Infrastructure Strategy

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1. Executive Summary

NHSScotland Infrastructure Strategy 2012-17

NHSScotland has both unprecedented challenges and opportunities that will directly influence the future path of its IT infrastructure. The current situation can be summarised as:

- recent history of strong levels of capital investment, which in turn demands 'refresh' capital over the coming years.
- an environment dominated by desktop computers with limited connectivity to other networks.
- internally-managed services replicated across NHSScotland.

Yet sustaining past levels of investment is unaffordable, while the existing technology model is being overtaken by the maturity of consumer and cloud solutions that now dominate and influence the corporate market. So if maintaining the status quo is not an option, decision makers and influencers need to ensure that as development takes place it will support the future needs of the business, allowing for a cheaper more flexible infrastructure.

In response to the challenges and opportunities, the Infrastructure Strategy addresses the layers of the infrastructure and its management by allowing NHSScotland to:

- limit capital spend by shifting from the historical model of “owning” the infrastructure, by increasing the use of “as a service” offerings provided by private and public cloud, allowing any capital funding that is available to be targeted strategically.
- adopt opportunities offered by the consumer market, in particular commodity mobile solutions and the benefits they offer in delivering information at the point of care.
- enabling the widening of the information sharing domain to beyond the traditional boundaries of the NHS, supporting NHS staff, external partners and citizens.

Various actions are set out in the strategy, with responsibility split between those for the National Infrastructure Group, who develop and agree consensus ways forward, and those for NHS Boards. The principal actions:

The National Infrastructure Group will:

- define a common approach to a number of key areas including common directory information, cross boundary authentication, risk assessments to support technology adoption and assessment of emerging technologies.
- establish communication channels with key strategic suppliers to publicise roadmaps for all areas of the infrastructure covering aspects such as application delivery standards.
• agree a financial planning forecast template to plan for future infrastructure spend.
• develop a roadmap, linked to future infrastructure spend for reducing duplication in hosting, storage and common applications, supported by the definition of a service catalogue of mixed private and public service offerings.
• support the specification of infrastructure replacement programmes for N3 and NHSMail, linking to the principles and approach of this strategy.

Boards will adopt the outputs of the National Infrastructure Group commissions, using the recommendations to support local implementation of this strategy. This will assist and support local infrastructure plans in the following ways:

• through use of the template agreed by the National Infrastructure Group have in place a financial planning forecast established by 2013 covering all layers of the infrastructure, to facilitate local funding decisions and identity collaborative opportunities supporting the population of a common service catalogue.
• during 2012 shared local requirements for N3 and NHSMail replacement programmes.
• by 2013 ensure they have a client computing plan established based on recommendations of the Future Desktop Strategy, to support the adoption of a mixed economy of lower cost client devices and minimise potential lock-in.
• by 2013 have identified opportunities for consolidation and de-duplication across all layers of the infrastructure and aligned this to the financial planning forecast, reducing the number of bespoke solutions.
• by 2014 make available electronic processes to support the identity and access management workflow to remove the unnecessary use of paper, reducing the lead time for access to systems for new users.

Whilst the period of the strategy is till 2017 it should be noted that the development of the infrastructure is an ongoing activity, therefore the Infrastructure Strategy should be considered a living document with a review of it’s actions in mid 2014.
2. Introduction

The strategic agenda for healthcare services in Scotland is set by the *Healthcare Quality Strategy for NHSScotland*\(^1\). This is the overarching strategic context for the direction, development and delivery of healthcare services for the years to come both in terms of securing quality improvements and in achieving the necessary efficiencies. The *Quality Strategy* and other national initiatives such as the Patient Safety Programme\(^2\) provide the policy context for *eHealth Strategy 2011-17*\(^3\) and its focus on six strategic eHealth aims. In addition, resilience as theme in the Information Assurance Strategy is implied in a number of the actions, therefore this document fully supports the strategic agenda’s and sets out the strategy for the ICT infrastructure of NHSScotland for the period of 2012-2017.

The Infrastructure Strategy will provide direction to a number of business areas primarily the eHealth teams within Boards, and in particular the eHealth Leads and Infrastructure Leads. It will also allow Scottish Government eHealth Directorate and other business areas from NHS Scotland, partner organisations and suppliers to reference this document as needs arise to understand how to align their own strategies, roadmaps and activities.

The Strategy Board has endorsed the second eHealth Strategy 2011-2017. It notes that a number of subordinate strategies will be put in place to underpin the delivery of its aims, with the Infrastructure Strategy being one. The eHealth Strategy highlights that convergence, standardisation, sharing services and exploiting investments will be key themes to the delivery of outcomes and this strategy supports this approach. This will ensure leverage of assets and extending effective life of the infrastructure.

Additionally the national technical eHealth Design Authority has been in place for some time and has established a set of Architectural Principles and a Standards Development Framework to assist Boards in making informed choices. The Infrastructure Strategy strengthens the role of the Design Authority alongside the Applications Strategy to support planning work towards delivering outcomes. The two strategies are complementary being underpinned by common drivers and goals.

2.1 Aims

The overall aim of the strategy is to provide for NHSScotland and its partners an affordable and rationalised infrastructure, where there is less concern about what devices users have and where they are accessing information from, and instead focusing efforts on securing the information. This is a transition from the current model of securing the infrastructure, achieving a model closer to that of the internet that allows for many applications on any device, at anytime and anywhere.

Development of the infrastructure is about an incremental, not wholesale change allowing greater business agility. It is a gradual and long term process where there can

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\(^1\) [http://www.scotland.gov.uk/Publications/2010/05/10102307/8](http://www.scotland.gov.uk/Publications/2010/05/10102307/8)
be no assumption of a one size fits all approach. Whilst there are a number of commonalities across Scotland there is a need to cover a diverse number of requirements, ranging from the particulars of local service provision through to available skill sets and geographical challenges.

Rather than being prescriptive, a vision, approach and a number of actions have been detailed for each layer so that Boards can adopt into their own local, regional and collaborative plans. The key is obtaining the right balance between commoditisation to obtain economies of scale versus diversifying to allow for local flexibility. It is the aim of the strategy to guide users and owners of the infrastructure in a common direction that ultimately provides the access to the services as required by the users.

2.2 Outcomes

The successful outcome of the strategy will see NHSScotland with an infrastructure that serves the core needs of the business, incorporating a range of COTS solutions to support the users and also interaction with external partners. By making available a range of services accessible by revenue spend the requirement for capital would be reduced whilst providing a flexibility range of solutions, effectively rationalising the plethora of local bespoke offerings.

This also ensures the Infrastructure Strategy aligns closely with the Applications Strategy to ensure the following:

- Rationalising

This is the main contributor towards convergence and is aimed at releasing cash savings.

Rationalisation means that action will be taken to reduce unnecessary duplication of ICT Infrastructure, to promote common hosting and to extend shared services. The aim will be, at all times, to look for a common approach to the acquisition and use of services to exploit NHSScotland’s combined buying power and to gain economies of scale.

There is still a diversity of operating environments (eg operating systems, infrastructure management tools and web hosting environments) deployed across Health Boards and the desire is to reduce this diversity so that a more common set of knowledge, expertise and best practice can be developed and shared to the benefit of all Boards.

Boards will be required to develop a common framework for ICT Infrastructure management, based on recognised industry standards such as ITIL, and will benchmark their ICT services to look for opportunities for on-going rationalisation.

This recognises that to achieve convergence the established eHealth governance structures around the approval of business cases will have a vital role to play.

- Extracting more value

This is the main contributor towards exploiting existing assets, services and software licensing arrangements, and is aimed at ensuring that new business needs can be met in a timely way, where possible, using what is already in place and paid for. Often
already deployed software tools or licenses for owned products provide capabilities that are underutilised. Before buying an additional new tool or service existing capabilities should be fully explored.

The adoption of server virtualisation within many Boards has reduced the cost of ownership of server installations, and the adoption of thin-client desktop and desktop virtualisation has contributed to a further reduction in costs while offering greater flexibility. In addition, Boards are now realising that the effective life of an asset such as a PC or laptop can be extended by more granular deployment of software and more flexible asset management that allows for still functional, but less powerful, components to be used elsewhere.

The routine benchmarking of ICT services will enable Boards to identify where further efficiencies might be possible. Where appropriate, by comparing like with like, Boards will be able to identify how more value can be obtained from their existing ICT infrastructure and from the teams that manage it. Equal scrutiny should be applied to external service providers to ensure that contracts continue to offer value for money and that Boards benefit from any cost savings that contractors achieve from rationalising their back-office approach or from deploying new technology.

- **Building (supplying) flexibility**

  This is aimed at reducing the cost of change. This recognises that a one-size-fits-all approach to the provision of ICT infrastructure and related services is no longer sustainable. On the other hand, the desire for more integration between services and systems points towards a greater adoption of standards and a shared approach to some fundamental aspects of service provision such as user authentication and common directory services.

  The incremental development of NHSScotland's ICT infrastructure over the next few years will be predicated by a drive towards wider and more flexible connectivity; the ability to easily integrate with other public sector networks; and the capacity to quickly and economically scale up to meet increased internal and external demand. As key contracts are renewed (such as the replacement for N3) they must be replaced with ones that offer flexibility and the ability to be managed in a way that ensures that there is no redundancy in capacity that is being paid for.

  The controlled adoption of open source or less expensive equivalents to what might be termed as “enterprise offerings” from large suppliers (eg operating systems, productivity tools and browsers) should be actively pursued as they offer economic alternatives to the more expensive packages where often much of the functionality is unused and unnecessary.

- **Choosing strategically**

  This is aimed at ensuring value for money over the lifetime of an ICT infrastructure asset or service and recognises that acquiring software, platform and infrastructure as services (eg from the so-called “cloud”) is now a feasible proposition for Boards individually and for NHSScotland as a whole. This will enable Boards to buy certain services when they need them and only pay for the time they are required.
Previous large contracts committed to by NHSScotland have brought with them unexpected dependencies that have resulted in increased costs or an inability to apply contract change in a way that suits the needs of NHSScotland (eg the NHSMail contract let by The Department for Health). Choosing strategically means that NHSScotland can exploit the wider choices that are available and can define service requirements predominantly in output rather than technology terms.

The descriptive approach of the Infrastructure Strategy is different, with the vision, approach and actions defined against the layers of the infrastructure as the base structure.

2.3 Scope

This strategy covers the elements that combine to provide the infrastructure that enables NHSScotland to run its clinical and business applications. This includes networks, data centres, storage, personal computers, office productivity suites, email and directory services.

In summary the infrastructure is the components that serve as the foundation upon which business specific applications and capabilities are built. This is indicated in the layers shown in figure 1.

![Figure 1 – Infrastructure Layers](image)

2.4 Drivers

The Infrastructure Strategy exists to support the decision making process around a number of key drivers during the period of the strategy. These are a mixture of both internal and external and present a variety of aspects that may or may not be in the control of eHealth teams.

The primary driver is a number of key contractual decisions that need to be made either where currently deployed technologies are reaching end of life or contracts reach a natural end. This spans the whole infrastructure from the network, operating system, productivity tools through to applications such as email.
Secondly there is also the requirement to support an increasing diverse technology portfolio particularly coming in the form of mobile and tablet devices. Historically there has been domination of PC’s and laptops but rapid advances in technology and a growing demand for information to be available in the right place at the right time. The use of mobile ICT is already commonplace outside of healthcare, and digital services available through other mediums such as television will demand a further level of connectivity that is not currently available through the NHSScotland infrastructure.

The third driver is the demand to provide an infrastructure that meets more diverse and extended user groups. Influences are also present from the shifting balance of healthcare, so an infrastructure that is flexible and supports collaboration needs to be developed to support integrated delivery arrangements with new delivery partners and citizens. As there is a drive to share information the infrastructure must have the capability to support the needs of the business, therefore the historical model of extending and funding the infrastructure out has covered the first two sections in figure 2 but this is not financially sustainable. Therefore there is a need to create a path to support a reduction the scale of the infrastructure whilst still meeting the key business requirements.

![Figure 2 – User Distribution](image)

Underpinning it all are financial drivers and the needs for consideration on the historical spend on infrastructure and how a service can be sustainable over the coming years. It should also be recognised that the current infrastructure has evolved rapidly over the last 15 years from small scale use of computers in a number of discrete business areas to the current deployment of 95000+ desktops and laptops geographically spread over 3200 locations. This has been supported by previously unprecedented funding to support the delivery of eHealth and whilst being a business enabler that has created a number of exemplary standardised and shared services it has also created an infrastructure that is now proving financially challenging to support. This has also created a delivery model where all endpoints are fully supported, managed and assured which is estimated to require capital investment in the region of £35m per annum to maintain the status quo. This financial requirement is refreshing what NHSScotland currently has is shown in figure 3.
Obviously this is not sustainable in the long term and new ways of providing an infrastructure to support the needs of the business within the financial constraints need to be adopted.

The strategy provides guidance that will inform NHS Board decision-making around the prioritisation of infrastructure spend within the framework of the eHealth Finance Strategy.

Furthermore it is expected that fiscal funding will continue to reduce till at least 2016 and not reach the funding levels seen pre 2010 again till 2028. Supply of capital has all but ceased therefore there needs to be greater consideration of service based options that can be revenue funded. Figure 4 - Strategic Hierarchy

As was alluded to in the introduction, a number strategies drive the direction of NHSScotland therefore influencing the direction of eHealth, these are shown in figure 4.

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4 Source: Dr Andrew Goudie, Scottish Government Chief Economic Advisor, 2011.
Whilst in turn eHealth owns a number of strategies providing further direction to the business in specific areas. This document acknowledges the other strategies to ensure Health Boards have a clear and concise understanding of how the different elements fit together and interact.

- **Quality Strategy**\(^5\) - aiming to deliver the highest quality of healthcare services to people in Scotland and, through this, to be recognised as amongst the best in the world. This will focus on the quality ambitions of patient centred, safe and effective healthcare.

- **eHealth Strategy**\(^6\) - sets out six new strategic eHealth aims of supporting people to communicate with NHSS, contributing to care integration, improving medicines safety; enhancing the availability of information for staff and maximising efficient working practices.

- **Comms and Stakeholder Strategy** - outlining stakeholder engagement and communication routes within eHealth, partner organisations and citizens.

- **Information Assurance Strategy** - the Information Assurance Strategy sets out how NHSScotland intends to ensure that the benefits which information technology brings to patients and health care professionals, such as improved co-ordination of care, are delivered within a culture which respects, values and keeps patients’ data secure.

- **Finance Strategy** - following a period of capital investment during the eHealth Strategy 2008-11 the building blocks for future IT enabled progress are now in place, and eHealth has moved from an application and hardware acquisition/development phase to exploiting the value of the new capabilities that have been acquired. From 2011-12, the majority of eHealth funding will be distributed to Boards rather than allocated on a project by project basis or spent centrally by the Scottish Government. This will include allocations for change programmes to deliver 6 strategic eHealth aims, applications and services enablers and infrastructure enablers.

- **Application Strategy** – recognises a constantly changing world that requires efficient delivery of functionality to enable the quality ambitions of NHSScotland in an environment of greater than ever pressure on public finances. A focus is required on reducing cost and providing more flexibility. Demands from new business initiatives should be met with a timely response and should avoid new expense by exploiting assets that have already been acquired. Incremental convergence around common systems and approaches should be used as a means to make collaboration easier, increase value for money, improve efficiency and simplify maintenance.

- **Person Centred eHealth Strategy** – focusing on five areas to deliver improvements in access to general information that the patient will find helpful, availability of booking appointments, getting access to test results, enabling peer support, and clinical interaction with the patient.

\(^5\) [http://www.scotland.gov.uk/Topics/Health/NHS-Scotland/NHSQuality](http://www.scotland.gov.uk/Topics/Health/NHS-Scotland/NHSQuality)

While the above strategies define the needs of the business there needs to be consideration of external influences, particularly from the technology market. Gartner Research (McDonald and Aron, Jan 2011) lists the top three CIO priorities for 2011 as cloud computing, virtualisation and mobile technologies. Previous years have also seen virtualisation in the top three, with both cloud and mobile becoming a priority over the last two years knocking web 2.0, enterprise applications and business intelligence down the list. This puts a number of elements of infrastructure continually in the top three priorities. There is also evident influence of consumer technologies in the workplace. This needs to be considered and how they should be addressed within the infrastructure of NHSScotland.

The Infrastructure Strategy also acknowledges national initiatives such as supporting the development of a Scottish Public Sector Network and the recommendations for common and shared services in the 2011 report from the McClelland Review of ICT Infrastructure in the Public Sector in Scotland\textsuperscript{7}. At the time of publication these are developing activities which health will need to consider how to support whilst at the same time ensuring they provide flexibility to meet the needs of NHSScotland.

\textsuperscript{7} http://www.scotland.gov.uk/Publications/2011/06/15104329/0
3. Strategy

3.1 Introduction

The strategy contains a vision and approach for each section of the infrastructure, from the user through to the network, infrastructure management is also covered. The content will support Boards allowing the development of plans locally and collaboratively to ensure successful delivery of the outcomes.

Boards need to ensure use of existing infrastructure should be maximised with consideration of what can be shared and what must be bespoke. This will lead to a better defined and agreed sharing of services that meet local business needs and lead to a lower cost infrastructure.

3.2 User

An effective identity service is the key building block to enabling access to information. The strategy is to establish and provide a range of identity services and standards that leverage the investment in the identity and access management service. The goal is to ensure that the infrastructure supports assured identity and enables user authentication as required within Boards and across boundaries to other Boards and beyond.

Approach

For user services the following approach should be adopted:

i. There is currently a single supplier dependency on Microsoft Active Directory. This is well embedded and is considered fit for purpose, therefore this approach should be continued and accepted as a business as usual cost. Boards should ensure this is incorporated in any financial planning forecasts.

ii. There has been an investment in a single sign on solution, Imprivata One Sign. Boards should continue to support the adoption of this solution as a key part of the infrastructure architecture, embedding it into the infrastructure and business as required to attain maximum benefits.

Actions

a) The use of Active Directory should be built upon to extract further value, but contained within that product set to reduce additional dependency creep from
neighbouring parts of the application stack. Additionally the Boards should work
together to standardise the information contained in the directory to support
greater NHSScotland wide and cross sector assured identity and collaboration.
The National Infrastructure Group should established a standard no later than the
end of 2012 for the minimum data fields linking to other programs of work such
as EESS.

b) Maintenance of identity is expensive and inefficient where it remains a manually
dependant process. There should be further use of electronic processes such as
access requests, password reset and account termination to reduce the cost
overheads. Boards should ensure they embed electronic process removing the
need for paper and signatures no later than the end of 2013.

c) A plan should be established by the National Infrastructure Group no later than
the start of 2014 to determine the requirement and options that support cross
Board authentication for users working across Board boundaries. This should
also determine how to use the current infrastructure to address issues of
providing timely access to temporary and mobile staff, therefore reducing further
the need to share logon credentials.

3.3 Applications

The strategy is for an infrastructure to support a wide range of feature rich
applications meeting the needs of the business, running on a variety of client
devices focusing on the browsers and virtualisation as the delivery methods.
NHSScotland should continue to promote activities that support the move
away from single supplier dependencies and adoption of a model that delivers
the benefits akin to the internet. To support lower cost client computing and
the adoption of commodity devices, particularly mobile solutions there needs
to be a drive to adopt open standards and move away from the current
technical cul-de-sac of compatibility with single browser versions.

Approach

For applications the following approach should be adopted:

i. As for client devices, the Future Desktop Strategy published in February 2011
contained a number of recommendations and a roadmap to allow Boards to plan
accordingly for infrastructure applications. Boards should ensure they are familiar
with this document and consider its recommendations as an integral part of the
local planning process.

ii. The Applications Strategy influences application choice. Boards should be aware
of and consider the contents of the Application Strategy in the local decision
making and planning process.
iii. Infrastructure applications are generally commodities and should be treated as such. There has been increased supplier maturity in recent years and there should be an increased focus on using COTS offering to reduce the internal support costs. Relevant procurements including the NHSMail replacement should consider COTS as a primary choice.

**Actions**

a) Increased consideration should be given in the future to how applications are delivered to client devices. Currently this is heavily dependent with the operating system and hardware. This creates a cost pressure that can eventually be reduced by increased adoption of primary applications delivered to a number of common browsers followed by application delivery technologies such as application virtualisation, desktop virtualisation and streaming. The National Infrastructure Group should establish an application delivery standard by the end of 2012 as an output of the Future Desktop Demonstrators.

b) Communications should be established to engage with the application supplier community to share NHSScotland’s strategic direction for the architecture at all layers. This will allow suppliers to align their roadmaps to ensure they provide solutions that are strategically aligned to NHSScotland during the lifecycle and at future procurement opportunities. This should be ongoing activity by Boards linked to the client strategy approach starting immediately in 2012 relaying the direction of travel for NHSScotland.

c) At present there is much duplication in provision of infrastructure applications. There should be a plan established by the National Infrastructure Group no later than the middle of 2013 aimed at reducing this duplication within NHSScotland and where opportunities exist sharing with other sectors. Whilst there are wider public sector opportunities, the key principle in collaboration is that governance is in place to ensure NHSScotland retains control of associated costs.

d) Consideration should be given to an NHSScotland application hosting service, offering common core applications on demand to end users. Initially focus should be in two areas, exploring provision of a ‘lite’ desktop offering email, productivity and internet access to users who do not require to work from a fixed location, secondly for applications that are required for short specific pieces of work then returned to the licence pool for reuse. A plan should be established no later than the middle of 2013 considering the options for scope and hosting.

**3.4 Client**
The strategy is to provide an infrastructure that enables the use of cost effective client devices that deliver information where the business requires it. Whilst there will be a future need for the traditional model of desktop PC’s and laptops there is a growing demand for the adoption of commodity mobile devices. There will be a move from the fully managed and assured model of client delivery to one where risk focuses on protecting the information, and less on the device as the governance of the client device will increasingly be outwith our control. The future delivery model needs to ensure it is supportive of an increasing number of technologies and must ensure that interdependences between the hardware, operating system and application are further reduced.

**Approach**

For client devices the following approach should be adopted:

i. In February 2011, the eHealth National Infrastructure Group completed work on the Future Desktop Strategy. It was accepted by the eHealth Leads and contains a number of recommendations and a roadmap to allow Boards to plan accordingly for client devices. The cost of NHSScotland’s current desktop provision is not considered to be particularly high in comparison with comparable organisations but this can potentially be further reduced with appropriate direction and supporting investment. Boards should ensure they are familiar with this document and consider its recommendations as the client device strategy for NHSScotland.

ii. In order to achieve the position of strategic and commercial advantage, NHSScotland Health Boards should continue investment in the adoption browser based applications and application virtualisation, and adopt a common approach to the security and network infrastructures that support the desktop.

iii. The Future Desktop Strategy presents a number of prioritised options for Boards to explore either individually or together. In formulating their own plans, Boards should consider their relative appetite for risk which is estimated to be reasonably high for the provision of desktop services. It is recommended to consider a path more closely allied to the consumer world, which will enable least investment and most flexibility over time.

**Actions**

a) Obtaining value for money will require investment in convergence on common standards to create a more supplier agnostic service, and position NHSScotland to take advantage of the emerging utility computing economy for the future. Inaction in this area will leave NHSScotland progressively isolated from the future direction of travel within the desktop market. Appropriate commissions to support further understanding should be established during 2012 and beyond such as the Supplier Demonstrators.
b) Historically, NHSScotland has made significant investments with Microsoft, leading to a position of relative dependence, or ‘soft’ and ‘hard lock-in’, within the Microsoft desktop environment. Boards should establish a client computing roadmap based on the recommendations of the strategy by the end of 2013 to minimise potential lock-in and assist understanding the total cost of solutions that are being proposed. This should be linked to the financial planning activities in the Infrastructure Management section.

3.5 Server

The strategy is to move to the commoditisation of server and storage infrastructure, establishing server and storage as a service access using a number of regional offerings supplemented with private and public cloud based services. This will support the provisioning of resources in a cost effective and timely manner to meet the variety of business requirements. Virtualisation is well established across NHSScotland and this should be further leveraged to enable the vision of server applications such as databases and web hosting turned on as required.

Approach

For server and storage provisioning the following approach should be adopted:

i. The adoption of virtualisation technologies has continued to increase with global statistics indicating virtual provisioning has surpassed physical installs since 2009. For a large number of applications the business case is proven and should this be further exploited to ensure maximum use of physical hardware is achieved. It should be ensured that the number of solutions incompatible with virtualisation is minimised.

ii. For requirements in the underlying server software stack, such as operating systems, databases and other server applications, Boards should ensure they have established the appropriate skills and knowledge to allow consideration and potential adoption of alternatives to the mainstream providers. Open source server software presents a lesser challenge than at the desktop, this should be recognised and exploited where possible.

iii. Server deployment should be underpinned by the principle of ensuring decisions are based on environmentally friendly options. Whilst consumption of power by the server estate has been reduced as an off set of the adoption of new technologies such as virtualisation, this will be overtaken in future years as the other challenges such as the need for increased storage.

Actions

a) There should be a roadmap developed for the adoption of cloud technologies, with consideration for what they can offer to meet the needs of the business.
NHSScotland at present has a number of examples where we consume services based on the principles of cloud. The use of cloud is more of a concern to security and governance colleagues for agreements such as Safe Harbor\(^8\) therefore infrastructure teams need to support them accordingly to assist understanding and recommendations. There is much use already of solutions in NHSScotland that are based on the principles of cloud. Public cloud is not the right solution for all business needs but it will meet some. The variety of needs and requirements should be understood, exploited and shared, in particular how existing virtualisation infrastructure can be used to establish a private NHS cloud. Boards should include all tiers of cloud offering an integral part of the service catalogue, with initial offerings being in place by the end of 2012 with a full range of offerings by 2015. Failure to do so will ensure that users circumvent infrastructure teams cutting any consideration of international legislation (ie SOPA\(^9\)) that may extend its jurisdiction overseas effectively leading to less control and greater risk.

b) Procurement of server and storage hardware is at present carried out on an individual Board basis therefore limiting any potential spending leverage. With the use of virtualisation, this will reduce the requirement to buy servers on a project by project basis, allowing Boards to establish and share their advance forecasts for server and storage hardware purchases more widely to open the possibility of joint procurements. Boards should link this to the financial planning activities in the Infrastructure Management section and should be agreed by the middle of 2013.

c) Supporting the hosting consolidation plan and to further exploit server virtualisation consideration should be given to how resources can be shared and commissioned over Board boundaries. Presently the creation of virtual servers is the domain of the local eHealth team but by standardising the service this could be made available outwith the host Board as a shared resource, providing scope for disaster recovery and eventually production instances. An effective service will lead to a number of Boards being centres of excellence for virtualisation, reducing the need for all to acquire and retain multiple specialisms. This service should look to provide initial offerings no later than the start of 2014.

d) With the demand for secure low cost storage increasing exponentially there needs to be an agreement established how this can be sustained in the future. Boards need to consider tiered offerings in their service catalogues to avoid users considering moving their data outwith the governance of NHSScotland. Additionally there should be engagement by Boards with the business and plans in place by the start of 2014 to agree the requirement for access information and appropriate retention timescales. Providing immediate access to all information should not be the standard and the business needs to understand the costs it is generating. The National Infrastructure Group should establish by the middle of 2014 where there is a need for long term digital storage, the use of external storage providers or a NHS collaborative to fulfil the archiving and backup requirements, offering storage on demand through a cloud based service.

\(^8\) http://export.gov/safeharbor/
3.6 Hosting

The strategy is to establish a rationalised, leaner hosting infrastructure for NHSScotland. This will support the cost effective delivery of services and allow for a reduction in capital spend required to maintain and develop facilities. By further reducing the legacy facilities that exist, NHSScotland should look to reduce demand by adopting commodity solutions hosted in the private and public cloud to meet the shifting demands of the service. The hosting vision is dependant on the underpinning network and needs to fully leverage capacity where this is available, recognising that greater availability of cost effective bandwidth now provides greater scope and increased options.

Approach

In developing an approach for hosting, the following should be adopted:

i. NHSScotland should not create any new data centre facilities. There are an adequate number of facilities across Scotland and effort needs to be put into making these available for reuse and sharing rather than pursing the option of new builds.

Actions

a) Boards should agree a hosting consolidation plan by the middle of 2013 for sharing of physical space with other Boards, public sector organisations and commercial partners. This will support the adoption of other approaches within the strategy, particular the offering of platforms and applications as a service. It should also factor in the requirements for business continuity and disaster recovery. Whilst consideration of partners external to the NHS may prove fiscally attractive, appropriate due diligence should be undertaken to ensure legal and cost reduction obligations are being met.

b) The business needs to articulate its requirements clearly so the tier level of hosting facilities can be supplied accordingly. To support this, a hosting service catalogue should be in place by the end of 2013 covering offerings from Boards and commercial suppliers. This will facilitate offering the business a tiered number of options to meet future requirements and move away from a one size fits all approach.

c) It should be standard practise for the business to be given the option to have disaster recovery in place for critical business applications with an agreed definition of the critical business applications to be supported. This should make use of other Board and partner organisation hosting where required and at a basic minimum it should be a warm facility. There should be use of reciprocal agreements as the primary choice to avoid any charging requirements. Boards should establish offerings and include in the hosting service catalogue by the middle of 2014.
3.7 Network

The strategy is for NHSScotland to build on the benefits that a single network has delivered over previous years whilst ensuring the future scope and scale is financially sustainable. A principle of reuse of existing connectivity should be prime and this will require NHSScotland establishing working models that support use of the Internet. Capacity and capability should be established to support the adoption and sharing of commodity services, consolidation of hosting and supporting the sharing of information with partner organisations and citizens. This will address many of the current challenges that exist due to segmentation of the NHS network from those it needs to engage with.

Approach

In developing the network the following approach should be adopted:

i. Widespread adoption of the N3 network has served NHSScotland well in standardising on a catalogue of services offered via a single platform with a common core. This has resolved legacy issues in areas such as network addressing and quality of service. This approach should be continued as part of the N3 replacement specification during 2012.

ii. The sharing of a contract with CfH has provided a number of benefits but also challenges. NHSScotland should continue to have a single wide area networking contract that benefits NHSScotland as a single entity, but opportunities should also be explored for collaborating with other public sectors within Scotland to reduce core costs and support joint working. Initially sharing a common infrastructure but with a view to reducing the number of links to other networks, enabling sharing of services within premises and enabling access to information providing seamless cross-sector capability without boundaries.

iii. There should be a continued approach to supporting secure applications and not relying on the security of the network. This will allow a greater adoption of cost effective commodity mobile and consumer offerings, enabling a reduction in the NHS network and greater use of the internet.

iv. There has been an increase in the number of Boards who have integrated the voice service into the eHealth service. This integration supports the convergence of voice onto a single data network although this is currently a relatively limited activity. Convergence of voice should be considered the preferred option and is a well defined route that will increase as the need arises to migrate from legacy PSTN offerings. To support this migration and future management Boards should consider their internal financial and management structures and how this can be best facilitated.

v. There should be a continuation of ensuring that local area networks meet local business requirements, with a focus on ensuring the availability of wireless solutions to support information being available at the point of care.
Actions

a) There should be a focus on making information available securely at the network edges through access points and integration service buses, whether to the Internet or other sectors supporting business partners and citizens. Connectivity to the NHS wide area network to access NHS information should not be a mandatory requirement as this will prove an expensive model to maintain. This should be defined by the Technical Assurance Group (a subset of National Infrastructure Group) as part of N3 replacement specification during 2012, and developed initially by delivery of the Optometry solution during 2012.

b) To support the increased requirement for mobility and home-working, in particular access to real or near time information, there should be an adoption of commodity services provided to support this. Although this may prove challenging in some regions depending on current 3G access and future 4G deployments, Boards should also consider appropriate collaboration either regionally or nationally to obtain these services, establishing requirements as part of the N3 replacement specification during 2012.

c) A wide area network, with a mixed infrastructure supporting a core for connectivity across regions in conjunction where available accessing connectivity for high speed regional COINS supporting centres of activity, has been successful and should be factored in by the Technical Assurance Group, as part of the N3 replacement specification during 2012.

d) The number of common core services such as traffic prioritisation and email relay on the wide area network is small, therefore additional services should only be supported and available as required, not as part of the standard offering. This will ensure a cost effective service and should be factored by the Technical Assurance Group as part of the requirements for the N3 replacement specification during 2012.

e) To reduce the number of bespoke solutions deployed for the increasing number of employees based in partner organisations, Boards should ensure that reciprocal arrangements are established for the provision of client hardware by the tenant organisation. The National Infrastructure group should establish during the latter part of 2012 a common access agreement that can be shared by all Boards and partner organisations. This should be supported by access to applications in a manner that is technically acceptable by all parties.

f) Successfully establishing and maintaining a single reliable video service is a key element of the network infrastructure. The principle is that the video service needs to meet the needs of the business and be supported accordingly. There is likely to be an increase in requirements to reduce travel and support an increasing number of diverse clinical requirements across greater time periods. The Board led collaborative approach in developing the service and associated standards has worked well, and this route should be considered for other similar future requirements. The business case for the Video Service should be agreed no later than 2013.
3.8 Infrastructure Management

The strategy is for Boards to continue to follow industry management frameworks such as ITIL, whilst sharing experience and recommendations with colleagues. There needs to be a continued focus in understanding the cost of the service through benchmarking and maturity models. As there is much commonality establishing successful management practices is time consuming activity there should an increase in sharing of best practice, policy and process documentation.

Approach

For infrastructure management the following should be adopted:

i. Opportunities should be continued to be explored to support the development of standards within the infrastructure with the primary focus on the adoption of industry wide open standards.

ii. Boards should continue to ensure they maintain a CMDB\(^{10}\) with proactive monitoring of the infrastructure, ensuring appropriate licence and asset tracking is in place.

Actions

a) A set of principles should be developed, agreed by the National Infrastructure Group and in place by the end of 2012 for assessing and adopting emerging technologies in the infrastructure where they provide benefits to the business. Focus should be on supporting timely adoption, avoiding unnecessary accreditation processes.

b) There should be a risk based approach to security, where IT Security Officers are positioned to provide the relevant risk assessment information, enabling the business to decide on the preferred approach. Security should be seen as enabler to the business where the status quo is challenged to ensure advances in technology can be adopted. The National Infrastructure Group should engage with the IT Security Officers forum to establish a number of collaborative workstreams, covering current and upcoming challenges commencing by the end of 2012.

c) The collaborative working approach should be further developed. It should be recognised that collaborative working can occur at a number of levels. In its most basic form the sharing of activities to inform colleagues of progress can be valuable. Opportunities will continue to exist but Infrastructure Leads need to

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\(^{10}\) A **configuration management database** (CMDB) is a repository of information related to all the components of an information system. It contains the details of the configuration items (CI) in the IT infrastructure.
establish clear direction and agreement from the business what outcomes are to be achieved. To facilitate this the National Infrastructure Group should agree a plan based on the approaches in this document and establish sign off with the eHealth Leads no later than early 2013.

d) Boards should ensure they have an agreed infrastructure finance roadmap in place by 2013 to support future funding discussions with the business. This should highlight the major investment dates required to support the local infrastructure and be aligned to the ICT Spend Survey.

3.9 Governance

The strategy is for Scottish Government and Boards to continue to follow established governance framework. This will continue to ensure the strategy and delivery of eHealth aligns to policy commitments of the Administration. Future development of the mechanism should be agreed using the collaborative approach that is currently undertaken.

Approach

For governance the following should be adopted:

i. As part of the implementation of the strategy and the future development of the infrastructure, a number of collaborative opportunities for services will be identified by the National Infrastructure Group. It is also expected that as part of any business case that is developed, the National Infrastructure Group will provide technical assurance to ensure any preferred options have an appropriate technically fit. Therefore where a compelling case exists and there is consensus, Boards should ensure they have in place a roadmap to support adoption of the service.

ii. The daily operational governance of eHealth and the infrastructure lies with the local Boards, who are responsible for the service they provide. Ultimately though, it acknowledges Boards are responsible to the eHealth Strategy Board and Chief Executive of NHS Scotland.
4. Appendix

This section contains the following sub sections:

- Strategy Development
- Roadmap

4.1 Strategy Development

The Infrastructure Strategy has been developed in collaboration with the established eHealth National Infrastructure Group. Consultation has occurred through a number of channels:

- The draft strategy has been distributed to the Chair of the National Infrastructure Group and all member Boards during development phases.


- With colleagues in eHealth Architecture and Design, also eHealth Clinical Lead and eHealth Lead Support.

- Presented to the eHealth Leads and CCLG to relay the themes and messages.

The development has also been supported by use of the eHealth Architecture Principles, recommendations from the McClelland Report on Public Sector ICT and market intelligence reflecting current industry trends.
4.2 Roadmap

- **2016-17**
  - **User**
    - 1. Fast user provisioning and crossboundary authentication (3.1,c)
  - **Applications**
    - 1. Common approach to directory information (3.1,a)
    - 1. Paperless provisioning (3.1,b)
    - 1. Application delivery plan (3.2,a)
    - 2. Application hosting service (3.2,d)
  - **Client**
    - 1. Supplier comms plan (3.2,b)
  - **Server**
    - 2. Board client computing roadmap in place (3.3,b)
    - 1. Advance purchase forecast available (3.4,b)
    - 1. Cloud adoption roadmap (3.4,a)
  - **Hosting**
    - 1. Cloud catalogue (3.4,a)
    - 1. VM service (3.4,c)
    - 2. Retention plan (3.4,d)
    - 3. Storage cloud (3.4,d)
    - 1. Hosting consolidate plan (3.5,a)
    - 1. Hosting catalogue (3.5,b)
    - 3. DR hosting (3.5,c)
  - **Network**
    - 1. Video service (3.6,f)
    - 1. Collaboration plan (3.7,c)
    - 2. Finance roadmap (3.7,d)
    - 1. ITSO engagement (3.7,b)
    - 1. Emerging tech principles (3.7,a)
  - **Infrastructure Management**
    - 1. N3 replacement specification (3.6,a,b,c,d,e)
    - 1. Cloud catalogue (3.4,a)

- **2015**
  - **User**
    - 1. Application delivery plan (3.2,c)
    - 2. Application hosting service (3.2,d)
  - **Applications**
    - 1. Supplier agnostic options (3.3,a)
    - 1. Cloud adoption roadmap (3.4,a)
    - 1. Advance purchase forecast available (3.4,b)
    - 1. Cloud adoption roadmap (3.4,a)
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  - **Server**
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    - 3. DR hosting (3.5,c)
  - **Network**
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    - 1. ITSO engagement (3.7,b)
    - 1. Emerging tech principles (3.7,a)
  - **Infrastructure Management**
    - 1. N3 replacement specification (3.6,a,b,c,d,e)
    - 1. Cloud catalogue (3.4,a)

- **2014**
  - **User**
    - 1. Application delivery plan (3.2,a)
    - 2. Application hosting service (3.2,b)
  - **Applications**
    - 1. Supplier comms plan (3.2,b)
    - 1. Paperless provisioning (3.1,b)
    - 1. Application delivery plan (3.2,a)
    - 2. Application hosting service (3.2,d)
  - **Client**
    - 1. Board client computing roadmap in place (3.3,b)
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  - **Infrastructure Management**
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    - 1. Cloud catalogue (3.4,a)
Configuration Management

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**eHealth Programme Approval**

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