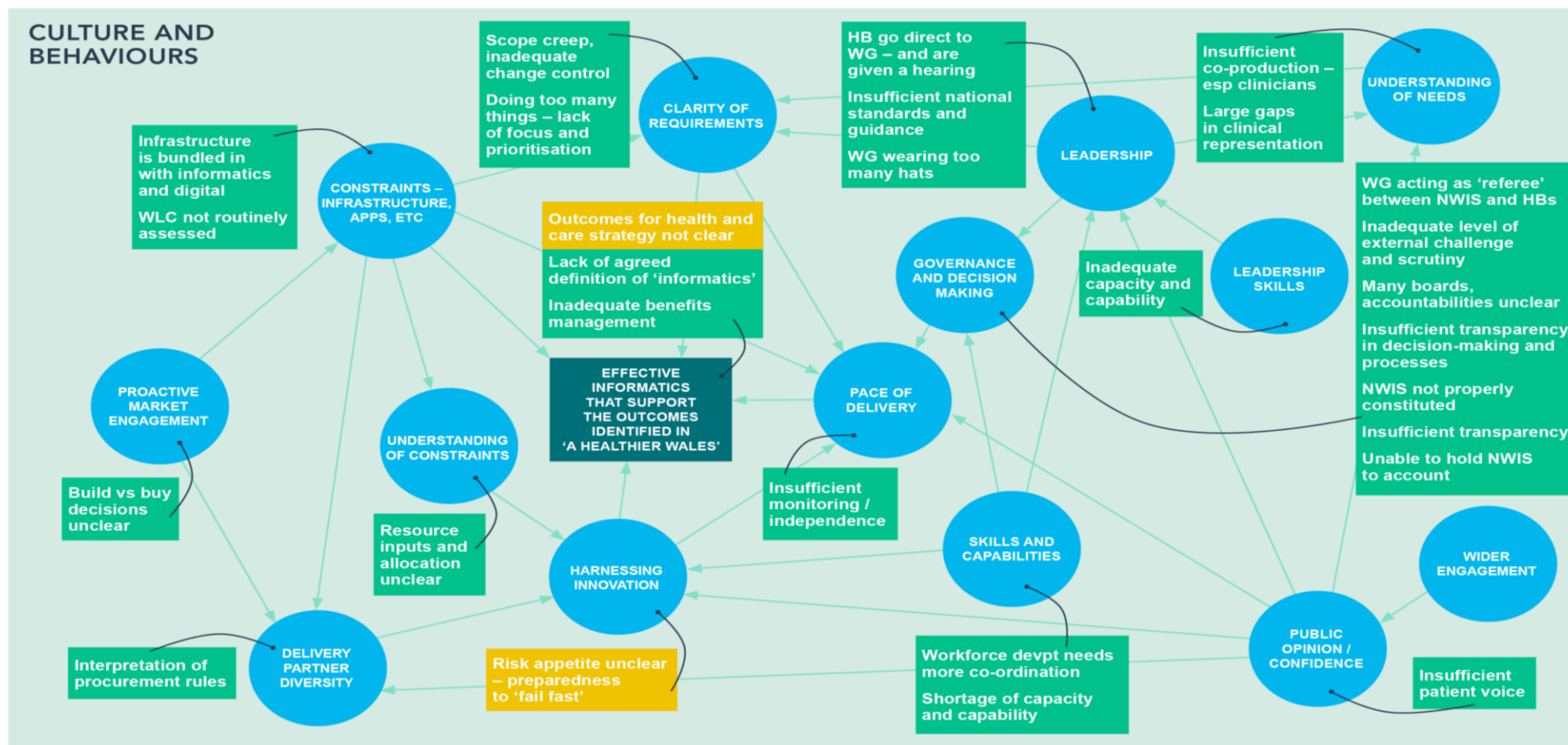


Figure 9: cumulative impact on the issues of the recommendations (1 to 11) and longer-term structural vision

Given these assessments and the fact that the vision provides a direction of travel that can inform decision-making in the interim period, rather than set out and score multiple options in this section, the Review team have set out in the next section a possible roadmap for moving towards the longer-term vision and an initial set of **delivery recommendations** covering the first two stages (year one and towards year three).

5.4.3 Potential Benefits of Longer-term Structural Vision

Recommendations 1 to 11 and the changes proposed in the longer-term structural vision are focused on all parts of the health informatics and digital system and as such the benefits that they bring can also be expected to be experienced across the system. In particular, the changes should allow more decisive strategic intervention as and when required.

The main headings across which benefits are expected are shown below with further detail provided in Appendix 13:

- transparency – for example, how priorities are decided upon and investment decisions made
- integration – for example, applying common standards and an open architecture
- capability – for example, providing digital leadership and capacity at the national level
- collaboration – for example, providing formal mechanisms at all levels (including national) for obtaining advice from the clinical and user community, throughout the whole life-cycle of new development
- efficiency – for example, streamlining the committee apparatus that oversees health informatics in Wales thereby reducing duplication and confusion
- equity – for example, ensuring that everyone in Wales has access to the same digitally enabled, clinical pathways
- innovation – for example, allowing opportunities and freedoms for local innovation

These benefits will accrue over time as the changes are made and consolidated across the system. Taken together, these benefits will lead to a much more robust and resilient system of health informatics, one that is properly equipped to make the significant contribution the Welsh Government requires and expects of it. In turn, this should support a step improvement in health outcomes, and a corresponding rise in the health and well-being of the people of Wales.

5.4.4 Overall Assessment of the Longer-Term Vision

The proposed changes across the whole system cover:

- system-wide recommendations:
 - strategic direction and leadership (recommendations 1 to 6)
 - enablers (recommendations 7 to 11)
- reconfiguration of the delivery community (the longer-term vision):
 - system structure
 - new configuration of the system elements (data, infrastructure etc.)

As discussed above, these points sufficiently address the intended design principles and outcomes, the principle evaluation criteria (governance, benefits / added value and stakeholders value add) and the current issues in the systems map to consider the next level of detail of how this could be implemented and what the detailed governance requirements might be.

It is probable that the precise shape of this longer-term structural vision is both likely to change (as technology continues to develop) and

should be developed / maintained by the newly appointed Health 'CDO' for Wales. Guidance elsewhere suggests that the rate of advance of digital innovation means that firm business planning can only look out around three years into the future. In addition, system procurement lifecycles are closer to four to five years now, compared to seven to ten years in the previous generation of system procurement. Whole system design principles should also be periodically reviewed.

It is also recognised that there are a number of major all Wales systems either at business case, procurement, implementation or rollout stage. These need to be clearly defined and kept under careful review (perhaps designated as NHS Wales Major IT / Digital Projects)

so that the proposed wider system changes do not disrupt their delivery, while recognising that those "in-flight" projects will need to be migrated to the new system structure defined in this report. These projects may therefore require short-term specific governance attention.

In conclusion, careful consideration is required of precisely how to establish and implement this new structure given the necessity for Welsh Government to take action now. This is considered in the next section through a set of **delivery recommendations** that should sit alongside the whole system recommendations made in section 4.4.

6 DELIVERING THE VISION

6.1 A ROADMAP FOR DELIVERY

Appendix 13 provides an exploration of a possible roadmap for delivery covering years one, three, five and longer-term (which is the vision described above and in Figure 7) as a series of schematics and explanatory text. The precise time-scale for the “longer-term” is unclear but may be ten or so years and may be something the technical architecture review is able to help assess, given the maturity or otherwise of current systems, data and infrastructure across Welsh Government, NWIS and DPOs.

The aim over time is to “un-bundle” the different components of the informatics / digital systems and reconfigure responsibility for management and delivery of Welsh Health informatics (the “black box” discussed in section 4.3 and Appendix 10). This reflects national and international current practice which is seeking to improve the quality and pace of digital health delivery, for example:

- in England where a recent report recommended “unbundling” the patient stack – services, data and infrastructure
- New Zealand, where there is a national infrastructure platform and a Health Information Standards Organisation and clear technical

foundations about architecture, standards, information governance and ICT capabilities

- Catalonia, Spain where there is an independent standards organisation
- Scotland where health informatics are separated out into different sub-services within Shared Services Scotland
- Norway where there is one national health network with common information technology services
- Victoria, Australia where the State-wide Health ICT Strategic Framework 2015 sets out Government and Health board roles, the importance of enablers, and the need for maturity models and minimum baselines to enable system evolution as digital capability in the system grows

(A summary of the research carried out on national and international approaches is provided in Appendix 11).

The technical architecture review which is being commissioned will need to assess questions such as:

- the kinds of open standards required for both data and infrastructure

- the current status of the existing architecture and how far it already supports those principles / standards. This is likely to include the extent to which existing monolithic systems such as LIMS provide all service elements – user interface, data and infrastructure (a “vertical” single system architecture) and whether / how such systems might be un-coupled to provide standard data and infrastructure that could be used by any compatible and approved application/service (a more “horizontal,” layered architecture)
- the gap between those two and the likely speed at which that gap could be closed

These questions are beyond the scope of this structure and governance Review but may impact and inform system delivery timescales.

The migration over time is essentially intended to provide a series of steps as follows:

- establish the framework within which health informatics is delivered through new strategic direction-setting, enablers and a new Informatics Standards authority
- re-constitute the way in which existing NWIS services are delivered
- transfer elements of current Health Board and Trusts delivery (data and infrastructure) into the new configuration (see below)
- consolidating, rationalise and achieve at least a minimum capability

Only then exploring future delivery options.

The actions required in the short and medium term to move towards the longer-term vision have been captured as a series of recommendations below.

6.2 DELIVERY RECOMMENDATIONS

6.2.1 Immediate and Year One Recommendations

The following recommendations are made (for immediate – year one - implementation).

Recommendations 1 to 11 (for ease of reference): recruit the central Health team (within Welsh Government and / or the new NHS Executive) and establish enabling processes, structures and capacity/capability.

Recommendations 12 to 14: split up and move the NWIS service components:

- **(Rec 12)** move Commercial services from NWIS to NWSSP “procurement” shared service (and widen the scope to encompass the whole of the commercial life-cycle). Future controls over commercial procurement are likely to require certain pre-conditions “hard wired” into them, which the shared service should establish and implement. For example, prior approval of the standards authority, the ability to rollout arrangements across Wales, ensuring equity of access to new systems / apps, etc.
- **(Rec 13)** move Infrastructure and Data from NWIS (together initially) to a single shared service (with options as to whether this is stand-alone, reporting directly to the ‘CDO’ or through NWSSP). There are potential governance implications for both the system as a whole and NWSSP which may dictate the route taken (see below) and will need to be kept under review. These are high-lighted in section seven below

- **(Rec 14)** Health informatics Apps / Service Team. In the short-term, this team is likely to include existing monolithic systems such as LIMS, before they are “unbundled” into their component parts, as well as apps development. Given the criticality of ensuring continuity, it is suggested that this function be under the authority of the ‘CDO’. This should be reviewed in the medium term – see Recommendation 24 below.

Given the desire to quickly disrupt and change the existing system, NWSSP may offer an immediate “home” for the data and infrastructure elements. However, this will in part depend upon the maturity of those elements and whether they can be considered as purely “back-end” transactional services which the NHS can collectively govern. If extensive further work is required to achieve that level of maturity, Welsh Government / the ‘CDO’ may opt to take more direct control of the governance in the short term. In any case, the delivery of these and the effectiveness of the modified governance structure suggested in section seven below, would need to be kept under review.

The Review team understand that possibly up to 90% of NWIS staff are currently involved in care and maintenance of existing systems – much of which is data and infrastructure. The team are also conscious of the need to handle the effects on staff carefully and sensitively, with full consideration given to the most appropriate processes / approaches to be used. These are likely to include an initial baseline assessment of current staffing (who works on what), existing employment arrangements and whether (and if so what) new arrangements might be required. For the majority of staff within NWIS, existing contracts with Velindre may remain in place, though transferred to NWSSP. Apps / development staff may need to transfer into Welsh Government Health Digital Team.

Recommendation 15: establish a single Standards Board for Welsh informatics covering:

- standards for canonical Data
- technical standards for architecture / infrastructure
- standards for Apps and ecosystem development.

As indicated above, existing work on standards as well as the technical architecture review will provide key inputs to this process. As the function is better understood, the future form for providing independent standards for Welsh health informatics will become clearer and should be developed in parallel (particularly if legislation is required). For the purposes of this report, it is assumed that this will an independent (of other delivery organisations) Informatics Standards authority (ISa) to which the Standards Board will transition over time.

Recommendation 16: establish the technical Systems Integrator & Management (SIAM) function (to ensure interoperability between different systems and services). The Review team suggest that this should report to the ‘CDO’ initially but could become an independent function over time.

Recommendation 17: establish the framework management system integration function (to ensure interoperability between different delivery organisations).

This function would draw on experience from other complex delivery systems. In many ways, this critical function can be thought of as enabling the inter-operability between the organisations that comprise the informatics system and the Review team suggest that it reports to

the 'CDO'. Over time, this function may become the "owner" of the Enablers shown in the structural diagrams above.

Recommendation 18: establish the management, accountability and governance framework – the new stage 1 committee structure – and dismantle ALL of the other governance committees (the next section provides an initial suggested view of this).

Recommendation 19: invest in staff with digital skills and digital education of clinicians and other staff.

Recommendation 20: establish the first Local Health Technical Ecosystem, linking to and building on the current initiatives with innovation centres such as the Life Sciences hub. The aim is to provide direct link which will enable transformation of clinical pathways and practices through digital enablement.

Recommendation 21: establish a programme to oversee implementation of these recommendations, reporting to the 'CDO'. This should include a comprehensive stakeholder engagement strategy and communications plan to relentlessly work with partners across the system. (This may provide the starting point and leadership for the framework management system integration function set out in recommendation 17).

6.2.2 Year Two and Three Recommendations

In addition, subject to the Review described above at the end of year one, the Review team further recommends the following for

²³ No formal recommendations are made at this stage for year five, although the process could be accelerated if sufficient progress has been made by the end of year

implementation in the medium term (between year two and year three²³).

Recommendation 22: establish the fully independent ISa (or agreed form that the independent standards organisation should take longer term) and migrate the accountabilities of the Technical Standards Board into the new organisation.

Recommendation 23: migrate the infrastructure and data components that remain in other DPOs into the relevant part of the NWSSP. In parallel begin the process to separate the data and infrastructure elements as each matures towards meeting ISa standards (see also next section in terms of ensuring that NWSSP delivery and governance are reviewed and assessed as being effective for the longer term).

Recommendation 24: review and learn lessons from the initial ecosystem pilot(s) and establish further pilot sites.

Recommendation 25: review and consider the future structural options for the remaining NWIS apps development team (options might include: migration to local ecosystems; consolidation as a central team to support implementation nationally; spinning out as a new tech health informatics organisation).

Recommendation 26: review and consider the most appropriate future structure and "home" for both the technical and framework management integration functions.

one. Hence the inclusion of this time-horizon, so further actions can be brought forward if / as required. See Appendix 13 for details.

The number and scale of the content of the recommendations reflects the challenges involved in establishing this new structure and the accompanying governance arrangements. The next section looks in more detail specifically at the governance arrangements.

Appendix 14 summarises how the 26 recommendations in this review align to those made in other recent reviews / reports.

6.3 EVALUATION OF YEAR ONE STEPS TOWARDS THE VISION

A high-level evaluation has been done against the agreed evaluation framework and the issues identified earlier mapped against the informatics systems map in Figure 2. This is similar to the one carried out for the long-term vision above and has been done to provide evidence that substantial progress can be made through actions taken now and over the next 12 months to address the issues identified with the current system.

6.3.1 Evaluation Framework

Again, this high-level scoring assumes that the recommendations 1 to 11 are also implemented in full.



Figure 10: evaluation of year one actions against the agreed framework

(Key as before)

As can be seen, the Review team has assessed that the year one actions, make good progress towards the longer-term vision, but further steps are required.

6.3.2 Systems Map and Issues

The results shown in Figure 11 below assume that recommendations 1 to 11 and the year one recommendations in the next section (12 to 20) are fully implemented (the colour key is as for Figure 5).

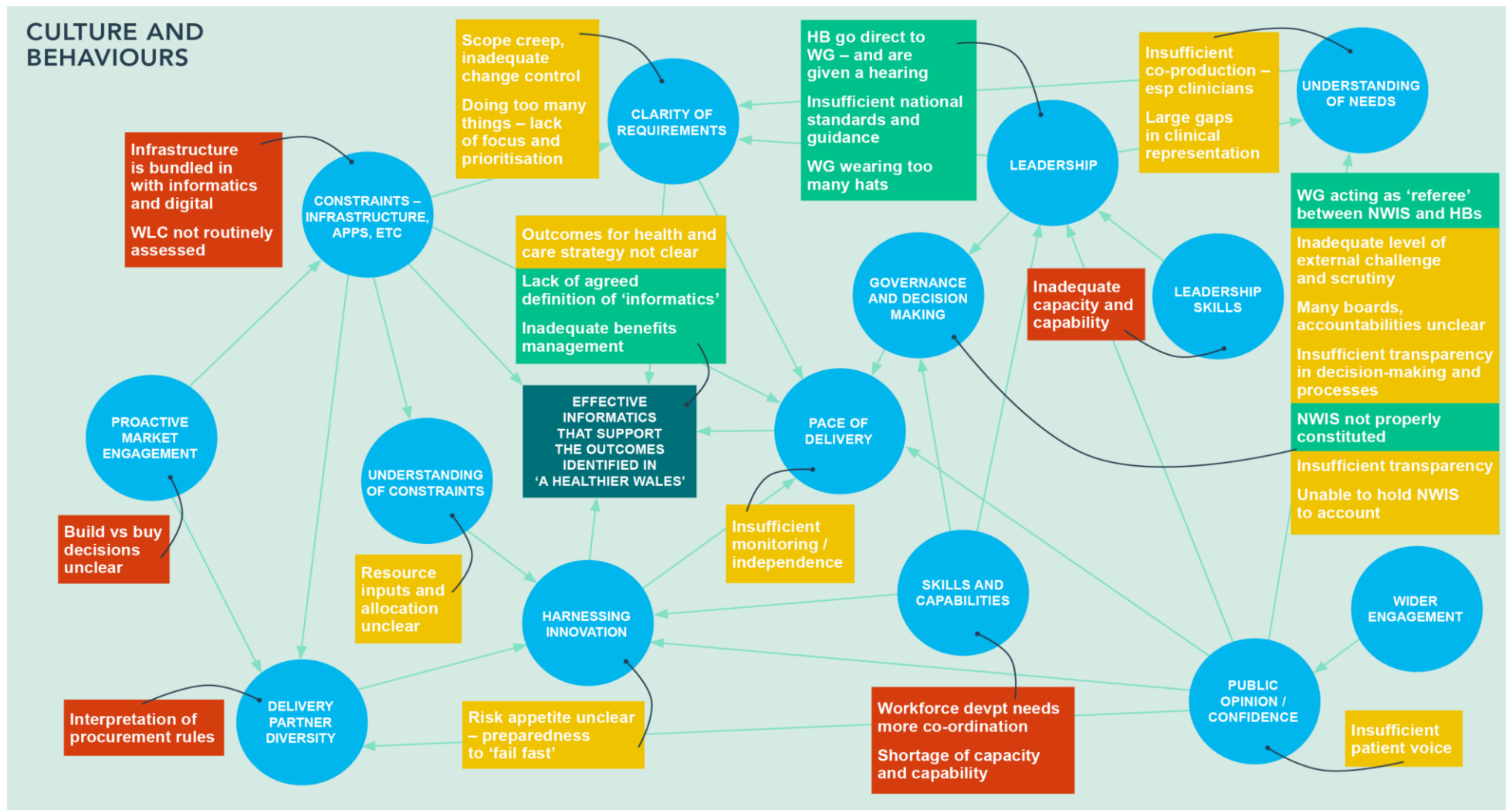


Figure 11: cumulative impact on the issues of the recommendations (1 to 20)

The Review team expect the medium-term recommendations to further improve the picture shown above, turning further issues either from red to amber or from amber to green (however, there is a dependency on how quickly the system matures and the behaviour and culture changes that need to under-pin it).

7 DETAILED GOVERNANCE IMPLICATIONS

As set out previously in this report, the various elements of the system constitute multiple “moving parts” that necessarily impact on each other. This section therefore provides a narrative and more detail of the governance implications of implementing the recommendations provided.

7.1 INITIAL PROPOSED COMMITTEE / GOVERNANCE STRUCTURE

Recommendation 18 proposes establishing a new year one Committee structure alongside the ‘technical standards board’ (recommendation 15).

The new ‘CDO’ and ‘CDTO’ roles (proposed in recommendations and five respectively) will want to influence what follows, as may other parts of the wider system as they are clarified (for example the Welsh NHS Executive, which is currently under Review and the separate technical architecture Review). This section should therefore be considered as providing initial suggestions setting out key roles, accountabilities and relationships. These would be enshrined in different ways over time.

7.1.1 Principles

The key principles underpinning the new governance structures are to:

- sweep away existing committees and structures (such as NIMB, IPAD etc.) as they have become discredited by association with a system that is seen as “broken”. The one exception is the CCIO Council, although this will be chaired by the new ‘CCDO’ and have an advisory role (see below for more details)
- establish separate and independent functions with their own governance arrangements to include advisory, standards, prioritisation, monitoring and reporting, and change portfolio management
- clarify relationships between the elements within the governance structure and the governance precedence rules which apply in the system
- provide checks and balances so that individual personalities are less able to dominate

7.1.2 System Governance and Leadership

A suggested top-level structure, which the 'CDO' (is likely to want to review and modify) is outlined in the diagram and paragraphs below.

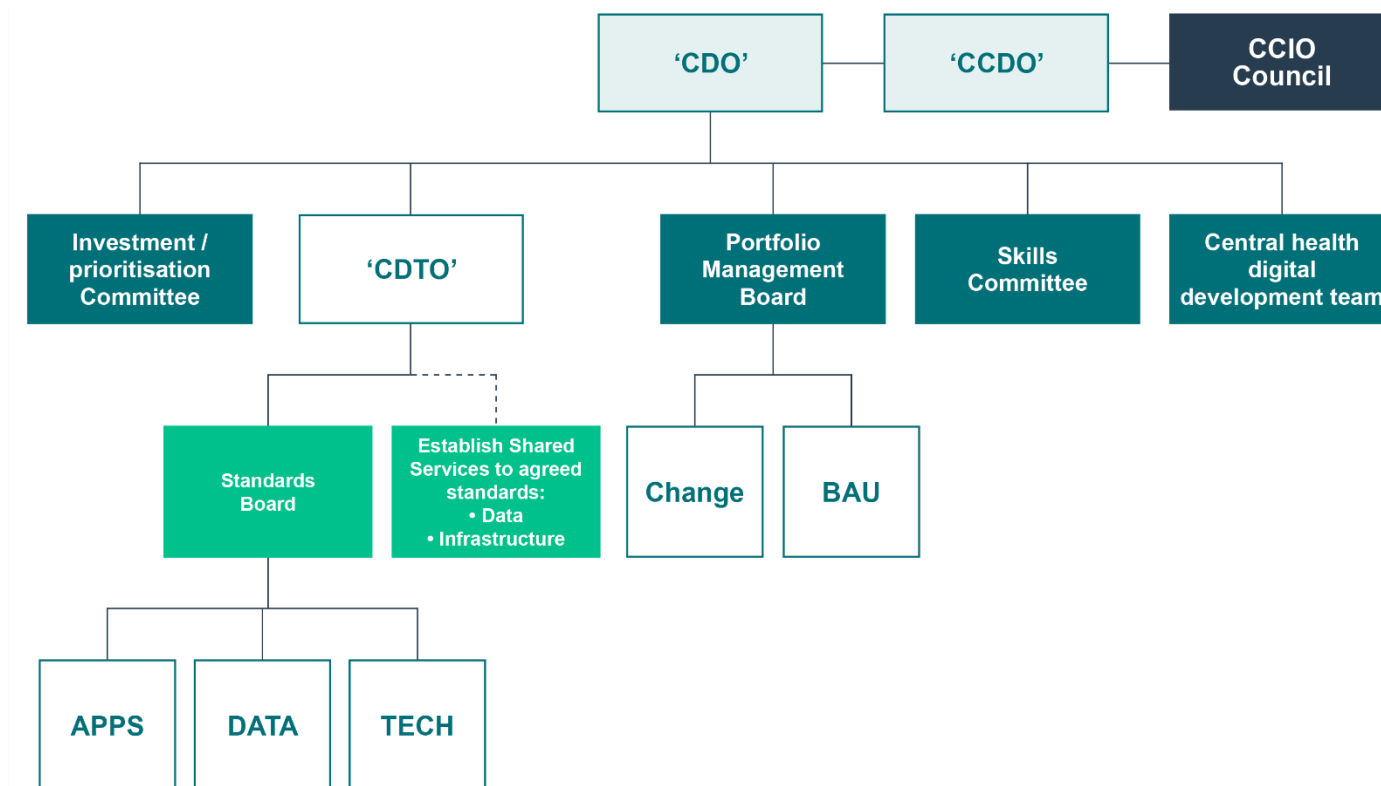


Figure 12: proposed initial board/committee structure for the whole system of health informatics

NOTE: the roles in inverted commas, refer to the three new digital leadership roles referred to in section 4.4.2 above – titles to be confirmed – 'Chief Digital Officer' ('CDO'), 'Chief Clinical Digital Officer' ('CCDO') and 'Chief Digital Technology Officer' ('CDTO') (straight-line indicate direct reporting / control, dashed lines indicate indirect reporting / influence / membership of the relevant boards / committees).

The relationships outlined above are intended to support the 'CDO' in discharging the accountabilities set out in recommendation two, to govern and be involved in all aspects of the informatics system in Wales (including management and delivery). Details are as follows.

I CCIO Council

An advisory body chaired by the new 'CCDO'. Whilst the latter will report directly to the 'CDO', the Council provides strategic clinical advice to help the 'CDO' execute their role. The CCIO Council is not a decision-making forum.

The CCIO Council is likely to comprise Clinical informaticians from across the Health Boards and Trusts in Wales as well as representation from those clinicians leading engagement at a delivery level (see recommendation eight above).

II Investment / Prioritisation Committee

A strategic, decision-making body likely to be chaired by the 'CDO' with representation from:

- the **clinical community** (probably through the 'CCDO')
- the **technical community** (probably through the 'CDTO')
- **each element of the new delivery community**. For example: applications / services (representation from any eco-systems and the remaining development team from what was NWIS), infrastructure shared service, data shared service, commercial shared service, the two integration functions – technical and management

The key role of this group is to consider business cases (and significant change control proposals that have been escalated to them) and prioritise investment over the medium to long term (two to five years)

It is suggested that over time **ALL** informatics development budgets are controlled by this group, who should take responsibility for Whole Life Costs (capital and revenue) as business cases are considered and funds allocated.

III 'CDTO' and Standards Board

The standards board is likely to be chaired by the 'CDTO' to establish standards for:

- canonical Data
- (open) architecture / infrastructure
- Apps and ecosystems.

The representation required for these is likely to be different and may be handled through different groups. The data and Apps groups will require strong user representation (clinical practitioners and patients), as well as technical input on accepted standards. The infrastructure group is likely to be more technical in nature and will include representatives from shared services, as well as external technical input from, for example, non-executive roles. All sets of standards are likely to be informed by the technical architecture Review currently being undertaken (as well as emerging national and international standards).

The key role of the board is to both set and police standards across ALL parties within the Welsh Informatics system.

In the medium term the responsibilities of the Standards Board will migrate to the Informatics Standards authority (recommendations 15 and 22).

As well as leading and directing this group, the key early priorities for the 'CDTO' are likely to be:

- establishing a roadmap for the migration of infrastructure and data to the standards set by the board, covering both NWSSP and other partners (such as Health Boards and Trusts). Again, this will be informed by the technical architecture Review
- establishing the technical integration function – the SIAM.

IV Portfolio Management Board

Again, this Board is likely to be chaired by the 'CDO' with representation from all of the DPOs, including:

- NWSSP
- Health Boards (HB)
- Trusts

Representation will also be needed from the Standards Board and integration functions, though in the short term, these could potentially be provided through the 'CDTO'.

The PMB is responsible for managing the portfolio – managing delivery of business as usual and change. As such it has the following functions:

- monitoring and reporting
- agreeing (or, if outside authority limits, identifying and recommending) actions for corrective actions
- dealing with and / or escalating risks (either affecting business as usual or change)
- making decisions on change requests (within its agreed delegated authority) or recommending and escalating change requests outside those limits

Given the scale of change and breadth of the programme of work, it may be appropriate to split the work of the PMB into sub-groups, reflecting, for example, change versus business as usual or along service lines (apps, data and infrastructure).

V Skills Committee

This may be part of the 'CDO's executive team rather than a committee. It will report directly to the 'CDO' and cover issues such as:

- capability assessment(s) of the current position – technical and business (clinician informaticians, change management etc.)
- capability needs assessments for the medium-term future against the same headings
- developing and gaining approval for investment in filling the gaps in capability identified through the first two bullets (through a formal business case process)

- maintaining some “horizon-scanning” capability to understand longer-term trends and possible capability needs (for example through links to universities and innovation hubs)

VI Central Health Digital Development Team

This team will comprise the c10% of NWIS staff currently engaged on development of new systems, including LIMS and others. Over time, the expectation is that these existing monolithic systems will be “unbundled” with component parts moved into data and infrastructure shared services, leaving a central apps / service development team.

7.2 GOVERNANCE AMONGST DPOS

Again, the details will need to be agreed between respective post-holders as appointments are made, but the initial suggestions are as below.

I ISa

Once established, the Review team believe that this should be an independent entity (like that in Catalonia), including its own board with non-executive membership / challenge. However, as functions of the standards board are better understood, the ‘CDTO’ will want to consider the best form for longer-term delivery, one option for which is the ISa as envisaged by the Review team. The ISa is likely to report to the ‘CDTO’.

II Shared Services

As indicated in recommendation 13 in section 6.2.1, there are choices as to where the “back-end” (data and infrastructure elements) of NWIS and the bulk of the staff will go:

- a stand-alone shared service which could report directly to the ‘CDO’ or have its own governance committee
- to NWSSP as a new shared service

The Review team recognises that this in part depends upon the maturity of the current systems and how easily they can be disaggregated and managed as a shared service. The recently commissioned architecture review should help to inform this. In the longer-term, once the “back-end” is seen as a more transactional service, NWSSP may prove the best option, allowing (NWSSP) management to focus on improving the efficiency and effectiveness of the services provided, a key driver for shared services organisations. Over time this may offer shared services to other sectors across Wales; the governance implications of such a change would need to be re-considered at that time.

As per recommendation 12, the procurement elements of NWIS will move to the NWSSP procurement / commercial shared service to provide a national approach to NHS procurement, including ICT.

It is assumed that the Partnership Committee structure will continue to govern the NWSSP. However, the adequacy of those arrangements (with the modifications suggested below) should be kept under review.

The following modifications to the committee structure are suggested:

- the 'CDTO' or 'CDO' will join the committee as custodian / steward of the national Welsh informatics commercial services (and potentially, infrastructure and data)
- consideration of any amendments that might need to be made to the hosting arrangements to reflect the wider role of the partnership within the health informatics system for Wales
- annual business plans for the infrastructure and data elements of the operation **must**:
 - demonstrate compliance with (or a roadmap to compliance with) the standards set by the Standard Board (and later ISa)
 - be driven by and conform to the strategic priorities set out by the Investment and Prioritisation Committee

- reflect the Technical Roadmap developed by the 'CDO' and 'CDTO'
- be developed with / informed by close discussion with the 'CDTO'.

III Health Boards, Trusts and Special Health Authorities

Whilst they continue to deliver infrastructure and data, DPOs must comply with (or demonstrate how they will move to compliance with) the standards set by the Standards Board and later the ISa.

DPOs' CDOs or CIOs to be accountable to the Portfolio Management Board for delivery of the priorities assigned to them by the Investment and Prioritisation Committee.

8 GLOSSARY OF TERMS

ALO	Arm's Length Organisation
APIs	<p>Application Programme Interfaces</p> <p>Usually sits between the infrastructure and apps. This standardises the way apps interact with the infrastructure. An Open API is one that is published and documented for third party developers and users.</p>
Apps	<p>Applications</p> <p>These are what the user sees, things like websites, mobile apps and data feeds.</p>
BAU	Business As Usual
"Black box"	In modern ICT terms they are "closed", often monolithic systems which tends to make change and innovation difficult, slow and expensive.
CCDO	Chief Clinical Digital Officer
CDO	Chief Digital Officer

CDTO	Chief Digital Technical Officer
Data	Core information in the system
Data standards	Define how databases are structured and how data is formatted and presented.
DevOps	A software development methodology that combines software development with information technology operations. The goal of DevOps is to shorten the systems development life cycle while delivering features, fixes and updates frequently, in close alignment with business objectives.
DPOs	Delivery Partner Organisations - both the clinical / patient user interface and the underlying systems: Welsh Government, 7 Health Boards, 4 Health Trusts, NWIS, NWSSP, Primary Care agencies.
Enablers	Systems and processes that underpin the smooth running of the overall system, such as approaches to portfolio, programme and project management and ways in which clinical and user participation is included throughout the whole life-cycle of

	development, implementation and improvement.
HB	Health Board
Health informatics	<p>The technological and business/change management support required to shift services to deliver improvement and value in health interventions to benefit patients. Ultimately, it is about patients/people/improvement. This therefore encompasses:</p> <ul style="list-style-type: none"> • the move from paper to digital • the enabling data and infrastructure requirements (and networks) • systems and applications (development and care / maintenance), recognising that agile digital solutions aim to join development and operations together (“devops”) • Clinical and non-clinical (back-office) business systems.

Health Informatics Ecosystem	Collaborations of application/service providers across a range of types of organisation, able to innovate to better deliver clinical and patient pathways using standard data and infrastructure (for example provided through shared services). These could be regional, local or national.
Health Informatics “system” in Wales	All organisations, bodies, boards and committees involved in setting strategic direction, planning, development, delivery and maintenance (including infrastructure) of health informatics / digital within Wales and the relationships between them.
HEIW	Health Education and Improvement and Wales
ICT	Information and Communications Technology
Infrastructure	Refers to core services which allow people to access and manipulate data, for example, user authentication, data access, search functionality and audit recording.
IMT	Information Management Technology: an umbrella term for the processes, systems, hardware and software a company uses to conduct its day-to-day operations.
Interoperability standards	Define how data, infrastructure and apps speak to each other
IPAD	Informatics Planning and Delivery Group

ISa	Independent Standards authority This authority will set national standards for all aspects of health informatics: data and infrastructure. It will also hold responsibility for policing their compliance.
LIMS	Laboratory Information Management System
NIMB	National Informatics Management Board
NWIS	NHS Wales Informatics Service
NWSSP	NHS Wales Shared Services Partnership
Open standards	Standards which are published and can be common to many different platforms (helping developers to quickly understand systems written by others and write their own compatible software).
PAC	Public Accounts Committee
PMB	Portfolio Management Board
PPM	Programme and Project Management

Shared Service	The provision of a service by one part of an organisation or group of organisations, where that service had previously been found in more than one part of the organisation or group. Thus the funding and resourcing of the service is shared and the providing department or organisation effectively becomes a service provider.
SIAM	Systems Integration and Management
Software standards	Define how code is structured, written and presented.
Systems integrator	System integration functions – both technical (inter-operability of ICT components through Systems Integration and Management - SIAM) and organisational integration management (inter-operability / collaboration / policing governance between organisations).
System wide governance	Governance structures, processes and relationships, including the management and leadership of digital health informatics in Wales.
WLC	Whole life costs
WG	Welsh Government

“Wicked problem”	<p>Wicked problems were first described by Horst W.J. Rittel and Melvin M. Webber in a 1973 article in Policy Sciences magazine. The Harvard Business Review describes a wicked problem “ . . . <i>[as having] innumerable causes, is tough to describe, and doesn’t have a right answer Not only do conventional processes fail to tackle wicked problems, but they may exacerbate situations by generating undesirable consequences</i>” (John C. Camillus, <i>Harvard Business Review</i>, May 2008).</p>
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9 LIST OF APPENDICES

The following Appendices, referred to in the body of the report, are available in a separate document:

Appendix 1 – commissioning letter

Appendix 2 – project brief

Appendix B –project team

Appendix 3 – extracts from recent reviews

Appendix 4 – key elements of the digital strategy for health and care in wales

Appendix 5 – current governance arrangements

Appendix 6 – delivery partner organisations (DPOs)

Appendix 7 –questionnaire completed by DPOs

Appendix 8 – list of stakeholders interviewed

Appendix 9 – DPO responses to the questionnaire

Appendix 10 – ICT system components

Appendix 11 – summary of research undertaken

Appendix 12 – potential benefits of longer-term vision

Appendix 13 – a possible road-map for delivery

Appendix 14 – mapping the recommendations from other recent reviews



JOINTLY OWNED BY



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WELSH GOVERNMENT REVIEW:

Future Structure and Governance for
Health Informatics in Wales

Appendices

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APPENDIX 1 – COMMISSIONING LETTER

**Cyfarwyddwr Cyffredinol Iechyd a Gwasanaethau
Cymdeithasol/Prif Weithredwr GIG Cymru Grŵp Iechyd
a Gwasanaethau Cymdeithasol**

Director General Health and Social Services/ NHS Wales
Chief Executive Health and Social Services Group



To: All Chief Executives

Cc: Exec Lead for Informatics (NIMB member);
Chief Clinical Information Officers (CCIO);
Associate Director for Informatics (ADI)

September 2018

Dear Colleagues

Welsh Government review into Informatics Governance in NHS Wales

As part of the Welsh Government's response to the recommendations
of the Parliamentary Review of Health and Social Care in Wales

(‘A Revolution from Within: Transforming Health and Care in
Wales’ January 2018) and the report from the Auditor General
for Wales(‘Informatics systems in NHS Wales’, January 2018),
an independent review has been commissioned to identify the
most appropriate and effective future structure and governance
arrangements for health informatics in Wales.

The review will be undertaken by a senior team, led by Anne Jarrett
from Local Partnerships 1 .The work will be undertaken in the period
September – November 2018 and recommendations made in
December 2018. Their project brief is attached for information.

I have set up an internal Welsh Government Assurance Group,
chaired by Frances Duffy, Director of Primary Care and Innovation,
to oversee the review with the aim to ensure that NHS Wales has
a system of health informatics that is capable of delivering the
aspirations of ‘Informed Health and Care’.

The Welsh Government is aware that there needs to be clarity in
the function, responsibility and accountability of each stakeholder
organisation; a clearly defined structure for the provision of informatics;
and that this structure is supported by appropriate governance.

The review will consider:

- The requirements of the whole system;
- How these functions are best organised and discharged through the various stakeholder organisations and structures;
- What leadership, operational and strategic management and governance arrangements need to be in place to deliver the system wide improvement required; &
- That there are clear lines of accountability between NHS Wales and the Cabinet Secretary for Health and Social Services and the Chief Executive of NHS Wales.

Local Partnerships will engage closely, via e-mail introduction initially, with a wide range of partners throughout the review. In discussion and interviews the team will be gathering issues and ideas and seeking evidence to inform the development of potential future options for the structure and governance of health informatics in Wales. Interviews will all take place during the fortnight after the 8 October. Examples of models of good practice from elsewhere in UK will also be brought into consideration.

Please can I stress that you are expected to engage and fully participate with Anne and her team over the next few weeks.

Yours sincerely

Dr Andrew Goodall



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APPENDIX 2 – PROJECT BRIEF



LOCAL PARTNERSHIPS' SUPPORT TO WELSH GOVERNMENT REVIEW INTO INFORMATICS GOVERNANCE IN NHS WALES

PROJECT BRIEF

Introduction

We are pleased to be able to respond to the Welsh Government's brief for a review into informatics governance in NHS Wales (received August 31st, 2018). Set out below is our proposed project plan for the implementation of this review.

Project Scope

It is our understanding from the brief that the review must consider the requirements of the whole system and how these functions are best organised and discharged through the various delivery partners and stakeholder organisations.

Specific actions must include:

- Identifying the most appropriate and effective structure and governance arrangements for health informatics in Wales
- How future effective leadership, design and delivery of the digital and informatics requirements for service transformation can be ensured;
- Ensure that changes to the most appropriate digital, technological and infrastructure developments take place at pace and are effective
- Ensure that Welsh Government has a system of health informatics that is capable of delivering the aspirations of 'Informed Health and Care' 2
- To clarify the function, responsibility and accountability of each partner and stakeholder organisations.

The review must be aligned to the issues identified by the Auditor General's report and including reference to Recommendation 6 of that report to undertake an appraisal to strengthen governance and oversight of all NHS partners and stakeholders involved in providing access to information and introducing new ways of delivering care with digital technologies.

Welsh Government expect that final arrangements must support:

- Independent scrutiny and greater transparency of performance and progress
- Clear lines of accountability between the new structures, the Chief Executive of NHS Wales and the Cabinet Secretary for Health and Social Services.

It is also to be noted that the learning from this review will be captured to help inform thinking about the development of a proposed new NHS Wales Executive Function.

Finally, there is other work in progress, or about to begin, in Welsh Government that relate to this review into informatics governance. This includes the four workstreams in the Informed Health and Care Strategy Delivery Programme and a recently commissioned review into systems architecture. Emerging issues from these workstreams will be kept in view in order that any implications for the final outcomes of this project are identified and understood.

Project Approach

Our approach is based on four key stages of work. A project set-up meeting is also proposed as part of the project management arrangements.

The underlying principles of our approach are:

- Regular project updates and communications with client
- Engagement with and gathering of information and responses from key delivery partner organisations
- Evidence based
- Independent expert input at all stages of the project
- 'Iterative' and flexible approach to project activities to allow for response to emerging findings, new information and lines of enquiry
- Ongoing 'confirm and challenge' environment within the project team to support options development and recommendations
- Review of examples of models and good practice from elsewhere in the UK and abroad.

The four key stages of work are:

- | | |
|----------------|--|
| Stage 1 | Review of current informatics governance |
| Stage 2 | Engagement with delivery partner organisations |
| Stage 3 | Options development |
| Stage 4 | Presentation of recommendations |

In addition to the Project Assurance Group meetings described below, we will hold weekly telephone calls to discuss progress and to raise any issues.

Project set-up

Key project activities	Project start up meeting with client
Outputs	<ul style="list-style-type: none">✓ Project brief:<ul style="list-style-type: none">- Scope- Objectives- Key deliverables- Timeframes- Management and reporting arrangements- Key success criteria✓ Identification of key delivery partner organisations✓ Summary project communication for project stakeholders
Outcomes	<ul style="list-style-type: none">✓ A shared understanding of the project scope, objectives, milestones and success criteria✓ Clear communication to stakeholders to ensure support for and engagement with project
Proposed time frame	End August 2018

A project Assurance Management Group will be established by the client to provide project oversight.

Membership will comprise:

- Director for Primary Care and Innovation
- Director of Transformation
- Chief Digital Officer for Welsh Government
- Deputy Chief Executive NHS Wales
- Programme Director for NHS Finance
- Independent member

1. Review of current informatics governance landscape

Key project activities	<ul style="list-style-type: none">✓ Document review. Including key strategies, reviews and reports, board papers✓ Information gathering and fact checking with representatives of NHS Wales Informatics Service (NWIS), Velindre NHS Trust and Welsh Government✓ Internal project review and development workshop
Outputs	<ul style="list-style-type: none">✓ Project briefing paper (1):<ul style="list-style-type: none">- informa¹ structure and governance mapping .- issues and concerns: system and organisation level- key drivers for change✓ Common set of questions for (written) response from key delivery partner organisations
Outcomes	<ul style="list-style-type: none">✓ Identification and understanding of:<ul style="list-style-type: none">- current arrangements and relationships for health informatics- key issues and concerns- future drivers for system change✓ Common approach to engagement with key delivery partner organisations
Proposed time frame	Completed by 2 nd October 2018

The initial focus will be on identifying and reviewing the current governance arrangements in place for the provision of informatics: the profile of roles and responsibilities between organisations and the oversight and governance arrangements around these. This will represent a current 'baseline position' from which any proposed changes will be considered.

¹ For example, this could comprise a "systems map" showing the logical relationships and influences between organisations / bodies.

Whilst this stage represents the main period of desk-based information and evidence gathering and 'research' activity, the potential iterative nature of the project's scope/key lines of enquiry means that this will be on-going throughout the work.

2. Engagement with delivery partners

Key project activities	<ul style="list-style-type: none">✓ Collection and analysis of organisational responses (written and from group discussion)✓ Meeting with delivery partner organisations✓ Follow up discussions (as required)
Outputs	<ul style="list-style-type: none">✓ Project briefing paper (2):<ul style="list-style-type: none">- thematic analysis of key issues, challenges and proposed changes- outline framework for potential future change
Outcomes	<ul style="list-style-type: none">✓ Key delivery partner organisation engagement and input✓ Evidence gathered from a range of perspectives and analysed for common themes and differences
Proposed time frame	Completed mid November 2018

We will meet with small groups of representatives (no more than 5) from 12-15 key delivery partner organisations. These will be determined by the client and will include, NHS Wales, NWIS, Health Boards, NHS Trusts and national agencies.

A set of questions will be prepared (as an output from stage 2) and sent to the organisations in advance of the meeting. The review team will receive written responses to these questions in advance of the meeting. The meeting will present an opportunity to explore in more detail and clarify the responses that have been received from the delivery partner organisation.

The information and evidence gathered from our engagement with delivery partner organisation engagement will not only further enhance our understanding of the existing system and its structures but also allow us to gather a range of perspectives on the current challenges, potential solutions and scope for potential system change.

Post these meetings, follow up telephone discussions with representatives will be scheduled as necessary to gather any additional information or clarification that is identified to support stage 3.

3. Development of options for proposed structure

Key project activities	<ul style="list-style-type: none">✓ Assembly of evidence base✓ Development of options and appraisal criteria✓ Appraisal of options✓ Expert 'confirm and challenge' input
Outputs	<ul style="list-style-type: none">✓ Project briefing paper (3):✓ description of options for future structures and governance arrangements✓ appraisal of options, including key implementation enablers and challenges
Outcomes	<ul style="list-style-type: none">✓ Expert input into development and testing of options✓ Independent appraisal of robustness of options
Proposed time frame	Completed mid November 2018

Using the outcomes from the previous stages of work, options will be developed for a future structure for health informatics and the appropriate governance arrangements to support each option.

'Models' and 'systems' structures employed elsewhere in the UK and abroad will also inform thinking and options development.

A set of appraisal criteria will be used as a framework within which to 'test' emerging options. This will include ensuring that:

- the relevant recommendations from the Auditor General's report are taken into account
- options are fit for purpose but retain any elements of flexibility required for future requirements.

4. Recommendations

Key project activities	<ul style="list-style-type: none">✓ Report and recommendations drafting✓ Final meeting with project assurance group and presentation of recommendations
Outputs	<ul style="list-style-type: none">✓ Final report and recommendations
Outcomes	<ul style="list-style-type: none">✓ Independent recommendations for future structure and governance arrangements for health informatics
Proposed time frame	Completed mid-December 2018

Through the development and 'testing' of options we will establish our recommendations going forward.

We will present our recommendations in a final report and as a presentation. Membership of the meeting where we deliver our final report will be determined by the client.

The final report will include an outline route map/plan for transitioning to any new proposed structure or governance arrangements.

An outline project plan is presented in Appendix A. (Not reproduced here as the time-line was extended by mutual agreement)

Project Team

The project will be undertaken by a core team with relevant skills and experience, supported by additional resources from within Local Partnerships as required. The team has experience of Welsh Government, the health sector, corporate governance, informatics and the approach utilised in other sectors.

The core project team will comprise:

- Anne Jarrett, Project lead
- Jim Scopes
- Martin Dove
- Ian Brown
- David Harrison

Pen portraits of our core team are provided in Appendix B.

Our wider team will include:

- **Val Knight** who, having spent 2 years working within Welsh Government leading the 21st Century Schools MIM programme has a thorough understanding of governance structures and requirements of Welsh Government
- **Julie McEver**, Deputy Corporate Director (Programmes and Projects) has a breadth of experience in supporting public bodies achieve fundamental change to the way public services are delivered.
- **Teresa Oliviere**, Head of legal, specialises in complex projects. Local Partnerships. She advises on all aspects of procurement, contracting and public administrative law.



APPENDIX B: PROJECT TEAM



We propose to resource the assignment with a senior team of Local Partnerships professionals. Our core team is set out below along with their profiles. This team will be supported by additional specialist resource as required.

Anne Jarrett

Anne has worked extensively throughout her career with public service provision and particularly the health and social care sectors delivering projects with, and for, the NHS, central and local government and the third sector. The common focus has been to support the design and delivery of high quality, innovative services that are responsive to the needs of the user and maximise the value of public resources.

Anne brings a wide range of planning, analytical and communication skills to support the public service reform agenda. This includes service evaluation, options appraisal, business case development, performance and impact management, stakeholder engagement and the facilitation of collaborative working across agencies.

Anne has been with Local Partnerships since its inception in 2009 and is Strategic Director for Health and Social Care Integration. Her work in recent years has included:

- Supporting the development and sustainability of public service spin outs
- Increasing the commercial capability of third sector organisations, including “contract readiness”
- Co-management of the Department of Health’s Social Enterprise Investment Fund (SEIF)
- Design and management of the Department of Health and Big Society Capital’s Technology Spin-Out Fund
- Structure and governance of health and wellbeing boards
- Development of impact measurement and management systems
- Inter-agency planning for new systems of integrated health and social care
- Options appraisal for alternative service models.

Jim Scopes

Jim has over 30 years' experience within the public and private sectors as both a management consultant and civil servant. He has worked at the most senior levels in UK government on strategy development, policy implementation, change management, and programme / project management. Jim was a partner at PA Consulting working with a range of public sector clients (including DWP, Environment Agency and MoD and its agencies) before re-joining the civil service, where, as Strategy Director at HM Revenue and Customs he established the new strategy unit.

Jim's ability to forge strong relationships and build effective teams has delivered significant value to the clients and organisations for which he has worked. He has led organisational change programmes, designed and delivered new operating models / ways of working, developed and delivered assurance approaches for projects and programmes, as well as designing and implementing governance and associated reporting mechanisms. Jim's previous roles have included: Associate Director, Sparknow Ltd. (a specialist change management consultancy); Programme Director, Assurance, Local Partnerships; Strategy Director at HMRC; and Partner in PA Consulting's Government and Public Services Practice.

Martin Dove

Martin has extensive public sector business change management and investment skills experience gained from working on the delivery of major programmes and projects. He is an experienced Assurance Reviewer and has reviewed infrastructure, facility and IT capital investment as well as mergers and acquisitions, outsourcing and shared services.

He works for the Welsh Government assurance hub with reviews including the all Wales Pathology Laboratory Information Management System, Clinical Futures and the new Grange University Hospital, and the South Wales Programme. Martin has over 15 years' consultancy experience, including as Mott MacDonald's Director of UK Health and Social Care. He qualified as a Chartered Accountant with PwC, worked for CDC in Africa and Thailand and the NHS in capital programme management, resource allocation, outsourcing and as a Finance Director. He has worked as a Local Partnerships Associate for seven years.

Ian Brown

Ian has over 20 years' experience in health and central government, leading a number of major health and wider government programmes and reviews. Ian is also an accredited NHS Project Director and OGC Gateway High Risk Review Team Leader and has carried out over 200 assurance and other project specific work for clients including the Welsh Government, Cabinet Office and the Department of Health.

Ian's work includes:

- Leading various Major Projects Authority reviews on the Department of Health's Proton Beam Programme and Projects;
- Providing corporate services support to the Programme Director for a Mental Health Trust, managing a portfolio including a £80m PFI project and a team of over 25;
- Redeveloping health infrastructure, project initiation, business case development, benefits management, project management and commissioning within the health sector.
- Within the IT sector, Ian has worked on the NHS Digital – Paperless 2020 programme, DWP New State Pensions; the patient records EPR programme for NHS Wales, and IT assurance reviews for a number of public sector organisations.

David Harrison

David has worked extensively in the public and private sectors. He is a qualified chartered accountant and spent some years in investment banking before joining the public sector in the 1990s, where he became a senior civil servant (Dept of Health and HM Treasury) and, for 11 years from 1999, led the health practice of Partnerships UK (PUK).

In the summer of 2010, David left PUK and began working as an independent consultant. David works almost entirely "government-side". He continues to advise into the health and well-being space. For some time, he has provided design and development advice to NHS England in respect of commissioning management (and informatics) support services provided to CCGs.

Most recently, at the beginning of 2018, David was commissioned by NHS England to assist in the design of the "10-Lot" Health Support Services Framework competition. This Framework provides access for NHS bodies and local authorities to services that can support the move to integrated models of care based on intelligence-led population health management, advanced analytics and digital and service transformation.

David acted as one of NHS England's principal quality and financial evaluators for bid submissions received from public, private and third-sector bodies seeking to gain access to this Framework. This Framework went live from August 2018 and David has been retained by NHS England to support early NHS adopters to activate the market and to run "mini-competitions" under the Framework.

As well as advisory support, David chairs Anglian Community Enterprise (ACE), a £60m turnover social enterprise spin-out from the NHS, which provides community health services, runs community hospitals and delivers health and well-being services. ACE also runs four GP practices, serving a population of circa 30,000.

David is a Trustee and Treasurer of User Voice, a charity led and delivered by ex-offenders. User Voice seeks to engage those who

have experience of the criminal justice system in bringing about its reform and to reduce offending. User Voice is chaired by Noel Gordon, a non-executive director of NHS England and Chairman of NHS Digital.

APPENDIX 3 – EXTRACTS FROM RECENT REVIEWS

Three reports issued in 2018 have highlighted clearly, and emphasised strongly, a number of significant issues that need to be urgently addressed in relation to the current structure and governance arrangements for health informatics and the digital agenda. These reports are:

- “A Revolution from Within: Transforming Health and Care in Wales,” The Parliamentary Review of Health and Social Care in Wales, January 2018.
- “Informatics systems in NHS Wales,” Auditor General for Wales, January 2018.
- “Informatics Systems in NHS Wales,” National Assembly for Wales, Public Accounts Committee, November 2018.

Despite the different lenses through which these reports have viewed health informatics and the digital agenda, a common set of themes emerges from them in respect of where and how change needs to be focused to galvanise the health and care system into a future that is led by digital technologies and delivers the benefits in quality, experience and efficiency required to improve health outcomes. The collective view from these reports is that the system is not “fit for the future” presenting as it currently does far too many constraints to deliver the Welsh Government’s ambitions.

In the context of this Review it has been important to note *all* the recommendations made by these different bodies outlining as they do where change needs to be focused and the reasons why. However, some of these recommendations have been specific in respect of the governance arrangements of the current Health informatics system:

- “A Revolution from Within: Transforming Health and Care in Wales.” The Parliamentary Review of Health and Social Care in Wales, January 2018.

Recommendation 7: Maximise the benefits of technology and innovation to pursue the Quadruple Aim and deliver more effective and efficient care. This needs the right culture, behaviours and leadership to embrace innovation. Embed collaboration and support prudent risk-tasking.

The Parliamentary Review also highlights the “Principles of Good Governance” to support what it identifies as strong and effective governance across organisational boundaries “*with mature partnership behaviour and the associated sharing of risk, accountability, delegation and reservation.*”

- “Informatics systems in NHS Wales,” Auditor General for Wales, January 2018.

Recommendation 6: Governance and Oversight: Welsh Government should carry out a wider appraisal of options to strengthen governance and oversight of NWIS. The final arrangements should ensure that:

- there is independent scrutiny of performance and progress
- there is greater transparency with papers and minutes of discussions placed in the public domain
- there are clear lines of accountability between NWIS and the Chief Executive of NHS Wales and the Cabinet Secretary
- “Informatics Systems in NHS Wales,” National Assembly for Wales, Public Accounts Committee, November 2018.

Recommendation 3: A review of the senior leadership capacity in terms of skill set and governance within both NWIS and the wider NHS Digital team.

Most recently, December 2018, the expert panel report for the Welsh Government, “System Reboot: Transforming public services through better use of digital,” presented a case for change across all public services to ensure the potential of digital approaches to improving

outcomes for the people who use public services and deliver cost savings for the public sector can be fully realised. The expert panel has made six recommendations to help shape the next steps towards the digital transformation of public services and provide a catalyst for initial and immediate action.

This Review has taken these recommendations and the reports from which they have been made as part of our evidence gathering.

It is also important to note here that Welsh Government is commissioning a digital architecture Review to assess the existing NHS Wales architecture (national and local systems and services deployed across NHS Wales) to determine if it is fit for purpose for delivering the future vision for health care in Wales. At the time of writing this report the commission was in the process of being awarded. The outcomes from this Review will need to be considered alongside the proposed structure and governance arrangements being proposed in this report.



APPENDIX 4 - KEY ELEMENTS OF THE DIGITAL STRATEGY FOR HEALTH AND CARE IN WALES



The digital strategy (first published as “Informing Healthcare” (December 2003) and refreshed in December 2015 as “Informed Health and Care: a digital health and social care strategy for Wales”) sets out the longer-term ambitions and establishes key priorities for early action. Specifically, it identifies four areas of focus:

- Information for you: People will be able to look after their own well-being and connect with health and social care more efficiently and effectively with online access to information and their own records, undertaking a variety of health transactions directly, using technology and using digital tools and apps to support self-care, health monitoring and maintain independent living
- Supporting professionals: Health and social care professionals will use digital tools and have improved access to information to do their jobs more effectively with improvements in quality, safety and efficiency. A “once for Wales” approach will create a solid platform for common standards and interoperability between systems and access to structured, electronic records in all care settings to join up and co-ordinate care for service users, patients and carers
- Improvement and innovation: The health and social care system in Wales will make better use of available data and information to improve decision making, plan service change and drive

improvement in quality and performance. Collaboration across the whole system, and with partners in industry and academia, will ensure digital advances and innovation is harnessed and by opening up the “once for Wales” technical platform allow greater flexibility and agility in the development of new services and applications

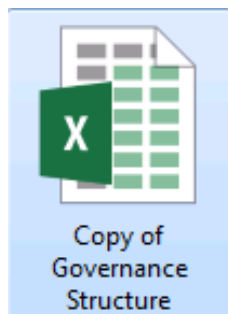
- A planned future: Digital health and social care will be a key enabler of transformed service in Wales. Joint planning, partnership working and stakeholder engagement at local, regional and national level will ensure that the opportunities and ambitions outlined in this strategy are prioritised, with planning guidance issued by Welsh Government in 2015.

These four priority areas have become operationalised through four workstreams within the Informed Health and Care Programme being delivered within NHS Wales.

This strategy also recognises that there are several challenges in relation to the current delivery environment in delivering the informatics/digital agenda that will achieving the future vision for health and social care. More specifically, it identifies that NHS organisations, local authorities and NWIS will specifically need to make changes that encompass:

- focused leadership
 - prioritisation of investment for technology and digital services
 - leadership at all levels across health and social care focused on ensuring the delivery of this strategy
- “fit for purpose” governance structures and planning processes
 - new approaches to stakeholder engagement which include having a voice and co-design of solutions
 - workforce development to address skill gaps in use of digital tools

APPENDIX 5 – CURRENT GOVERNANCE ARRANGEMENTS





APPENDIX 6 – DELIVERY PARTNER ORGANISATIONS (DPOS)



The following DPOs participated in this review:

- Abertawe Bro Morgannwg University Health Board
- Aneurin Bevan University Health Board
- Betsi Cadwaladr University Health Board
- Cardiff and Vale University Health Board
- Cwm Taf University Health Board
- Hywel Dda University Health Board
- Powys Teaching Health Board
- Public Health Wales
- NHS Wales Informatics Service
- NHS Wales Shared Services Partnership
- Velindre NHS Trust
- Welsh Ambulance Service NHS Trust

APPENDIX 7 – QUESTIONNAIRE COMPLETED BY DPOS



QUESTIONS TO DELIVERY PARTNER ORGANISATIONS IN ADVANCE OF INFORMATICS GOVERNANCE REVIEW MEETING

Introduction

The questions below are mostly designed to allow a 'yes / no' answer; we will explore the detail behind the reasons for your answers and the supporting evidence, when we meet with you later this month.

For the purposes of answering the questions, please:

- Answer from the perspective of your organisation; so 'you' refers to your organisation
- Consider 'the system' as encompassing all the organisations involved in the design, development and delivery of health informatics across Wales – Welsh Government and NHS Wales (see also next bullet)

- Consider 'informatics' as encompassing all aspects of implementation of the digital strategy for health systems and health information in support of clinical change and improved outcomes.

Questions

1. What role does your organisation have, if any, in the following aspects of the national informatics system across Wales (please list all that apply):
 - a. Understanding national digital needs
 - b. Providing national leadership for informatics in Wales
 - c. Governance and decision-making for informatics in Wales
 - d. Developing the overall / national skills and capabilities available to informatics in Wales
 - e. Proactive engagement with partner organisations (the market for digital)
 - f. Setting standards for informatics / digital services
 - g. Understanding and interpreting public opinion / confidence in informatics / NHS ICT in Wales

h. Other (please specify role)

2. Are you satisfied with the current design and delivery system for health informatics/digital services across Wales?

3. Do you think that the leadership of health informatics/digital services in Wales is working well?

4. Are accountabilities, responsibilities and authority-levels clear across the whole system?

5. Are you satisfied with the way strategic direction is currently set for health informatics / digital services?

6. Do you consider there is effective planning of the delivery of health informatics/digital services?

7. Do you think that the pace of delivery [of systems / changes] is fast enough?

8. To meet the aspirations of 'Informed Health and Care', do you believe that the current system has:

a. the capability (skills and experience)?

b. the capacity (enough resources)?

9. Are there constraints to the design and delivery of digital health and care services in Wales?

10. Is there adequate engagement to ensure a diversity of digital partners in Wales?

11. Do you believe there is a relationship between good health informatics and improved patient care?

12. Do you think that adequate attention is given to change / culture change management when health informatics / digital systems are delivered?

Lastly, please could you list your top five informatics/ digital health priorities?

1.

2.

3.

4.

5.

Please return your responses 48 hours in advance of the meeting date to

Thank you.



APPENDIX 8 – LIST OF STAKEHOLDERS INTERVIEWED



Simon Dean, Deputy CEO, NHS Wales

Frances Duffy, Director Primary Care and Innovation, Welsh Government

Ifan Evans, Director Technology and Transformation, Welsh Government

Caren Fullerton, Chief Digital Officer, Welsh Government

Huw George, Informed Health and Care Programme: “Information For You” lead

Eric Gregory, Member of Parliamentary Review of Health and Social Care in Wales

Andrew Griffiths, Chief Information Officer for Health Wales, NHS Wales Informatics Service

Steve Ham, CEO, Velindre NHS Trust

Paul Hollard, Independent Member of Project Assurance Group

Rhidian Hurle, Chief Clinical Information Officer Wales, NNS Wales Informatics Service

Mark Jeff, Welsh Audit Office

Peter Jones, Deputy Director, Digital Health and Care, Welsh Government

Alun Lloyd, Programme Director, Welsh Government

Matthew Mortlock, Welsh Audit Office

Dr. Rob Orford, Chief Scientific Officer for Health, Welsh Government

John Peters, Informed Health and Care Programme: “Improvement and Innovation” lead

Dan Phillips, Informed Health and Care Programme: “A Planned Future” lead

Prof. John Williams, Informed Health and Care Programme: “Information for Professionals” lead

APPENDIX 9 – DPO RESPONSES TO THE QUESTIONNAIRE

Questions	Yes	No	Partial	Total
1. What role does your organisation have, if any, in the following aspects of the national informatics system across Wales (please list all that apply):				
a. understanding national digital needs	10	–	2	12
b. providing national leadership for informatics in Wales	9	2	1	12
c. governance and decision-making for informatics in Wales	7	1	4	12
d. developing the overall / national skills and capabilities available to informatics in Wales	8	3	1	12
e. proactive engagement with partner organisations (the market for digital)	9	–	2	11
f. setting standards for informatics / digital services	7	3	1	11
g. understanding and interpreting public opinion / confidence in informatics / NHS ICT in Wales	6	4	2	12
2. Are you satisfied with the current design and delivery system for health informatics/digital services across Wales?	–	7	5	12
3. Do you think that the leadership of health informatics/digital services in Wales is working well?	–	10	2	12
4. Are accountabilities, responsibilities and authority-levels clear across the whole system?	–	11	1	12

Questions	Yes	No	Partial	Total
5. Are you satisfied with the way strategic direction is currently set for health informatics / digital services?	1	7	4	12
6. Do you consider there is effective planning of the delivery of health informatics/digital services?	1	7	4	12
7. Do you think that the pace of delivery [of systems / changes] is fast enough?	–	12	–	12
8. To meet the aspirations of “Informed Health and Care,” do you believe that the current system has:				
a. the capability (skills and experience)?	1	6	5	12
b. the capacity (enough resources)?	1	9	1	11
9. Are there constraints to the design and delivery of digital health and care services in Wales?	12	–	–	12
10. Is there adequate engagement to ensure a diversity of digital partners in Wales?	1	9	2	12
11. Do you believe there is a relationship between good health informatics and improved patient care?	11	–	1	12
12. Do you think that adequate attention is given to change / culture change management when health informatics / digital systems are delivered?	–	12	–	12

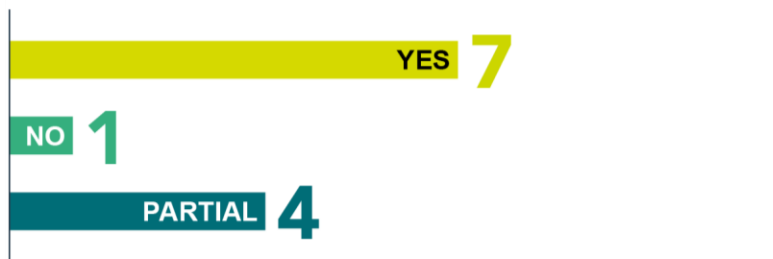
1.a Understanding national digital needs



1.b Providing national leadership for informatics in Wales



1.c Governance and decision-making for informatics in Wales



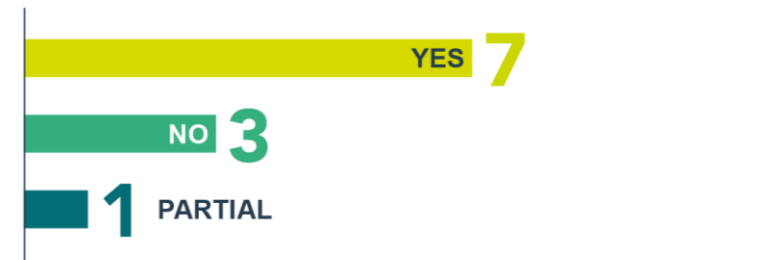
1.d Developing the overall / national skills and capabilities available to informatics in Wales



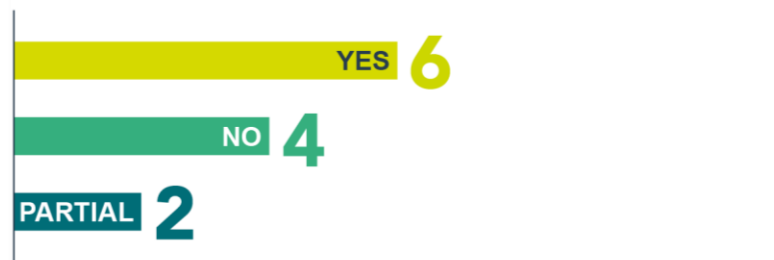
1.e Proactive engagement with partner organisations (the market for digital)



1.f Setting standards for informatics / digital services



1.g Understanding and interpreting public opinion / confidence in informatics / NHS ICT in Wales



2. Are you satisfied with the current design and delivery system for health informatics / digital services across Wales?



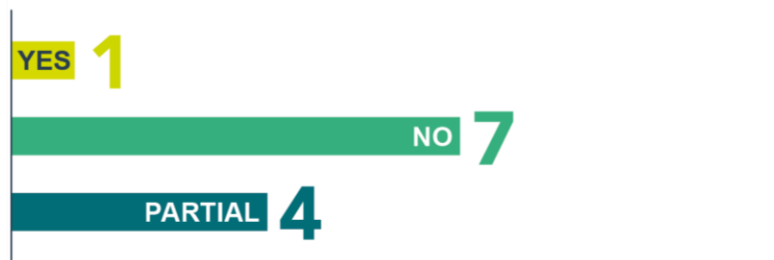
3. Do you think that the leadership of health informatics / digital services in Wales is working well?



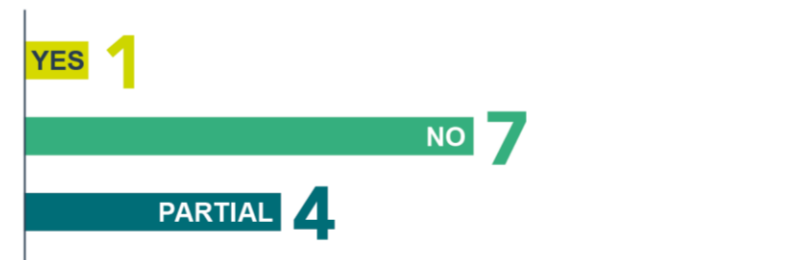
4. Are accountabilities, responsibilities and authority-levels clear across the whole system?



5. Are you satisfied with the way strategic direction is currently set for health informatics / digital services?



6. Do you consider there is effective planning of the delivery of health informatics/digital services?



7. Do you think that the pace of delivery [of systems / changes] is fast enough?

YES 0

12

NO

PARTIAL 0

8.b To meet the aspirations of “Informed Health and Care,” do you believe that the current system has the capacity (enough resources)?

YES 1

NO 9

1 PARTIAL

8.a To meet the aspirations of “Informed Health and Care,” do you believe that the current system has the capability (skills and experience)?

YES 1

NO 6

PARTIAL 5

9. Are there constraints to the design and delivery of digital health and care services in Wales?

YES

12

NO 0

PARTIAL 0

10. Is there adequate engagement to ensure a diversity of digital partners in Wales?



11. Do you believe there is a relationship between good health informatics and improved patient care?



12. Do you think that adequate attention is given to change / culture change management when health informatics / digital systems are delivered?



APPENDIX 10 – ICT SYSTEM COMPONENTS

This Appendix provides a high-level overview of what is meant by various system components (data, infrastructure, apps and “ecosystem”). Traditionally, many ICT systems comprise most of these elements in a single “black box” solution; this is also defined below.

BASIC OLD “BLACK BOX” MODEL

- everything is integrated and is controlled exclusively by the developer
- nobody else sees anything except the user interface (e.g. a website)
- changes can only be commissioned through the developer
- nobody else can work on or amend or extend or improve the system
- if you ditch the supplier you lose everything and have to start from scratch
- if you get any data or any code you will probably not be able to understand it

- the developer holds all the power, and effectively controls prioritisation, pace and pricing
- broadly, this describes the systems that NWIS currently provides, some of which are in turn provided by third-party suppliers

DATA, INFRASTRUCTURE AND APPS

- **Data** means core information in the system
- **Infrastructure** means core services which allow people to access the data, things like
 - User authentication, data access, search functionality, audit recording
 - A Form generators, software libraries, report templates
- **Apps** are what the user sees, things like: websites, mobile apps, data feeds
- An **API** usually sits between the infrastructure and apps. This standardises the way apps interact with the infrastructure. An **Open API** is one that is published and documented for third party developers and users. For example:

- Apps must use the common “user authentication service,” rather than writing their own software or
- Apps are not allowed to directly access database(s), they must use the “data access service”

This approach is considered more efficient, more secure, easier to audit and forces more consistency.

STANDARDS AND TOOLS

- **Data Standards** define how databases are structured, and how data is formatted and presented
- **Software Standards** define how code is structured, written and presented
- **Interoperability Standards** define how data, infrastructure and apps speak to each other
- All of these standards can be enforced and validated to make software consistent, easier to share, easier to reuse, easier to write, easier to update and easier to integrate
- **Open Standards** are published and can be common to many different platforms (helping developers to quickly understand systems written by others and write their own compatible software)
- A **Software Development Kit (SDK)** typically bundles together an Open API, Open Standards, Tutorials and Examples, a way to test software, and a way to authorise or to deploy software
- **Open Source Software** is published. This allows others to copy and adapt for their own use, to contribute enhancements and improvements (with control on how changes are accepted) and to

see how software works so they can write better compatible software of their own

DEVELOPER ECOSYSTEM

- A **developer ecosystem** uses tools like an Open API, Open Standards, Software Development Kit and Open Source Software
- This speeds up software development and extends functionality by allowing people to more quickly write new apps and services, sometimes in unexpected ways
- Developer ecosystems provide peer support and accelerated learning, through people sharing software challenges and solutions, identifying bugs and writing enhancements
- “Core” developers are part of a wider ecosystem and third-party developers are a resource which can be drawn on to support data and infrastructure services
- Many companies use a developer ecosystem model internally, allowing development teams to work together flexibly
- Several companies require everyone to use data and infrastructure services on the same terms, using the same interoperability standards
- Business will often take the best product enhancements and extensions into the core infrastructure

EXAMPLES

- Joomla:

- World's second biggest Open Source Content Management System
- 2 million active websites, 9% of business websites, 3% of the entire Web
- Anyone can download and use the “core” infrastructure for nothing
- Almost 8000 templates extensions, both paid for and free
- Developers supported through SDK, online forums, events, paid for training
- Xero:
 - World's second biggest Open Source Content Management System
 - 2 million active websites, 9% of business websites, 3% of the entire Web
- Anyone can download and use the “core” infrastructure for nothing
- Almost 8000 templates extensions, both paid for and free
- Developers supported through SDK, online forums, events, paid for training
- Apple:
 - World's second biggest Open Source Content Management System.
 - 2 million active websites, 9% of business websites, 3% of the entire Web
 - Anyone can download and use the “core” infrastructure for nothing
 - Almost 8000 templates extensions, both paid for and free
 - Developers supported through SDK, online forums, events, paid for training

APPENDIX 11 – SUMMARY OF RESEARCH UNDERTAKEN

This Appendix provides a high-level “light touch” overview from brief research based around “*What are the optimal structure and governance arrangements for whole system Health Informatics, ICT and Digital services?*” It also includes follow-up examples of practices quoted to us during our interviews with DPOs and individuals.

Specifically, the research covers structures in Scotland, Northern Ireland, England, Victoria (Australia), New Zealand, Norway and Catalonia. The outcomes from this overview were used to:

- enhance knowledge and inform understanding and analysis of current system shortcomings
- assist in developing future structure and governance options, assessment criteria and evaluation approach

The table below identifies a set of broadly defined common themes across the systems and provides examples to illustrate this. For some of these systems the “theme” may have greater prominence or be a more significant component than others but it nonetheless appears to be, at least, an underlying guiding principle or strategic objective.

Key Common Themes		Illustrative Examples from our Overview
Strong government control and leadership	Centralised, top down resourced decision-making capability and structures in control of strategic direction and investment priorities	Norway Norway represents the most centralised system where there is one eHealth platform. A Directorate of eHealth is responsible for overall setting of standards and for leading development and application of health formation technology in health care.

		<p>New Zealand</p> <p>The Ministry of Health has overall responsibility for the health and disability system, acts as the Minister of Health's principal advisor on health policy and maintains a role as funder, monitor, purchaser and regulator of health and disability services. Within the Ministry of Health there are two sub-committees:</p> <ul style="list-style-type: none"> – Technology and Digital Services business unit oversees the Ministry's eHealth work programme. It advises on the implementation and use of information technology systems – Capital investment Committee advises on all matters relating to capital investment in the health system <p>There is a national infrastructure platform and a Health Information Standards Organisation and clear technical foundations for architecture, standards, information governance and ICT capabilities.</p> <p>Victoria, Australia</p> <p>The devolved health care system sets out a clear ICT governance model (to deliver its strategy). The state-wide Health ICT Strategic Framework 2015 sets out government and Health Board roles, the importance of enablers and the need for maturity models and minimum baselines to enable system evolution as digital capability in the system grows. It describes a set of accountabilities, processes and auditable and measurable controls that drive alignment of ICT with provider organisation and health system strategies to ensure objectives are achieved, risks are managed and resources are allocated effectively.</p> <p>The Department for Health has responsibility for policy regarding decisions about priorities for publicly funded ICT investment.</p>
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		<p>Scotland</p> <p>2018 established a national health and care digital decision-making Board made up of Executive representatives of the Scottish Government, Local Government and the NHS, with additional support and advice from industry, academia and the third sector. The Board will make national decisions for investment, priorities and policy as well as working to achieve greater consistency in digital health and care.</p>
<p>Separate properly constituted Arm's Length Organisations (ALOs) for delivery</p>	<p>This includes:</p> <ul style="list-style-type: none"> - structured formal leadership - external challenge 	<p>Scotland</p> <p>National Shared Services providing IT services in two separate common business units to NHS Scotland:</p> <ul style="list-style-type: none"> • Information and Intelligence: compiling and using the potential of Scotland's national health and care datasets. Supporting decision makers with information, intelligence and tools to assist in planning and managing local health and care services • Information Technology: providing end to end efficient, effective and safe IT services to NHS Scotland. Ensuring clinical and information governance is embedded across all systems. Includes infrastructure services, accreditation and testing, solutions and applications. <p>Strong governance is in place and is provided by the following: Portfolio Board, Portfolio Management, and Design Authority Customer Reference Group.</p> <p>Northern Ireland</p> <p>Business Services Organisation (BSO): established to provide a broad range of support services to health and social care organisations throughout Northern Ireland.</p> <p>Information Technology Services (ITS) supports over 50,000 users across nearly 300 services and systems is responsible for annual ICT expenditure of around £30 million.</p>

		<p>These services range from the routine support of large, complex clinical, business and social care systems, to the procurement and implementation of large projects supporting the ongoing modernization and transformation of health care in Northern Ireland:</p> <ul style="list-style-type: none"> • business systems • ICT Business support • community social service primary care • infrastructure and architecture • integration, data warehousing and new systems development • secondary care clinical systems • programme management
Strong business management processes	<p>Portfolio Management</p> <p>Planning and execution</p> <p>PPM and agile</p>	<p>Northern Ireland</p> <p>BSO ITS provides a programme management service which includes:</p> <ul style="list-style-type: none"> • implementation of Programme project standards • providing information to HSCB as commissioners • performance management: reporting against progress time, resource and budget, support training and mentoring of project managers/small team of “peripatetic” project managers

		<p>Victoria, Australia</p> <p>ICT governance model includes benefits being effectively monitored and managed at system, programme and project levels. For example, identifies these as:</p> <p>System level:</p> <ul style="list-style-type: none"> • monitoring sector wide compliance with standards • evaluating and reporting on benefits realised • monitoring and reporting on maturity state of the sector • enabling cross-sector learning • project assurance of strategic ICT investment activities <p>Organisation level:</p> <ul style="list-style-type: none"> • tracking quality project assurance • evaluating ICT enabled outcomes • establishing collaboration initiatives • monitoring and reporting ICT related risk management strategies
Healthtech ecosystems	Different approaches to innovation and funding	<p>Victoria, Australia</p> <p>Exploring alternative commercial models for ICT investments is identified as a strategic objective. A need has been recognised for ICT funding to support a diversity of approaches to ICT delivery, ranging from complex change programs to the deployment of specific capabilities as a service. Given the mixed ICT maturity of the sector, and the need for progressive implementation of ICT capabilities to meet the baseline</p>

		<p>requirement, there is a need for a model that balances both capital and operational funding. To help achieve this, it is proposed that the system will:</p> <ul style="list-style-type: none"> • explore alternative funding models: develop a “toolkit” and principles for approved sources of funding to help provide transparency for the system. Some key types of funding to be considered, include: <ul style="list-style-type: none"> ○ self-funding by the health service ○ cash flow support, such as a loan from the department based on recoverable cashable benefits ○ grants from the department. These might include seed funding for innovative (pioneering) projects that have state wide applicability • reform the barriers between ICT and capital investment: reform how health ICT is financed across the system, including moving away from funding ICT via capital expenditure and capital approval processes toward funding through operating expenditure. Where possible, health services will have greater capacity to leverage operational funding to invest in ICT, particularly where there are productivity benefits • explore alternate commercial models for ICT investment: These includes more innovative commercial models, such as Public-Private Partnerships (PPP) and more pragmatic “risk/reward” agreements to help attract private sector investment and expertise, and to help mitigate risk • increasingly, capture opportunities associated with “as a service”: health organisations, including the department and the health services, will have increasing opportunities to procure ICT capability “as a service.” These would include models that begin with a smaller initial footprint that can be scaled up as demand increases. • consider rewarding meaningful use: health services could utilise a funding model that, at least partially, pays the organisation based on adoption, and/or meeting
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		<p>certain achievable outcome criteria. For example, perhaps part “block” funding, and part “meaningful use” funding based on agreed targets.</p> <p>Catalonia, Spain</p> <p>Tic Salut Social Foundation is an agency within the Ministry of Health that works to promote the development and use of ICT and networking in the field of health. It acts as an observatory for new trends, innovation and the monitoring of emerging initiatives.</p> <p>One of its roles is to act as facilitator in the transformation of the Catalan health model by creating synergies between health technology and knowledge entities. It acts as a catalyst which can identify the demands of the sector and turn them into products so that health is more proactive, user-friendly and sustainable. In this role it:</p> <ul style="list-style-type: none"> • records, identifies and categorises the ICT sector’s needs and opportunities • undertakes the role between supply and demand on behalf of healthcare providers, social providers and businesses • develops a dynamic portal of business innovations for the health sector and social providers
Separation of different informatics and digital activities	Breaking up the patient stack into apps / systems, data and infrastructure	<p>England</p> <p>The October 2018 policy paper (The Future of Healthcare) proposes unbundling the patient record and having separate contracts and separate approaches for each “piece” of the stack in order for the NHS to:</p> <ul style="list-style-type: none"> • improve and upgrade each layer without disrupting the others

		<ul style="list-style-type: none"> • get the benefit of the country's digital and technology specialists in the areas they know best, no longer requiring a specific workforce to support bespoke systems • create a modular ecosystem of digital services competing on quality to meet the needs of all staff and patients in every specialty and every part of the country • no longer have to undergo expensive, risky and disruptive data migrations every time a different digital service is used • break those large contracts that give little freedom into a series of smaller contracts that let NHS take advantage of the best approaches and features • ensure that privacy and security aim for safeguarding patient data and are protected with the most up-to-date architectures
Centralised standard setting for data and infrastructure	For data and infrastructure	<p>Catalonia, Spain</p> <p>Tic Salut Social Foundation is an agency within the Ministry of Health that works to promote the development and use of ICT and networking in the field of health, acts as an observatory for new trends, innovation and monitoring of emerging initiatives and provides services for the standardisation and accreditation of products. Its role includes the development and deployment of IT health standards to achieve interoperability as an "Office of Standards and Interoperability."</p> <p>It is committed to a national network that allows for the integration between numerous IT systems used by healthcare providers, from clinical data to administrative functions. In order to achieve interoperability of systems and agents, it focuses on the development and deployment of ICT standards. This role includes:</p> <ul style="list-style-type: none"> • defining and developing common interoperability model • validating the use of standards

		<ul style="list-style-type: none"> developing and offering a catalogue of companies who offer accredited developments <p>New Zealand</p> <p>The Health Informatics Standards Organisation (HISO) was established in June 2003 and continues today as the governing body for health information standards in New Zealand. It is a committee operating under the authority of the Ministry of Health and accountable to the Chief Technology and Digital Services Officer (CTDSO).</p> <p>HISO governs the selection, development and adoption of information and digital standards for the health and disability sector.</p> <p>HISO's overall purpose is to ensure that appropriate standards contribute to value and high performance in the health system to benefit the public through the best use of information and digital technology. The standards lifecycle may include tracking, evaluating, selecting and adapting international standards, and commissioning new standards for national use. Successful adoption is achieved when the published standards are used productively in widely implemented solutions.</p> <p>To meet these objectives, HISO is responsible for ensuring that standards are:</p> <ul style="list-style-type: none"> aligned internationally and based on best practice evidence consistent with the national strategic and architectural direction introduced in consultation with the sector promoting collaboration and innovation published and proactively maintained supported by implementation guides and tools
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		<p>England</p> <p>The October 2018 policy paper (The Future of Healthcare) includes ensuring that there is a modern technology architecture in place, requiring all suppliers to adhere to common standards. It states that digital services and IT systems which are used in the NHS will have to meet a clear set of open standards to ensure they can talk to each other and can be replaced when better technologies are created. The document talks of creating a plug and play architecture where any module can be swapped out.</p> <p>NHS Digital's Technology Standards Framework, October 2018</p> <p>This framework outlines the key standards for clinical safety, the use of data, interoperability and design interactions. In determining the right standards to be used across the system, the following principles have been developed:</p> <ol style="list-style-type: none"> 1. These standards should be based on international standards and only specialised where it is necessary for these standards to be adopted, such as using the NHS Number as the primary identifier. 2. These standards are open standards. 3. These standards address the user needs of patients and care professionals. 4. We have a clear evidence base that these standards are useful, usable and used. 5. We have considered how these standards apply across health and care.
Clinical and user advisory bodies	Recognises as a priority the need to ensure clinical staff and "users" are involved at a strategic level in identifying requirements and priorities and	<p>Scotland</p> <p>Design Authority Customer Reference Group</p>

	as clinical groups buying-in to new services and systems	<p>Provides assurance to the Shared Services Portfolio Board that the portfolios are engaging stakeholders appropriately, following the right processes for producing strategies and business cases, aligning with national policies and initiatives.</p> <p>Catalonia, Spain</p> <p>The governance of the TIC Salut Social includes three advisory boards:</p> <ul style="list-style-type: none"> • Patient Advisory Board of Catalonia: This Board represents various patient advisory bodies when dealing with the Catalan Government, allowing patients to have direct representation in proposing issues they consider relevant and have active participation in policy development. IIC Salut Social is engaged with the Board's ICT department • Scientific Advisory Board: This Board is an open consultative body made up of independent experts who come from different academic disciplines. Its function is to advise and guide in the development of strategies to expand the use of ICT • Business Advisory Board: Serves as advisory and participating body of the companies which collaborate with TIC Salut Social. Made up of 156 leading companies in the sector which voluntary collaborate with the objectives in the development of ICT and networking <p>Victoria, Australia</p> <p>Clinical and Consumer reference groups are established to provide advice to the ICT Executive Board.</p>
Separation of commercial and procurement services	Enables earlier market engagement and more robustness in procurement. Key role of Standards Authority	<p>Northern Ireland</p> <p>The Procurement and Logistics Service, commonly known as PaLS, is the sole provider of professional procurement and logistics services to all public Health and Social Care (HSC) organisations in Northern Ireland (NI). It is a recognised Centre of Procurement</p>

<p>from digital and informatics services</p>	<p>policing common standards and requirements</p>	<p>Expertise (CoPE) established under the Northern Ireland Public Procurement Policy as approved by the Northern Ireland Assembly, and was re-accredited in October 2013.</p> <p>New Zealand</p> <p>New Zealand (NZ) Health Partnerships is led, owned and supported by the country's 20 District Health Boards (DHB) and was established as a Crown subsidiary on 1 July 2015. Each DHB has an equal stake in NZ Health Partnerships and equal voting rights and "interact" as "co-creators," shareholders and customers. Its initiatives are focused on creating financial efficiencies for DHBs to help them meet the increasing demands placed on the health system. The focus is on administrative, support and procurement activities that have direct and indirect clinical benefits. NZ Health Partnerships also works collaboratively with a number of public and private sector organisations to ensure the successful delivery of programmes and services. These include Ministry of Health, The Treasury, Ministry of Business, Innovation and Employment (MBIE), Department of Internal Affairs, National Health IT Board, Central TAS and HealthShare.</p>
<p>Digital competence, capability and capacity as a key system enabler</p>	<p>For clinicians and executives</p>	<p>Victoria, Australia</p> <p>Their strategy recognises that technology is only one factor and a holistic approach is required. The system needs to build deep transformational capabilities to manage the volume and complexity of change that will be required over the next decade. This will ensure that the system is able to:</p> <ul style="list-style-type: none"> • integrate ICT into clinical and administrative reform to deliver outcomes at both an organisation level and at a system level • cultivate "transformational leadership" capabilities across the system, including executive, clinical and ICT professionals to help improve leadership in, and navigation of, clinical and ICT reform projects • empower clinicians to drive change. Enhance clinical governance structures and engagement and ensure each group has effective and knowledgeable clinical

		<p>leadership and clinical change agents. Further develop the leadership role of informaticians to bridge the gap and help optimise alignment between clinical care and ICT.</p> <p>It is intended that the system will further develop an appropriately skilled health IM and ICT workforce with sufficient capacity to support key ICT delivery programs across the system. The system will:</p> <ul style="list-style-type: none"> • shape and deliver an IM and ICT capability model that addresses priority capability requirements: from ICT planning through to ICT delivery. Initial areas of focus include Chief Medical Information Officers (CMIO), Chief Clinical Information Officers (CCIO), health informaticians, ICT business analysts, systems integration and program and change management specialists • improve data and information management capabilities: a key area of focus will be helping the system improve its information management capabilities, including data governance and data quality, to improve accurate insight from health system data • create a model for sharing resources across organisational boundaries including resources employed by health organisations and by external partners. The capability model will be established to help keep up-to-date with the rapid pace of changing skills requirements and will ensure agility when responding to system needs • attract and retain skilled health informaticians: to ensure success, ICT projects must have skilled health informaticians working alongside ICT and clinical teams. Until the informatics workforce is substantially larger, organisations should identify people in the current workforce who can contribute their clinical and process knowledge to the planning, implementation and adoption of ICT. <p>Catalonia, Spain</p> <p>One of the functions of the Tic Salut Social foundation is to collaborate with universities on professional development, the creation of shared knowledge, the training of new</p>
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		<p>professionals and the updating of knowledge and adaptations to new technological environments.</p> <p>This includes:</p> <ul style="list-style-type: none"> • participating and encouraging training in interoperability • identifying, facilitating and standardising university training course • developing a marketplace for ICT training courses • carry out ICT training in the field of health and social care
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APPENDIX 12 – POTENTIAL BENEFITS OF LONGER-TERM VISION



Benefits are expected from improved levels of:

- transparency by making clear:
 - the location of authority, accountability and responsibility
 - the mechanisms by which functions are discharged, and how those discharging these functions are held to account
 - how priorities are decided upon and how associated investment decisions are made
 - the progress being made by programmes/projects, and the actions taken in the event of delay or failure
 - the assurance mechanisms that are in place, some of which will be independent and which will inspire confidence in project delivery
 - the costs and risks of programmes and projects
- Integration by:
 - providing clear strategic direction and rigorous oversight
 - applying common standards
 - developing open architecture and system interoperability
 - fostering collaborative working across technical, clinical and user communities
- capability by:
 - providing digital leadership and capacity at the national level
 - strengthening technical expertise available, both at the national level and at senior levels within DPOs
 - deploying more effective skills and resources across the system
 - proactive management of future-facing skills requirements
- collaboration by:
 - providing formal mechanisms at all levels (including national) for obtaining advice from the clinical and user community throughout the whole life cycle of new development (i.e. in design, testing and implementation)

- capitalising fully on relationships with other digitally-ambitious sectors in Wales, with academia and with global digital suppliers to access and develop both insourced and outsourced digital capabilities available to the NHS in Wales
- efficiency by:
 - streamlining the committee apparatus involved in overseeing health informatics in Wales, thereby reducing duplication and confusion
 - monitoring progress more effectively and timeously and intervening more decisively when programmes/projects fall short of agreed milestones and/or benefits
 - prioritising by using clear and consistent criteria, leading to investments that complement and cohere both with each other and with existing infrastructure and systems in Wales
 - assessing whole-life costs and expected benefits along with whole-life affordability coverage to inform investment appraisal
 - tracking and managing the realisation of benefits so that full investment value is obtained
- equity by:
 - ensuring that all parts work to common standards and clearly identifying All-Wales single system implementations with which organisations need to comply
 - ensuring that everyone one in Wales has access to the same digitally enabled, clinical pathways
 - prioritising investment which allows for scalable solutions which can offer benefit across Wales
 - using pooled and properly scaled resources to maximise benefits across the system as a whole
- innovation by:
 - allowing opportunities and freedoms for local innovation
 - involving and developing a wider community of digital suppliers through the use of common standards
 - seeking out and exploiting ideas from users, clinicians and other care professionals

APPENDIX 13 – A POSSIBLE ROAD MAP FOR DELIVERY

A suggested roadmap is provided for years one, three, five and longer-term (which is the vision described above and in Figure 7) as a series of schematics and explanatory text in the sections below. The precise time-scale for the longer-term is unclear but may be ten or so years and may be something the technical architecture Review is able to help assess, given the maturity or otherwise of current systems, data and infrastructure across Welsh Government, NWIS and DPOs.

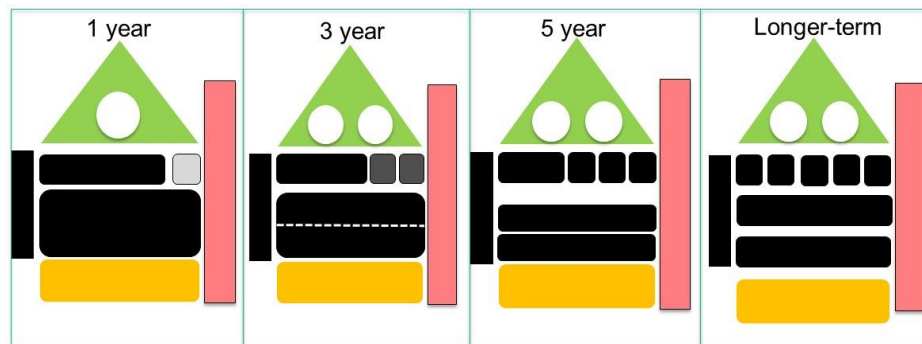


Figure 13.1: schematic road-map of structural changes for health informatics

As illustrated in the schematic above, the aim over time is to “unbundle” the different components of the informatics / digital community responsible for management and delivery of Welsh Health informatics (the “black box” shown in figure 4: “structural components of Welsh informatics.”) This reflects national and international current practice which is seeking to improve the quality and pace of digital health delivery, for example:

- in England where a recent report recommended “unbundling” the patient stack: services, data and infrastructure
- New Zealand, where there is a national infrastructure platform and a Health Information Standards Organisation and clear technical foundations about architecture, standards, information governance and ICT capabilities
- Catalonia, Spain where there is an independent standards organisation
- Scotland where health informatics are separated out into different sub-services within Shared Services Scotland which has development out of NHS Shared Services
- Norway where there is one national health network with common information technology services

- Victoria, Australia where the State-wide Health ICT Strategic Framework 2015 sets out Government and Health board roles, the importance of enablers and the need for maturity models and minimum baselines to enable system evolution as digital capability in the system grows

(A summary of the research carried out on national and international approaches is provided in Appendix 8).

The technical architecture Review which is being commissioned will need to assess questions such as:

- the kinds of open standards required for both data and infrastructure
- the current status of the existing architecture and how far it already supports those principles / standards. This is likely to include the extent to which existing monolithic systems such as LIMS provide all service elements – user interface, data and infrastructure (a “vertical” single system architecture) and whether / how such systems might be un-coupled to provide standard data and infrastructure that could be used by any compatible and approved application/service (a more “horizontal,” layered architecture)
- The gap between those two and the likely speed at which that gap could be closed

These questions are beyond the scope of this structure and governance Review but may impact and inform system delivery timescales.

The migration over time is essentially intended to provide a series of steps as follows:

- re-constituting the way in which existing NWIS services are delivered
- transferring elements of current HB delivery (data and infrastructure) into the new configuration (see below)
- consolidating, rationalising and achieving minimum capability
- only then exploring future delivery options.

This is presented in four time-defined steps as set out below.

YEAR 1

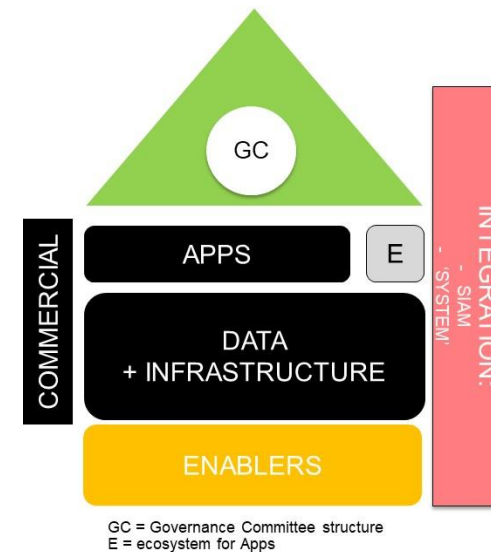


Figure 13.2: proposed year one structural changes for health informatics

The key elements are:

- governance and direction-setting: establishing new governance committee structures under the auspices of the 'CDO' (the circle). This includes establishing national standards (a single “standards board”) and, if appropriate, starting the process of establishing a fully independent Informatics Standards Authority (ISA). See section five for more details
- delivery of services:
 - for NWIS, separating Applications / Services from Data and Infrastructure and moving the latter into the NWSSP (black boxes). (**Note** at this stage the infrastructure and data management by other DPOs is not migrated). There are options for where the remaining NWIS applications / development team might sit (see section 4.8.3 below)
 - establishing first pilot(s) “ecosystem(s)” for health application development at a local level (grey box). These could build on existing initiatives to develop innovation centres
- integration (white box): start of establishment of:
 - Technical Systems Integrator & Management (SIAM) function
 - framework management system integrator function

YEAR 3

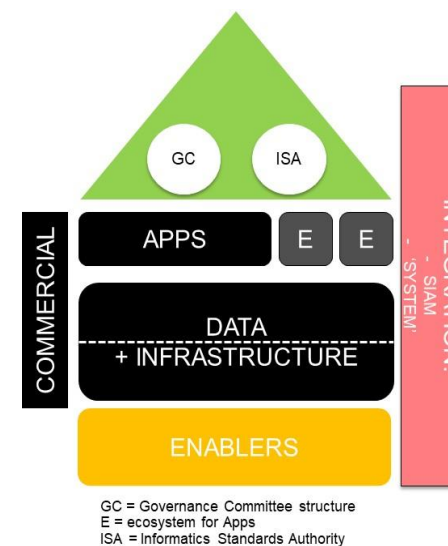


Figure 13.3: proposed year three structural changes for health informatics

The Review team have provided a further set of recommendations in the following section, for progressing from year one to year three of implementation. However, it might be appropriate to re-affirm these additional elements, once the following have been tested:

- progress against the other recommendations in this report
- that the direction of travel remains appropriate given any changes (for example, to technology or the operating environment).

At this point, the Review team suggest that year three might expect to see:

- governance and direction-setting: a fully independent ISa with the accountabilities of the standards board transitioned into it. Other committees / boards continue (the two circles). See section five for more details
- delivery of services:
 - consolidation of data and infrastructure within NWSSP. At this stage there would be migration of data and infrastructure out of Health Boards and Trusts into the shared service (completed by year three). Also, the start of separation of the two from each other (data and infrastructure)
 - infrastructure moving towards a fully open architecture and the standards set by the ISa; data similarly
 - applications / services: further ecosystem pilot(s), with the model beginning to mature (dark grey boxes). The remaining centralised development function may be preparing to transition to either a local ecosystem or a small centralised team that will support implementation of national solutions (for example as they are scaled up from local innovations) or as a semi-independent provider of apps (which could take several forms, see below)
- integration: maturing of both the technical and framework management integration functions.

YEAR 5

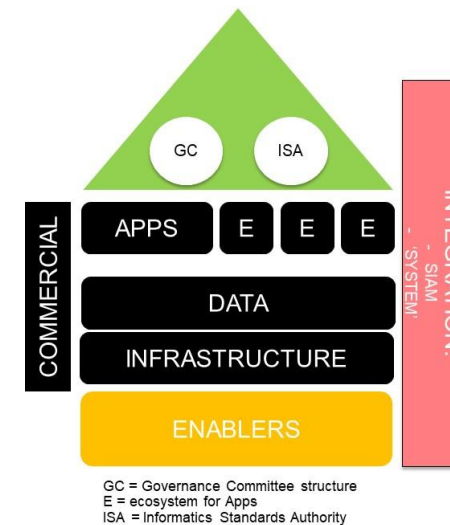


Figure 13.4: proposed year five structural changes for health informatics

Again, the following initial view will need to be tested against progress and direction of travel (no formal recommendations are made at this stage, although the process could be accelerated if sufficient progress has been made by the end of year one; hence the inclusion of this time-horizon):

- governance and direction-setting: mature operation of the ISa and other governance committees / boards
- delivery of services:

- all data and infrastructure provided through NWSSP (or an independent shared services organisation) with the maturing of separation of the two (data and infrastructure)
 - infrastructure maturing and close to fully meeting the open architecture and the standards set by the ISa; data similarly
 - applications / services: mature local ecosystems working alongside and co-existing with the remaining central team
- integration: mature technical and framework management integration functions.

LONGER-TERM VISION

As for the elements shown in section 5.4.1 and figure 13 above (though this “destination” may never be achieved as envisioned today as future technology developments may dictate other solutions and approaches).

APPENDIX 14 – MAPPING THE RECMENDATIONS FROM OTHER RECENT REVIEWS

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
Recommendation 1 Appoint a 'Chief Digital Officer' ('CDO') for health in Wales within Welsh Government or within the redefined NHS Exec function who is accountable for developing the "Intelligent / Active Investor" role, including: ✓ Working with the Welsh Government policy leads for health and care as well as digital	R7 Harness Innovation and accelerate infrastructure developments: integration challenges R9 Capacity to transform increase capacity at a national level to drive transformation and strengthen leadership nationally (regionally and locally) R9 Supporting action: as part of the national	R1-4 Strategy R5 Leadership R6-7 Governance R12-13 Benefits management	R3 Review of the senior leadership capacity in terms of skillset and governance within both NWIS and the wider NHS Digital team R3 and Strategy R4 and Governance and leadership	R2 Establish clear digital leadership in Wales

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
<ul style="list-style-type: none"> ✓ Strategy – including setting the framework within which the system operates ✓ A technical roadmap ✓ Governance (see next recommendation) ✓ Monitoring, reporting and independent assurance of delivery ✓ Establishing open and transparent relationships across the system. 	executive function and the civil service delivery function of the DG role, the WG should consider making explicit and publicising its role with respect to strengthened executive function for NHS Wales			
Recommendation 2 Under the auspices of the ‘CDO’, provide clear leadership, accountability and governance structures for each of the following <ul style="list-style-type: none"> ✓ Investment / prioritisation – 	R7 Harness Innovation and accelerate infrastructure developments R8 Align system design to achieve results R9 Capacity to transform increase capacity at a national level to drive transformation and strengthen leadership	R1-4 Strategy R5 Leadership R6-7 Governance R12-13 Benefits management	R3 Review of the senior leadership capacity in terms of skillset and governance within both NWIS and the wider NHS Digital team R3 and Strategy R4 and Governance and leadership	R2 Establish clear digital leadership in Wales R3 Develop and introduce digital service standards R5 Create an approach to incentivisation and spend controls

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
<ul style="list-style-type: none"> ✓ Advice ✓ Portfolio Management Board ✓ Whole system delivery management ✓ National Open Standards ✓ Informatics skills, capabilities and innovation 	<p>nationally (regionally and locally)</p> <p>R9 Supporting action: as part of the national executive function and the civil service delivery function of the DG role, the WG should consider making explicit and publicising its role with respect to strengthened executive function for NHS Wales</p>		R4 and Delivering new systems	
<p>Recommendation 3</p> <p>Appoint a 'Chief Clinical Digital Officer' ('CCDO') within Welsh Government (likely to be a part-time role) who should:</p> <ul style="list-style-type: none"> ✓ Report to the 'CDO' 	<p>R9 Capacity to transform increase capacity at a national level to drive transformation and strengthen leadership nationally (regionally and locally)</p> <p>R9 Supporting action: as part of the national executive function and the civil service delivery function</p>	R5 Leadership	<p>R3 Review of the senior leadership capacity in terms of skillset and governance within both NWIS and the wider NHS Digital team</p> <p>R4 and Governance and leadership</p>	R2 Establish clear digital leadership in Wales

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
<ul style="list-style-type: none"> ✓ Be accountable for the clinical advice provided to the 'CDO' ✓ Chair the CCIO Council, which should be the source of the advice that the 'CCDO' provides to the 'CDO' and other "boards" 	of the DG role, the WG should consider making explicit and publicising its role with respect to strengthened executive function for NHS Wales			
Recommendation 4 Appoint a health Digital Technology Officer (DTO) within WG accountable for both setting and policing standards and maintaining the technical roadmap	<p>R9 Capacity to transform: increase capacity at a national level to drive transformation and strengthen leadership nationally (regionally and locally)</p> <p>R9 Supporting action: as part of the national executive function and the civil service delivery function of the DG role, the WG should consider making explicit and publicising its</p>	R5 Leadership	<p>R3 Review of the senior leadership capacity in terms of skillset and governance within both NWIS and the wider NHS Digital team</p> <p>R4 and Governance and leadership</p>	<p>R2 Establish clear digital leadership in Wales</p> <p>R3 Develop and introduce digital service standards</p>

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
	role with respect to strengthened executive function for NHS Wales			
Recommendation 5 Given the problems / issues across the whole system set out in the report it would be enormously beneficial to consider new appointments to the roles of CDO, CCDO and CDTO for Wales	R9 Capacity to transform increase capacity at a national level to drive transformation and strengthen leadership nationally (regionally and locally)	R5 Leadership	R3 Review of the senior leadership capacity in terms of skillset and governance within both NWIS and the wider NHS Digital team R4 and Governance and leadership	R2 Establish clear digital leadership in Wales
Recommendation 6 Continue to develop and update the strategy (Informed Health and Care) and the supporting technical road map , ensuring that:	R7 Supporting action: WG and all DPOs should reassess their strategic priorities R8 Align system design to achieve results	R1-4 Strategy	R3 and Strategy	R2 Establish clear digital leadership in Wales

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
<ul style="list-style-type: none"> ✓ It is outcome focused ✓ It includes clear, binding definitions provided for key terms (for example, informatics, digital, infrastructure, commercial etc.) ✓ Is informed by best and emerging digital practice elsewhere ✓ Future developments are considered and understood, including the skills and capabilities required ✓ Future delivery/project execution approaches are considered and their implications for Welsh digital services is understood 				

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
Recommendation 7 Implement Portfolio management: <ul style="list-style-type: none"> ✓ Balancing portfolio between BAU and delivery of change ✓ Ensuring transparent monitoring and reporting ✓ Indep. assurance of programmes and projects 	R7 Harness Innovation and accelerate technology and infrastructure developments: R8 Align system design to achieve results	R6 -7 Governance	R3 and Strategy	
Recommendation 8 Develop digital project planning and execution including: <ul style="list-style-type: none"> ✓ Clinical user and engagement ✓ Change mgt./culture change mgt. ✓ Ensuring sufficient resource time for 	R8 Align system design to achieve results	R10 Project management R12-13 Benefits management	R3 and Strategy	R1 Design public services around the needs of the user

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
<p>engagement and change mgt. roles</p> <p>✓ Indep. delivery assurance</p>				
<p>Recommendation 9</p> <p>Ensure better application of Programme and Project Mgt. principles in particular whole system improvements in:</p> <p>✓ Governance</p> <p>✓ Change control</p> <p>✓ Benefits Realisation</p>		<p>R10 Project management</p> <p>R12-13 Benefits management</p>	R3 and Strategy	
<p>Recommendation 10</p> <p>Invest in IT commercial services that look beyond buying decision to Full Life Cycle of:</p> <p>✓ Understanding needs</p> <p>✓ Understanding/managing the market</p>	<p>R7 Harness Innovation and accelerate infrastructure developments</p> <p>R8 Align system design to achieve results</p>	R10 Project management	R3 and Strategy	R5 Create an approach to incentivisation and spend controls

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
<ul style="list-style-type: none"> ✓ Ensuring compliant fulfilment of needs ✓ Contract management 				
Recommendation 11 Further develop the digital competence, capability and capacity at each level of the system, including: <ul style="list-style-type: none"> ✓ Exec and non-exec Board and senior management awareness ✓ Clinical practitioners at all levels ✓ Role of senior digital directors and interface with Directors of Finance, Planning and Strategy 	R4 A great place to work: align workforce with new service models R7 Harness Innovation and accelerate infrastructure developments	R11 Project management	R4 and Governance and leadership	R4 Identify skills and capability gaps and develop a plan to close these
Recommendation 12	R7 and supporting action: NWIS (and NWSSP) should have greater national	R6 -7 Governance	R3 Review of the senior leadership capacity in terms of skillset and	

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
Move Commercial services from NWIS to NWSSP “procurement” shared service (and widen the scope to encompass the whole of the commercial life-cycle)	presence and authority linked to a strengthened National Executive and the WG should review their hosting and accountability arrangements.		governance within both NWIS and the wider NHS Digital team R4 and Governance and leadership	
Recommendation 13 Move Infrastructure and Data (together initially) with options as to whether this is stand alone, reporting directly to the ‘CDO’ or through NWSSP	R7 and supporting action: NWIS (and NWSSP) should have greater national presence and authority linked to a strengthened National Executive and the WG should review their hosting and accountability arrangements.	R6 -7 Governance	R3 Review of the senior leadership capacity in terms of skillset and governance within both NWIS and the wider NHS Digital team R4 and Governance and leadership	
Recommendation 14 Move Health Informatics Aps/Service team	R7 and supporting action: NWIS (and NWSSP) should have greater national presence and authority linked to a strengthened	R6 -7 Governance	R3 Review of the senior leadership capacity in terms of skillset and governance within both	

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
It is suggested that this function be under the authority of the 'CDO'	National Executive and the WG should review their hosting and accountability arrangements.		NWIS and the wider NHS Digital team R4 and Governance and leadership	
Recommendation 15 Establish a single Standards Board for Welsh informatics covering: <ul style="list-style-type: none"> ✓ Standards for canonical data ✓ Technical standards for architect/infrastructure ✓ Standards for Apps and ecosystem development 	R7 and supporting action: common standards and platforms should be mandated whenever possible	R2 Strategy	R4 and Delivering new systems	R3 Develop and introduce digital service standards

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
Recommendation 16 Establish the technical Systems Integrator and Management (SIAM) function To ensure interoperability between different systems and services	R7 Harness Innovation and accelerate technology and infrastructure developments: R8 Align system design to achieve results	R2 Strategy R10 Project management		
Recommendation 17 Establish the framework management system integration function To ensure interoperability between different delivery organisations	R7 Harness Innovation and accelerate technology and infrastructure developments: R8 Align system design to achieve results	R10 Project management		

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
Recommendation 18 Establish the management, accountability and governance framework – new stage one committee structure- and dismantle all other governance committees	R9 and supporting action: As part of the national executive function and the civil service delivery function of the DG role, the WG should consider making explicit and publicising its role with respect to strengthened executive function for NHS Wales	R6-7 Governance	R3 Review of the senior leadership capacity in terms of skillset and governance within both NWIS and the wider NHS Digital team R4 and Governance and leadership	R2 Establish clear digital leadership in Wales
Recommendation 19 Invest in digital staff and digital education of clinicians and other staff	R5: A great place to work R9: Capacity to transform, dynamic leadership, unprecedented cooperation	R5 Leadership R11 Project management	R4 and Governance and Leadership	R4 Identify skills and capability gaps and develop a plan to close these

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
Recommendation 20 Establish the first Local Health Technical Ecosystem Linking to and building on the current initiatives with innovation centres	R7 and supporting action: the development of new digital products and services will benefit from collaboration between industry, academia and NWIS.	R10-11 Project management		R4 Identify skills and capability gaps and develop a plan to close them
Recommendation 21 Establish a programme to oversee these recommendations reporting to the 'CDO'			R2 WG set out a clear timetable for putting the digital infrastructure of NHS Wales on a stable footing	

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
Recommendation 22 Establish the fully independent ISa	R7and supporting action: common standards and platforms should be mandated whenever possible	R2 Strategy		R3 Develop and introduce digital service standards
Recommendation 23 Migrate the infrastructure and data components that remain in DPOs into the relevant part of NWSSP In parallel begin the process to separate the data and infrastructure elements				

Review Recommendations	Parliamentary Review (January 2018)	Auditor General's Report (January 2018)	Public Accounts Committee (November 2018)	Expert Panel report for WG (December 2018)
Recommendation 24 Review and learn lessons from the initial ecosystem pilot(s) and establish further pilot sites	R6: A Health and Care System that's always learning			
Recommendation 25 Review and consider the future structural options for the remaining NWIS apps development team				
Recommendation 26 Review and consider the most appropriate future structure and "home" for both technical and framework management integration functions				



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