National Infrastructure Platform Services

Architecture Vision

Purpose

The Strategic Architecture Vision document clarifies the purpose of the defined business drivers and demonstrates how a solution will be achieved by a proposed architecture development.

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Distribution

Name	Title	Issue Date	Version
Demetri Baroutsos	Enterprise Architect, Health Benefits		
ArchAG	Architecture Advisory Group		
ServAG	Service Delivery Advisory Group		
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Approver	Signature	Issue Date	Version
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Document References

Ref	Title	Author	Version	Location

Glossary

The following table is a summary of common terms, acronyms and nomenclature commonly referred to in this document.

Term	Definition
SCCM	System Centre Configuration Manager is Microsoft's tool for managing groups of windows-based computers
SCOM	System Centre Operations Manager is Microsoft's monitoring and reporting tool for a windows based computing environment
PKI	Public Key Infrastructure is the hardware, software, people and processes needed to manage digital certificates within an organisation
Cloud Computing	"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models."
Connected Health (CH)	A project to deliver an effective private network available to all health providers across the Midlands region. The design is based upon the MoH Connected Health HISO standard.
Architecture Building Block (ABB)	Architecture Building Block is a term used within the TOGAF Architecture Methodology. It refers to a grouping of functionality defined to meet a business need. Depending on the level of detail the architecture expresses, these building blocks are either conceptual functional items or actual products.
ADM	Architecture Development Methodologies
Functional Component (FC)	Functional Components represent the logical grouping of related building blocks (called Functional Blocks)
SDP	Service Delivery Point – the location that regional Connected Health implementations connect to the National Connected Health backbone
TOGAF	The Open Group Architecture Framework

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1. Executive Summary

1.1. Background

The Health Sector is a complex, multi-faceted business that services a geographically dispersed catchment across the whole of New Zealand. This profile means that there is heavy reliance on technology to support business services and processes.

The technology that supports these business services has historically been delivered in a piecemeal, fragmented manner, without adherence to overall guiding frameworks, or as part of a cohesive sector strategy. Typically investment occurs driven at local levels, with little or no alignment to national objectives, or the ability to derive value from scale.

With the advent of a national and regional focus in the health sector, and a move away from the historically fragmented approach, there is a key requirement to understand the potential impacts associated with the move to a regional or national approach, the viability of such a move and the value proposition that this strategy does or does not deliver.

A feasibility study has been prepared to allow for an informed assessment by the primary stakeholders in a national infrastructure, Health Benefits Limited, the National Health IT Board and the 20 DHB's.

Subsequent to this study, it has been decided to continue pursuing this initiative and HBL has been tasked with preparing a "Case for Change" for the National Infrastructure Platform Services. This Architecture Vision provides the architectural framework for the on-going development of the National Infrastructure Platform Services

1.2. Context Reference

The National Health IT Plan sets strategic direction for health sector ICT investment through a portfolio of workstreams. HBL, ITHB, DHBs and the Bipartite Action Group (responsible for change management arising from DHB restructures or service changes) have agreed to the following activities and scope for the National Infrastructure Programme (aligned with the Health IT Plan workstream 8):

1. Prepare a baseline operating cost and resource profile for Information Services (IS) functions.
2. Understand the current state of ICT activity across the DHBs and Regions
3. Identify options for cost savings and benefits across the sector, for sector reinvestment, through optimising process, people and systems
4. Work with the Sector's established IS groups, DHBs and Central Government, to identify preferred options and to provide these to DHBs for consultation with staff and unions.
5. Subject to consultation; detailed planning activity; further evaluation of the options and finalisation of any business cases; lead and develop projects to implement the business cases
6. Lead and support the development of national standards, procurement and governance for the National Infrastructure Programme.

The National Infrastructure Programme is working closely with other HBL Programmes to design and deliver common supporting Infrastructure, Services and Platforms to enable the delivery of the sector benefits attributable to those workstreams (FPSC, HRIS, FMSS).

A key focus for the Programme is to support and enable greater levels of clinical integration of health care services via the provision of national information systems, common platforms and services, available to the whole sector, regardless of where patient health care is provided. Other areas being contemplated include supporting local, regional and national collaboration between health care professionals across and beyond what have been traditional DHB boundaries. Reducing duplication of effort, and the consolidation of common requirements, to deliver efficiencies of scale are also of importance.

1.3. Mandate

The mandate to validate a national infrastructure is inherent in the following statements:

- It is agreed there is a single National IT plan for the health sector that needs to incorporate supporting IT infrastructure priorities.
- Oversight of a single IS plan for the Health Sector will be provided jointly by the HBL NIPS Governance Structure – PRP, Service delivery Advisory Group and Technology and Architecture advisory group, supported by Commercial Vendor Advisory Group and the Private Sector Reference Group
- There is a clear need to integrate the sector's approach to IT investment to effectively manage the limited pool of financial and people resources, reduce wastage and realise economies of scale.
- Delivery of a national IT infrastructure to support and provision clinical and non-clinical applications is seen as a shared priority.

1.4. Strategic Context

To ensure alignment of a national approach to infrastructure, it is important the strategic context of this activity in relation to the primary stakeholders is clearly articulated.

Additionally integrated reporting at the CEO Information Group has highlighted the sector need for Infrastructure, and the planned investment anticipated in regional and national systems. The strategic alignment with each of the primary stakeholders is shown below:

1.4.1. Health Benefits

- Fits with principles
  - Consolidation, Standardisation, Rationalisation
  - Deliver lower cost operating environments
  - Sector-wide initiative

1.4.2. IT Health Board

- Aligns with IT health Plan
  - Back-office Infrastructure Accounted for as workstream 7 of the National Health IT plan
  - Unwritten assumption that clinical apps and systems will require provisioning of necessary supporting infrastructure
  - Vision

1.4.3. DHB Regions

- Aligns with regional IS plans
  - All assume infrastructure investment will be required to one degree or another

1.5. Business Drivers

In the context of the national infrastructure, the feasibility assessment working group identified a number of key business drivers that were considered as part of the critical evaluation of the proposed approach to national infrastructure, and used to benchmark all decisions.

- Cost Avoidance, Efficiency and Predictability
- System Availability and Uptime
- Fosters and supports sector innovation
- Disaster Recovery Planning
- Business Continuity (for ICT only)
- Compliance – business and legislative
- Agility and Responsiveness to business

- Accessibility of Information
- Application Delivery Simplification
- Performance and Response
- Privacy and Patient Confidentiality
- demand
- Flexibility to support business change
- Support for sector change and standards

1.6. Information Service Drivers for National Infrastructure

In the context of the national infrastructure, the feasibility assessment working group identified a number of key IS drivers that were considered as part of the critical evaluation of the proposed approach to national infrastructure, and used to benchmark all decisions.

- Economies of Scale
- Efficiency of Scale
- Improved Operational Management
- Improved Support Management
- Productivity gains
- Improved Data Centre Management
- Better utilisation of Specialist Resources
- Improved Capacity Management
- Improved Provisioning Capability
- The need to support and "manage" Regional and National Programme initiatives
- Improved and standardised service levels
- Improved and standardised SLA management
- Responsiveness to change
- Address inequalities in access to IT services
- Cost predictability
- Cost efficiency
- Disaster Recovery capability
- Test and Development
- Lack of co-ordinated design and architecture
- Simplification

1.7. **Vision Statement**

To provide platform infrastructure services capable of supporting all Health Sector systems, whilst designing to support regional and national scalability. To enhance automation, delivery, integration and standardisation, reducing known risks associated with current implementations.

1.8. Benefits Statement

At this stage of the architecture cycle, the expected benefits are hard to quantify in a meaningful way and each benefit identified will be validated as part of the on-going design and planning activity associated with the projects that will arise out of delivery of this platform vision. An initial view of anticipated benefits are summarised below.

1.8.1. Initial Benefit Statement

National infrastructure will also indirectly assist in the achievement of numerous other soft benefits through improved productivity, increased collaboration, and provision of a foundation for other initiatives

It is clear that even at this initial stage, there are enormous benefits that can be gained by providing a consolidated and rationalised National Infrastructure Platform Service for the Health Sector.

By optimising investment and approaching the platform as a key enabler of health sector ICT services, we can provide a supporting framework for both the current and planned Programmes of Work, whilst supporting the objectives of the NHITP.

1.8.2. BUSINESS BENEFITS

1.8.2.1. Financial benefits will likely include:

- Reduction in infrastructure Capital Expenditure, due to consolidation into fewer data centres
- Reduction in infrastructure Warranty and Maintenance Costs, due to consolidation into fewer data centres
- Reduction in hardware, software, power and facility costs due to better densities and scale in larger data centres
- Reduction is cost of workstations, via aggregrated demand and purchasing economies of scale
- Operational efficiencies due to better concentration and utilisation of resource
- Procurement efficiencies due to larger scale procurement activities, and lack of repetition of these activities

1.8.2.2. Non-Financial Benefits will likely include:

National Infrastructure is likely to directly facilitate the following intangible benefits.

- Infrastructure foundation for future shared regional and National IT services: information, sharing, health care services and business applications, voice and video
- Improved Service Levels for infrastructure
- Improve services and clinical care
- Reduced business risk, including improved system uptime and greater reliability.
- Known/predictable year-on-year operating costs.
- Improved security.
- Ability to share data centre capacity for disaster recovery and backup.
- Reduced technical risk
- Smarter collaboration
- Improved use of people and skills
- Increased confidence in infrastructure

1.8.3. Technical Benefits

1.8.3.1. Consistent Architecture

By aligning subsequent architecture, planning and design activity with this Vision, consistent infrastructure across all domains will be achieved with a reduction in complexity and re-work required.

1.8.3.2. Infrastructure Abstraction

Infrastructure Abstraction provides the ability to deliver the right service/solution from any appropriate location or to mix and match infrastructure without any impact to the users.

Additionally, being able to perform hardware refreshes without interrupting user activities removes the likelihood of moving into a state of being on unsupported platform equipment.

1.8.3.3. Platform Virtualisation:

National Infrastructure will provide the building blocks to enable virtual application and desktop delivery, meaning the Sector can become increasingly device agnostic with respect to the delivery of its applications.

This leads to the ability to update/upgrade infrastructure with a reduced impact to the end users.

1.8.3.4. Reduce hardware infrastructure

Decrease number of server, storage, networking and other physical components are required to meet the computing needs of the Sector.

1.8.3.5. Lower Real Estate and Facility Costs

By consolidating and virtualising physical infrastructure a much reduced physical footprint is required, lowering the costs of facility and hosting of services.

1.8.3.6. Reducing Environmental Impact

By reducing and implementing technology that is more power efficient, we reduce our impact on the environment.

1.8.4. Additional Operational Benefits

1.8.4.1. Shorten Cycle Times

With the entire infrastructure virtualised, services can be shifted and provisioned far more rapidly, leading to faster cycle times. These advantages can increase the productivity of our overall workforce, while reducing costs, and align directly with the Quality Improvement and Financial priorities for the Sector.

1.8.4.2. Faster Resolution of Customer Issues

Enhanced management and monitoring of services means issues can be resolved more quickly, reducing the cost required to field calls and handle interactions. Users can provision and manage their own test and/or development environments, independent of other systems. This leads to higher user satisfaction and increased productivity.

1.8.4.3. Faster Project Completion

By removing the physical build components of project lifecycles, faster project delivery is possible. These capabilities can also bring the same benefits to product development time, resulting in decreased time to market for new initiatives. Faster provisioning of systems is possible through the use of virtual technologies and automation tools.

1.8.4.4. Automation

By automating manual processes involved in provisioning services operationally, manpower costs and time to deployment are shortened dramatically. Use of automation decreases the time spent by operations staff on "mundane" tasks and frees them to get involved in higher value project activities.

1.8.4.5. SLA Management

Platform will provide the ability to be able to set and track SLAs by application, provided that the appropriate monitoring suite is installed and operational through the health sector.

2. Strategic Vision

2.1. The National Infrastructure Platform Services Mission

The goal of Platform is to address the needs and support the delivery of the mission. The National Infrastructure Platform Services mission is as follows:

> ***Providing access to the right information, in right amount, to the right person, at the right time, in the right place, to enable the right decisions to be made for the needs of the sector, or for the patient.***

National Infrastructure Platform Services will do this indirectly by providing essential foundation resources and services to support the delivery of Health Sector systems.

2.2. Vision Statement

To provide platform infrastructure services capable of supporting all Health Sector systems, whilst designing to support regional and national scalability. To enhance automation, delivery, integration and standardisation, reducing known risks associated with current implementations.

2.3. In Scope

The following are deemed to be in scope of national ICT infrastructure:

- National ICT infrastructure should support all sector participants
- National ICT infrastructure includes the following high level items:

No	Scope item	Description
001	Governance Frameworks	The National Infrastructure will incorporate the Governance Frameworks required for the platform to operate
002	Management Frameworks	The National Infrastructure will incorporate the Management Frameworks required for the platform to operate
003	Architecture Frameworks	The National Infrastructure will incorporate the Architecture Frameworks and standards required for the platform to operate
004	National Data Centres	Consolidated National Data Centres to host the National Infrastructure
005	Technology Platforms	The required technology platforms required to deliver National Infrastructure Platform Services, including but not limited to: Data centre, Wide Area Networks, Voice, Video, platform infrastructure, management and monitoring technologies

2.1. Out of Scope

The following are considered to be out of scope for National Infrastructure:

No	Out of Scope item	Description
001	Application Specific Workloads	National Infrastructure Platform Services will provide the platforms for these to be deployed onto, but application specific requirements are out of scope.

3. Architectural Governance

The National Infrastructure Platform Services programme of work will be subject to Architectural Governance.

Architecture governance is the practice and orientation by which enterprise architectures and other architectures are managed and controlled at an enterprise-wide level.

It includes the following:

- Using the Program Management Office to ensure compliance with internal and external strategies, standards and regulatory obligations.
- All projects identified as being required to fulfil the architecture vision shall use an approved project management methodology. This will provide a system of controls over the creation and monitoring of all activities to ensure the effective introduction, implementation, and evolution of the architecture vision within the Health Sector.
- The architecture strategy framework is integral to NATIONAL INFRASTRUCTURE PLATFORM SERVICES, and will be used to ensure all strategic deliverables are relevant both to the overall local, regional or national requirements as well as meeting the existing and future planned architecture.

All architecture amendments, contracts, and supporting information must come under governance control in order to register, validate, ratify, manage, and publish. These processes will ensure the orderly integration with existing governance content.

3.1. Compliance

All elements of this Architecture Vision need to comply with the relevant policies and standards as defined in the Health Sector Enterprise Architecture.

3.2. Dispensation

There are no areas of this Architecture Vision that require Architectural Dispensation. Dispensation will be tracked throughout the project lifecycle and will be managed as part of the TOGAF methodology in place.

3.3. Monitoring and Reporting

Performance management is required to ensure that both the operational and service elements are managed against an agreed set of criteria. This will include monitoring and reporting against service and operational-level (SLA and OLA) agreements. This is part of a separate stream of work under the auspices of the service programme, the Services Advisory Group

3.4. Change Management

There are three types of change management in an information systems world: architecture re-work, technical and human.

3.4.1. Architecture Re-Work

Where a change impacts two stakeholders (or two systems) or more, then it is highly likely to require an architecture redesign and re-entry to the Architecture Development Method (ADM) cycle. In basic terms this means that such a change requires the input of the Architecture team.

3.4.2. Technical Change Management

Changes to the National Infrastructure Platform Services environment will be provided through the establishment of Change Management protocols as part of the ServAG working groups.

This entails detailed investigation and testing under both controlled and stress conditions, peer review, planned outages approved by the Change Advisory Board and communication to users.

3.4.3. Human Change Management

The main focus of human change management for this architecture vision should be operational training.

Supporting this, an extensive communications plan will be created as a part of the HBL programme activities which will provide the following information with regards to this project:

- Stakeholders and their needs
- Communications
- Communication owners (who is responsible for providing the communication)
- The media by which a communication will be delivered - intranet, Espresso, email, presentation
- The target audience
- Who has input to a communication
- The communication content and purpose
- When or how often a communication will be distributed}

4. Business Objectives

The following primary business objectives were identified for the Platform Vision:

Identifier	Objective	Priority
BO 01	Maximise sector value by improving service quality	M
BO 02	Increase the value of such services to the sector	M
BO 03	Set acceptable sector standards and practices	M
BO 04	Capture efficiencies	M
BO 05	Leverage economies of scale	M
BO 06	Encourage innovation and provide on demand infrastructure flexibility and capability	M
BO 07	Consolidate and rationalise a wide range of existing ICT provider supply and services contracts.	M
BO 08	Provide a computing platform that is capable of supporting Health Sector systems indefinitely, subject to advances in technology and services	M
BO 09	Have definable SLAs for service delivery that can be measured and reported.	M
BO 10	Provide the ability to provide rapid and cost effective responses to requests for new services.	M
BO 11	Increase system performance, reliability, and availability.	M
BO 12	Allow support for regional and national initiatives.	M
BO 13	Deliver a supported, manageable platform.	M
BO 14	Provide more from technology investments.	M
BO 15	Provide more dynamic & effective use of infrastructure resources.	M

These have been mapped to requirements and considered as part of this Architecture Vision.

5. Scoping the Architecture

5.1. Proposed Future State

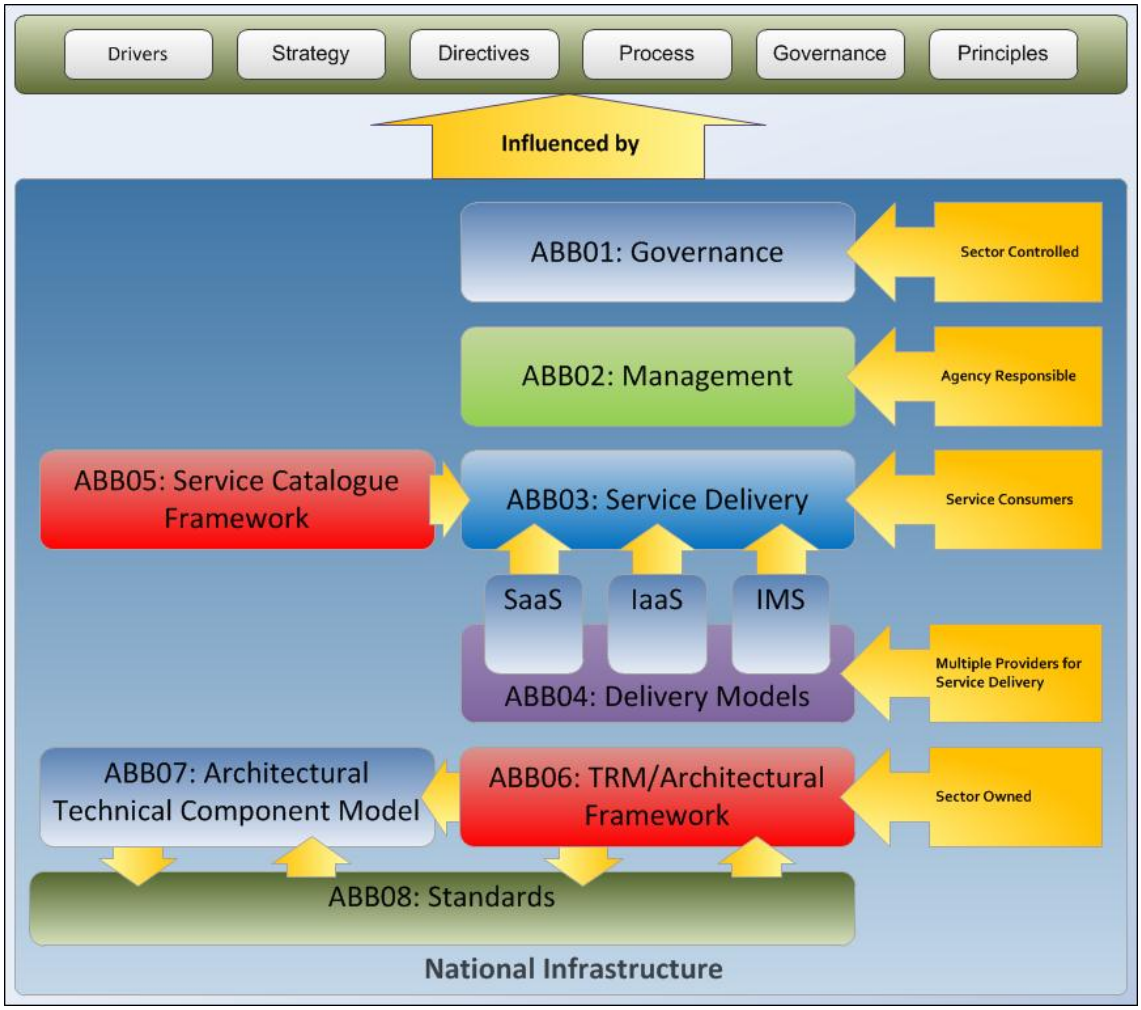
For a national IT infrastructure to be successful, an approach that is all inclusive, and is not simply centred on technology choices is essential.

To achieve the Architectural Vision, the following architectural building blocks (ABB's) are deemed to be mandatory in the development of the National Infrastructure Platform services. These building blocks span both the business as well as technical domains, and engagement with the appropriate stakeholders in the development of these is critical.

These Architectural building blocks are as follows:

- ABB01: Governance
- ABB02: Management
- ABB03: Service Delivery
- ABB04: Delivery Models
- ABB05: Service Catalogue Framework
- ABB06: National Infrastructure Platform Services Technical Reference Model and Architectural Framework
- ABB07: Architectural Technical Component Model
- ABB08: Standards

While some of these ABB's may be considered to be bound by a higher level ABB, for instance the TRM would deconstruct to the Architectural Technical Component model, they have deliberately been shown to highlight their importance and the influence direction. The primary ABB's considered are shown graphically below:



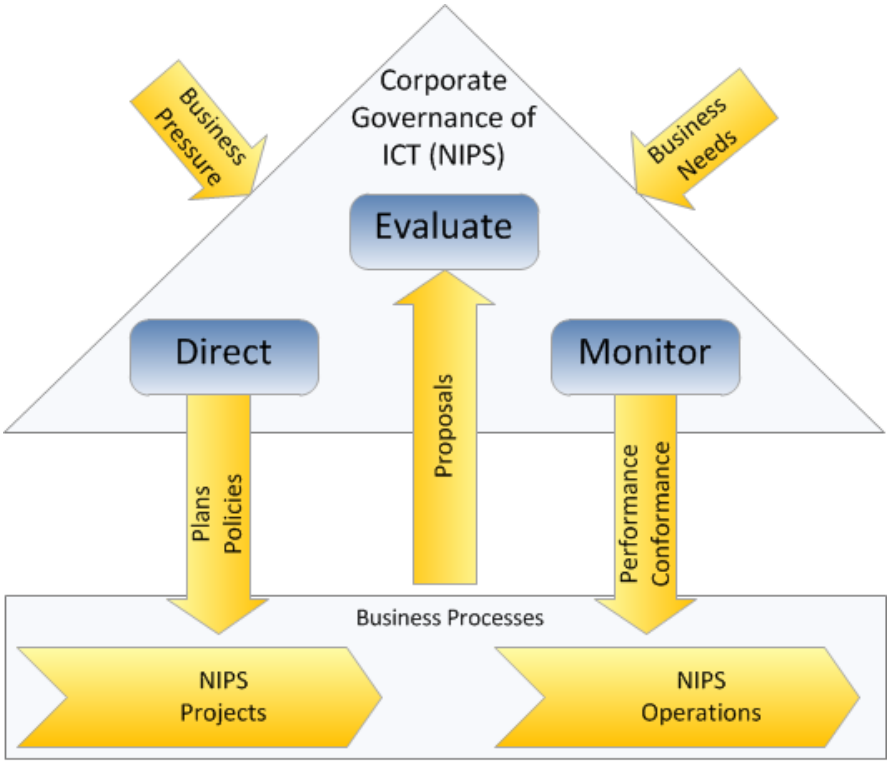
6. Future State Architectural Building Blocks

The following sections describe the Application Building blocks required to deliver the National Infrastructure Platform Services Vision.

6.1. ABB 01: Future State Governance

Governance is an essential part of the success of the national infrastructure and it is a requirement that this is sector owned. A Governance framework needs to be established with the appropriate representation and it will follow industry best practise frameworks like ISO/IEC 38500, or COBIT.

Formalised frameworks like ISO/IEC 38500 Corporate governance of information technology standard will provide a framework for effective governance of IT to assist the National Infrastructure Platform Services Governance Group to understand and fulfil their legal, regulatory, and ethical obligations in respect of their organisations use of IT.



ISO38500 Overview

This ABB needs to be developed as part of the future state architectural vision, with the following primary areas of responsibility for the governance function to include:

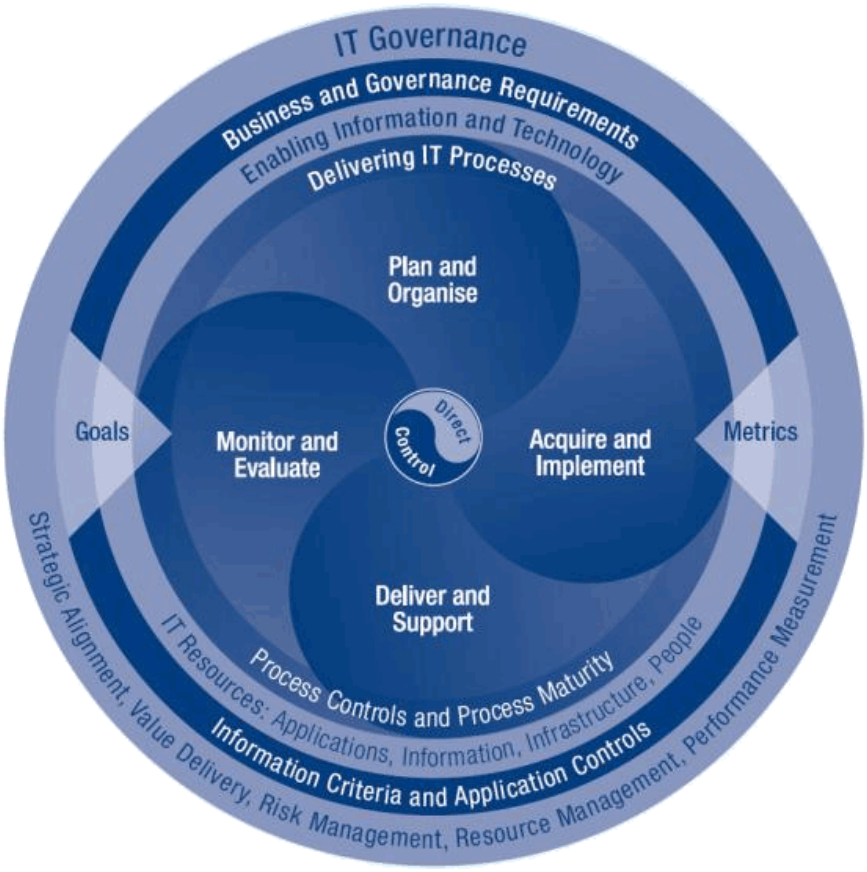
- Define a Strategic Plan
- Provide IT governance
- Financial Management
- Communications
- People Management
- Quality Management
- Risk Management
- Identify solutions
- Supplier management
- Service Level Management
- Monitor and evaluate IT performance
- Monitor and evaluate internal control
- Ensure compliance with external requirements
- Define processes, organisation and relationships

6.2. ABB 02: Future State Management

. A Management framework needs to be established with the appropriate representation and it will follow industry best practise frameworks such as COBIT.

COBIT is an IT governance framework and supporting toolset that allows managers to bridge the gap between control requirements, technical issues and business risks. COBIT describes IT processes and associated control objectives, management guidelines (activities, accountabilities, responsibilities and performance metrics) and maturity models.

COBIT supports enterprise management in the development, implementation, continuous improvement and monitoring of good ICT-related practices.



COBIT Circle

This ABB needs to be developed as part of the future state architectural vision.

Initial required business functions are shown below in the table below, and represent an initial view of the functions that will be required to support this approach. They are not meant to be exhaustive, and further work is required to validate and formalise these functions, as part of the development of National Infrastructure Platform Services.

- Business Service Management
- SLA Management
- Supplier /Contract Commercial
- Governance Structure
- Project Management
- Service Delivery and Support
- Architecture
- Operational Level Management
- Procurement
- Portfolio Management
- Financial Management

6.3. ABB 03: Future State Service Delivery

Oversight of service delivery will be part of the management functions created in ABB 02: Future State Management, and will be to an agreed set of service level agreements and in alignment with the service descriptions that are developed as part of ABB 05 Service Catalogue Framework.

Service will be able to be delivered from any of the appropriate delivery models, described in ABB04: Delivery Models,

Local service delivery will remain an option, but the assessment criteria for systems to be local will need to be robust to ensure that is not a simple opt-out option for participants in the national infrastructure.

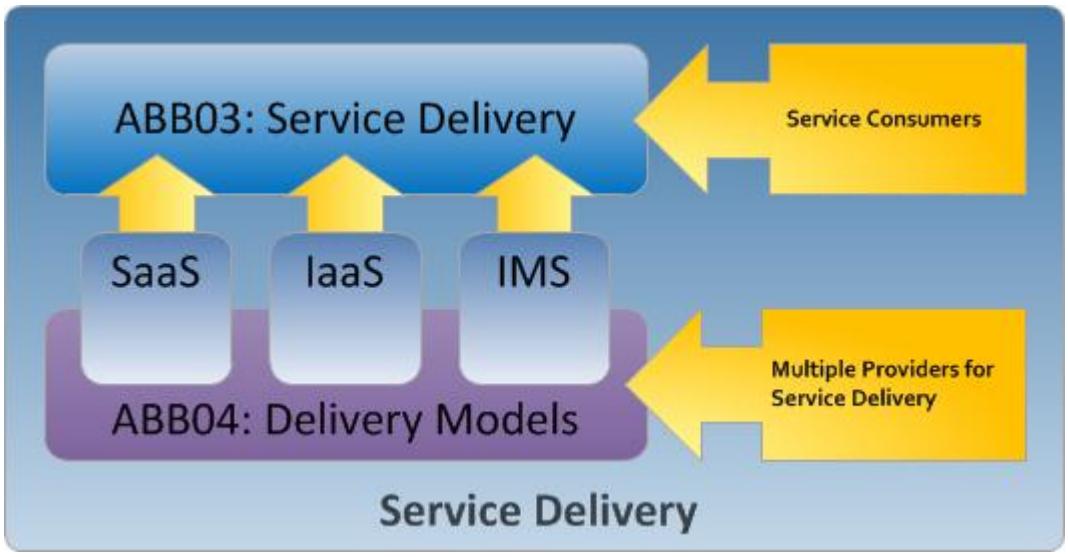
6.4. ABB 04: Future State Delivery Models

Delivery options will include, but are not limited to, the following delivery mechanisms:

- SaaS: Software as a Service
- IaaS / PaaS: Infrastructure as a Service / Platform as a Service.
- IMS: Infrastructure Managed Services

SaaS, IaaS and PaaS delivery is predicated on service provision by external software, infrastructure and platform service providers, and alignment to All of Government and DIA initiatives should be strongly investigated for appropriateness and re-use by the sector.

Infrastructure Managed Services are service provided internal to the sector, whether DHB local/regional or national in location.

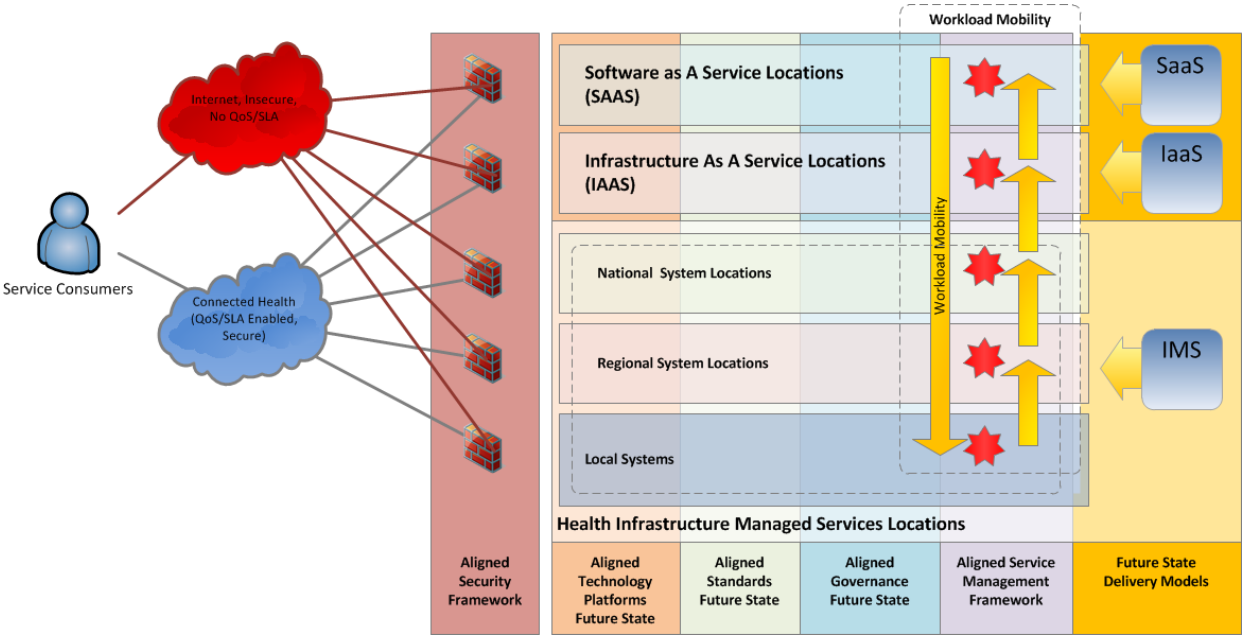


It should be noted that none of these service delivery options are mutually exclusive, and it is likely that any particular service delivered may well make use of a combination of these services combined to deliver the required outcome.

Definition of service boundaries and management of end to end SLA delivery, as well as the ability to provide scorecards for services delivered will allow for benchmarking and continual improvement of services delivered.

A defined technology future state for all the relevant components for the Infrastructure Managed Services components will ensure that all Infrastructure Managed Services will deploy the same technology components, where appropriate to support workload mobility, while the architectural framework will ensure service portability and choice across SaaS, IaaS and IMS delivery models.

This concept is shown graphically below.



Location of services will be determined by a number of factors, and the National Infrastructure Platform Services will develop a set of guidance principles as well as templates that will be to be used in determining the optimal delivery location for a particular service. These are likely to include the following factors as part of the service delivery location assessment:

Location Determination Factors

- Competition (Choice)
- Risk
- Compute Failure
- Technical Risk
- Politics
- Cost
- Manpower
- Sunken Cost
- Location Cost
- Capacity Sizing
- Confidence
- Location/Recovery
- SLA Level
- Business Disruption
- Bandwidth

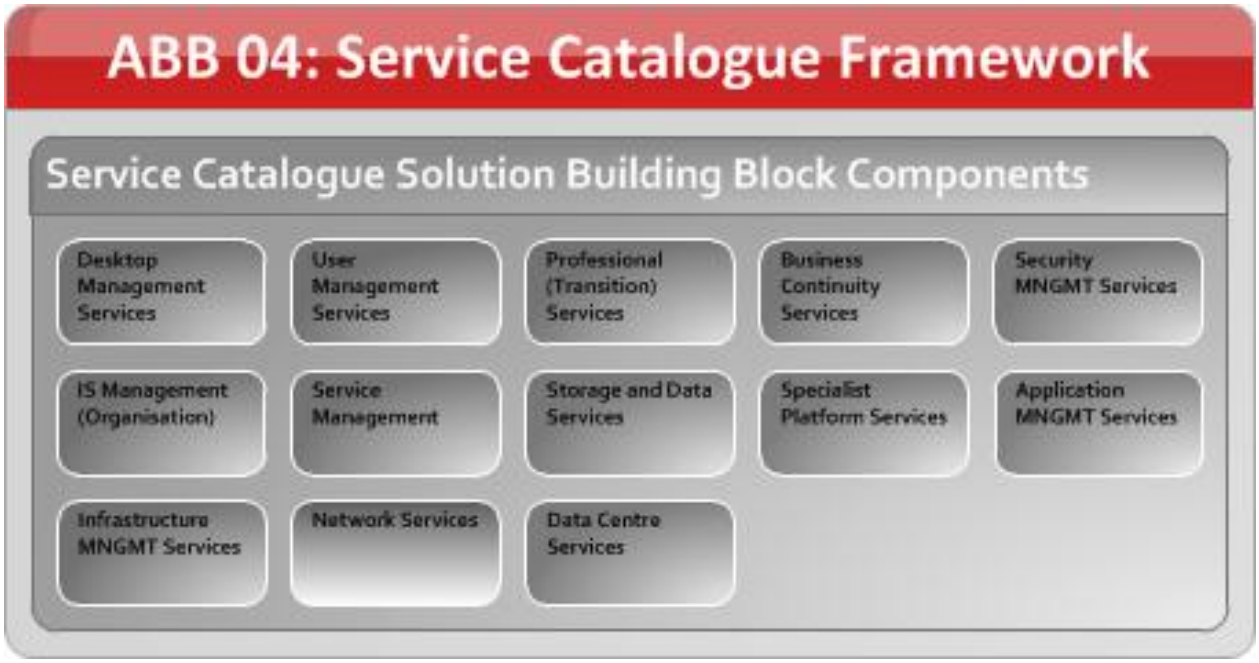
Additionally it is likely that a number of constraints is likely to be considered, these mat well include constraints such as the following:

Local Determination Constraints:

- Bandwidth
- Legacy
- Cost
- Economic
- Political

6.5. ABB 05 : Service Catalogue Framework

The Service Catalogue Framework defines all services available as part of the National Infrastructure Platform Services. This includes service construction (who, what, where, when, how), individual service boundaries, Service Level Agreements applicable, and DR and BCP services (for ICT systems and services and NIP Platforms only).



6.6. ABB 06: Architectural Framework

6.6.1. Target Architecture:

The architecture vision for Platform Services is to provide a dynamic infrastructure that abstracts each layer in the infrastructure stack from all other layers thus supporting improved agility, infrastructure availability, and dynamic growth. It supports service delivery from different providers both internal to the sector as well as external service providers, and achieves this by strong adherence to a common set of standards, common components where appropriate and standard service definitions.

The National Infrastructure Platform Services Vision is predicated on virtualisation. It is envisioned that all applications and services will be provided as virtual (not physical) components, whenever possible allowing for seamless workload mobility.

The future state National Infrastructure Platform Services envisions an environment where all physical layers are abstracted from each other enabling component independence. What this means is that a virtualisation layer or wrapper is provided for by the design allowing for abstraction and separation of components, and the ability to provide support for the applicable service delivery mechanisms.

This change moves the Sector along a path of ubiquitous computing. Providing an abstracted architecture supports the concept of "cloud computing" thus enabling seamless delivery of services to the end users from the most appropriate place to where they need the service.

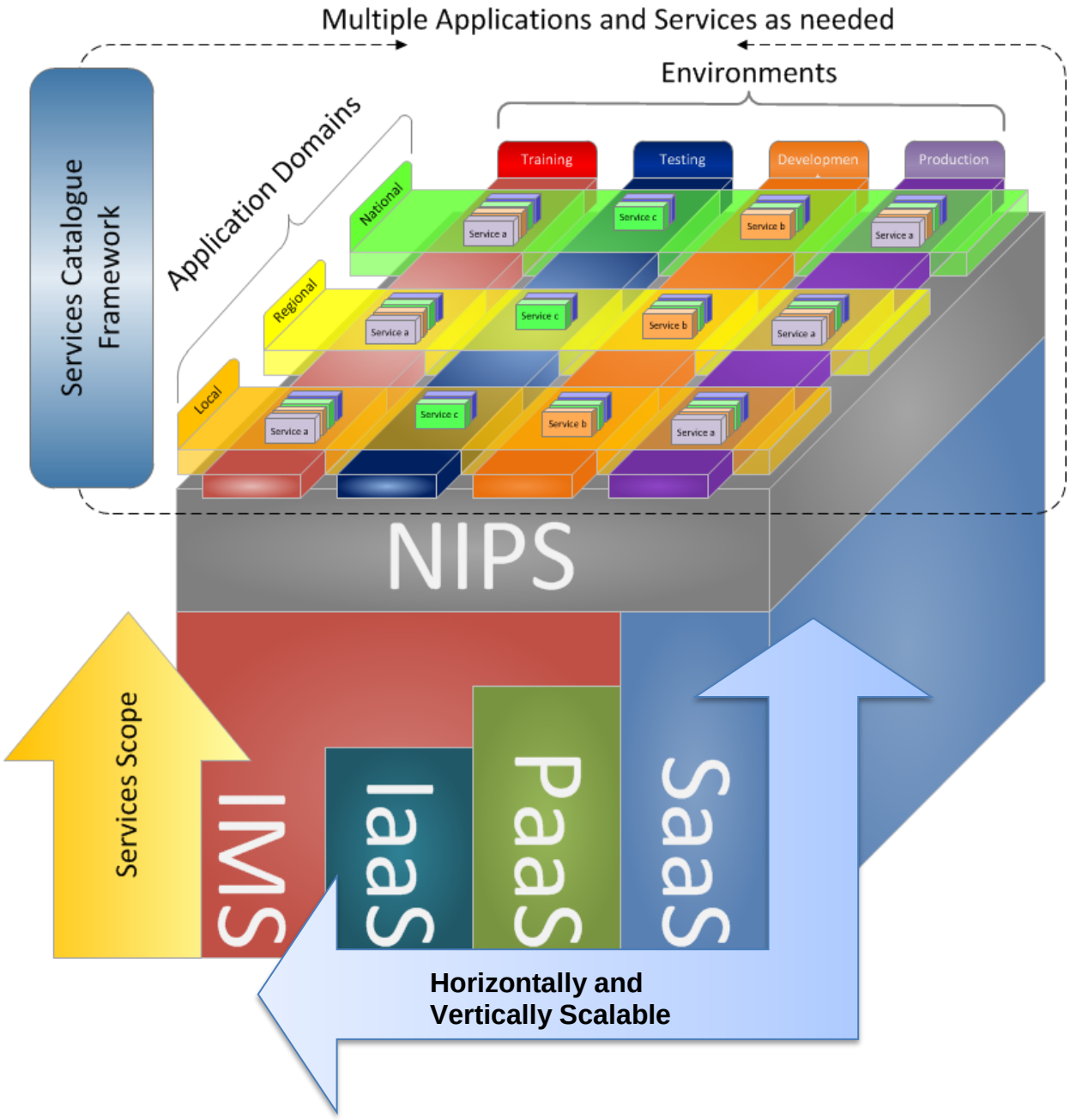
This Platform Architecture breaks down into a number of Solution Building Blocks (SBB's) to meet the needs of the Health Sector. It provides in essence a Private "Cloud" that is horizontally as well as vertically scalable, and meets the core business objectives. These are detailed in Section 7.6.3

6.6.2. Abstracting Business Services

By creating a series of technical and business abstraction layers across all of the Solution Building Blocks, it is possible to effectively create business support layers that allows for multiple application domains and environments, and supports service delivery form the identified service delivery models, inclusive of SaaS, PaaS, IaaS as well is IMS.

By definition the services scope of each is bound by the Services Catalogue framework, and the actual scope of services is different across the delivery models, with IaaS providing the lowest subset of services, followed by PaaS. SaaS and IMS will provide the most complete services scope, with all of these services delivered, governed and managed by the Health Sector.

This allows for optimal re-use of components, whilst the National Infrastructure Platform Services providing a management layer for the various domains. This is best described graphically as per the diagram below:



To achieve the abstraction of services for this Platform Vision, some fundamental changes are required in the deployment methodologies, moving from a dedicated per application physical computing model to one of services built on an abstracted platform.

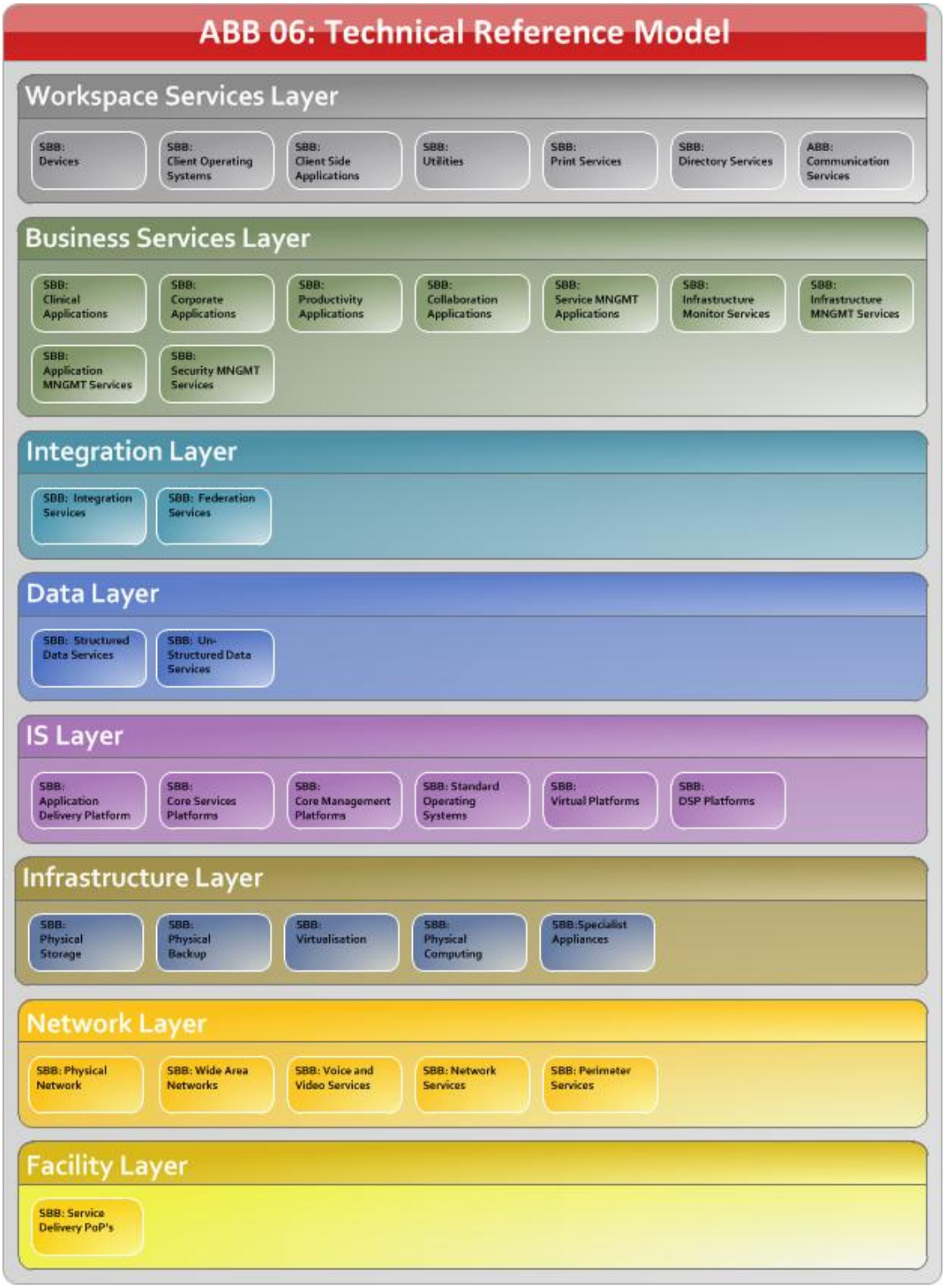
It is necessary to change the existing way that the clinical and corporate platforms are deployed. Even though the fundamental Solution Building Blocks are very similar, and in fact are mostly re-usable, with the exception of end of life components.

To support this vision a number of Solution Building Blocks (SBB's), grouped into their associated layers, have been defined. The following sections define the target state Solution Building Blocks of the National Infrastructure Platform Services. These are to be described more fully in the relevant Reference Architectures.

6.6.3. Technical Reference Model

Sector Architects have worked through and agreed the major technical components that are required for National Infrastructure Platform Services.

Broad consensus on a future state conceptual architecture has been achieved by the group. The Solution Building blocks required For National Infrastructure Platform Services is shown graphically in the Technical Reference Model below:



It should be noted that a number of elements in this Technical Reference Model are the domain of other Architecture Vision and Reference Architectures, and are shown in the TRM for completeness of the National Infrastructure Platform Services vision.

The Technical Reference Model is broken into discrete individual layers that groups the various Solution Building Blocks into their relevant domains. It should be noted that as a particular architecture is more completely developed, certain Solution Building Blocks shown in single layer at the vision level of the architecture will deconstruct to span multiple layers. The Solution Building Blocks in this Vision are more fully described at the individual layer level in the attached Appendix 7, and will be incorporated into subsequent design documentation and expanded as appropriate.

7. Appendixes

7.1. Technical Component Model

7.1.1. Facility Layer

National Infrastructure Platform Services Facilities will supply enterprise class data centre services including the following components to a minimum Tier 3 Standard:

- Fire/Smoke Protection,
- Physical Security,
- Air Conditioning,
- Cabling
- Power,
- Rack,
- UPS.

They will support the establishment of Service delivery Points of Presence, and aligned to a common Facilities Framework and national standards.

7.1.1.1. SBB: Service Delivery Points of Presence

Service delivery points of presence will need to be determined as part of the development of the National Infrastructure Platform Services programme of work.

The proposed future state for Service delivery Points of Presence is as follows:

- Minimal replication of Regional and National data centres, these are to be consolidated as far as practical.
- Local and legacy systems to be deployed into an appropriate tier of datacentre,
- An anticipated agreed National Infrastructure Platform Services data centre Tier level of 3 or 4 (to be determined) – Tier 4 unlikely
- Located within or as close to the points of interconnect (POI) for Connected Health:
  - Northern,
  - Midlands
  - Central,
  - Southern
- Redundant high speed connections meshing the Data centres to allow for service portability.
- Service Delivery taking account of Connected Health standards and practices. Or delivered to a higher level of service and capability.
- Service Delivery Demarcation points to be at the Service Consumers site boundary
- Ability to consume both IaaS and SaaS services

The relevant tiers for Service Delivery Points of Presence are as follows

Tier 1: Local DHB systems

- Only for non-critical and legacy systems, that are not virtualised
- Single non-redundant distribution path serving the IT equipment
- Non-redundant capacity components
- Basic site infrastructure guaranteeing 99.671% availability

Tier 2: Local DHB systems, support workload mobility

- For local systems that do not have particular DR and High availability requirements, and for the delivery of small scale localised and virtualised systems, that support workload mobility, aligned to national infrastructure standards

- Fulfils all Tier 1 requirements
- Redundant site infrastructure capacity components guaranteeing 99.741% availability

Tier 3: National Infrastructure Platform Services

- Primary location for all regional and national systems
- Fulfils all Tier 1 and Tier 2 requirements
- Multiple independent distribution paths serving the IT equipment
- All IT equipment must be dual-powered and fully compatible with the topology of a site's architecture
- Concurrently maintainable site infrastructure guaranteeing 99.982% availability

Tier 4: Not applicable

- Fulfils all Tier 1, Tier 2 and Tier 3 requirements
- All cooling equipment is independently dual-powered, including chillers and heating, ventilating and air-conditioning (HVAC) systems
- Fault-tolerant site infrastructure with electrical power storage and distribution facilities guaranteeing 99.995% availability

7.1.2. Network Layer

7.1.2.1. SBB Physical Network

Rather than the traditional approach of separating LAN and SAN traffic, the new Platform switched infrastructure will be built utilising unified fabric technologies.

Unified Fabric provides the flexibility of high-performance, highly available networks to serve diverse data centres needs including the lossless requirements to carry storage traffic (FC, FCoE, iSCSI, NAS) over Ethernet.

Offering the best of both LAN and SAN worlds, Unified Fabric will enable storage network users to take advantage of the economy of scale, robust vendor community and aggressive roadmap of Ethernet while providing high-performance, lossless characteristics of a Fibre Channel storage networks.

Convergence reduces total cost of ownership through both reduced Capex (host interfaces, cables, and upstream switch ports) and Opex (power, cooling, and rackspace/floorspace) and was designed to be adopted incrementally without forklift upgrades and without disruption to existing management and operations procedures. It will deliver reliable, agile and cost-effective network services to servers, storage, and applications while improving the user experience.

Unified Fabric will facilitate better support of virtualisation and cloud services with improved staff utilisation, more efficient resource utilisation (more load on servers and storage), lower TCO, and better resiliency and uptime.

National Infrastructure Platform Services will deploy an integrated switching infrastructure to allow dynamic provisioning and reallocation of Ethernet and storage resources between platform systems.

An aligned IP internal address schema range to be deployed to replace multiple local schemas. Deployment of a standardised network address space across all Health Sector participants, based on an agreed National IP address range. Ensure that the core IP Design aligns with the proposed shared services zones in the Sector, and can be multi-tenanted effectively as a national platform.

Deploy Virtual Switch Blades and Virtual Switches, allowing for wiring, network and operational simplification, enhancing security and enablement of live migration of server loads, locally and regionally.

Storage Switching Infrastructure inherits most of the features and benefits of the computing switch infrastructure, whilst reducing overall port count, the storage switching infrastructure will drive consolidation and efficiency in the Service Delivery Points of Presence

The ability to scale regionally and nationally will provide the ability to leverage multiple storage systems for redundancy and lower cost of ownership. It will provide heterogeneous access to multiple storage solutions. There will be the ability to integrate into secure public cloud storage services for lower grade data storage.

7.1.2.2. SBB: Wide Area Networks

Robust Wide Area networks, providing for multi service delivery, and defined security parameters which is based on the Connected Health Architectural Framework will be deployed. At all times, services will use the same common Connected Health Networks for service delivery and the proliferation of multiple networks into multiple locations will be removed.

7.1.2.3. SBB: Voice and Video Services

Voice and Video services will align to national standards, and these services will be provided from national platforms. Sector voice and video traffic will travel over sector wide area networks and utilise sector gateways to the external parties, whilst providing low cost and standardised internal communications.

7.1.2.4. SBB: Network Services

Network Services will be standardised across the sector, and they will provide a uniform and ubiquitous means of accessing the services.

Redundant Domain Naming Services will provide provides name resolution for all users and devices within the environment.

Redundant DHCP services will provide IP addresses to clients and servers. Devices that require a static IP address will be assigned them via reservations within the DHCP service rather than having to set static addresses on devices.

7.1.2.5. SBB: Perimeter Services

Robust and secure perimeters will be established at the edge of all service delivery Points of Presence, and these will be aligned to national standards. Wherever practical, services will be consolidated and rationalised, for instance Anti-Malware services will be provided as a service to all sector participants. Remote Access capability will be delivered nationally.

7.1.3. Infrastructure Layer

7.1.3.1. SBB Physical Computing

Physical computing platforms will be architected and aligned to the same standards. The computing platform will be treated as a pure processing utility that hosts server workloads. Enclosure integration with management tools will allow the powering down of servers during times of low use and provide the ability to deploy server workloads where and when required.

Boot from SAN technology will also assist in delivering an agile server platform for workloads that require physical servers. As the computing platform ages, new hardware will seamlessly integrate and replace older hardware, and workloads will be seamlessly migrated to new platform hosts with no requirement for downtime.

Computing enclosure hardware will be standardised across the sector to promote reusability and strengthen supportability. Minimal use will be made of any compute resources that are not blade compatible. For these a standard compute platform that fits into the overall topology will be utilised.

Computing Enclosures are a core component in delivering an agile, high performing National Infrastructure Platform Service. The Computing Enclosures will adopt best of breed technologies to allow the most efficient use of server resources when required enclosure integration with management tools will allow the powering down of servers during times of low use and provide the ability to deploy server workloads where and when required. Ethernet and storage networking will be highly integrated allowing administrators to orchestrate computing resources as and when required without potentially impacting production services. As the enclosure platform ages, new hardware will seamlessly integrate and replace older hardware without having to use “forklift” approach to refresh hardware disrupting service.

The computing enclosure infrastructure will ideally promote “Green” computing and utilise space efficiently with each enclosure offering the maximum server/footprint ratio.

Computing enclosure hardware will be standardised across the Sector to promote reusability and strengthen supportability.

7.1.3.2. SBB: Physical Storage

The storage infrastructure will consist of storage systems deployed in a tiered model. A tiered model will allow services to consume either highly available, high performing disk or lower performing cheaper storage, whilst allowing administrators to maintain management and control across all tiers.

Utility Storage will handle provisioning, tiering, and storage management autonomically—intelligently, at a sub-system level, without administrator intervention.

Chip-based storage will be deployed to provide ultra-fast storage to services where required. Support for Solid State Drive (SSDs), Fibre Channel, and Nearline (enterprise SATA) capacity within a single array will deliver consolidated, tiered application services as well as cost and performance optimisation. Massively and autonomically striped levels of RAID 0, 1, 5, and RAID MP (Fast RAID 6) will deliver tiered application services from highly consolidated arrays.

Optimised storage service levels on demand will be achieved by non-disruptively converting data service levels as needed across SSD, Fibre Channel, and Nearline storage tiers. Scalable, cost-effective levels of Fibre Channel and iSCSI host connectivity will ensure maximum consolidation value and fabric simplification.

Presentation of storage to hosts will be a flexible, dynamic process with no impact to services. Capacity limitations will not inhibit the environment as storage expansion will be completely seamless. The storage infrastructure will not be susceptible to performance degradation under any circumstances.

Multi-tenancy will allow storage systems to provide greater operational agility and efficiency to clients. The system's architecture will support environments where multiple "tenants"—different groups of users from different departments or even different enterprises—run diverse workloads securely on a common storage system while maintaining excellent service levels, high capacity utilisation, and efficient operation. This is made possible in part by mixed workload support that enables transaction- and throughput-intensive workloads to run without contention on the same system. The resulting alleviation of data centre sprawl can reduce storage our footprint by 50% or more

Cloning and mirroring between storage systems will achieve the desired continuation of service required by the National Infrastructure Platform Services stakeholders. Storage network integration into other sector or All of Government sites will provide the backbone to initiate disaster recovery capability.

A health storage network will be provisioned through the foundations of the connected health framework that will allow each DHB in a region to hold a subset of storage – essentially a “mesh” including controllers and disks, if one component fails, a redundant component hosted in another DHB will provide continuation of service, essentially creating a large redundant pool of shared storage to support Health Sector activity.

7.1.3.3. SBB: Physical Backup

The future state platform vision must put in place strategies to cope with an ever increasing requirement to backup and archive data to ensure the backup platform can scale with ease to meet demand.

The backup infrastructure must meet the capacity and performance requirements to successfully secure all data hosted on the platform within the required time windows and retain it in accordance with the Health Sector’s policies.

The backup infrastructure will tightly integrate with the platforms storage infrastructure network to ensure data can be transferred from the tiered storage to backup storage at maximum throughput.

The requirement to install backup agents on virtual guests will be reduced as backups of virtual guests will be taken directly from the storage system.

The backup infrastructure will have the ability to secure data from or backup data to other Sector participant sites utilising a shared Ethernet and storage network.

The backup platform will be scalable with the ability to present storage as and when required to meet demand with no down time. Additional backup servers will be able to be added at any time to increase performance and availability of the backup infrastructure.

A combination of private and secure public storage will be leveraged to meet offsite backup requirements. All existing backup systems will be consolidated into one master system to reduce complexity and management overheads.

A single archive solution that integrates with the backup platform will ensure the most optimal use of storage is achieved through de-duplication technologies. User self-service will allow users to restore files from backup and allow users to choose from previous versions.

7.1.3.4. SBB: Virtualisation

Use of appropriate hypervisor technologies dependant on service role will ensure that the required abstraction occurs across all physical components of the infrastructure. This is not limited to the compute function but also applies to storage, switched and user virtualisation to name a few.

7.1.3.5. SBB: Specialist Appliances

Specialist Appliance based hardware solutions will be used where appropriate to lower overall support costs to the Health Sector. These will be standards based, and may well perform specialists roles. Examples of these include Firewall appliances, Data and application appliances like Exadata and Exalogic appliances.

7.1.4. IS Layer

7.1.4.1. SBB: Application Delivery Platforms

National Infrastructure Platform Services will provide the ability to stream applications on-demand to users based on group membership. This includes streaming directly to client devices, into VDI session or presentation virtualisation sessions.

Users will be able to select the applications they require to perform daily duties from an application portal, and automated workflow management will provide managers approval ability.

A national application repository will allow the Sector to share and access pre-provisioned applications ready for simple customisation and delivery to end users. Standard applications will have the ability to be subscribed to and from Sector sites.

National Infrastructure Platform Services will provide the ability to sequence applications, allowing them to be delivered by the streamed application technology, this means applications will no longer need to be “packaged” and installed into computers to allow users to run them.

National Infrastructure Platform Services will provide presentation virtualisation services that are capable of supporting the current demand and future growth. This will allow a corporate applications, typically run on Windows to be accessed using other devices such as the Apple iPAD, Android/Linux tablets and smart devices; this will result in greater portability of applications for users.

National Infrastructure Platform Services will provide a web services environment that is capable of all supporting web functions required. The web services platform will be highly available and highly optimised through the use of hardware web acceleration and load balancing devices.

Certificate security will be offloaded from the web platform hosts to perimeter appliances ensuring that any new web service is secure by nature without additional certificate requirements. Web applications will have the ability to roam between nodes as the application will not be tied to local file stores on web servers.

National Infrastructure Platform Services will provide a VDI environment that is capable of presenting virtual desktops to those users that require them. The VDI environment will provide power users a rich, agile on demand computing session whilst allowing administrators to retain control and security from the data centre.

Offline VDI client technology will be deployed to replace laptop operating systems, improving data security and promoting flexibility with “user owned” laptops being able to be used to access corporate services

7.1.4.2. SBB: Core Services Platforms

The core services platforms that support National Infrastructure Platform Services will be standardised across the Health Sector where appropriate to provide the service and support portability across the Sector. Participants from varying organisations will have common toolsets in place to increase the available technical resource pool, and streamline training and operational support of the National Infrastructure.

National Infrastructure Platform Services will consume Public Key Infrastructure (PKI) that will consist of hardware, software, people, policies, and procedures that are needed to create, manage, distribute, use, store, and revoke digital certificates. National standards will be supported and adopted once published.

A redundant Active Directory environment will ensure authentication services are always available.

Dynamic printing services will be delivered to end users increasing efficiency and reducing waste. “Follow Me” printing will ensure users can submit a print job and retrieve it from any printer they chose simply by walking up to it and swiping their staff ID badge.

User Virtualisation will provide consistent and seamless working environments across a range of application delivery mechanisms, making the working environment predictable and responsive, simplifying IT administration and reducing costs.

7.1.4.3. SBB: Core Management Platforms

Platform services will deploy a suite of toolsets to manage the platform and its associated services.

Provisioning services will allow desktops to be provisioned for users within minutes. These desktops will be portable between devices providing “hot-desking” capability. Server workloads will be provisioned easily and on demand using single “master” images to reduce SAN storage requirements.

Configuration management will ensure all platform services conform to a “desired configuration” state and the service will audit configuration changes to ensure management are able to track any unauthorised changes within the platform.

Inventory management will ensure all sector owned resources are accounted for and asset managed in accordance with relevant guidelines.

Profile management will provide users with a consistently good computing experience regardless of device they use to access services. The service will ensure settings and customisations are retained between differing access platforms. Applications will have the ability to be “rolled back” to a last know good state – reducing support costs. Administrators will have the ability to provide granular application “lock down” policies if required.

Application monitoring will ensure all mission critical applications are performing at optimal levels and will alert administrators when thresholds are breached. Endpoint monitoring will ensure administrators can quickly determine any components of the infrastructure that may be impacting performance between users and services.

Patch and anti-virus management will ensure all systems are protected against the latest security threats. The new desktop and application delivery methods will ensure patches can be deployed across systems and devices within hours rather than weeks. Regional patch management repositories will allow DHB’s to share resources to speed up deployments and reduce re-work around testing and deployment.

7.1.4.4. SBB: Standard Operating Systems

Standards will enforce which server operating systems will be used within sector platforms. To support the vision of “computing platforms as a utility” operating systems and workloads will be virtualised where possible, allowing services to move seamlessly between computing platform resources.

Vendors will have to conform to the Sector’s operating system standards before a service is integrated into the environment and clear vendor roadmaps will show operating system supportability to assist with planning cycles.

As operating systems are released, the National Infrastructure core management systems will be upgraded to support the delivery of these operating systems to ensure the platform remains in an up to date state.

Operating system provisioning will be streamlined to reduce the amount of operational time spent on provisioning tasks to support new services.

7.1.4.5. SBB: Virtual Platforms

The virtual computing platform will take full advantage of the dynamic core infrastructure made available through the network, storage and computing resources. Hypervisors will be deployed according to the organisations requirements for performance, management, availability and cost effectiveness.

This means the Sector may deploy more than one hypervisor to suit production, test or training platforms to save its spend on licensing.

All systems will have the ability to host a replica copy of production as a lab, training and or staging area for testing, development and research purposes.

Provisioning of guests will be achieved through a dedicated virtual server provisioning technology that allows the re-use of virtual images, dramatically saving on SAN storage.

Scalability will not be an issue as all hosts will be treated as pure processing utilities allowing workloads to seamlessly move between server hosts.

Management tools will facilitate accurate usage statistics to allow “chargeback” processing when and where required. This will ensure funds are always available to support the scale out of the platform.

Testers and trainers will be provided an interface to control environments and “roll back” environments to previous states.

7.1.4.6. SBB: Data Services Platform

Platform will provide a data services environment that is capable of supporting all database storage and database functions required.

Charge back capturing and processing will ensure projects pay to scale the platform as required to ensure sufficient funds exist to support the scale out of the platform.

A hybrid model will allow integration to cloud services such as the Microsoft Azure SQL platform.

The platform will cater for test, training and development environments.

7.1.5. Data Layer

7.1.5.1. SBB: Structured Data Services

National Infrastructure will provide standards based Structured Data Services to support the deployment of services to the Sector as a whole. These services will be aggregated and rationalised on common database platforms and be supportable.

7.1.5.2. SBB: Un-Structured Data Services

National Infrastructure will provide standards based Un-Structured Data Services to support the deployment of services to the Sector as a whole.

7.1.6. Integration Layer

7.1.6.1. SBB Integration Services

National Infrastructure Platform Services will provide integration platforms that will accelerate and rationalise integration of applications and integration to third parties across the sector. These will provide an Enterprise Service Bus to the health sector as a whole and ease the deployment and replacement of clinical and corporate applications by simplifying integration requirements. These services will align to national standards and frameworks, including the National Interoperability Framework.

7.1.6.2. SBB Federation Services

National Infrastructure Platform Services will deliver federated Services will provide the means to authenticate and control regional and national systems and people access. The vision is that National Infrastructure Platform Services service access and roles are driven by the National Human Resources Information Systems.

7.1.7. Business Service Layers

Business Services Solution Building Blocks are defined in more detail in the National Reference Architecture for Workspace, and only a brief summary is provided in this Vision document for reference.

7.1.7.1. SBB: Clinical Applications

SBB: Clinical Applications includes all applications that are used to view and store clinical data. These applications should all require application authentication to ensure only trusted access to the data they contain.

7.1.7.2. SBB: Corporate Applications

SBB: Corporate Applications covers all applications that are required by the business that are not covered under another heading below. Examples include, LOB applications, HR systems etc. Any systems that contain personal information will require application level authentication.

7.1.7.3. SBB: Collaboration Applications

SBB: Collaboration Applications contains components that relate to methods of collaboration, whether that be voice or electronic.

Whenever practical National Infrastructure Platform Services will deliver national services for these, for example email, EDRMS capability, Portal capability or Unified Messaging.

7.1.7.4. SBB: Service, Infrastructure, Application and Security Management Applications

These Solution Building blocks contain the client side application for management of National Infrastructure. It is envisaged that these will be as consolidated as possible, and align to overall national standards.

7.1.8. Workspace Services Layers

Workspace Services Solution Building Blocks are already defined in detail in the National Reference Architecture for Workspace, and only a brief summary is provided in this Vision document for reference.

7.1.8.1. SBB: Devices

SBB Devices consists of all devices that are used to access systems, applications or information that is provided by the National Infrastructure Platform Services. In the past, standardisation of devices was the only way to assure compatibility with software, but compliance with standards now makes device selection simpler. In saying that, standardisation should be considered from the buying power, support, spares and training point of view.

7.1.8.2. SBB: Client Operating Systems

SBB: Operating Systems contains the locally installed OS software that is required on all devices

7.1.8.3. SBB: Client Side Applications

SBB Devices consists of all devices that are used to access systems, applications or information that is provided by the National Infrastructure Platform Services. In the past, standardisation of devices was the only way to assure compatibility with software, but compliance with standards now makes device selection simpler. In saying that, standardisation should be considered from the buying power, support, spares and training point of view.

7.1.8.4. Utilities

SBB: Utilities contains the utility / tool software components that are required. There will be a variance of the tools required between the available devices.

7.1.8.5. Print Services

SBB: Print Services consists of all of the print related services to be provided

7.1.8.6. Directory Services

SBB: Directory Services contains the components that make up the directory services function.

7.1.8.7. Communication Services

SBB: Communication Services contains components that relate to methods of communication, whether that be voice, video or electronic.

7.2. ABB 07: Architecture Component Model

The proposed technology future state components are shown in more detail in the table attached as Appendix 3. It should be noted that the technologies selected for these components are indicative, with the agreement that all elements should conform to standards across ALL health sector technology deployments, unless there is specific dispensation for variation.

It in no way suggests predetermined choice or selection of a particular vendor or technology outside of due process and probity requirements, including pre-requisite procurement activities.

7.3. ABB 08: Standards

Mandated National IT infrastructure standards are required and will play a key role in service portability, reduction in cost and efficiency.

The type of services delivered will dictate the degree to which IMS, SaaS and IaaS will need to conform to these standards, for example, standards may apply to storage systems used as part of an IMS but not a SaaS solution.

While there is agreement of certain relevant standards already in the sector, formal requirements and evaluation of options needs to performed as a next step and a national standards library for infrastructure should be developed to support the Vision and subsequent phases in the National Infrastructure Platform Services programme of work.