HSE Design Authority

ISF Programme ICT Asset Base
Workstream 2.2

Application & Technology
"TO BE" Logical Architecture

Delivering eHealth Ireland

Office of the Chief Information Officer



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Table of Contents

1 Architecture Executive Summary 5

2 Introduction 7

2.1 Background and Context 7

2.2 National ICT Integrated Services Framework (ISF) 8

2.3 Development and Maintenance of this Architecture 9

3 Architecture principles 13

3.1 HSE principles 13

3.2 Generally Accepted Applicable Principles 15

3.2.1 Global Principles 15

3.2.2 Enterprise Architecture Principles 15

4 Architecture Description 17

4.1 To Be Application Architecture Heat Map (consolidated) 18

4.1.1 Application Architecture heatmap of HSE systems 18

4.1.1.1 Application Architecture heatmap of HSE systems 19

4.1.1.1 Application Architecture heatmap of GPIT systems 22

4.1.2 Technology Architecture Heatmap of HSE systems 23

4.2 Logical Architecture View 29

4.3 System Users 30

4.4 Access Channel Layer 30

4.5 National Products and Services Layer 32

4.5.1 Standards and Architectural Design and Governance 32

4.5.2 Architecture Core Services 33

4.5.2.1 Discharge Service 33

4.5.2.2 National Contact Point 33

4.5.2.3 Health Identifiers: Patient, Provider, Location 34

4.5.2.4 National Authentication and Authorization Service 35

4.5.2.5 Terminology Lexicon Service 35

4.5.2.6 Patient / Provider Relationship Service 36

4.5.2.7 Report Service 36

4.5.2.8 Summary Care Record 37

4.5.2.9 Patient Clinical Information Service 37

4.5.2.10 Data Access Services 37

4.5.2.11 Record Locator Service 38

4.5.2.12 Referral Services 38

4.5.3 Architecture Core Applications *40*
4.5.3.1 EHR 40
4.5.3.2 Electronic Transfer of Prescription 40
4.5.3.3 Labs (LIS) 41
4.5.3.4 PACS / RIS 41
4.5.3.5 Ambulance 41
4.5.3.6 UHI - Universal Health Insurance 42
4.5.3.7 Patient and Provider Portal 42
4.5.3.8 ERP - Enterprise Resource Planning 43
4.5.4 Architecture Data Services *43*
4.5.4.1 Activity Data 43
4.5.4.2 Demographic Data 43
4.5.4.3 Security Data 44
4.5.4.4 Audit Data 44
5 Scenarios 45
5.1 Scenario A 45
5.2 Scenario B 48
6 Roadmap 52
6.1 Roadmap Approach and Principles 52
6.2 Maintaining a pragmatic roadmap 53
7 Appendix: Cross mapping between the business capabilities map and the Application architecture 55
8 Appendix: Theoretical scenarios for care settings 58
8.1 Primary Care 58
8.1.1 Ireland – Referral *58*
8.2 Acute Care – Discharge (synchronous) 59
8.3 Health and Wellbeing Care – Breast Cancer Screening 60
8.4 Community Care - Health and Social Care Integration 61
9 Appendix: Glossary 63
9.1 Appendix: Terminology 63
9.2 Appendix: Acronyms 64

1 Architecture Executive Summary

The ISF "To Be" logical architecture describes a future architecture for eHealth in Ireland. The architecture includes all care settings, and all systems, at a high level. The architecture supports the eHealth Strategy and Integrated Care Programmes through standards, common identifiers, common services and where practical and cost effective, central core applications. The architecture enables integration and migration to the future architecture on a phased basis.

The architecture is based on the "As Is" assessment, workshops with stakeholders, HSE principles, eHealth Strategy and business capability requirements identified during the HSE operating model project.

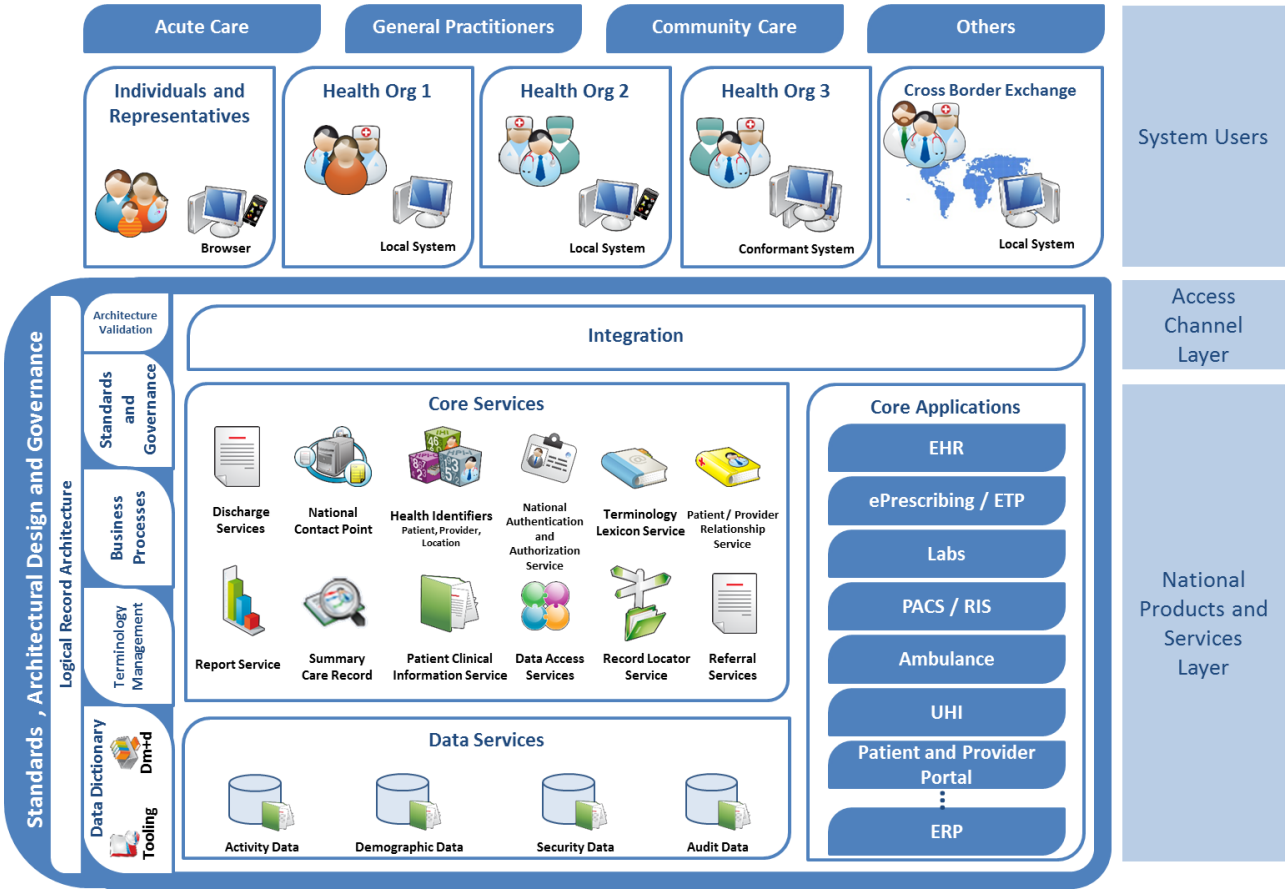


Figure 1. Architecture Vision

Care Settings and System Users

Different Healthcare organisations are depicted under the care settings of Acute Care, General Practitioners, Community and Others. Organisations will include users such as patients, clinicians, social, mental health and community workers and others. Organisations will have local IT systems, which may be integrated with the HSE core systems. The architecture will define, certify and enforce standards for integration, requiring that systems are conformant with the standards before integration can proceed.

Healthcare Organisations within a single care setting (e.g. different Acute Hospitals) will be able to choose the most appropriate approach for them to integrate with this architecture. Over time, integration with core systems (e.g. use of the IHI) will become mandatory. However, the approach by which individual organisations implement this integration will be determined by them, in conjunction with the ISF Design Authority. For example, different hospitals, with different PAS systems may choose different approaches to implement the IHI. One hospital may decide to modify their PAS to support the IHI, and another may choose to migrate to a central core EMR for Acute Hospitals, when available.

The eHealth initiative and National Contact Point will require the integration of national eHealth systems with eHealth systems in other countries. System users therefore potentially includes systems outside the Republic of Ireland.

Integration

The integration tier provides a single logical gateway into core HSE systems. The integration tier will provide standards based channels for synchronous and asynchronous messaging between local users, local systems and the HSE core. Key functions will include security, messaging, syntactic transformation and auditing.

The integration tier is a single logical gateway. In practice, this will likely be implemented as a number of specialised systems. It will initially include the integration functionality in PCRS and Healthlink. Over time, this will be evolved based on integration and security requirements.

Core Services

Core Services comprises key national HSE systems that are used by other systems and applications. These are the kernel of the architecture and enable the functional connections between applications. The core services shown in the HSE to be architecture have been identified based on the requirements for integration and consistent views and behaviour across systems and care settings. For example, the requirement for clinicians to have a synopsis of a patient's history is met by the Summary Care Record core service and necessary integration with this.

Data Services

A number of logical data services are depicted. The architecture defines that defined HSE datasets should be normalised, integrated and held centrally where necessary to support business capabilities. The detailed contents of these will be driven by the Information Architecture and the detailed design of core applications and core services.

Core Applications

As noted above in "Care Settings and System Users", applications may be central or local. Applications includes clinical and administrative applications for all care settings. Regardless of whether applications are central or local, they will integrate using the same standards with the Core Services.

A Core Application is a central national application, typically deployed as a single instance. As local applications require replacement or major upgrades, consideration should be given to migrating instead to a national core application, where available. Use of national core applications should improve the level of integration while reducing the cost of integration.

Standards and Architectural Design and Governance (Design Authority)

The architecture is based on integration between systems (services and applications) that comply with specifications and standards. Ensuring alignment between the diverse organisations and systems across the Irish health landscape will require an active Design Authority (DA) able to set and enforce the necessary standards. The DA is responsible for designing and governing the architecture. This includes responsibility for the detailed design of the central components and integration with these and creation of integration specifications and validation of the integration.

The DA will govern the definition of the Logical Record Architecture (LRA) for the HSE. Creation of the LRA will require close working with clinicians and other SMEs with the required domain knowledge. The DA will require tools to create and manage a data dictionary and terminologies. This is a necessity to enable data models, data types, messages and terminologies to be created and managed. Business Process Analysis is a powerful tool for designing and architecting connected solutions that integrate and function well tooling will be required to support this.

Although not part of the technology of the architecture, it is critically important that the Design Authority engages with projects to advise, review and assist projects in integrating with and using the architecture. For example, a project may require guidance on the correct use of a standard, or may require an extension to a specification to accommodate a new requirement. It is important that the DA is able to engage in these design decisions and is seen to accelerate and assist projects, rather than being an obstacle. Projects include new systems and the integration of some portion of the 1,700 existing systems with the architecture, where connected functionality is needed

2 Introduction

2.1 Background and Context

The Health Services Executive (HSE) has established the National ICT Integrated Services Framework (ISF) (of which this document forms a part of) in order to enable the delivery of the eHealth Strategy for Ireland.

The purpose of the eHealth Strategy is to provide an outline of eHealth and demonstrate how the individual citizen, the Irish healthcare delivery systems - both public and private - and the economy as a whole will benefit from eHealth.

It shows how the proper introduction and utilisation of eHealth will ensure:

- The patient is placed at the centre of the healthcare delivery system and becomes an empowered participant in the provision and pursuit of their health and wellbeing.
- The successful delivery of health systems reform and the associate structural, financial and service changes planned.
- The realisation of health service efficiencies including optimum resource utilisation.
- Ireland's healthcare system can respond to the challenge defined by the EU task force report - Redesigning health in Europe for 2020 - to ensure that in the future all EU citizens have access to a high level of healthcare, anywhere in the Union, and at a reasonable cost to our healthcare systems.
- The potential of eHealth as a driver for economic growth and development can be realised.

Figure 2. eHealth Strategy for Ireland - Health Service Executive

A national approach to interoperability is vital to Ireland's eHealth agenda as it drives toward more electronic interconnectivity and contributes to delivering anticipated cost savings, enhanced health delivery opportunities including Money Follows the Patient (MFTP) and Universal Health Insurance (UHI). Within the Irish healthcare setting there exists an increasing demand for greater healthcare information exchange between individual practitioners, provider organisations and government agencies. As demonstrated internationally, in order for interoperability to

succeed it is necessary to establish and apply a suite of nationally-defined standards. In recognition of this need the HSE has established the National ICT ISF.

The ISF is an Interoperability Framework offering shared standards based tools and language for defining and aligning the business and interoperability context for Ireland's eHealth systems. Most importantly, it provides a services architecture which is independent of technology.

eHealth does not only apply to a healthcare organisation in isolation but also to the exchange of clinical information on an industry-wide basis. The ISF will enable the HSE to overcome data silos and facilitate systems and services to grow in an aligned and evolutionary manner. The ISF embraces all of the core ICT systems, technologies and associated business processes. It aligns with mandatory national and European standards and associated initiatives including requirements for record portability across jurisdictional boundaries.

2.2 National ICT Integrated Services Framework (ISF)

Healthcare Interoperability is a complex concept with a simple end goal. Its overall objective is to enable the provision of better health for individuals and communities. Interoperability requires the successful operation of many interlocking pieces at increasing levels of sophistication, most of which reside within or are hosted by the HSE's ICT platform and are funded by the HSE.

As a solution to this challenge, the HSE has established an Integrated Services Framework (ISF) project for its ICT technologies and information architecture. The Framework will be standards based. It will shape the manner in which we acquire, test and deploy new ICT technologies and software applications and also ensure solutions are aligned with the HSE's strategic objectives.

Implemented correctly, the framework will ensure that the required levels of integration between systems are achievable, and provision for a national Electronic Health Record (EHR). Attaining this requires significant coordination and cooperation among both internal and external stakeholders.

True interoperability is a particularly difficult task if undertaken all at once. Since standards change over time it is recognised that interoperability should be treated as a direction as well as an objective end point. It is also recognised that interoperability should be tackled in distinct workable steps, starting from the most straightforward and moving toward the most intricate and multifaceted.

As a starting point, the Integrated Services Framework (ISF) has defined the programme into twelve key inter-related work-streams, most of which are categorised within the technical or information architecture domains. Each work-stream has a sponsor from the project board to ensure it is accorded the appropriate level of support and maintains full alignment with corporate strategic programmes. Each workstream will progress from a current state ('As-Is') specification to a project board approved ('To-Be') specification. In this manner, due consideration will be given to the integration of existing legacy technologies, and accordance to accepted global best practices and standards.

In addition, there will also be an interdependent association between the ISF Framework project and emerging National ICT solutions, as the clinical needs of National ICT Programmes requires a leap to semantic interoperability, and standardisation provides a means to facilitating patient safety, quality, and enhanced patient care. Without semantic interoperability, data can be exchanged but there is no assurance that it can be used, or understood correctly by the receiver.

A fundamental requirement for the ISF project is that the adopted approach will integrate existing legacy technologies and also where appropriate adopt recognised global best practices.

There are twelve workstreams whose outputs will shape the final Framework document. These cover technical and information architectures, strategic approach, presentation, and governance requirements for the framework.

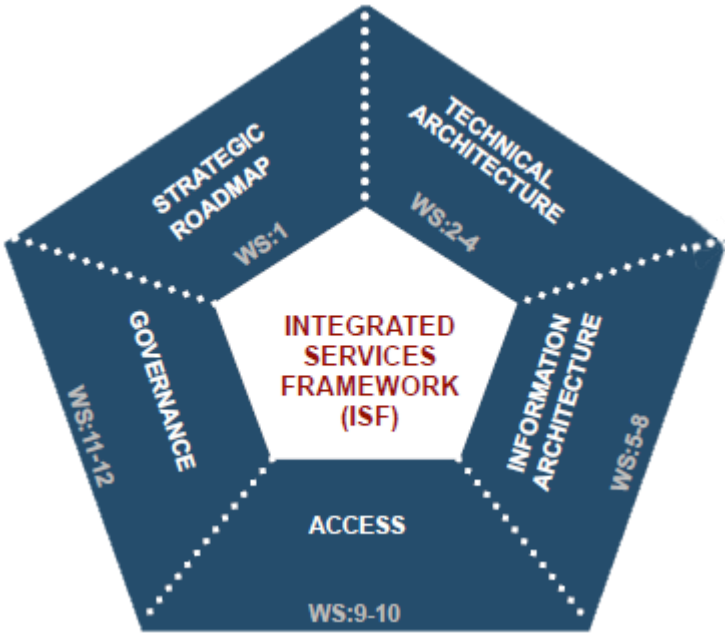


Figure 3. ISF Programme - Health Service Executive

The process for defining this architecture is described by the following workstreams, defined by the ISF:

WS2: Technical Infrastructure Work Stream (ICT Platforms, Technologies & Asset Base): An overview and developmental roadmap for the standards based referential technology framework. It will provide overarching guidance on the identification and selection of compatible technical platforms and focuses on higher level standardisation and integration parameters of the model.

WS3: Software Applications Reference Base (Applications Portfolio, Standards, & Toolsets): A referential portfolio of software applications and the associated standards for enabling integration of services. It will embrace both commercial and in-house software applications within its scope along with specification for maintenance standards.

The application and technical architecture provides two views:

The "AS-IS" provides a view of a set of representative systems, but doesn't provide a complete overview of the entire landscape at HSE. Although a limited scope, the "AS-IS" is a key input to the "TO-BE", since it allows key gaps or missing components in the current landscape to be identified.

The scope of the "TO-BE" is substantially wider, since it must cover the future architecture over the short, medium and long term. Also, it takes account of new trends in Health IT and some operational and governance aspects required to manage the ISF Programme. Governance structures will be covered by ISF work streams 11-12.

2.3 Development and Maintenance of this Architecture

As part of an Enterprise Architecture and based on the best practices like TOGAF, the maintenance and update of the architecture is a key factor to success.

In order to produce an effective and practical "TO-BE" architecture which accords with the reality of the enterprise, the architecture has to be developed in an iterative process.

A tested way to achieve this purpose is use the ADM (Architecture Development Method) methodology that is described in TOGAF.

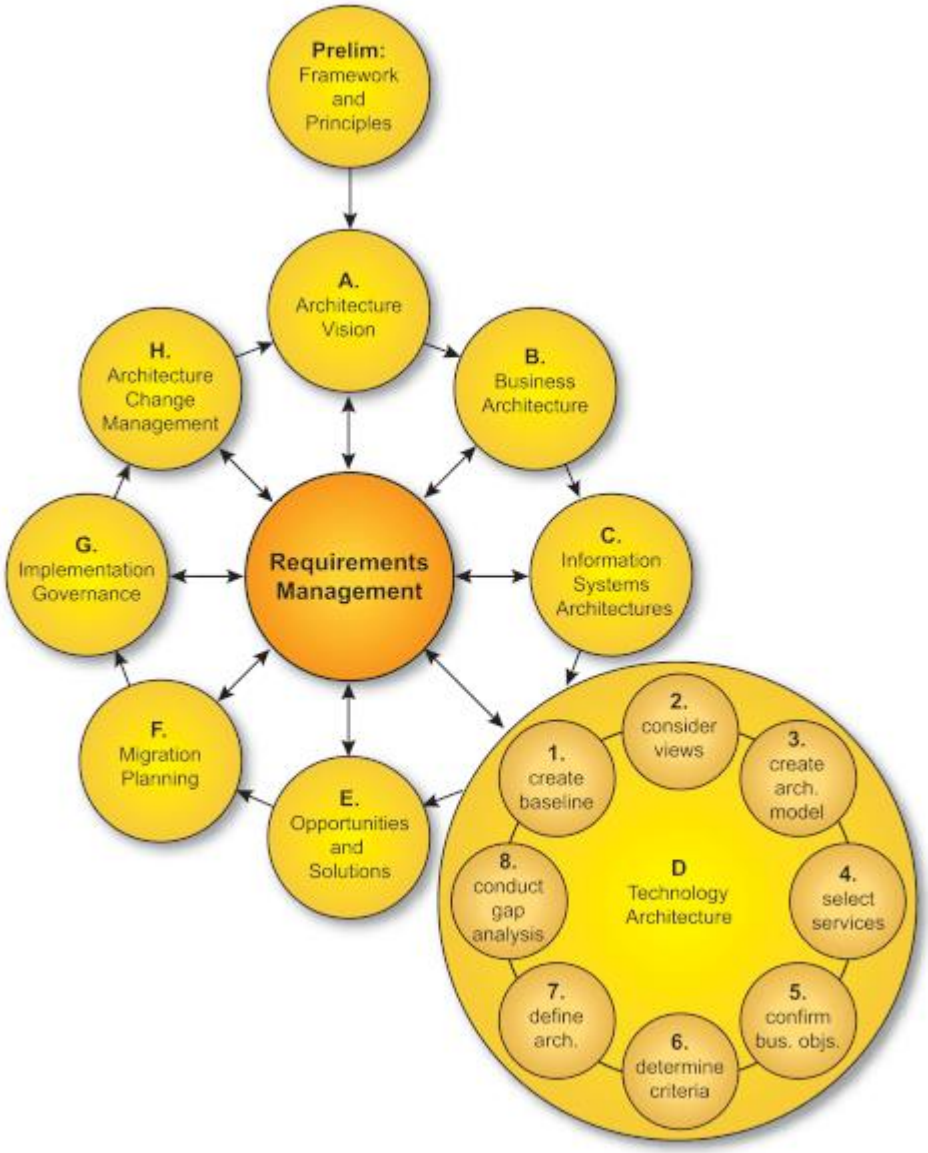


Figure 4. ADM Extended into Technology Architecture - ©The Open Group

The TOGAF ADM is the result of continuous contributions from a large number of architecture practitioners. It describes a method for developing and managing the lifecycle of enterprise architecture, and forms the core of TOGAF.

Throughout the ADM cycle, there needs to be frequent validation of results against the original expectations, both those for the whole ADM cycle, and those for the particular phase of the process.

- The ADM is iterative, over the whole process, between phases, and within phases. For each iteration of the ADM, a fresh decision must be taken as to:
    - The breadth of coverage of the enterprise to be defined
    - The level of detail to be defined
    - The extent of the time horizon aimed at, including the number and extent of any intermediate time horizons

- As a generic method, the ADM is intended to be used by enterprises in a wide variety of different geographies and applied in different vertical sectors/industry types. As such, it may be, but does not necessarily have to be, tailored to specific needs. One reason for wanting to adapt the ADM, which is important to stress, is that the order of the phases in the ADM is to some extent dependent on the maturity of the architecture discipline within the enterprise. In this architecture document, the business case for doing architecture is not addressed, and therefore creating an Architecture Vision is almost essential.

The methodology below describes the most useful development iterations. For the purpose of this document, the most useful is the Architecture Development Iteration.

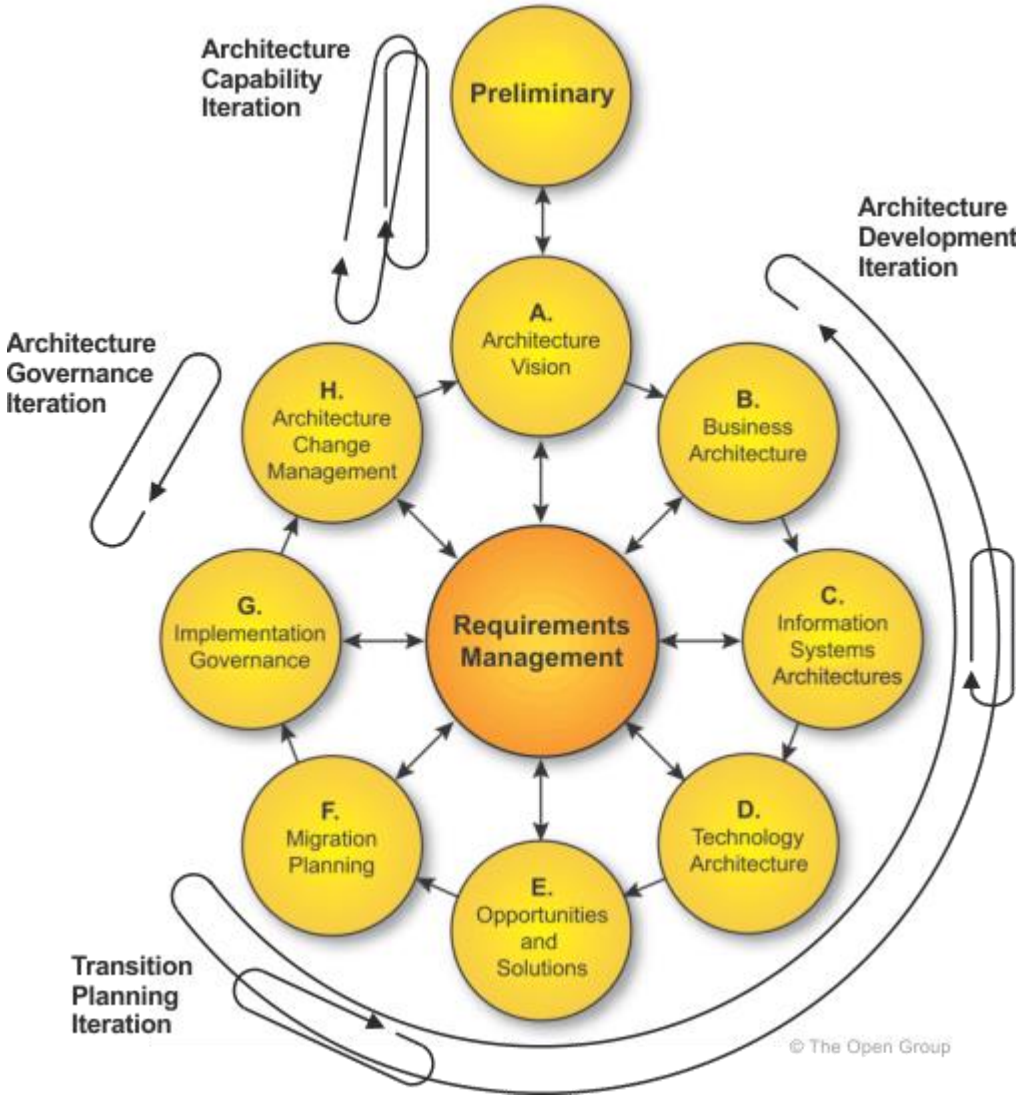


Figure 5. ADM Iterations – ©The Open Group

- **Architecture Capability** iterations support the creation and evolution of the required Architecture Capability. This includes the initial mobilization of the architecture activity for a given purpose or architecture engagement type by establishing or adjusting the architecture approach, principles, scope, vision, and governance.
- **Architecture Development** iterations allow the creation of architecture content by cycling through, or integrating, Business, Information Systems, and Technology Architecture phases. These iterations ensure that the architecture is considered as a whole. In this type of iteration stakeholder reviews are typically broader.

As the iterations converge on a target, extensions into the Opportunities and Solutions and Migration Planning phases ensure that the ease of implementation of the is considered as the architecture is finalized.

- **Transition Planning** iterations support the creation of formal change roadmaps for a defined architecture.
- **Architecture Governance** iterations support governance of change activity progressing towards a defined Target Architecture.

3 Architecture principles

This section describes the principles used to define the current architecture. There are a range of principles in different layers. There are HSE principles, general principles and layer specific principles for Technology, Application and Data.

A good set of principles will be founded in the beliefs and values of the organization and expressed in language that the business understands and uses. Principles should be few in number, future-oriented, and endorsed and championed by senior management. They provide a firm foundation for making architecture and planning decisions, framing policies, procedures, and standards, and supporting resolution of contradictory situations. A poor set of principles will quickly become disused, and the resultant architectures, policies, and standards will appear arbitrary or self-serving, and thus lack credibility. Essentially, principles drive behaviour.

There are five criteria that distinguish a good set of principles:

- **Understandable:** the underlying tenets can be quickly grasped and understood by individuals throughout the organization. The intention of the principle is clear and unambiguous, so that violations, whether intentional or not, are minimized.
- **Robust:** enable good quality decisions about architectures and plans to be made, and enforceable policies and standards to be created. Each principle should be sufficiently definitive and precise to support consistent decision-making in complex, potentially controversial situations.
- **Complete:** every potentially important principle governing the management of information and technology for the organization is defined. The principles cover every situation perceived.
- **Consistent:** strict adherence to one principle may require a loose interpretation of another principle. The set of principles must be expressed in a way that allows a balance of interpretations. Principles should not be contradictory to the point where adhering to one principle would violate the spirit of another. Every word in a principle statement should be carefully chosen to allow consistent yet flexible interpretation.
- **Stable:** principles should be enduring, yet able to accommodate changes. An amendment process should be established for adding, removing, or altering principles after they are ratified initially.

3.1 HSE principles

- **Users should have access to the full local record, and core national record at the point of care delivery.** Users of healthcare systems in Ireland should have the benefit of access to relevant clinical data at the point of care delivery. Users include Patients, Clinicians, Care Staff and any person or connected system that accesses HSE IT systems within the scope of this architecture. In future, this may include international Users who access HSE systems e.g. as part of the future National Contact Point.
  The HSE architecture aims to provide a consolidated core national record that contains key demographic and clinical details together with a summary of care and events across all care settings.
  Implementing this principle will require local systems to integrate with and publish data to core systems.

- **Solutions should enable full "circle of care": Prevent, Access, Entry, Assess, Treat, Evaluate, Transfer, Maintain.** The concept of the "circle of care" is that healthcare is an ongoing continuous process. Patients are initially in a stage of health & wellbeing maintenance (prevent). If an a health event occurs, the patient may access care services, enter into a care setting, receive assessment, treatment, transfers before returning to health & wellbeing maintenance. This cycle will repeat many times during the patient's lifetime.
  HSE solutions should support this complete cycle of care with appropriate Information Technology solutions. This requires integration between HSE "core systems", core applications, applications that are local to individual care settings (GP, Acute Hospital, Departmental, Community, Mental Health and others).
  Integration should enable process level integration, enabling a process (e.g. transfer of care) to be supported with IT across care settings.

- **There should be a single, consistent identifier for patient, practitioner and location.** The Individual Health Identifier (IHI) Bill provides for patient and practitioner identifiers. Identifiers are also required for locations. Identifiers are required as a fundamental enabler of patient care records, to improve data protection through accurate data linking, and improve management through more accurate reporting.
  The IHI must be applied to all systems that integrate with the HSE architecture, where a patient, practitioner or location is being described.

- **Access and entitlements should be common and consistently enforced across all systems.** User access should be based on a single identity. Entitlements to access functionality and data should be based on consistent rules that are applied across all systems. Entitlements should be based on role and relationship to the patient. This is required to enable efficient entitlement management and audit of access and access rights.

- **Solutions should enable federated, hybrid or centralised solutions to be implemented in a phased manner, using standardised interfaces.** The HSE has a mix of federated, centralised and hybrid (in-between) systems. This architecture will support all of these options now and in the future. To support future solutions, in particular solutions that integrate across systems, it will be necessary for current and future systems to implement standardised interfaces and integrate with the rest of the HSE estate. This will be implemented in a phased manner, and fallback mechanisms to enable manual workarounds in organisations and systems that have not achieved electronic integration will be required.

- **Core national components, described by standards, must be identified and built early on.** The national core components are the foundations for all other components which integrate with the core. A stable core is important, as changes to the core in future would have the potential to disturb many systems. The core will define the interfaces for all non-core systems to integrate with, and enable the integration of these other systems.
  To maximise the stability, take advantage of lessons learned in other countries, and reduce integration costs, standards should be used to define the core components, where practical.

- **Point of care systems and system processes integrate and use these core systems.** Local and central point of care applications will integrate with core systems to provide functionality and a connected view of information to end users. Additionally, system processes will integrate with and use the core systems to automate and connect processes across multiple care applications and care settings.
  It is preferred, but not required, that processes are implemented centrally, rather than being implicitly orchestrated by end user systems.

- **Solutions should facilitate an ecosystem** that enables healthcare delivery and health data access across the full health care delivery spectrum. This principle states that the architecture should promote an open ecosystem in which solutions from multiple vendors can operate to deliver healthcare services and data.

- **Standards area a foundational principle for enabling national health information exchange capability.** Adherence to standards is a foundational principle of the ISF Programme and the OCIO Design Authority, and critically important to enable health information exchange between systems and teams within the health service. The ability to accurately share information is essential for the implementation of the eHealth strategy

- **Standards are a foundational value of the HSE's principles of operation.**

3.2 Generally Accepted Applicable Principles

3.2.1 Global Principles

These principles are understood as widely accepted as they have been successfully used as architecture principles in similar situations. These principles are adopted as applicable to the HSE future architecture.

- **The architecture must be scalable:** The architecture provides a baseline to support future business volume growth requirements. The architecture must be able to scale both horizontally and vertically to meet system requirements that are defined based on business volumes. While a certain amount of scale is needed, solutions should not be "over-sized" to account for a lack of planning.

- **The architecture builds a strong foundation for the future:** The architecture establishes the building blocks on which future capabilities can be built. The architecture framework should provide capabilities that can accommodate existing solutions.

- **The architecture provides an approach that lets systems share common functionality for integration:** The architecture provides common integration and data management services across the group.

- **The architecture is based on common standards:** The solution will define consistent standards for integration that can be applied throughout various architectures, whereby definitions are understandable and available to all users. Standards will be defined for reusable software components, software delivery and managing information.

- **The architecture provides a secure environment:** Confidential data will be kept secure, both at rest and in motion, as it flows across the gateway.

3.2.2 Enterprise Architecture Principles

A different set of principles was selected from the TOGAF best practices that are relevant for the HSE and in line with the Design Authority directions.

- **Requirements-Based Change:** Only in response to business needs are changes to applications and technology made. This principle will foster an atmosphere where the information environment changes in response to the needs of the business, rather than having the business change in response to IT changes. Unintended effects on business due to IT changes will be minimized. A change in technology may provide an opportunity to improve the business process and, hence, change business needs.

- **Control Technical Diversity:** Technological diversity is controlled to minimize the non-trivial cost of maintaining expertise in and connectivity between multiple processing environments. There is a real, non-trivial cost of infrastructure required to support alternative technologies for processing environments. Limiting the number of supported components will simplify maintainability and reduce costs. Components may be COTS or Open Source and cost assessment must assess and include the cost of support requirements.

- **Interoperability:** Software and hardware should conform to defined standards that promote interoperability for data, applications, and technology. Standards help ensure consistency, thus improving the ability to manage systems and improve user satisfaction, and protect existing IT investments, thus maximizing return on investment and reducing costs. Standards for interoperability additionally help ensure support from multiple vendors for their products, and facilitate supply chain integration.

- **Data is an Asset:** Data is an asset that has value to the enterprise and is managed accordingly. Data is a valuable corporate resource; it has real, measurable value. In simple terms, the purpose of data is to aid decision-making. Accurate, timely data is critical to accurate, timely decisions. Corporate assets are carefully

managed, and data is no exception. Data is the foundation of our decision-making, so we must also carefully manage data to ensure that we know where it is, can rely upon its accuracy, and can obtain it when and where we need it.

- **Data is Shared:** Users have access to the data necessary to perform their duties; therefore, data is shared across enterprise functions and organizations. Timely access to accurate data is essential to improving the quality and efficiency of enterprise decision-making. It is less costly to maintain timely, accurate data in a single application, and then share it, than it is to maintain duplicative data in multiple applications. The enterprise holds a wealth of data, but it is stored in hundreds of incompatible stovepipe databases. The speed of data collection, creation, transfer, and assimilation is driven by the ability of the organization to efficiently share these islands of data across the organization. Shared data will result in improved decisions since we will rely on fewer (ultimately one virtual) sources of more accurate and timely managed data for all of our decision-making. Electronically shared data will result in increased efficiency when existing data entities can be used, without re-keying, to create new entities.

- **Data is Accessible:** Data is accessible for users to perform their functions. Wide access to data leads to efficiency and effectiveness in decision-making, and affords timely response to information requests and service delivery. Using information must be considered from an enterprise perspective to allow access by a wide variety of users. Staff time is saved and consistency of data is improved.

- **Data Security:** Data is protected from unauthorized use and disclosure. Open sharing of information and the release of information via relevant legislation must be balanced against the need to restrict the availability of private personal identifiable, classified, proprietary, and sensitive information. Existing laws and regulations require the safeguarding of national security and the privacy of data, while permitting free and open access. Pre-decisional (work-in-progress, not yet authorized for release) information must be protected to avoid unwarranted speculation, misinterpretation, and inappropriate use.

4 Architecture Description

This section describes the technology and application architecture (the Architecture) within the context of wider enterprise architecture concepts. In this context, the architecture allows for multiple configurations driven by the business and the operational model of the enterprise. This architecture will need to be updated and aligned in future with the clinical business processes which are yet to be defined.

The architecture defines the layout, integration and distribution of the key core components, as well as defining role of Design Authority, which is a key architectural entity.

The architecture requirements were collected during workshops with a wide group of stakeholders, as well as through the identification of business capabilities needed to support different care settings. Therefore, the architecture is defined by the business capabilities and the need to support these through the application and technology architecture level.

In this section the architecture is analysed and described from three viewpoints: Logical, Application and Technology. These viewpoints are intrinsically related to provide a uniform architecture that can be applied in the short, medium and long term.

Architectures that are created to address a set of issues within an enterprise require a frame of reference so that they can be considered as a group as well as separately. The dimensions that are used to define the scope boundary of a single architecture (e.g. level of detail, architecture domain, etc.) are typically the same dimensions that must be addressed when considering the integration of many architectures.

Industry thinking suggests that architecture integration needs to be begun at the lower end of the integration spectrum starting with the business domain. Consideration should be given to key factors, such as, the granularity and level of detail in each artefact, and the maturity of standards for the interchange of architectural descriptions.

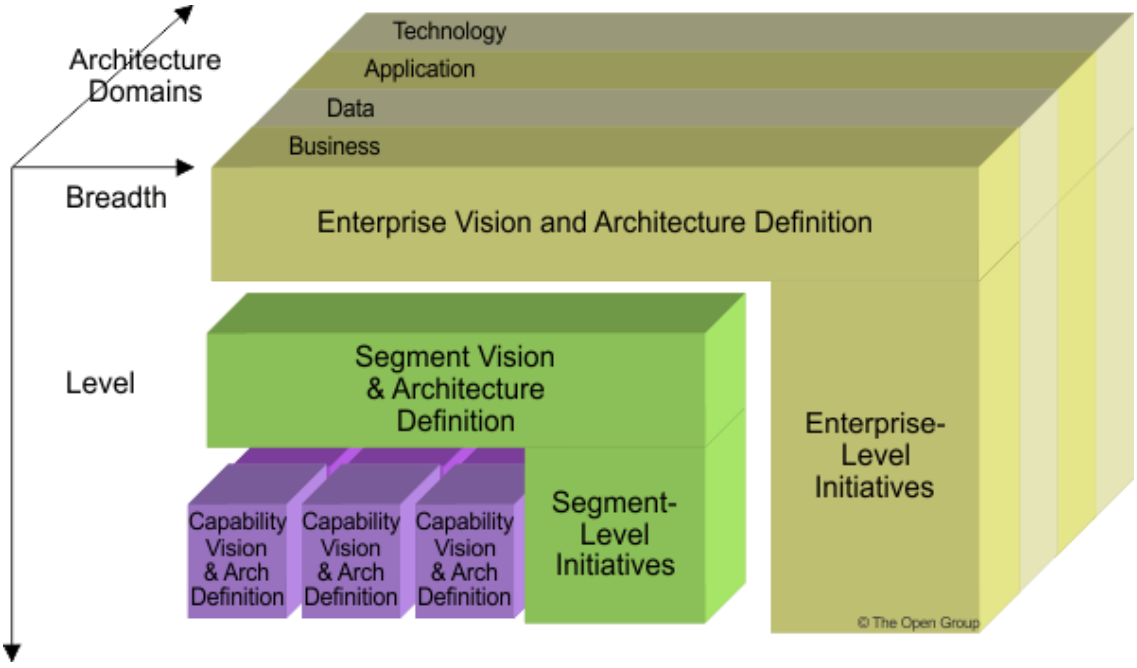


Figure 6: Integration of Architecture - ©The Open Group

If the HSE moves towards a common and integrated information infrastructure, universal data models and standard data structures, integration toward the high end of the spectrum (i.e. towards application and technology domains) will be facilitated. However, there will always be the need for effective standards governance to reduce the need for manual co-ordination and conflict resolution.

4.1 To Be Application Architecture Heat Map (consolidated)

The Application Architecture Heat Map provides a view of the all architecture capabilities required in the To Be architecture, as well as colour coding each capability to show the current state.

Three sources of information were used to produce the heatmap:

- **"As-Is" Assessment:** The "As-Is" provides the starting point for the To-Be Architecture. During the analysis of the "As-Is" architecture an agreed sample set of systems was analysed. Although these systems do not provide a complete view of the HSE landscape they provide a good reference point to define the To-Be Architecture. The separate As-Is Assessment document lists the systems surveyed (Section 3.1.1) and the results of the survey.
  Additional input was provided by relevant HSE Stakeholders with regards to the capabilities of departmental and point of care systems which were not included in the sample of systems for the assessment.

- **Business capabilities map:** The separate "ICT Operating Model Review" project defined desired business capabilities grouped by care setting. These were in a stable draft state when they were used as high level requirements to develop this architecture.

- **To-Be Workshops:** During the to-be workshops, principles, requirements and potential architectures were discussed and agreed with stakeholders in order to define the To-Be architecture.

The heatmap is divided into sixteen application architecture domains that were described in detail in the previous deliverable: "ISF Programme ICT Asset Base ITT - Workstream 2_1 - AS IS".

Application Domains	
Common Portal Infrastructure	Point of Care Applications
Outreach	Security and Access Control
Report Service	Service and Incident Management
Templates	Services and Service Co-Ordination
System Gateways	Analytics
Data Integration	Enterprise Resource Planning
xRM	Payer and Reimbursement
Unified Communications	Service Management

4.1.1 Application Architecture heatmap of HSE systems

The application architecture can be divided in two different viewpoints: Those systems under the control of HSE and those outside the control of HSE.

In this context, the application architecture must be shown in two separate diagrams:

- Application Architecture heatmap of GPIT systems
- Application Architecture heatmap of HSE systems

Both diagrams are detailed using the following four colours to identify the current capabilities for the future architecture:

1. Yellow: A Gap. An application module that is identified as required in the future state of the architecture without any system able to provide it at present.
2. Light Green: In this case, an application module will be required in the future and there is a system capable of offering the functionality with changes. The current system is considered as a good starting point to provide the functionality.
3. Dark Green: There is a current system that can offer the functionality required for that application module with minimal changes.
4. Grey: An application module in the reference model that is not identified as required to satisfy current business capability requirements.

4.1.1.1 Application Architecture heatmap of HSE systems

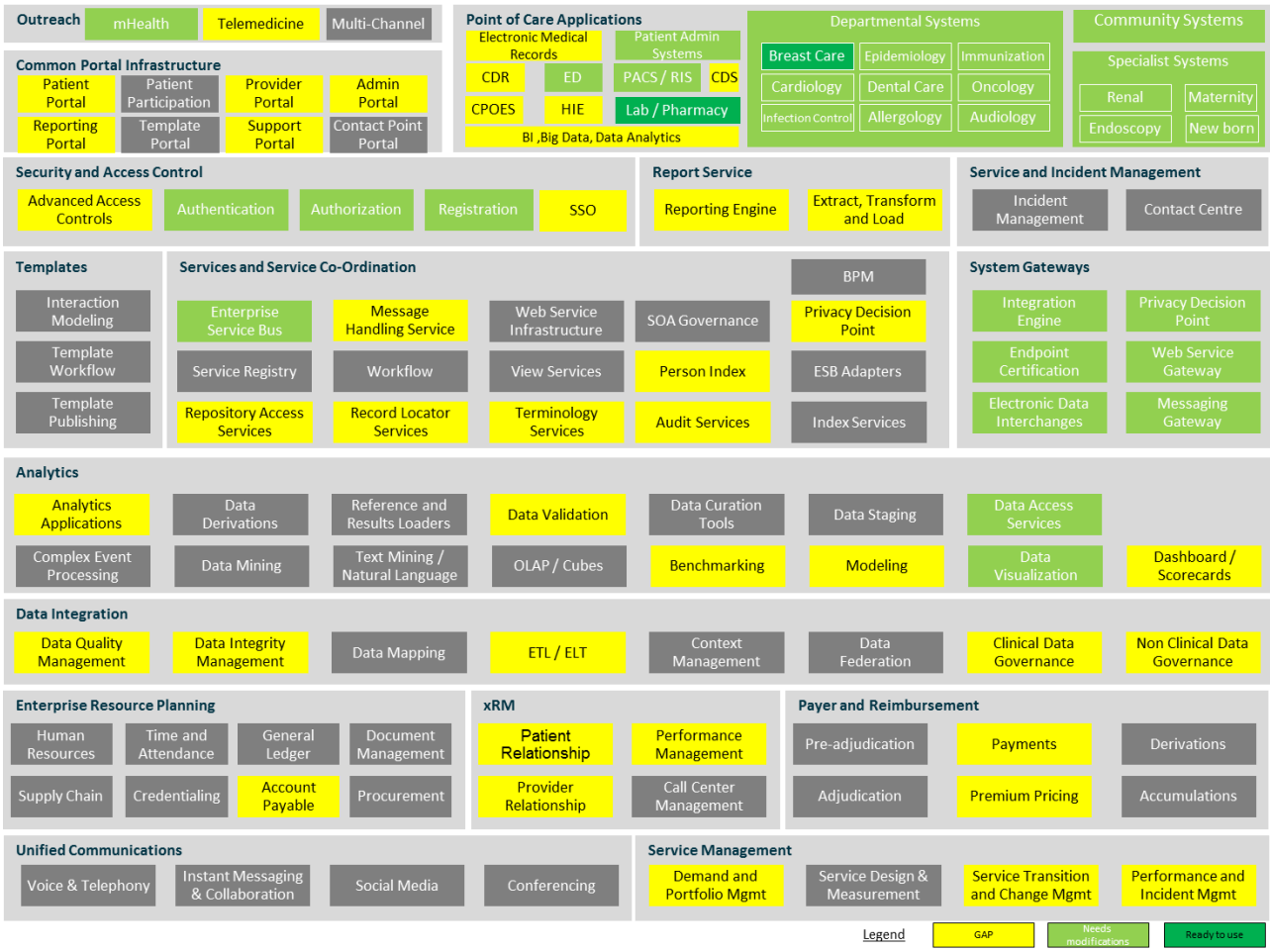


Figure 7. Application Architecture heatmap of HSE systems

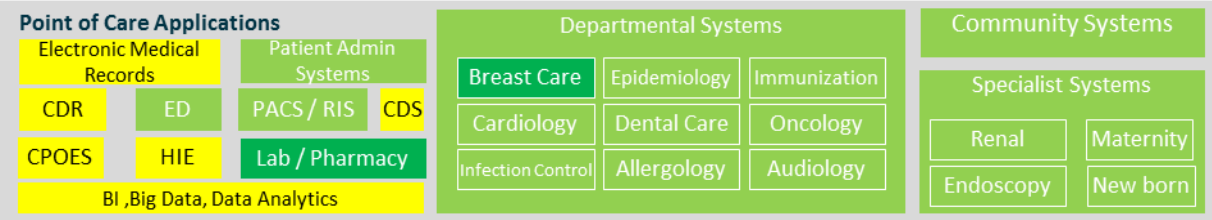
The application architecture services depicted in the diagram above are groupings of health specific functionality in each area. In practice, one system will implement one or more functionalities. The diagram depicts that there are many functionalities that either require modification to fit in with the architecture (e.g. use the IHI, SCR) or are gaps between what is present, and what is required to implement the eHealth strategy.

Few current systems are able to meet future requirements without modification. Primarily this is because most systems will require modification to use the new national health identifier, to integrate with summary care records, and to integrate with other clinical systems such as Electronic Transfer of Prescription.

However, much of the necessary functionality already exists in a state where it can be modified to support future requirements. Recent national systems such as NIMIS, PAS and many departmental systems can be modified to meet future requirements.

A more detailed analysis would be required on a system by system basis to definitively determine the path for each of the 1,700+ systems in HSE (which is outside the scope of this document). This will need to examine the cost of modification, the benefits of different levels of integration with the new architecture and the timelines involved. This examination should be performed where systems require access to services or functionality provided by the new architecture including the IHI, SCR and other core services.

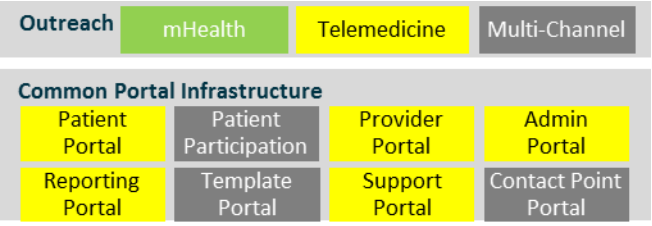
- **Point of care applications**



Point of care applications include the functionality directly used by clinicians and other users in a care setting. There is good existing coverage of functionality in this domain, however, changes are required to many applications, to integrate with new core services. For example, effective use of the IHI will require modifications to all systems to use this number, and will additionally require some systems (e.g. PAS, GPIT or others) to be modified to create or modify IHIs and associated demographic details.

New functionality is required (e.g. EMR, CPOEs, CDS) to improve the level of IT support for clinical care to international norms and/or to meet capability requirements identified by the operating model project.

- **Outreach and Common Portal Infrastructure**



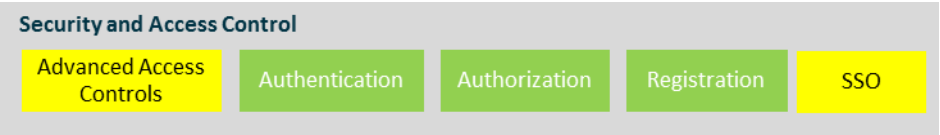
This domain requires new functions to support requirements for communication and engagement with patient groups. The mobile devices are one of the key objectives to improve the patient care and promoted health. There are some systems that touch slight the right approach.

Telemedicine will be a key outreach capability which can be enabled in the near future.

Patient, provider, support and admin portal are key modules which will increase outreach and sharing of health information, ultimately improving care outcomes. A portal is a tangible way to improve the user experience and will demonstrate how the architecture provides improvements above the As-Is state from a user perspective.

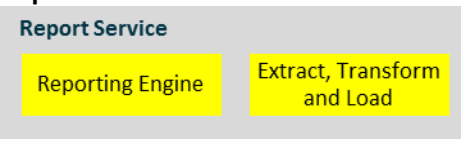
A reporting portal is necessary to ensure the utility and demand of these systems can be monitored and reported against in centralised and easily accessible manner.

- **Security and Access Control**



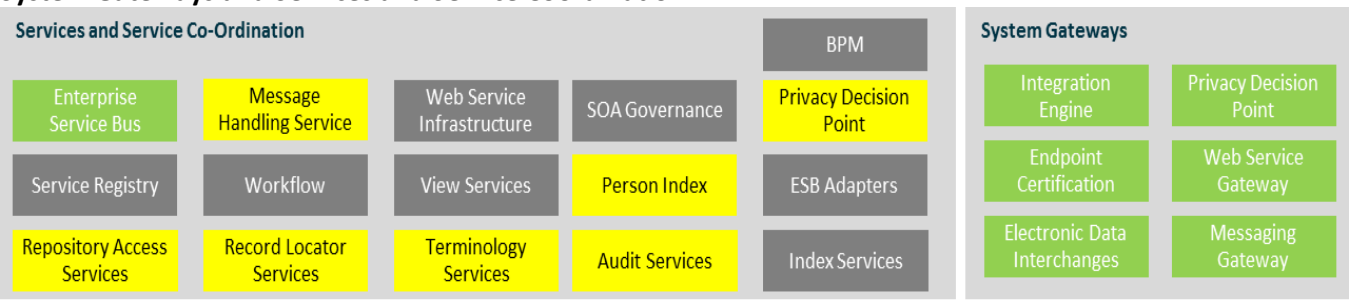
Security is a key domain as it affects all systems across the HSE. Currently there is a goal to achieve a common security platform, however, this will require effort to adapt it to the future state. To provide a common security approach other modules have to be included in the scope like the incorporation of Single Sign On (SSO) and Advanced Access Controls. All these modules will be set to enable some key functionality required (such as multiple logins) and improved productivity through simplified interaction between multiple systems.

- **Report Service**



The future state includes reporting capabilities which require a Reporting Engine and ETL (Extract Transform and Load). This provides a feed to the reporting engine with data in real-time. These modules are set to provide timely information by which to make decisions.

- **System Gateways and Services and Service Coordination**



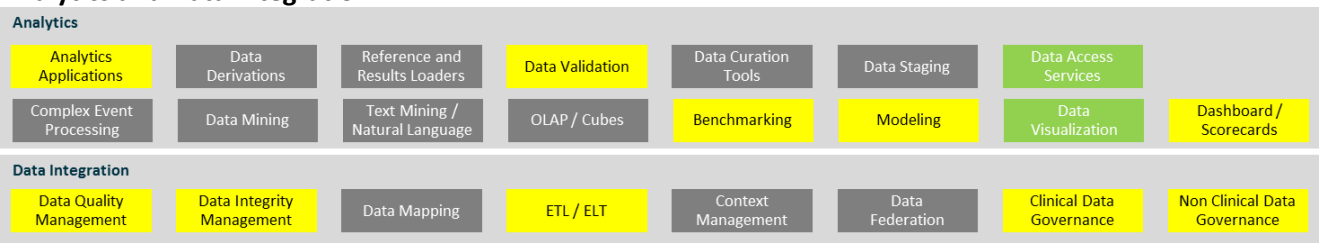
The above domains provide much of the functionality in the Integration Layer within the logical vision described previously. The modules identified as required are key to enabling the entire architecture vision.

Some current systems like Healthlink and PCRS provide part of the functionality required and should be reused since they are considered a stable starting point to achieve the future architecture.

Based on the future requirements a series of gaps have been identified and will need to be covered to provide a uniform and consistent functionality in the future.

"Service and Service Co-Ordination" domain supports an important part of the core services described in the architecture vision. The gaps in the "System Gateways" domain are a high priority as they are key to enabling the integration layer and in fact, provide the major components of the integration layer.

- **Analytics and Data Integration.**



Analytics and data integration are both aspects of the LOM as they enable the analysis and modelling of system capacity. The analytic application will cover key business capabilities which allow for the control and measurement of enterprise data (e.g. procedures).

There are some initial approaches that are being used to support data visualization and to manage the access to data services, however, future effort is required to adapt them to be useful in the future architecture.

Standardization and establishment of core data models will be required to fully enable these modules. The employment of standards guarantees an adequate integration of the data and a uniform way to access that information. The establishment of standards based data models provide a solid base for interoperability and allow for platform independence regardless of the data layer.

The employment of a reference data model such as HL7 RIM together with standards allows for a wide range of platforms to offer these application modules with complete interoperability.

As health data is intrinsically sensitive it is important that all the application modules related with the governance, data access, quality and integrity are given due consideration and perform properly. The rules governing this layer must be set up correctly from the outset in order to align with regulations and avoid data breaches.

- **Enterprise Resource Planning, xRM ,Payer and Reimbursement**

A key aspect of the health system is the relationship between patients and providers and therefore it is important to be able to measure the performance of this relationship.

In order to enable an UHI and reimbursement, there are two key application modules; Payments and Premium Pricing. Both are currently gaps which have to be covered in the future architecture.

- **Unified Communications, Service Management**

The service management domain includes the following application modules which are considered gaps:

1. Demand and Portfolio Mgmt
2. Service Transition and Change Mgmt
3. Performance and Incident Mgmt.

All these modules guarantee service continuity by managing demand across portfolio services, as well as enabling incidents to be managed in a timely and efficient manner while also measuring quality.

All these application modules enable and support the logical systems described in the next section and are aligned with the business capabilities.

4.1.1.1 Application Architecture heatmap of GPIT systems

General Practitioner IT systems (GPIT) are the IT systems used by GPs within Ireland. These systems are outside the control of the HSE, as they are not funded by the HSE. For this reason they are depicted separately.

GPIT systems contain a significant portion of a patients overall Personal Health Record (PHR), and the GP is the route by which patients access many other health services. These systems are already integrated with some HSE systems through Healthlink.

To identify the systems under the control of HSE, the following styles are used:

- No line: Under the control of HSE.
- Dotted line: Out of the control of HSE.

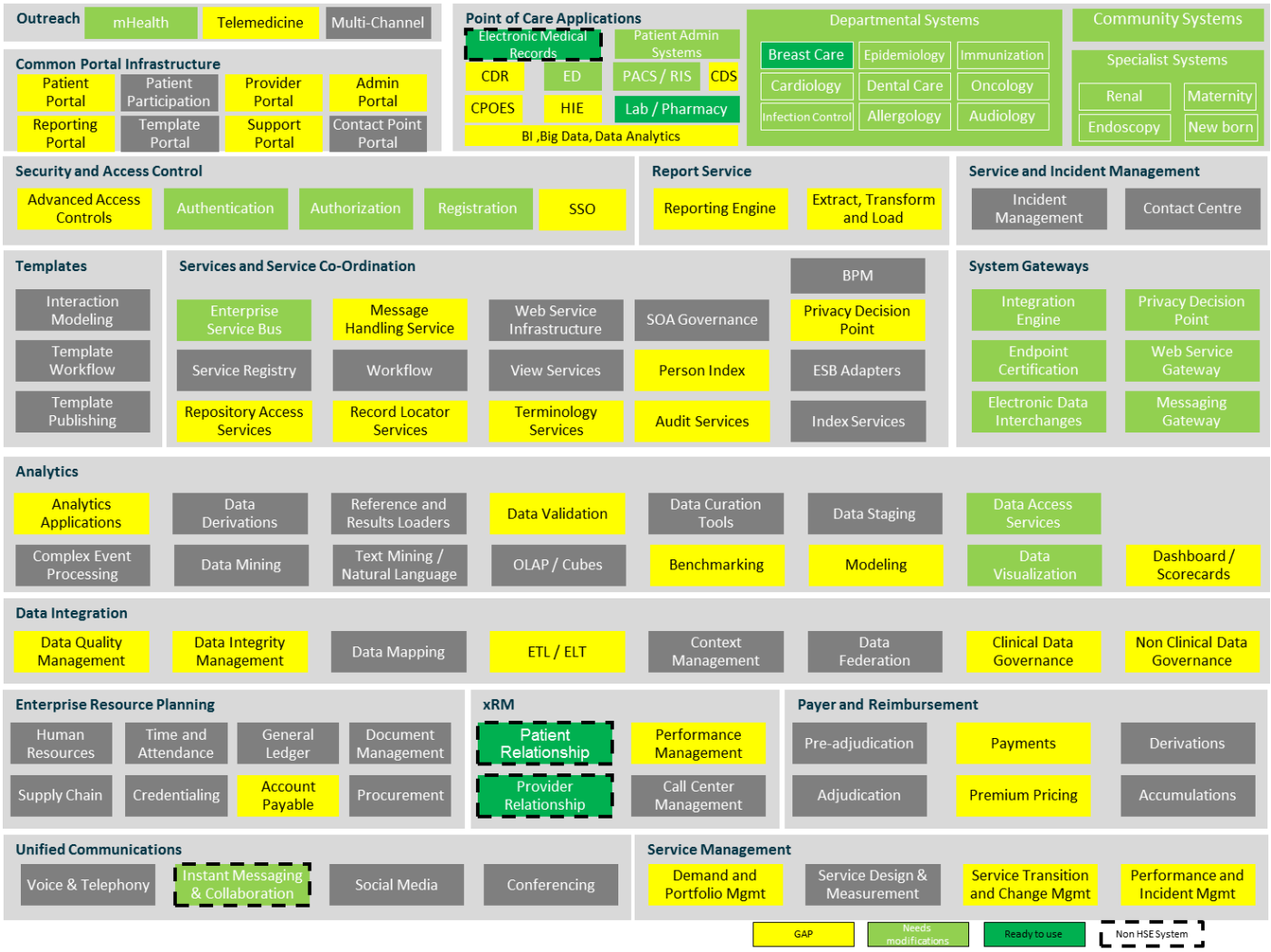


Figure 8. Application Architecture heatmap of GPIT systems

The heatmap which demonstrates the future architecture includes application modules that would be delivered by GP Systems and therefore are outsite the control of HSE.

In this context the following application modules are ready to use:

- Electronic Medical Record: The GP Systems offer EMR functionality relevant in a general practice context.
- Patient Relationship: This application module is covered in current GP systems.
- Provider Relationship: This application module is covered in current GP systems.

There are some application modules from the GP Systems that require more changes to be utilised in the future architecture. A particular focus is the Instant Messaging & Collaboration module. Currently GP Systems offer this capability, but the current implementation is not aligned with the future architecture and will need to be changed.

4.1.2 Technology Architecture Heatmap of HSE systems

Based on the application architecture defined to enable the business capabilities, the following technical architecture heatmap is required to support the application architecture. The purpose of the heatmap is this section is to provide a summary view of the technical capabilities provided by the architecture.

Figure 9. Technology Architecture Heatmap of HSE systems

This view shows the current technology components based on requirement and current capability, as documented in the as-is assessment. There are many components that can be reused, albeit with major changes. In this case the changes could be hard to implement cost effectively, because the capability is provided by different systems and will require a rationalisation process prior to adapting the component itself.

Existing databases and platform infrastructure (network, servers, operating systems and databases) provide a sound infrastructure platform, that can be built on with limited modifications required.

Currently there are multiple technologies in use, that have been introduced by systems to meet their needs, without reference to a common standard. For example NIMIS, MedLIS, HealthLink and PAS are each on different technologies. The Design Authority should rationalise this over time, but this variety is accepted for the short and medium term. To ensure a proper integration and guarantee a seamless process the use of technical standards is a key factor for all integration points.

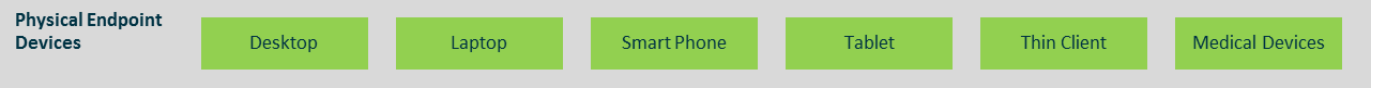
The technical architecture does not force any specific distribution (central V local). However the centralization of technical components provides more benefits in the majority of the cases. In the same way, the homogenization of

technical components across the systems is a more beneficial approach. Although standardization should reduce costs and improve service levels, the Design Authority should enable deviations from standards where justified. For example, piloting innovative new services should be supported, but ultimately new technologies must have a planned route on the HSE technology roadmap.

Below, the technical components are described in detail.

As a general comment on the technology architecture below, there is less certainty about the future technology requirements, as all the technical details of the future applications are not clear at this stage. **Therefore, this architecture should be expected to evolve significantly in future iterations, although it is not expected this will drive any structural change in the application architecture and overall logical architecture.**

- **Physical Endpoint Devices**



This domain covers the standards physical endpoints such as desktop or laptop. Other physical endpoints focused on mobile health are currently in use, and as expected medical devices.

Although the HSE has a coverage across all endpoints, there is variety and diversity in many areas, and a lack of standardisation. For example, although tablet devices and smart phones are in use, there are many platforms and a lack of management tools necessary for the thorough management of this estate.

- **Desktop**

The Desktop represents the logical interface which users interact with, and use to access services.

Desktops require modification to update to recent versions of operating systems and other tools. Further changes may be required to support the application architecture and/or applications in the future. This point will require update and iteration in the future, as the architecture is designed in detail.

- **Identity and Access Management**

This domain is focused in security and therefore is critical for the future architecture. PCRS and Healthlink already implement technologies such as Public Key Infrastructure (PKI) and Identity Directories.

The security requirements imposed by the application architecture require Access Tokens to control the access between systems as well as to standardize the way cross-border systems interact with the national systems.

Although changes are required, extensive reuse of existing registered identities should be possible. E.g. most GPs and Pharmacies already have identities registered in HSE systems, and reusing these without a re-registration should be possible.

- **Mobile Computing**

Mobile computing is growing rapidly as an access channel. The architecture needs to support mobile as an access channel and a governed platform.
A key component on mobile computing is the way the software is deployed and distributed. In HSE there is currently a gap in this component and it is required to support properly mobile computing in the enterprise.

The other critical component is security, since mobile devices can be accessed in any place. The confidentiality of communications is key and it is more important when the information exchanges are health data.

These components must be revised and adapted as well as covering the gap identified to support properly the business capabilities in mobile health.

There are systems currently in build that will publish applications for mobile devices (Windows 8.1). It is understood that this platform is governed by existing HSE desktop governance, and not subject to the issues above. However, when HSE wish to support other platforms, the capabilities above are required.

- **Gateways Infrastructure**

The architecture vision defines an Integration layer that has to be supported technically by these technical elements. These technical elements currently exist in the landscape but are implemented multiple times with a variety of technologies.

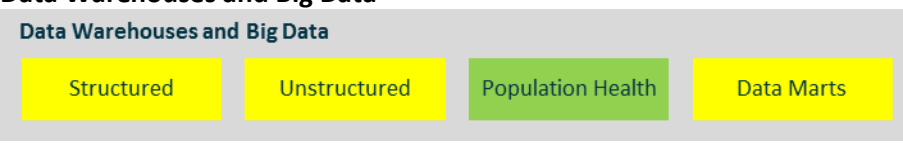
These technical elements will be required to meet the integration requirements. Therefore these components are critical and have to be prioritized to support the future architecture.

- **Network**

These technical components are widely used across all the systems.

Although there is a central management for networking, many systems have their own networks outside the control of HSE and there are various nets that have to be unified into a common network to ensure consistent connectivity and security.

- **Data Warehouses and Big Data**



The current HSE data warehouse provides some reporting functions. Based on the demand for future reports, the need to support standards, terminologies and a Logical Record Architecture and enable analytics and reporting, there is a requirement for additional technical capabilities in this space.

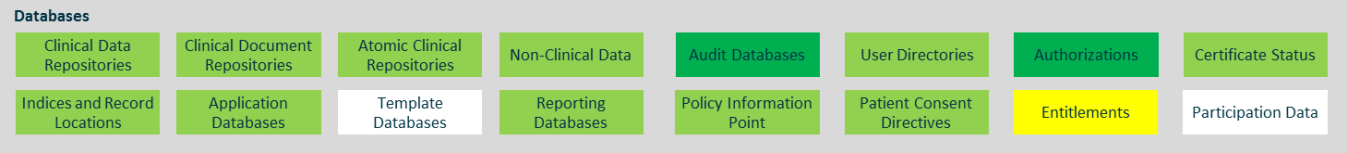
- **Information Security**

Many of these technology capabilities exist to some extent today, but will require changes to support future requirements.

The Design Authority will need to define standards and procedures for the secure technical processing of information.

Standard approaches, supported by technology where necessary, should be defined, implemented and enforced.

- **Databases**



In this technology domain, there are a number of elements such as the audit of databases and authorizations that can be reused with minor changes.

In general this domain has a good initial shape to support the requirements but changes are required.

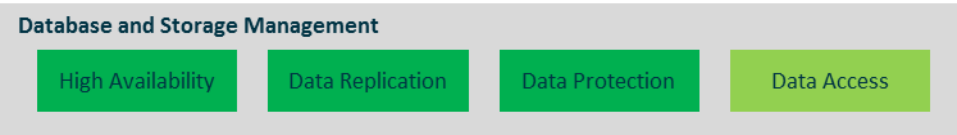
There are key components like a database for certificates and authorizations that are closely related with the some key core services such as “Authorization and Authentication”.

- **Storage**

The HSE SAN infrastructure will likely require changes to support new services.

Use of Public or Private Cloud is under consideration for future use, but at present there is no requirement for this technology.

- **Databases and Storage Management**



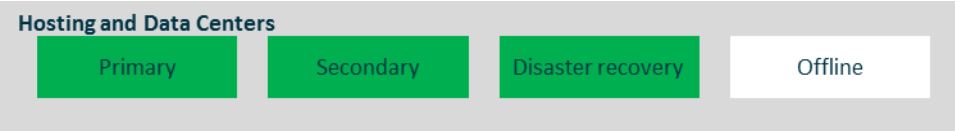
In this domain, HSE provides a good baseline for the future. These technology components are provided by HSE as a central services and are well managed.
Some modification or additions will be required to support the data access / data service requirements.

This domain affects horizontally the entire HSE landscape and plays a key role in the enablement of the business requirements.

- **Servers**

From a server point of view, HSE infrastructure currently provides virtual servers. These are working well and only require minor changes. Additional servers will be required to support the application architecture.

- **Hosting and Data Centers**



This domain is well implemented and requires few changes to adapt them to other technical elements that use them. The protection of the health data in this low level is a key factor of success to enable many others technical and application components.

4.2 Logical Architecture View

This section describes a logical distribution of the architecture proposed in detail. The purpose of this diagram is show the different roles involved in the architecture and the logical relation between them.
The diagram shows the minimum or required services defined to provide a consistent and strong architecture align with the eHealth Strategy for Ireland.

The diagram itself is not an exhaustive list of all the services or applications possible. It reflects the minimum elements across the different care settings. In this way, the logical distribution implies for some services a specific approach (federated, centralized, etc...) but the architecture is generic enough to allow multiple configurations on it.
With this premises the logical distribution of the architecture proposed is described as follow:

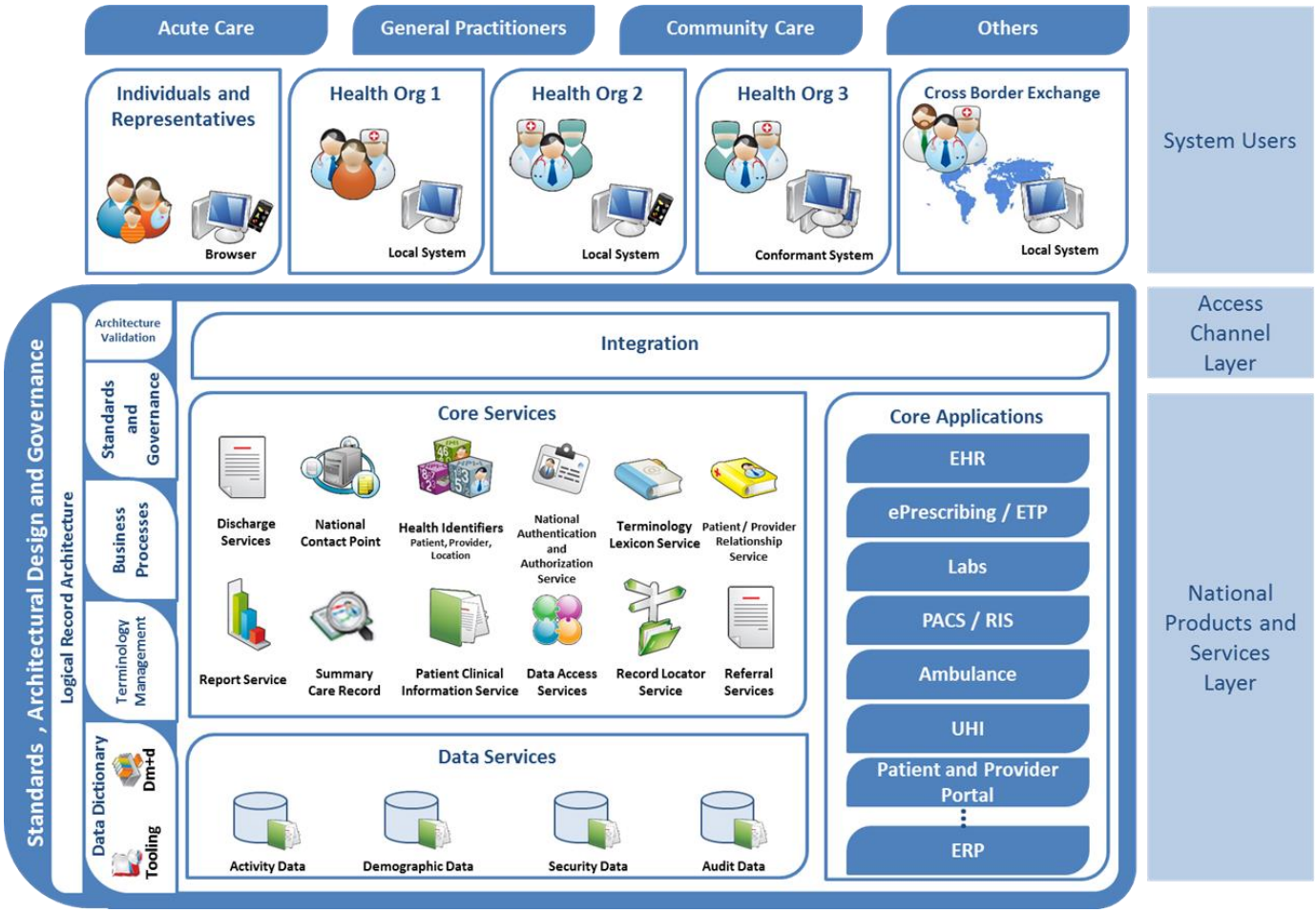


Figure 10. Architecture Logical View

The Logical Architecture has been based on examination of a number of different potential architectures that could meet HSE requirements. This architecture option has been selected based on the following factors:

- Ability to meet the requirements for business capabilities
- The architecture supports local systems and central systems
- The architecture enables integration of current and future applications around common services and identifiers
- The architecture is compliant with and supportive of the HSE Architecture Principles
- The architecture supports a gradual move towards connected systems. A big bang implementation is not required, and a phased build out, aligned to budgets and requirements is fully supported.

The architecture has been reviewed against other national architectures for health, and it contains features similar to those in other national systems.

The diagram is divided in three high levels:

- System Users: It depicts the systems that will use the core national set of products and services through the "Access Channel". This requires all the systems have to complete the certification under the integration framework defined. This enable to be able to employ and consume the services exposed in the national core.

- Access Channel Layer: This layer covers the application modules and technical components to allow the access to the core components under the architectural principles established.

- National Products and Services Layer: Contains the national core services, application and data services to provide the functionality required to enable the interoperability with other systems.

4.3 System Users

System users comprise all users of HSE systems. Users may be humans or IT systems. Users may be internal or external to HSE.

Examples of users include the following:

- Patients
- Patient IT Systems, integrated with HSE core systems (e.g. a patient's medical device)
- General Practitioners
- General Practitioner IT Systems, integrated with HSE core systems
- Community Care workers
- Nursing staff in public, voluntary and private hospitals
- Hospital Consultants, acting in a public or private work capacity
- IT Systems, local to public, voluntary and private hospitals, integrated with HSE core systems
- Cross border systems

Users will require to be registered and authenticated to appropriate standards before any access to systems is granted.

Appropriate legal and contractual agreements will be a pre-requisite.

In the case of non-human Users (i.e. interfaced IT systems), part of the legal and contractual pre-requisites for integration with the core will require conformance to defined HSE standards. These standards are expected to include a complete technical definition of the interface (e.g. an IHE profile) and additionally management standards (e.g. Information Governance, Security).

In the case of Patient medical devices, additional technical certification for the clinical functions performed would likely be required.

4.4 Access Channel Layer

The purpose of the Access Channel Layer is to provide a single logical layer for integration between core HSE systems and other systems.

The Integration layer is a single logical solution. Technically, it may be implemented by a number of different technical components.

In the as-is state, both Healthlink and PCRS integrate with the GP systems and/or pharmacy systems. For historical reasons, but have implemented separate registration, certification, authentication and authorisation processes and technologies.

In future, and based on a pragmatic phased implementation, the integration layer should have a single implementation of each function. For example, it should be possible as part of future upgrades and maintenance to systems to rationalise the security functions to a single common solution used across existing and future systems, integrated with, and based on IHI identities.

From an application architecture point of view, this layer must offer the following modules as part of its main functionality:

- PEP - Policy Enforcement Point: Point which intercepts user's access request to a resource, makes a decision request to the PDP to obtain the access decision (i.e. access to the resource is approved or rejected), and acts on the received decision
- PDP - Policy Decision Point:: Point which evaluates access requests against authorization policies before issuing access decisions
- Endpoint Certification: Entity to allow third parties registration to obtain electronic certificates that allow uses this layer.
- Electronic Data Exchange: method that provides standards for exchanging data via any electronic means, usually EDI (X12, EDIFACT).
- Web Service Gateway: This component work as a gateway to support the interaction based on the web services standards.
- Messaging Gateway: This other gateway is designed to deal with the HL7 messages specification through different technologies.

From a technology architecture point of view those application modules have to cover the following technical components:

- Enterprise Service Bus: Middleware that provides fundamental services for interaction and integration with between architectures.
- HIE Gateway: This gateway specifically focus on health sector for the exchange of information.
- Direct Messaging: It allows send and receive messaging directly between systems.
- Public Key Infrastructure: This element establishes an infrastructure based on the security of public electronic certificates that works as keys to talk with other systems.
- Access Tokens: Enable the access to the systems based on electronic tokens. These tokens are an opaque string that identifies a user, app, or page and can be used by the app to make API calls.
- Secured Endpoint: Establishes a point of access for external systems in a secured manner.
- Secured Messaging: Establishes an endpoint to send/receive messages in a secured manner.

4.5 National Products and Services Layer

4.5.1 Standards and Architectural Design and Governance

A Design Authority is required to govern the standards and architecture used across HSE Systems.

Standards Design & Governance.

Effective communication requires that information issuers and recipients share a common "reference framework" that allows for interaction. Standards provide this common framework, promoting uniformity in the definition and identification of health system components, whether they are objects, diagnosis, people, or interventions.

As defined in the "Standards Catalogue", the standards maintenance procedure involves the Design Authority administrating and operating the governance of standards, with input from subject matter experts on the content of each specific standard. For example, in defining the standards for integration of an Electronic Transfer of Prescription, experts would likely include security experts and pharmacy experts.

Architecture Design & Governance

TOGAF defines Architecture Governance as the practice and orientation by which enterprise architectures and other architectures are managed and controlled at an enterprise-wide level.

The Architecture Design function will be responsible for the design of technology to meet business capability and process requirements. The Architecture Design function will also advise, and work with the business as a partner, to shape the design of functions and capabilities.

In practical terms, this means that the Architecture Design function within the Design Authority will

- **Design and maintain the enterprise architecture of HSE**. A key part of this is to define the layers, systems and services to create a re-usable, component based IT landscape that meets the business requirements. This will involve creation of implementable technical specifications for core services in the HSE, and securing agreement from stakeholders for these specifications. The design will require iteration and refinement as the landscape evolves.
- **Provide architecture support to projects, and sign off on designs**. Projects will be supported from the Design Authority with architecture support, to ensure that the core services are used correctly, and that if new core services are required that these are identified early, correctly designed and implemented in time to support projects. A key function is to review and sign-off on project designs at key milestones (e.g. requirements, end of design, end of build). However, the review for sign-off should not be the first interaction between project and Design Authority – advice and input should be sought at an early stage to avoid delays.
  Refusal to sign off on a design by the Design Authority may be escalated to the Governance Board, but a project may not proceed without an architectural signoff.

4.5.2 Architecture Core Services

The architecture core services describes the services has been identified to be centralized in a national core level. The services identified are carefully selected to provide the maximum performance with the minimum impact, nevertheless to provide some of these services other systems have to be modified.

All the services must be aligned with the standards defined for their purpose in order to facilitate the interoperability. This will establish the basics and will be a key gear to adapt the architecture during the iterative process of refinement.

The services that are defined are logical services. Services perform functions within an overall Service Oriented Architecture (SOA). Services may be physically implemented using existing systems or through new systems, either COTS or Open Source. Services, and the HSE SOA, will be governed by the HSE Design Authority.

4.5.2.1 Discharge Service

The discharge service provides covers the functionality associated with the management of discharge documents through HSE landscape. The enablement of this service provides a set of benefits that impact in the quality of care of the patient and savings in the public services.

Application Architecture	Technology Architecture	Information Architecture
Standards	**Standards**	**Standards**

4.5.2.2 National Contact Point

This service allows the interaction with other platforms outside HSE. This NCP will be based on standards to allow a seamless exchange of information related with an Irish patient in another Health System (e.g. NHS). The NCP also enables visitors to Ireland to have their records retrieve from their home country.

By enabling the transfer of information between national organisations, the NCP improves the healthcare both are able to provide. It is an enabler for cross border care services.

Application Architecture	Technology Architecture	Information Architecture
Standards	**Standards**	**Standards**
• IHE-XDS Cross Enterprise Document Sharing		

• IHE-PIX Patient Identifier Cross Referencing • IHE-PDQ Patient Demographics Query Sharing • IHE-XD-LAB Sharing Laboratory Reports • IHE-XDM Cross Enterprise Document Media Interchange		

4.5.2.3 Health Identifiers: Patient, Provider, Location

This service uniquely identifies patients, providers and locations within Health in Ireland, together with demographic data for each. It includes the application functionality to create and maintain the identifiers and associated data.

Healthcare identifiers are the building block for eHealth. They are unique numbers that help the healthcare provider make sure the personal health information is linked with the right person.

There are 3 types of Healthcare Identifiers:

- *Individual Healthcare Identifier (IHI)*: Allocated to all Irish individuals and others who seek healthcare in Ireland.
- *Healthcare Provider Identifier:* Allocated to healthcare providers involved in providing patient care
- *Healthcare Location Identifier:* A location identifier uniquely identifies a location within Irish Healthcare.

Each Local Health Organization is expected to maintain an Enterprise Master Patient Index (EMPI). Each EMPI is expected to support a common set of patient identifiers (i.e. first name, last name, date of birth, etc.). When a provider queries for a patient's medical history (via a Clinical Care Application), the provider is expected to enter those common identifiers. This query is initially handled by the EMPI of which the Local Health Organization , in turn, the Local EMPI routes this request to the IHI located in the National Core Services layer.

Application Architecture	Technology Architecture	Information Architecture
• Person Index		
Standards	**Standards**	**Standards**
• IHE-PIX Patient Identifier Cross Referencing. • IHE-PDQ Patient Demographics Query		• GS1 Healthcare • ISO/TS 27527 Health informatics -- Provider identification • ISO/TS 22220 Health informatics -- Identification

		of subjects of health care • OID

4.5.2.4 National Authentication and Authorization Service

This service provides functions to enable

- Authentication of an identity based on credentials
- Authorization of the identity to perform specific functions
- Public Key Infrastructure (Certificate Authority, Registration Authority, Certificate Revocation List) components
- Directory service to provide standards based directory functions to necessary applications
- Trust / Single Sign On service to enable propagation of trust between systems e.g. using SAML or CCOW

Although it contains other components, the most prominent component of this service is the Certificate Authority (CA). A CA issues certificates to trusted users and applications and, in turn, allows for validation that the user or application is trusted when they attempt to access the Services layer. Other aspects of this service include a Certificate Revocation List (CRL) and an Online Certificate Status Protocol (OCSP) Responder.

Application Architecture	Technology Architecture	Information Architecture
• Security And Access Control	• Identity and Access Management • Certificate status • Policy Information Point	
Standards	**Standards**	**Standards**
• SAML v2 - Security Assertion Markup Language • ISO 17090-3:2008 • OASIS-XSPA		

4.5.2.5 Terminology Lexicon Service

Service to perform translation between terminologies. This service will assist with the integration between systems compliant with conflicting standards. The service will enable translation from one terminology to another in a consistent, repeatable manner.

As an example, this could perform translation between LOINC and SNOMED applications requiring this function.

Application Architecture	Technology Architecture	Information Architecture
• Data Integration	N/A	• Syntactic • Semantic • Protocol Customisations

Standards	Standards	Standards
• PCD-RTM – Rosetta Terminology Mapping		• Dm+d • SNOMED CT • ICPC-2 • ICD-10 • ICD-10-AM • OPCS-4 • MEDDEV • RxNorm

4.5.2.6 Patient / Provider Relationship Service

This service is related to the identifiers and authentication / authorization service. This service is consulted as part of access to patient records. It records read and write access to patient records, and enables audit for inappropriate access.

Application Architecture	Technology Architecture	Information Architecture
• Security and Access Control (Advanced Access Control)	• Audit Databases • Consents • Entitlements • Policy Information Point	• Identity and Access Management (Relationships)
Standards	**Standards**	**Standards**

4.5.2.7 Report Service

The report service provides reporting across all central data sources. It provides functionality to query across data sources, present the data in user friendly reports, enable drilldown through reports and downloading of results.

The architecture will provide the technology solution to enable reporting on data

- That has been consolidated into the HSE data warehouse
- That has been made available via the Data Services core service

Application Architecture	Technology Architecture	Information Architecture
• Reports (Report Engine, ETL)	• Data Warehouse & Big Data	
Standards	**Standards**	**Standards**

4.5.2.8 Summary Care Record

The Summary Care Record (SCR) will be updated by compliant local systems after defined events. The level of detail and completeness in the SCR and should be progressively extended in successive iterations of the architecture.

The value of the SCR to health practitioners will increase based on the completeness of the information. Experience from other counties has shown that integrating data from GP systems in particular is of high value to the patient, as it enables other practitioners to have a more complete view.

Application Architecture	Technology Architecture	Information Architecture
• Data Quality Management • Data Integrity Management	• Databases (Clinical Data Repository)	• A subset of clinical data
Standards	**Standards**	**Standards**
		• ASTM CCD • HL7 Version 3 Clinical Document Architecture or CDA v2 • CEN/ISO EN 13606 • OpenEHR Clinical Models • FHIR

4.5.2.9 Patient Clinical Information Service

This service offers access to the set of information related with the patient. Orchestrate and manage push information and retrieve information from the core repository for a patient.

Application Architecture	Technology Architecture	Information Architecture
Standards	**Standards**	**Standards**

4.5.2.10 Data Access Services

Data access services will provide a single central point to enable retrieval of data. This may retrieve data from the Summary Care Record, or from local systems integrated with the core.

The Data Access services are a logical service. The technical implementation should present a minimal number of technologies and protocols to users of data, while supporting access to all data sources in to HSE.

Application Architecture	Technology Architecture	Information Architecture
• Data Integration		
Standards	**Standards**	**Standards**

4.5.2.11 Record Locator Service

Record Locator Service (RLS) is updated by compliant systems when specific records, defined by the Design Authority, are created. The RLS enables users and systems to identify that records exist, and from where to retrieve them.

Examples of records include images, test results, scanned documentation, correspondence and other unstructured or semi-structured information.

The RLS is the core service that receives and stores information in the Document Registry. This service allows providers to determine the existence and location of patient documents that are located within other Health organization. The RLS does not contain clinical data. Rather, it receives information (i.e. patient identifier and record location, but not actual clinical data) about new patient records created at Local HIEs and stores this information in the Document Registry. A new entry is created in the Document Registry each time a new entry is created in a Local Document Registry.

Application Architecture	Technology Architecture	Information Architecture
• Services and Service Coordination (Record Locator Service)		• Indexes and Registries (Record Locator Service)
Standards	**Standards**	**Standards**
• IHE-XDS - Cross Enterprise Document Sharing		

4.5.2.12 Referral Services

The referral services enable the full cycle of operation of an electronic referral. The service orchestrates and manages the query, scheduling and attachment of referral documents. This service under the premises of best practices in this area, trends to centralize its subservices, but other approaches are possible as well.

Application Architecture	Technology Architecture	Information Architecture
• Services and Service Coordination • Time and Attendance		

• Pricing		
Standards	**Standards**	**Standards**

4.5.3 Architecture Core Applications

This section describes the major systems in the core as a national application. The list is not exhaustive and there are more applications. This section only enumerates those applications that at least should be there.

4.5.3.1 EHR

The Electronic Health Record (EHR) is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. Included in this information are patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports. The EHR automates and streamlines the clinician's workflow. The EHR has the ability to generate a complete record of a clinical patient encounter - as well as supporting other care-related activities directly or indirectly via interface - including evidence-based decision support, quality management, and outcomes reporting.

An EMR contains the standard medical and clinical data gathered in one provider's office. Electronic health records (EHRs) go beyond the data collected in the provider's office and include a more comprehensive patient history.

For example, EHRs are designed to contain and share information from all providers involved in a patient's care. EHR data can be created, managed, and consulted by authorized providers and staff from across more than one health care organization.

Application Architecture	Technology Architecture	Information Architecture
Current System/s		
Standards	HL7 EHR System Functional Model	

4.5.3.2 Electronic Transfer of Prescription

National solution for Electronic Transfer of Prescription (ETP). ETP is a substantial portion of end to end ePrescribing, and enables prescriptions to be created by practitioners, stored in the ETP service, retrieved by pharmacists and dispensed to patients.

It is the secure exchange of prescription information between prescribing software (e.g. a GP's electronic medical records system) and pharmacy dispensing systems. Ensuring that medicines information can be shared is the foundation for a range of healthcare benefits for both prescribers and consumers. ETP is an important step towards an ehealth-enabled healthcare system and improved medication management.

Application Architecture	Technology Architecture	Information Architecture
• Point of Care Applications (EMR)		
Current System/s		

4.5.3.3 Labs (LIS)

It provides the specific functionality integral to the management of a General Laboratory department (chemistry, haematology, microbiology, etc.) and the management of a reference laboratory.

Physicians and lab technicians use laboratory information systems to supervise many varieties of inpatient and outpatient medical testing, including haematology, chemistry, immunology and microbiology. Basic laboratory information systems commonly have features that manage patient check in, order entry, specimen processing, result entry and patient demographics. A LIS tracks and stores every detail about a patient from the minute they arrive until they leave and keeps the information stored in its database for future reference.

Application Architecture	Technology Architecture	Information Architecture
Current System/s	The MedLIS system currently in procurement will provide this function. MedLIS will require some changes to integrate with new core services.	

4.5.3.4 PACS / RIS

The central application must provide the functionality of a standard PACS (picture archiving and communication system). PACS is an evolving healthcare technology for the short and long term storage, retrieval, management, distribution and presentation of medical images.

In conjunction with the PACS, it must provide a radiology information system (RIS) to managing radiological record and associated data in a multiple locations.

Application Architecture	Technology Architecture	Information Architecture
• PACS/RIS	• Databases	• Clinical Data, Images
Current System/s	The NIMIS system (McKesson RIS/PACS), currently live in most in-scope settings provides this function. NIMIS will require some changes to integrate with new core services. NIMIS is already integrated with the most relevant applications. Integration with the future core services will enable NIMIS to participate fully in using the IHI, SCR and PCIS.	

4.5.3.5 Ambulance

Ambulance dispatch, location, and communications management.

Application Architecture	Technology Architecture	Information Architecture

• Departmental Systems		
Current System/s	The new Ambulance solution performs this function.	

4.5.3.6 UHI - Universal Health Insurance

Universal Health Insurance (UHI) is the plan for mandatory health insurance for Ireland.

There is a plan focus in a major reform programme for the health system, the aim of which is to deliver a single-tier health service, supported by Universal Health Insurance (UHI), where access is based on need and not simply on ability to pay.

This means:

- The population will have equal access to healthcare based on need, not income;
- Everyone will be insured for a standard package of curative health services;
- There will be no distinction between "public" and private" patients;
- Universal GP care;
- Universal hospital care will include independent, not-for-profit trusts and private hospitals;
- Social care services will be outside of the UHI system but integrated around the user;
- The health system will be based on a multi-payer insurer model, with competing insurers

A UHI solution will be required to enable the implementation of this solution.

Application Architecture	Technology Architecture	Information Architecture
Current System/s		

4.5.3.7 Patient and Provider Portal

The patient and provider portal will provide a single point of contact where patients and providers can each access relevant information for their needs.

- The patient should be able to see their demographics and summary care records.
- Providers should be able to access reports, standards etc.

The portal tool provides no health functionality on its own. It enables presentation of pluggable functionality ("portlets", "web parts" etc).

Application Architecture	Technology Architecture	Information Architecture
• Outreach • Common Portal Infrastructure		
Current System/s		

4.5.3.8 ERP - Enterprise Resource Planning

Enterprise Resource Planning (ERP) includes core corporate systems such as HR, Finance, Procurement and Payroll. ERP systems exist in the core and in the local settings at present, and both will continue in future.

Integration between ERP and other systems will be essential for future initiatives such as "Money Follows the Patient". These initiatives are not yet defined in detail.

Application Architecture	Technology Architecture	Information Architecture
• Enterprise Resource Planning		
Current System/s		

4.5.4 Architecture Data Services

The concept of the architecture data services is to group different sets of data together.

4.5.4.1 Activity Data

Activity Data includes records of events, procedures, capacity and other data across the HSE. The purpose of the central store is to provide a standardized, normalized store of authorative data.

Users will include clinical researchers and management reports.

All this information can be used for many purposes like analytics or during the performance management. The quality of the information stored is directly related with the number of events that the HSE want to track and the number of systems committed with this purpose.

Application Architecture	Technology Architecture	Information Architecture
Current System/s		

4.5.4.2 Demographic Data

Demographic Data includes the personal identifiable data related to identities and activities. The demographic data is key information in health sector to establish a relationship between a patient and its patient identifier, exchange information between systems without a common identifier and many other common uses across the health systems.

Application Architecture	Technology Architecture	Information Architecture
• Non-clinical Data		

Current System/s	

4.5.4.3 Security Data

Security Data includes the security directories, digital certificates and relationships enabling authentication, authorization, access decisions and data access decisions to be taken.

Application Architecture	Technology Architecture	Information Architecture
• Endpoint Certification • Privacy Decision Point • Enterprise Service Bus		
Current System/s		

4.5.4.4 Audit Data

The information stored is different from the Activity Data repository in the objective and purpose of the data store. This repository is focused in security and tracking to maintain a complete view of the interactions with the systems according with the legislation in terms of data protection. It guarantees a complete traceability for the following information:

- Audit data includes records of system and data access.
- This includes successful and unsuccessful access. It includes read and update access.
- Integration services and core services will update the audit data store.

Application Architecture	Technology Architecture	Information Architecture
• Audit Services • Data Access Services • Privacy Decision Point		
Current System/s		

5 Scenarios

The purpose of this section is to demonstrate the practicality of the architecture and to test it in different scenarios, to varying levels of detail. Although the scope of this work doesn't cover detailing business processes, all the scenarios proposed are based on a general understanding of how the processes should work.

These scenarios have are interrelated and attempt to cover the full Continuum of Care:

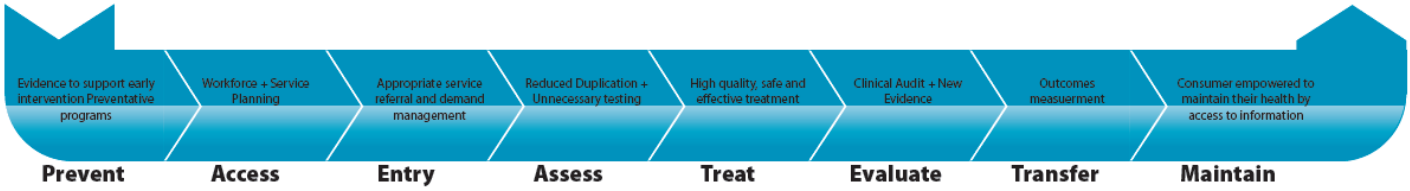


Figure 11. Continuum of CARE

5.1 Scenario A

Sean is 72 years old and has a BMI of 32. Sean last attended his GP 5 years ago. A HSE Health & Wellbeing preventative care programme identifies that Sean is at risk of Type-2 diabetes.

- As part of the Health and Wellness programme, Sean is referred to his GP for screening.
- During the check-up, the GP tests Sean's blood sugar levels. Sean's GP determines that Sean has diabetes, and updates the GPIT system which updates the national Primary Care EHR (PCIS).
- Sean is referred to the hospital for an assessment by an endocrinologist.
- The endocrinologist examines Sean, confirms the diagnosis and tentatively prescribes Isophane premix.
- The ePrescribing system examines Sean's current medications and allergies, and flags Sean is already prescribed an Ace Inhibitor by his GP and recommends Metformin as an alternative.
- Sean is referred to his GP for local medical management and to a Health and Wellbeing programme for education to manage his new condition.

The following high level diagram shows the key interaction between the systems. The diagram has to be read from left to right to follow the order established in the description.

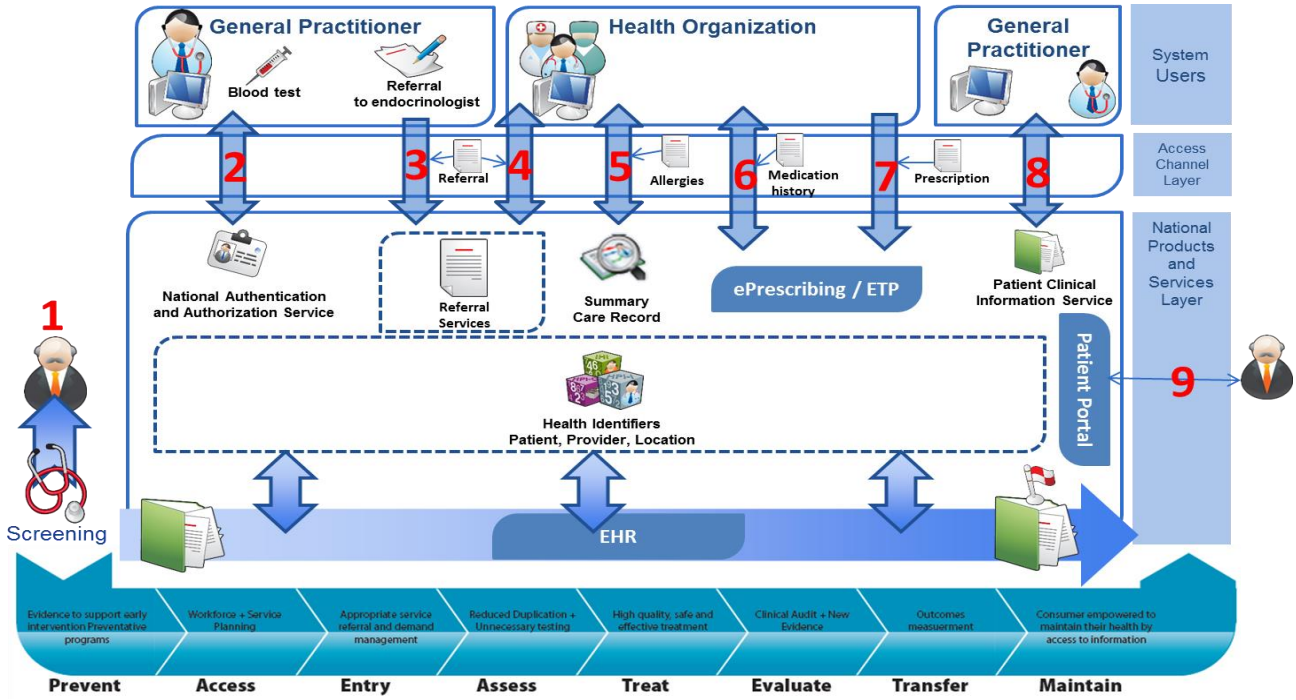


Figure 12. Scenario A Business Process High Level

Action number	Description	Architectural components involved
All actions that involve a system	During the entire process there are some core services and applications that continually used. These services are: • IHI: Operate the get and locate the patient identifier services • National Authentication and Authorisation: Every time an external system needs to use a core services, it has to authenticate against this service first. During the entire process, some information is aggregated into the patient record in the national EHR.	• Health Identifier Services • National Authentication and Authorization Service • National EHR
1	A HSE Health & Wellbeing preventative care programme identifies that Sean is at risk of Type-2 diabetes. The Health & Wellbeing systems use the information from the patient store in the national SCR to identify him and request he visit a GP for screening	• Health & Wellbeing Systems • Summary Care Record Services • Health Identifiers for patient
2	During the check-up, the GP tests Sean's blood sugar levels. Sean's GP determines that Sean has diabetes, and updates the GPIT system which updates the national Primary Care EHR (PCIS). The GP System authenticates itself against the core national services using its electronic certificate under via a secure connection.	• GP System • National Authentication and Authorization Services • Health Identifiers for patient
3	Sean is referred to the hospital for an assessment by an endocrinologist. The GP System use the national core services to send a referral which also checks for an available appointment slot in the Hospital closest to Sean.	• GP System • Core Referral Services • Health Identifiers for patient
4	The endocrinologist retrieves the referral to check the comments provided by the GP about Sean.	• Hospital System • Core Referral Services • Health Identifiers for patient
5,6	The endocrinologist examines Sean, confirms the diagnosis and tentatively prescribes Isophane premix. The endocrinologist checks Sean's SCR using the Hospital System in order to retrieve allergies and then gets the information from the national ePrescribing system for medication history. The endocrinologist identifies that Sean is already prescribed an Ace Inhibitor by his GP and recommends Metformin as an alternative.	• Hospital System • ePrescribing core system • Summary Care Record • Health Identifiers for patient
7	Sean is referred back to his GP for local medical management and to a Health and Wellbeing programme for education to manage his condition.	• Hospital System • ePrescribing core system • Health Identifiers

		for patient
8	When Sean goes back to his GP, the GP System retrieves the care program prescribed by the endocrinologist through the national PCIS.	• GP System • Patient Clinical Information Services • Health Identifiers for patient
9	Through the national patient portal Sean can review the care program and review his test results and his SCR.	• National Patient Portal • Health Identifiers for patient

5.2 Scenario B

2 years later, Sean collapses while out shopping. An ambulance is called, and Sean is taken to an Acute hospital.

- *While in the ambulance, the paramedics retrieve Sean's Summary Care Record, and identifies that he has diabetes as it is included in his care plans*
- *On arrival at the hospital, Sean is assessed as having had a stroke, and this diagnosis is confirmed after further tests.*
- *Sean is prescribed cardiovascular medication which is compatible with his diabetes medication*
- *A social worker is assigned to the case to assess and coordinate his rehabilitation requirements. These include Physiotherapy, SLT and OT.*
- *Based on Sean's clinical needs, a nursing home stay is prescribed for 1 month, and automatically scheduled*
- *A Public Health Nurse and a GP are advised of Sean's care plan via electronic notification into their care systems*
- *During the nursing home stay, Sean's housing is modified to enable him to live independently with support in the community.*
- *Sean is discharged from the nursing home to live at home, and his GP and PHN are notified.*
- *The PHN works with Sean to arrange appropriate after care and home support.*

The following high level diagram shows the key interaction between the systems. The diagram has to be read from left to right to follow the order established in the description.

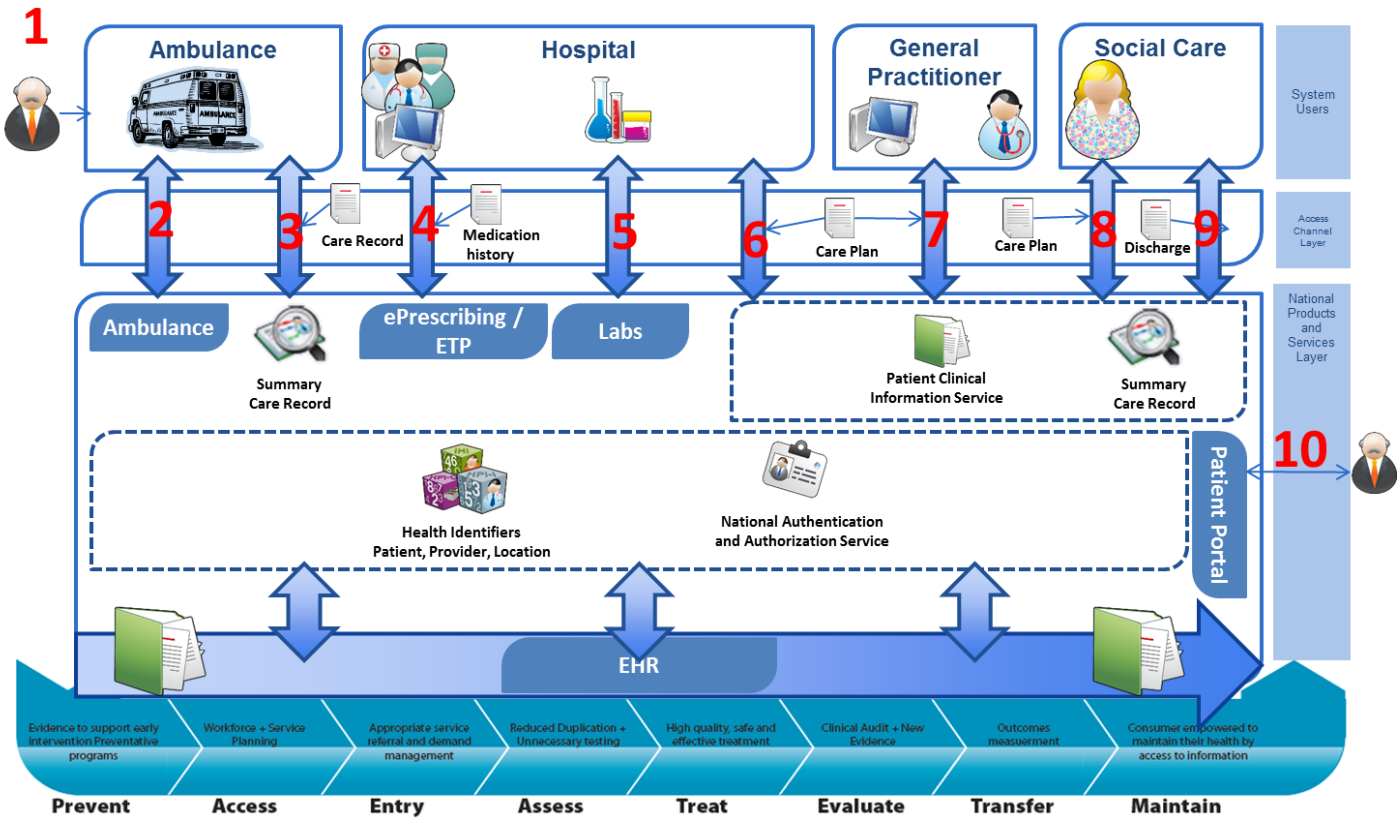


Figure 13. Scenario B Business Process High Level

Action number	Description	Architectural components involved
All actions that involve a system	During the entire process there are some core services and applications that continually used. These services are: • IHI: Operate the get and locate the patient identifier services • National Authentication and Authorisation: Every time an external system needs to use a core services, it has to authenticate against this service first. During the entire process, some information is aggregated into the patient record in the national EHR.	• Health Identifier Services • National Authentication and Authorization Service • National EHR
1	Sean collapses and an ambulance is called.	• N/A
2,3	While in the ambulance, the paramedics retrieve Sean's Summary Care Record, and identifies that he has diabetes as it is included in his care plans During this action the Ambulance Application uses core services to query for Sean's identifier and retrieve his SCR. All the interactions are made through the Integration Layer.	• Ambulance Core Application • Core SCR Services • Health Identifier Services • National Authentication and Authorization Service
4	On arrival at the hospital, the Hospital System retrieves the medication history from the ePrescribing Services to help during the diagnosis.	• Hospital System • ePrescibing Services • Health Identifier Services • National Authentication and Authorization Service
5	Sean is assessed as having had a stroke, and this diagnosis is confirmed after further tests. The results for the test are stored through the national lab application, which centralizes the labs results for a patient.	• Hospital System • Health Identifier Services • National Authentication and Authorization Service • Labs National Application
6	Sean is prescribed cardiovascular medication which is compatible with his diabetes medication. A social worker is assigned to the case to assess and coordinate his rehabilitation requirements. These include Physiotherapy, SLT and OT. Based on Sean's clinical needs, a nursing home stay is prescribed for 1 month, and automatically scheduled.	• Hospital System • Health Identifier Services • National Authentication and Authorization Service

	The hospital system sends the care program to the Patient Clinical Information Service to store and the program is associated with Sean's patient identifier.	• Patient Clinical Information Service
7	GP is advised of Sean's care plan by an electronic notification in their care system. The GP System retrieves the care plan from the "Patient Clinical Information Service". To be able to use the core services, the GP system must have authenticated itself using the central national authentication and authorization service.	• GP System • Patient Clinical Information Service • Health Identifier Services • National Authentication and Authorization Service
8	A Public Health Nurse is advised of Sean's care plan by an electronic notification in their care system. During the nursing home stay, Sean's housing is modified to enable him to live independently with support in the community. The PHN works with Sean to arrange appropriate after care and home support. The nurse retrieves the care program using a Social Care System which accesses the national PCIS.	• Social Care System • Patient Clinical Information Service • Health Identifier Services • National Authentication and Authorization Service
9	Sean is discharged from the nursing home to live at home, and his GP and PHN are notified. The Social Care System using the SCR service sends the discharge document to the national SCR.	• Social Care System • Summary Care Record Services • Health Identifier Services • National Authentication and Authorization Service
10	Through the national patient portal Sean can review the care program.	• National Patient Portal

In the following scenario an additional view is provided in a more detailed format (BPMN) for the three first interactions. These correspond to action 1 - 6 in the above table.

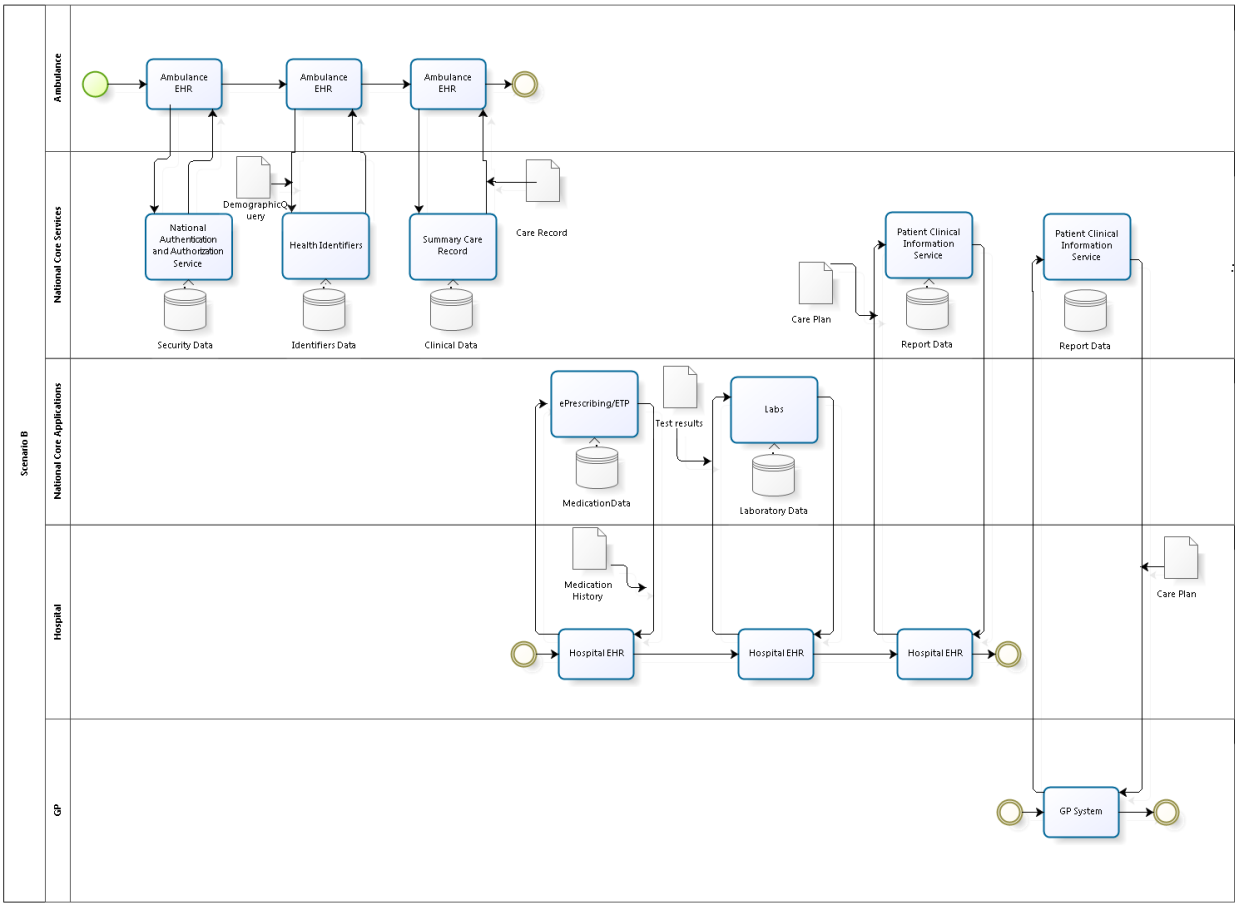


Figure 14. Scenario B Business Process BPMN

6 Roadmap

6.1 Roadmap Approach and Principles

This section presents a potential roadmap for the implementation of this architecture. It also presents the implementation of core and local applications using the architecture.

The roadmap is defined based on the following principles:

- **Maximize Benefit to the Enterprise**: Information management decisions are made to provide maximum benefit to the enterprise as a whole. Decisions made from an enterprise-wide perspective have greater long-term value than decisions made from any particular organizational perspective. Maximum return on investment requires information management decisions to adhere to enterprise-wide drivers and priorities.
- **IT Responsibility:** The IT organization is responsible for owning and implementing IT processes and infrastructure that enable solutions to meet user-defined requirements for functionality, service levels, cost, and delivery timing. Effective alignment of expectations with capabilities and costs ensures that projects are cost-effective. Efficient and effective solutions have reasonable costs and clear benefits.

The following inputs have been used in designing the roadmap

- **Priorities:** The clinical and organisational priorities established during the TO-BE workshops
- **Dependencies & Experience:** Dependencies between components determines part of the sequence; Experience implementing similar architectures has also been used to define the sequence below.
- **Patient needs:** Patient needs, across the continuum of care, have been used to schedule projects.
- **eHealth Methodology**: The methodology and approach proposed for the eHealth Strategy for Ireland is considered as methodology approach for the roadmap.

The output of these is the following indicative draft roadmap:

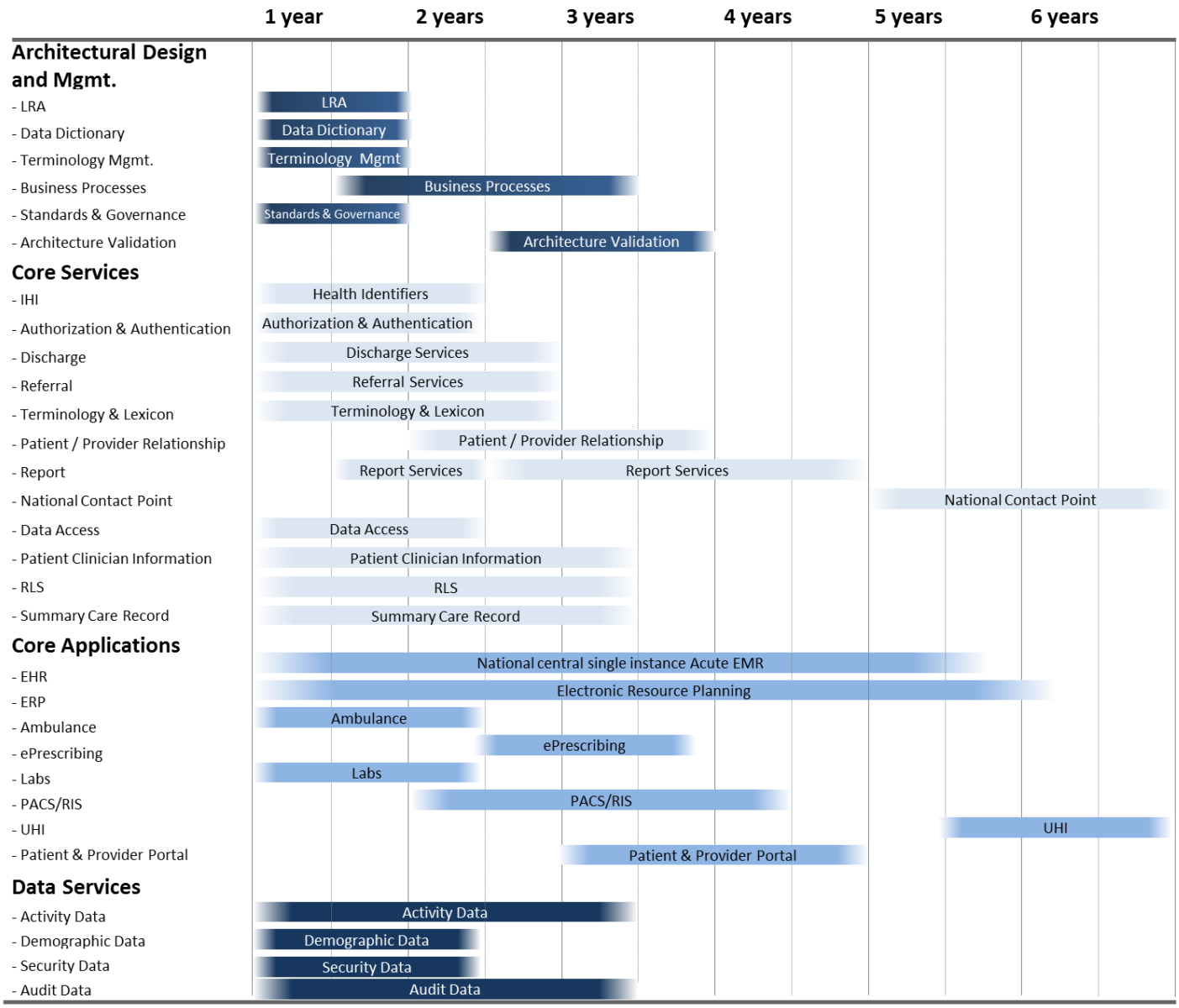


Figure 15. Roadmap

The roadmap above represents timeframes to update existing systems in order to align with future architecture.

6.2 Maintaining a pragmatic roadmap

In creating the roadmap a number of real-world considerations must be balanced. While the roadmap presented above includes the considerations that are current as of early 2015, the roadmap will require regular updates to ensure continued alignment to HSE priorities. The considerations include:

- **Prioritise dependencies for priority services:** In order for high-priority end-user applications such as MedLIS, or CHG EMR to use the IHI, SCR or other core components, the core components must exist first. Therefore these components must be prioritised for early implementation. In general, architecture must precede application by at least 1 project phase, to avoid delays.

- **Alignment with principles**: the roadmap should reflect the principles of this architecture. As one example, the "Control Technical Diversity" principle should be interpreted to prefer a smaller number of products that

are tightly aligned, compared to an approach where each component in the logical architecture would have a 1:1 correspondence with a product in the actual physical implementation.

- **Implement cohesive systems:** The roadmap will be implemented by purchased or custom built systems or services, with integration between them. However, one product may implement multiple services. For example, there are multiple market offerings that could provide a combination of components such as Summary Care Record, Record Locator Service, National Clinical Information System and Patient Portal with minimal integration.

- **Reuse and refactor existing systems:** There is significant capability in existing systems that is required in the future state (items depicted in green in the to-be application architecture diagram in section 4.1). These components should be reused or refactored (modified to fit in with the future requirements). Examples of this may include reuse of HealthLink or PCRS as elements of the future Integration layer.

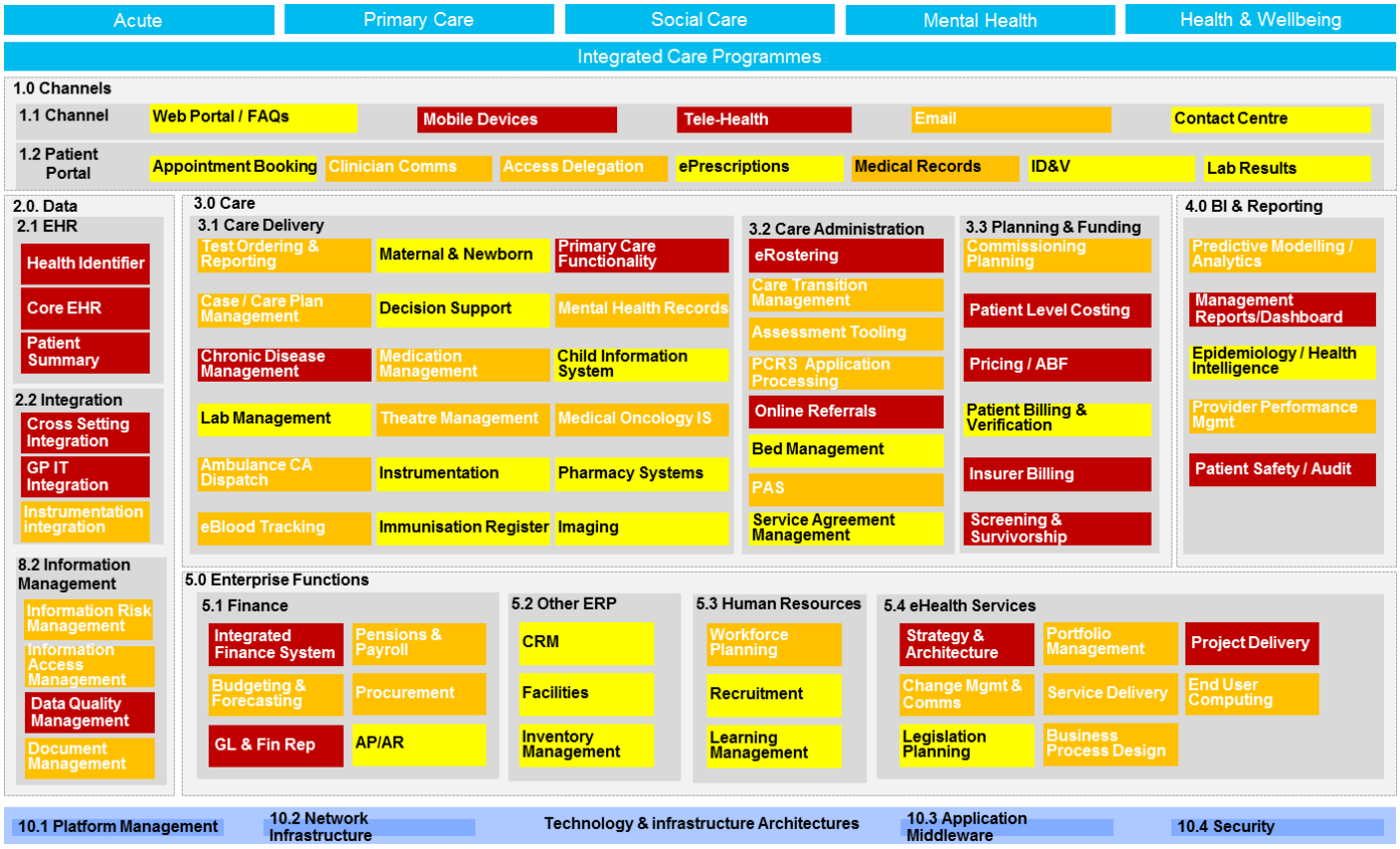
The roadmap takes account of known dependencies between projects, and priorities of projects. As HSE and National priorities evolve, the architecture roadmap may need to be modified to remain in-sync with the business requirements.

7 Appendix: Cross mapping between the business capabilities map and the Application architecture

The separate "ICT Operating Model Review" project defined desired business capabilities grouped by care setting. These were in a stable draft state when they were used as high level requirements to develop this architecture.
The To Be Application Architecture is directly related with this map. In this section this relation is described in enough detail to highlight key elements of this mapping.

The business capabilities map is detailed using the following three colours to identify the current priority of each business capability:

1. Yellow: A priority.
2. Orange: Medium priority
3. Red: High priority



There are three different relationships:

- The application domains that are dependencies for most or all business capabilities.
- Those application domains that enable one or more business capabilitydomains
- Those application domains that enable a specific business capabilities domain

All these relationships are related in the following table:

Business Capability domain	Business Capability subdomain	Application Architecture domains
All	All	• Security and Access Control

		• System Gateways • Services and Services Co-ordination
1.0 Channels	1.1 Channel	• Outreach • xRM
	1.2 Patient Portal	• Common Portal Infrastructure
2.0 Data		
	2.1 EHR	• Point of Care Applications ○ Electronic Medical Records
	2.2 Integration	• Data Integration • Point of Care Applications ○ HIE

	2.3 Information Management	• Data Integration
		  ○ Data Quality Management
		  ○ Data Integrity Management
		  ○ Clinical Data Management
		  ○ Non Clinical Data Management
		• Analytics
		  ○ Data Access Services

3.0 Care		

	3.1 Care Delivery	• Point of Care Applications
		  ○ Departmental Systems
		  ○ Community Systems
		  ○ CDS
		  ○ Specialist Systems

	3.2 Care Administration	• Point of Care Applications
		  ○ Patient Admin System
		• xRM
		  ○ Performance Management
		  ○
		• Enterprise Resource Planning

	3.3 Planning & Funding	• Payer and Reimbursement
		  ○ Payments
		  ○ Premium Pricing

4.0 BI & Reporting		• Report Service
		  ○ Reporting engine
		  ○ Extract, Transform and Load
		• Analytics
		• xRM
		  ○ Performance Management
		• Point of Care Applications
		  ○ BI, Big Data, Data Analytics

5.0 Enterprise Functions		
	5.1 Finance	• Enterprise Resource Planning ○ Account Payable

	5.2 Other ERP	• xRM
		  ○ Patient Relationship
		  ○ Provider Relationship

	5.3 Human Resources	• xRM

		○ Performance Management
	5.4 eHealth Services	• Service Management ○ Demand and Portfolio Management ○ Service Transition and Change Mgmt. ○ Performance and incident Mgmt.

This section is not intended to be normative since the project "ICT Operating Model Review" is not completed at the point in time this document is finalised, and the business capabilities are defined separately in this project.

8 Appendix: Theoretical scenarios for care settings

These scenarios must be considered as "examples", don't represent a real business process analysed with the clinicians. The scenarios selected are based on key business priorities for each care setting.

In these scenarios appear services/application and data services identified as necessary, but in a real approach, these elements could be there or not. It is only to exemplify how new components could fit in the architecture proposed.

These scenarios are described in BPMN notation mainly because provide a deeper detail than the practical scenarios. It includes the systems, services, data sources, messages exchanged and roles involved, as well as the order of the elements.

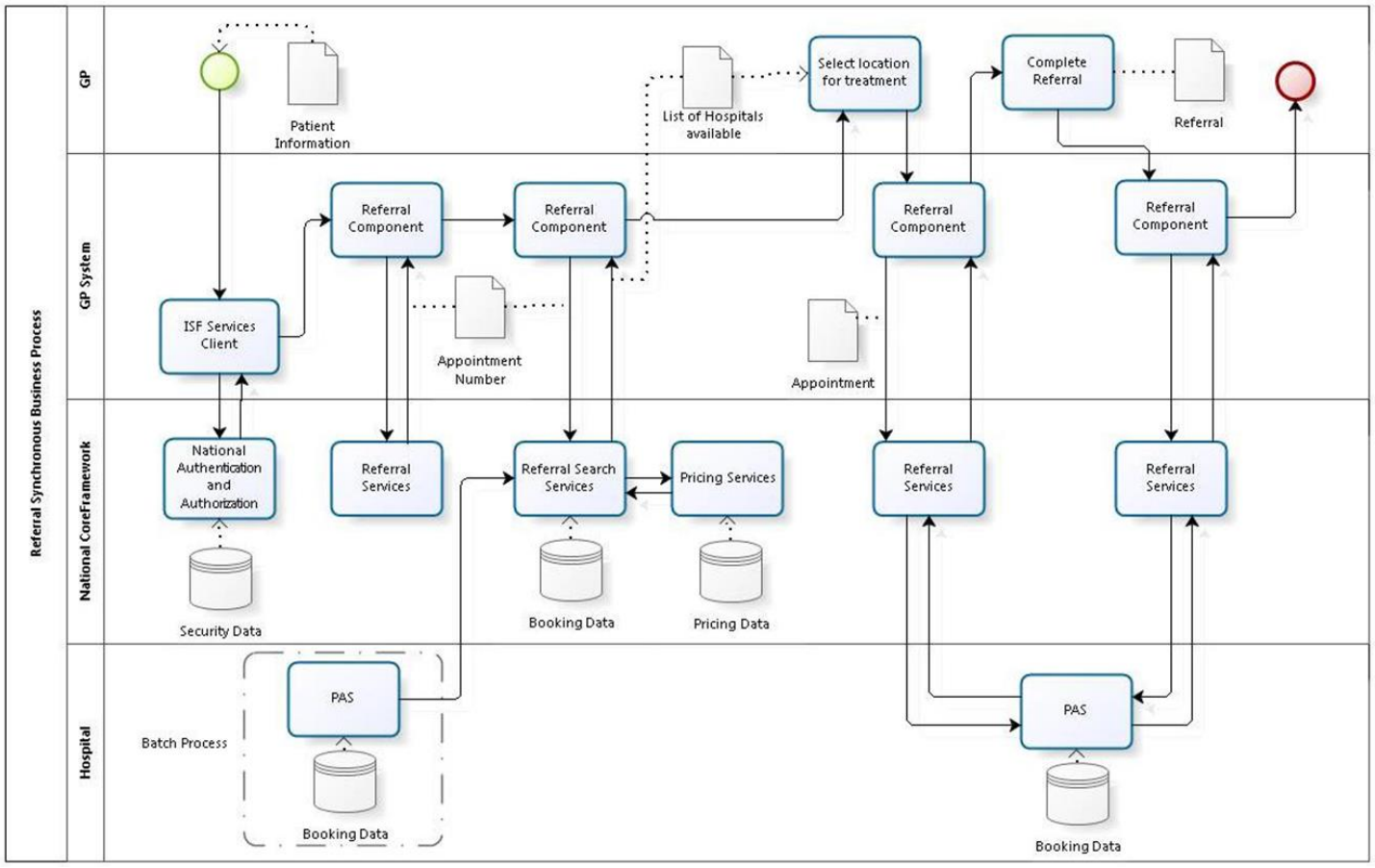
8.1 Primary Care

8.1.1 Ireland – Referral

Mrs. Murphy has a long history of a painful left hip. Until recently she has coped well with painkillers, but during a follow-up consultation it becomes apparent that she is encountering increasing discomfort and immobility.
After discussing possible options, her GP, Dr. Kelly, decides that a referral to an orthopaedic outpatient appointment to explore surgical options is indicated. He asks Mrs. Murphy if she is interested in having an appointment with the shortest wait or would prefer to only take a local appointment. Mrs. Kelly indicates that she would prefer a local appointment. Dr. Murphy activates the Referral Service option on his local system.

- *A Request for Service interaction ensues and a message is sent to Referral Service with Mrs. Murphy's National Patient Number. Referral Service responds with a Confirm Service Request message containing an Appointment Number (AN).*
- *After the AN is received, a component is launched with the AN allowing a seamless transition directly into the context of the AN.*
- *Dr. Kelly uses the Referral Service Search facility to locate services in the local area. In negotiation with Mrs. Murphy, he selects an appropriate appointment in the orthopaedic outpatient clinic run by Mr. O'Sullivan, a new consultant at the local hospital.*
- *Once an appointment has been selected, the Referral Service sends a Request Appointment Confirmation message to the local hospital system to ensure that the selected appointment time is still available. The local system responds with a Confirm Appointment message. Referral Service sends the local hospital system an Application Acknowledgement message to indicate that it should now book the appointment. Referral Service can now confirm that the appointment has been booked and Dr. Kelly prints out the appointment details and any requirements stipulated by the clinic for Mrs. Murphy to take home.*
- *Mrs. Murphy leaves the consultation room and Dr. Kelly enters the referral information for Mr. O'Sullivan in the GP system. On completion, the referral letter is encrypted and sent electronically to Referral Service as a Referral message where it is stored. The local hospital system may access Referral Service to view the referral.*

The following business process shows the different interactions under the architecture defined and also includes the new services identified beside the core components.

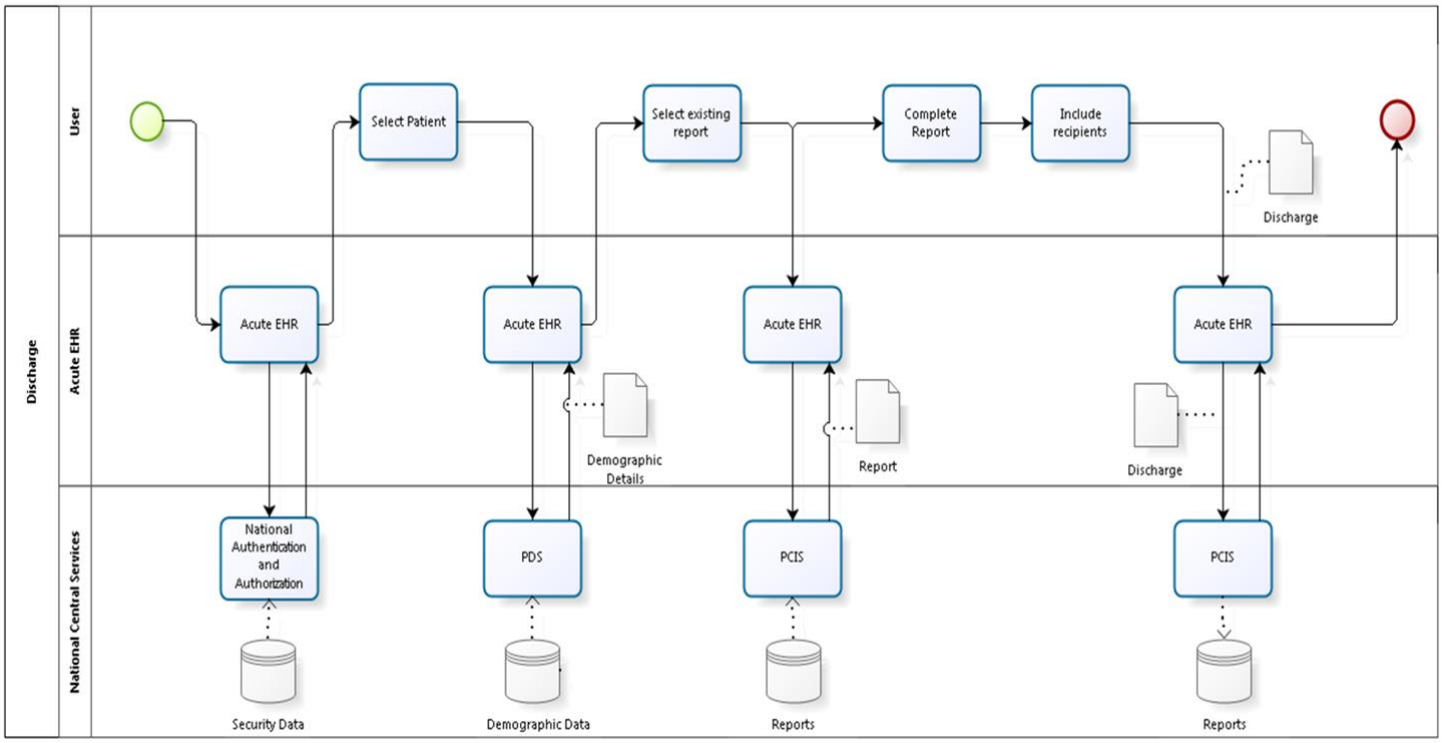


8.2 *Acute Care – Discharge (synchronous)*

Aisling is a new mother of 32 years. After a successfully caesarean, her obstetrician Dr. Doyle wants to discharge her and let Aisling and her baby rest at home with followup care in the community.

- *Dr.Doyle finds Aisling's record.*
- *Dr Doyle retrieves a draft of the existing report.*
- *Dr.Doyle completes the details for the ongoing care and documents some advice for Aisling.*
- *Finally Dr.Doyle includes her nurse in the report.*
- *The discharge document is filed in the Patient Clinical Information System.*

The following business process shows the different interactions under the architecture defined and also includes the new services identified beside the core components.

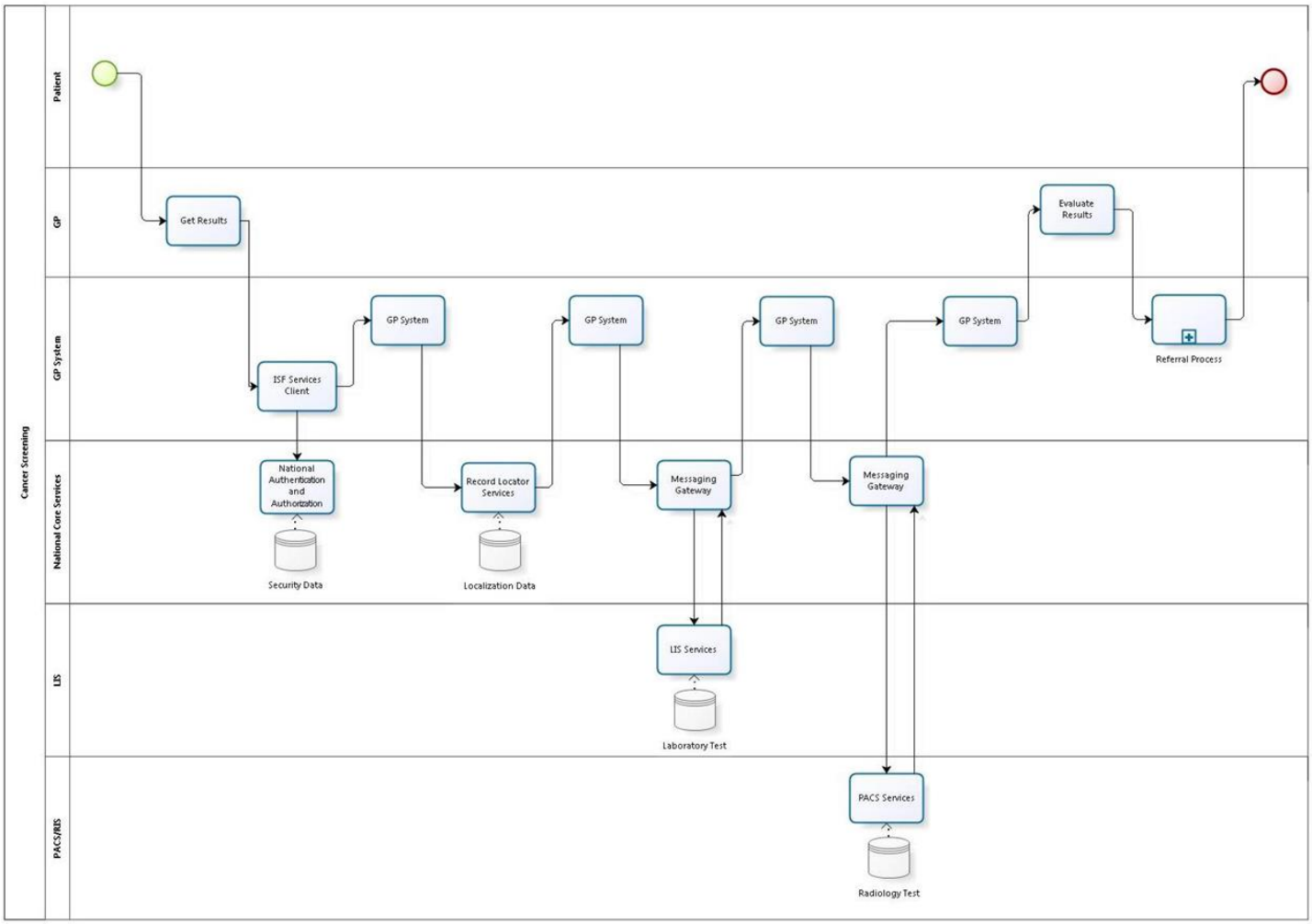


8.3 Health and Wellbeing Care – Breast Cancer Screening

Mrs. Murphy receives a screening notification because she matches the profile for a breast cancer screening promoted by HSE to prevent this disease.

- *Initially Mrs. Murphy arranges an appointment with her GP.*
- *Her GP requests a mammography and a blood test.*
- *After she gets the results, she visits her GP again to discuss her results*
- *Unfortunately, her GP identifies a possible breast cancer at a very early stage.*
- *Her GP refers her to an oncologist.*
- *Thanks to an early discovery of the disease, Mrs. Murphy improves her prognosis.*

The following business process shows the different interactions under the architecture defined and also includes the new services identified beside the core components.



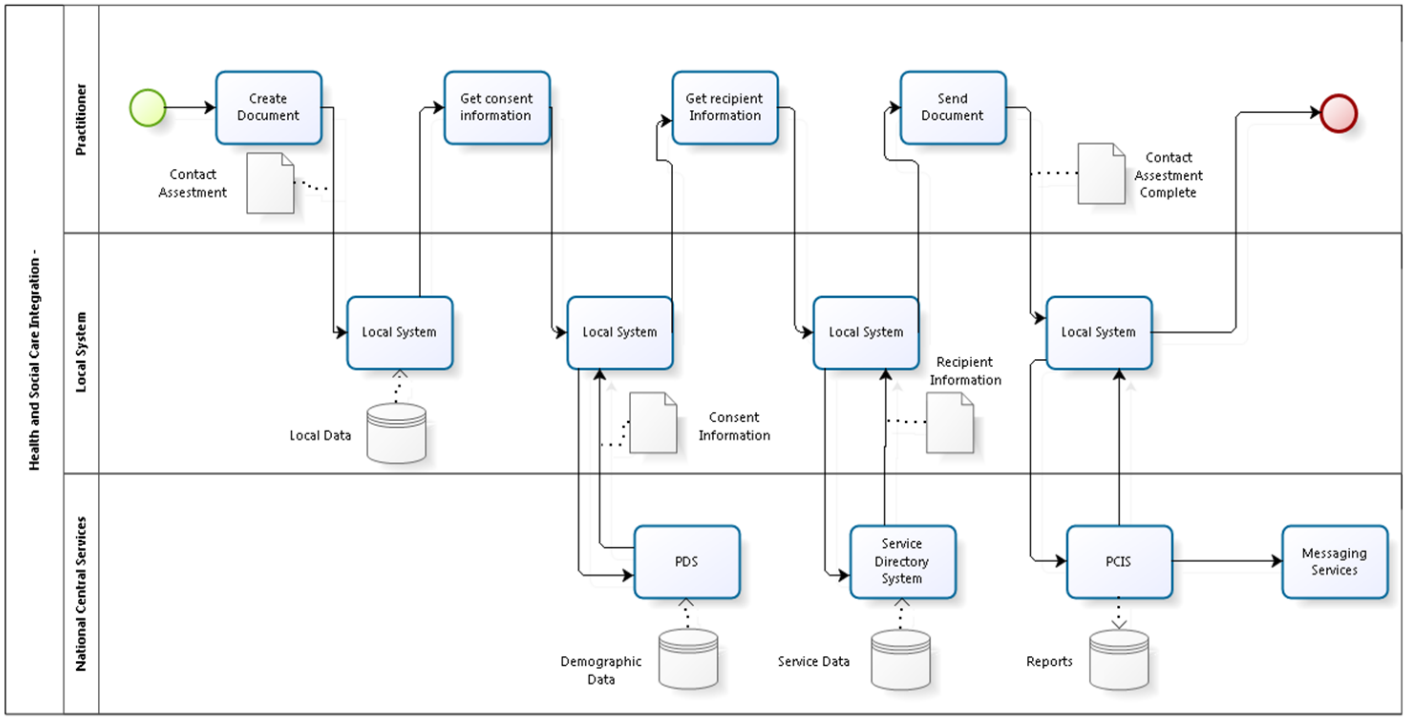
The diagram involved the following systems:

8.4 Community Care - Health and Social Care Integration

Sean is a 50 year old man who had a stroke several months ago and is being cared for at home by his wife.

- *He was recently admitted to St Agnes Ward in St Vincents from the emergency department, following a fall when getting out of the shower.*
- *He has a body rash caused by antibiotics prescribed for a chest infection by his GP.*
- *Whilst on the ward, Sr Margaret, the ward sister, completes a contact assessment for Dr. Jones and refers him to Ms Ward, who is the ward physiotherapist, for a mobility assessment and to social services as she feels carer support may be needed when Sean returns home.*

The following business process shows the different interactions under the architecture defined and also includes the new services identified beside the core components.


Health and Social Care Integration -
Practitioner
Local System
National Central Services
Create Document
Contact Assestment
Get consent information
Get recipient Information
Send Document
Contact Assestment Complete
Local System
Local System
Local System
Local System
Local Data
Consent Information
Recipient Information
PDS
Service Directory System
PCIS
Messaging Services
Demographic Data
Service Data
Reports

9 Appendix: Glossary

9.1 Appendix: Terminology

Term	Definition
(Base) Standard	"As defined in European legislation (Article 1,paragraph 6, of Directive 98/34/EC), a standard is a technical specification approved by a recognised standardisation body for repeated or continuous application, with which compliance is not compulsory and which is one of the following: - International standard: a standard adopted by an international standardisation organisation and made available to the public. - European standard: a standard adopted by a European standardisation body and made available to the public - national standard: a standard adopted by a national standardisation body and made available to the public."
Interoperability	The ability of disparate and diverse organisations to interact towards mutually beneficial and agreed common goals, involving the sharing of information and knowledge between the organisations, through the business processes they support, by means of the exchange of data between their respective ICT systems.
Interoperability Governance	"Interoperability governance covers the ownership, definition, development, maintenance, monitoring, promoting and implementing of interoperability frameworks in the context of multiple organisations working together to provide services. It is a high-level function providing leadership, organisational structures and processes to ensure that the interoperability frameworks sustain and extend the organisations' strategies and objectives."

Service Level Agreement	"A formalised agreement between two cooperating entities; typically, a service provider and a user. Expressed in the form of a written, negotiated contract. Typically, such agreements define specific metrics (Key Performance Indicators— KPIs) for measuring the performance of the service provider (which in total define the 'service level'), and document binding commitments defined as the attainment of specific targets for certain KPIs, plus associated actions such as corrective measures."

9.2 Appendix: Acronyms

Acronym	Definition
ED	Emergency Department
CDR	Clinical Data Repository
CDS	Clinical Decision Support
HIE	Health Information Exchange
CPOES	Computerised Practitioner Order Entry Systems
BPM	Business process management
ESB	Enterprise Service Bus
SOA	Service Oriented Architecture
ETL	Extract Transform Load
PAS	Patient Administration System
PACS	Picture archiving and communication system
RIS	Radiology information system
BMI	Body mass index