

# **The target architecture for health and care in England 2022**

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## References

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[1]	NHS Digital Enterprise Architecture Principles	<a href="#">URL</a>

## Glossary of Terms

Abbreviation	What it Stands For
CIO	Chief Information Officer
DSA	Data Sharing Agreement
dm+d	Dictionary of medicine and devices
EPR	Electronic Patient Record
GP Data	General Practice Data
ICS	Integrated Care System
NDOS	National Data Orchestration Service
NEMS	National Event Management Service
NHSD	NHS Digital
NHSE	NHS England
NRL	National Record Locator
PDS	Patient Demographics Service or Pathology Demographics Service
PESTLE	Political Economic Social Technology Legal Environmental
PET	Privacy Enhancing Technique
PHR	Patient Health Record
PROMS	Patient Recorded Outcome Measures
PREMS	Patient Recorded Experience Measures
RDDT	Regional Directors Digital Transformation (forum)
ShCR	Shared Care Record
SDE	Secure Data Environment
TRE	Trusted Research Environment

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# 1. Executive Summary

## 1.1. Summary

The impact of an ageing population in England is taking its toll on the NHS. Increasing demand for appointments, medical treatment, and social care needs, as well as a shortage of staff to meet this demand, is putting huge stress on our NHS and is leading to suboptimal outcomes for patients and staff. Furthermore, in the digital age more and more of the population are using digital technologies to give them more convenience, more knowledge, and better experiences. The NHS must leverage the opportunities digital brings to not only provide better experiences but to also reduce the burden on an overworked workforce.

The COVID-19 pandemic has shown that it is possible to use digital services and new technologies to deliver new services quickly and to reduce the burden on staff by automating workflows, better management of connected data and connecting systems seamlessly using recognised data standards.

There is an inflection point now in NHS England (NHSE) where increasing demands, rising costs and a shortage of staff could lead to a downward spiral making it difficult to sustain an equitable NHS for all. A modern architecture, therefore, must set out how to join systems together, connect data pipelines, avoid duplication, and make it easy to build the right things whilst addressing the pain points experienced day-to-day by patients, caregivers, and professionals alike.

By empowering the 42 Integrated Care Systems (ICSs) that were established earlier this year the target architecture will connect pathways allowing authorised professionals access to health and care data. For direct care, this will mean access to the patient record across any boundary so that a full picture is available to ensure decisions are taken with the best possible information to hand. Health and care professionals will be able to access their patient's health information throughout the care spectrum (primary care, hospitals, community, mental health, and social healthcare). It means giving the patient access to their record and allowing them to have more control over who can see it, as well as using it proactively to manage their own health.

It will give ICSs more intelligent insight into capacity and demand management, health inequality and workforce planning. Key decision makers will be armed not only with "what is happening right now?" but also predictions as to "what will happen?" to ensure better forward planning, rather than just reacting. Using data more intelligently across ICSs helps to reduce the variability of health and care services.

For research and innovation, it means using modern privacy-enhancing technologies to ensure data is de-identified and patient privacy is always protected but open large datasets to accelerate medical research and advancements in medicine.

By using the target architecture to inform priorities, roadmaps, and key investments and to work smarter together it is possible to drive down the cost of IT, avoid the inefficiencies of duplication across the system and invest money where it is needed the most. Additionally, implementing the target architecture will reduce the burden on the NHS health and care workers helping to improve working conditions and reducing time on keyboards and, therefore, giving time back to address both a work/life balance and more time with the patients.

The target architecture describes what should be delivered nationally, regionally, and locally and how they connect in each of the four primary use case types, namely:

- Direct Care
- Population health and proactive care
- Planning, oversight, and service improvement
- Research and Innovation

It also provides concrete architectural patterns across these four use types to highlight how the people and the systems should interact across the boundaries of national, regional, and local.

This is not an attempt to reintroduce the National Programme for IT (NPfIT) and, if any value came from this programme, it is the learnings from its failure and ensuring these are not repeated. This is not an overambitious and unwieldy centralised model but rather a way to better support the ICSs by delivering the right product and services in the centre that are commodity to all. This then allows ICSs to focus on the key differentiators and innovation to drive better experiences.

The target state architecture must be the agreed direction of travel – it provides the bigger picture view or "north star". It will require collaboration and discipline to work together to make it a reality. Communities of practice and an agile governance framework will underpin this to ensure roadmaps are transitioning towards the target state. Where there is a deviation then teams must come together to discuss a way forward to avoid big deviations and to understand the consequence and how to steer it back on track.

Like any target state architecture, it will evolve and adapt to the changing needs of the NHS. There are certain 'no regrets' elements of the architecture that must be delivered to improve data movement and put in place the building blocks to support a future NHS. Connecting systems and responding to real-time events and changes in the patient journey offer the ability to deliver a much-improved experience whilst giving health and care professionals the right information at the right time.

Virtual wards and remote monitoring are becoming more prevalent as the NHS works smarter to provide a better service for patients with long-term conditions, or require 24/7 monitoring but in less stressful environments, such as their own home. These services take the burden away from the hospitals with reduced A&E admissions, improved bed utilisation. However, these services are still hindered by a lack of interoperability and real-time data transfer between remote monitoring platforms and Electronic Patient Records (EPRs) meaning staff working at Digital Care Hubs have to consistently switch between multiple systems re-keying patient information. The national hub (see Section 6) will allow seamless data movement to authorised users and systems, as well as notification of key events such as "discharge from inpatient care", "A&E attendance" and "admit to inpatient care". The possibilities that an event-based real-time health and care exchange bring to improved outcomes and reduced burden is exciting and the target state puts the key components in place to finally make this a reality.

The target state addresses several key themes that have historically hindered data movement leading to a suboptimal service such as the poor quality of data, multiple sources and formats of data and privacy and security restrictions.

CIOs, Regional Directors for Digital Transformation (RDDTs), architects across the ICSs have taken part in its design, as well as clinical, policy, cyber and information governance professionals over a period of nine months.

## 1.2. Summary of Key Points

At a national level the target architecture will:

- facilitate a consistent patient experience using the NHS app which will provide the citizen/patient with the key clinical data e.g., pathology, medications persisted nationally in the Health and Care Hub.
- support population health and planning, oversight, service improvement with national services e.g., cohorting, data collection and reporting services.
- provide national data analytics and business intelligence services via the Federated Data Platform (FDP).
- support research and innovation with national Secure Data Environment (SDE) access.
- support clinical operations, workforce planning and management.



At a regional level it will:

- support shared care records and personal health records for direct care. FDP will monitor and support interventions for immunisation and vaccination programmes.
- support population health by a combination of national services and regional ICS data systems and population health apps. FDP will provide regional FDP applications, analytics, and integration service for population health and person insight.
- support planning, oversight, and service improvement by regional ICS data systems and reporting dashboards and by FDP for specific use cases e.g. supply chain and workforce deployment and capacity planning to meet operational needs.
- support research and innovation by sub-national SDE access. SDE and FDP will be complimentary, and that solutions and data will be shared (under strict information governance) to maximise value for money and avoid unnecessary duplication.

At a local level it will:

- direct care and population health will be supported by local apps and local data systems.
- support specific use cases around elective recovery, care coordination, vaccinations, and supply chain by providing access to the FDP.
- Support research and innovation by providing access to national and sub-national SDEs.

## 2. Introduction and Purpose

A target architecture is critical to aligning the business, data, application, and infrastructure building blocks required to meet the strategic goals of NHS England (NHSE). Given the size and complexity of NHSE there is a sprawl of applications and data that has led to siloed data and duplicated systems. Systems are procured and implemented without an understanding of the bigger picture and whether they can easily integrate to allow data to be easily accessible.

Conway's Law states that the architecture and the systems that are designed will inevitably reflect the organisation's communication structure. The effect of Conway's Law on the NHS is plain to see. Patients who cross these organisational and system boundaries are met with a suboptimal service. They must repeat their story because their patient record is not accessible, and the authorised health and care professionals must ask a lot of questions to try and rebuild this picture.

Digital shared care records help but there are different levels of maturity and whilst some are close nobody has a complete record spanning all possible health and care pathways and the patient themselves cannot easily access them. This is not only a huge burden on everyone's time but also prone to errors. Patients carry manila folders around with them in anticipation of the questions that will no doubt be asked in fear of missing some bit of information and not recreating a full picture. The proposed architecture pattern for direct care will solve this problem once and for all.

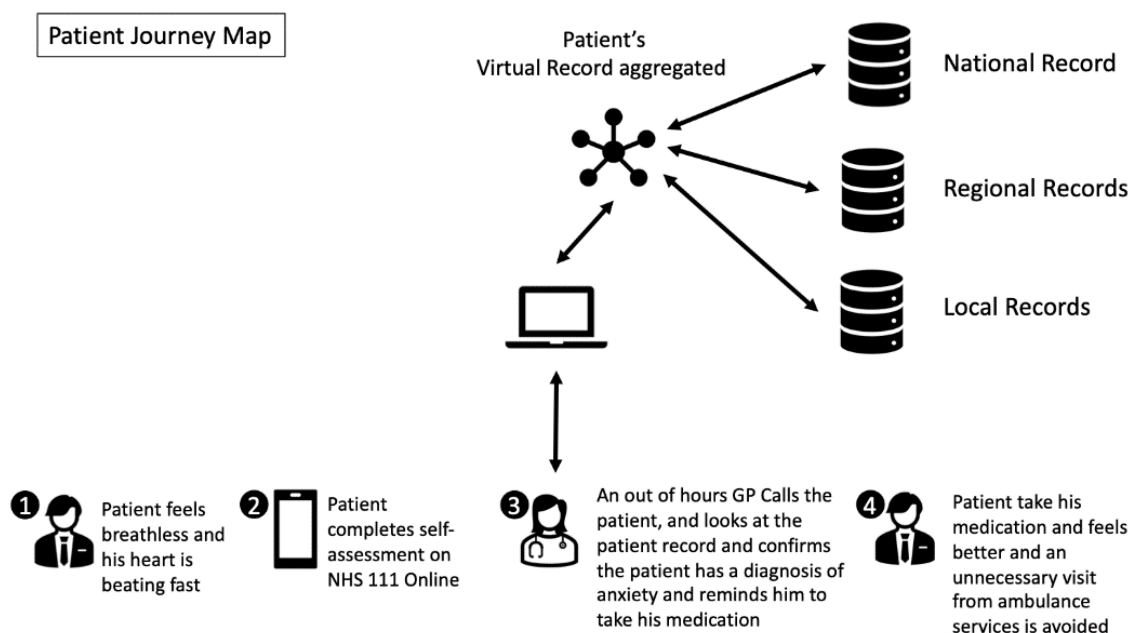


Figure 1 – Patient Journey

### The patient's point of view

***"My name is Mr A, and I am 56 years old. Last Wednesday, I started feeling breathless and my heart was beating fast. I completed my symptom assessment on NHS111 online and I was told I will get a call from the NHS 111. An out of hours GP called who initially said she was going to arrange an ambulance, but she looked on her computer and confirmed with me that I had history of anxiety and reminded me that I had forgotten to take my medication. She called back later to check on me and I was fine. It saved me an unnecessary visit from the ambulance services."***

The above story highlights the importance of making the patient record readily available to authorised health and care professionals to ensure the right decisions are made. Without this information, an unnecessary burden is placed on already overstretched services and the patient experience is poor.

### The professionals' point of view

***"I assessed a breathless patient over the phone who had significant palpitations and presyncope. I was almost certainly going to arrange an ambulance but then on accessing our local shared care record it came to light he had a background of anxiety and was on propranolol. He hadn't taken his medication that morning. I advised him to take it. I eventually called the patient back to reassess and he was symptom free. I was able to give him the best support and treatment and freed up an ambulance to treat patients elsewhere."***

This quote from an out-of-hours GP illustrates why it is so important to be able to share information safely and securely between professionals who provide care to people. Not only did it improve the outcome for the patient, but it also avoided an unnecessary trip to the hospital for the patient and freed up scarce resources.

But this doesn't happen by accident. It requires a combination of tools and systems which bring together information from multiple sources and present it to busy health and care professionals when they need it, where they need it and in a form that helps them do their job as productively as possible, whether on a desktop, mobile or tablet.

Putting in the infrastructure that makes this happen is complicated and needs a carefully thought thorough plan to bring together the data, the applications, the standards, and the surrounding operating environment. This is our Target Architecture on how national systems will evolve to support ICSs. A high-level conceptual model of how the health and care digital landscape will look to support the delivery of health and care services in the 21st century. The audience of this document is ICS digital teams including CIOs, digital leads, architects, and national teams. The conceptual model has been reviewed and evolved with our partner ICSs and multiple stakeholders including CIOs. The engagements have raised the challenges around interoperability across ICS boundaries and how key building blocks like the Federated Data Platform (FDP) and Secure Data Environments (SDE) fit together.

The Health and Care ecosystem in England is a complicated mixture of organisations involved in all aspects of planning and delivering care. Without a map, an individual organisation will - understandably - pursue their own ambitions and objectives independently in their own way. However, the pursuit of individual aims and objectives without referring to a common reference point can lead to suboptimal solutions which fail to deliver on collective outcomes, require rework and create technical debt.

Integrated Care Systems (ICSs) are geographically based partnerships that have been developing for several years, however, the Health and Care Act puts them on a statutory footing from July 2022. Consequently, it is critical that ICSs are supported in their strategic decision making as soon as possible and in future years. As it stands, ICSs are not fully aware of national offerings, and consequently it is difficult to understand what they must provision themselves and what capabilities, standards and policies may be in place to support this.

The Target Architecture should provide:

- National health and care digital programme leaders with clarity on what this means for their programmes, what they should be focussing on and what piece of national architecture they can expect to reuse.
- Local digital leaders – in integrated care boards, in trusts, in primary care, in social care, in local government - with a guide to help them determine what national products and services they can use and rely on, freeing them up to focus on local deployment and innovation.
- Digital systems suppliers with clarity on what they are expected to do to ensure that their products and services can plug in – and interwork – with national and local systems. This includes statements around standards

The target architecture must look beyond current organisational boundaries and create a conceptual model that can work for all partners, increasingly designed around on the people receiving care.

It is recognised that the architecture is not building on a green field site. Across the health and care landscape, there are huge range of existing systems. Some are well-advanced and sophisticated; others are ageing legacy systems. Replacement of some of the legacy systems soon will be unaffordable and so the target architecture needs to take account of the transition it will need to go through over the next few years.

## 3. Use Cases

### 3.1. The Four Key Use Case Types

To set the context the architecture is designed around the four primary use case types that cover health and care services in England. For each of these use case types the architecture covers the business capabilities, and supporting applications, services, and data flows/ integration required to deliver the desired strategic goals and outcomes.

These use cases relate to patient-related data, but it must not be forgotten that the data is needed for the other support functions that are essential for the smooth operation of the healthcare care system. However, the focus of the attention should be on the core purpose of the ecosystem which is delivery of care.

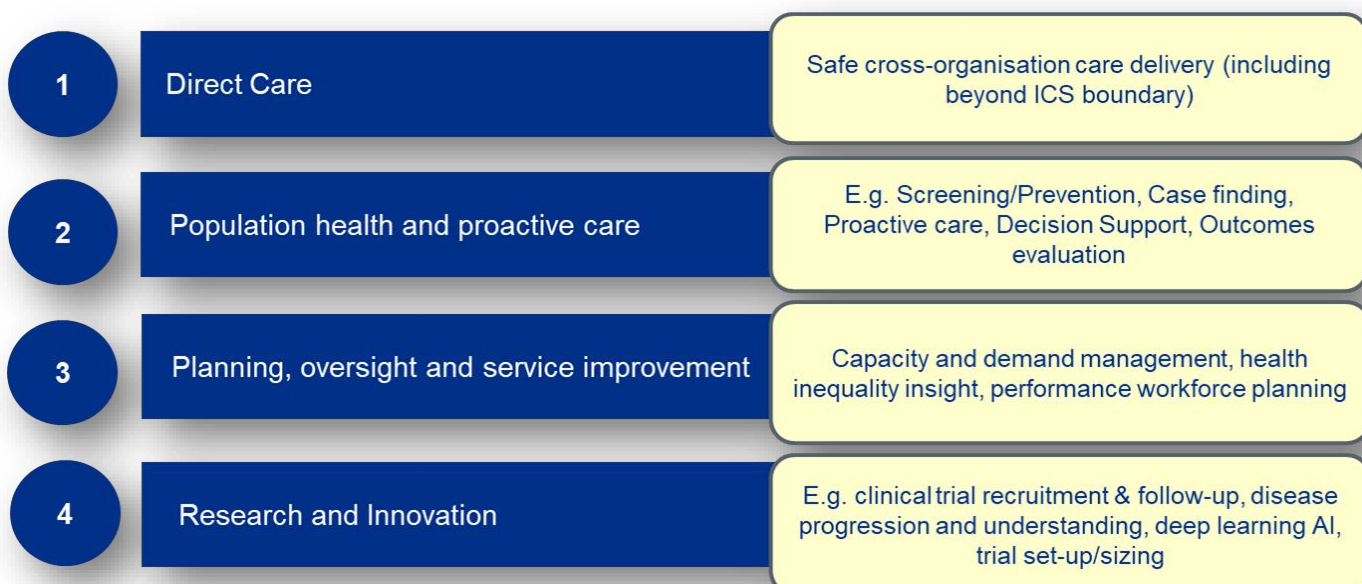


Figure 2 - Use Cases

#### 3.1.1. Direct Care

Direct care is provided by health and social care staff working in care teams, which may include doctors, nurses, and a wide range of staff on regulated professional registers, including social workers. It leads to improved patient care, safety, and experience.

It includes access to real-time data with read and write access and identifiable data required to deliver direct care. Health and social care staff depending on their role would need access to patient records including appointments, care plans, communications, safeguarding etc.

Individual direct care is therefore the activity most associated with the benefits to patients and should be at the heart of the target architecture. Without the ability to capture store and exchange information derived at the point of care to a high level of quality, it cannot be realistically considered how that information - in any other form - can be reliably used for any other purpose.

### **3.1.2. Population health and proactive care**

Population health addresses the need to be able to explore whole populations to better understand the specific needs of cohorts within those populations, whether based on geography, age, or condition. It includes screening, prevention, case finding, proactive care, decision support and outcomes evaluation. It leads to improved population health, effectiveness, and reduced health inequality.

Risk prediction and stratification is a specific task within the remit of population health management which identifies those cohorts for whom a direct intervention may be possible.

It includes access to daily or real-time data updates and identifiable data might be required by authorised staff to enable direct care (ICS level user and below e.g., place, provider).

### **3.1.3. Planning, oversight, and service improvement**

Service improvement and operational planning use case is to monitor operations/services to ensure how they could be more efficient and productive. It includes capacity and demand management, health inequality insight, performance management, workforce planning and financial and contract management.

The users are health and care staff and other Arm's Length Bodies (ALBs) users e.g., Care Quality Commission. It includes access to weekly or hourly data updates (depending on criticality of action).

Health and social care staff depending on their role would need access to data so that individual patient cannot be identified.

### **3.1.4. Research and innovation**

Data can be used to discover which treatments work best, in which patients, and which have side effects. It can be used to drive innovation across the life sciences sector. This includes clinical trial recruitment & follow-up, disease progression and understanding, deep-learning AI, and clinical trials set-up. This leads to improved population health, reduced health inequality and positive economic impact.

The users are academic institutions, charity sector and industry researchers. It includes access to weekly or monthly data. The data is anonymised for majority of use cases so that there is no patient identifiable information. Trial recruitment and follow up requires re-identifiable data.

## 4. Alignment to Strategy

### 4.1. Strategic Outcomes and Objectives

The analysis of several <sup>[1]</sup> business and digital strategies at national and through the engagement of several ICSs has led to a set of distilled collective objectives that the architecture is responding to, to enable the required business change to take place, these are:

#### 1. For all to have easy access to manage the right information

- People can access their own data with tools to contribute to their care and empower them to make informed choices
- Digitise records throughout the ecosystem.
- Create a single virtual record for individuals joining data from health and care partners safely.
- Make available operational data, such as bookings and appointments

#### 2. Accelerate medical and health-tech innovation

- Establish Secure Data Environments as the default place to do research

#### 3. Drive effective decision-making in business real-time through timely access to data

- Invest in secure data environments to power life-saving research and treatments
- Embed digital tools to support communication and collaboration across ICS and in Multi-disciplinary teams

#### 4. Create the foundational capabilities for personalised and accessible healthcare services

- Instil Digital-First thinking into Care pathway and service design
- Expand remote monitoring tools and virtual wards, and access to options that support the needs of the community.

#### 5. Provide the workforce with digital tools to improve workforce skills, planning and deployment

- Build the capability to enable staff fluidity across the ecosystem

#### 6. Reduce the burden of completing jobs through simplifying experiences

- Establish a single digital front-door for self-service, safeguarding and to support communication.
- Leverage improvements and innovations in technology to enhance care
- Develop inclusive, accessible digital solutions that free up staff time for those who prefer traditional approaches to care

[1] Long Term Plan 2019, ICS Design Framework, WGLL, Data Saves Lives and 2 volunteer ICSs



## 4.2. “Must execute well” Capabilities

To achieve the desired outcomes and objectives, a small set of “must execute well” business capabilities underpin the ability for the health and care system to succeed in achieving the goals and outcomes outlined in the strategy. Business capabilities essentially describe everything that the system can do or must do to meet its goals.

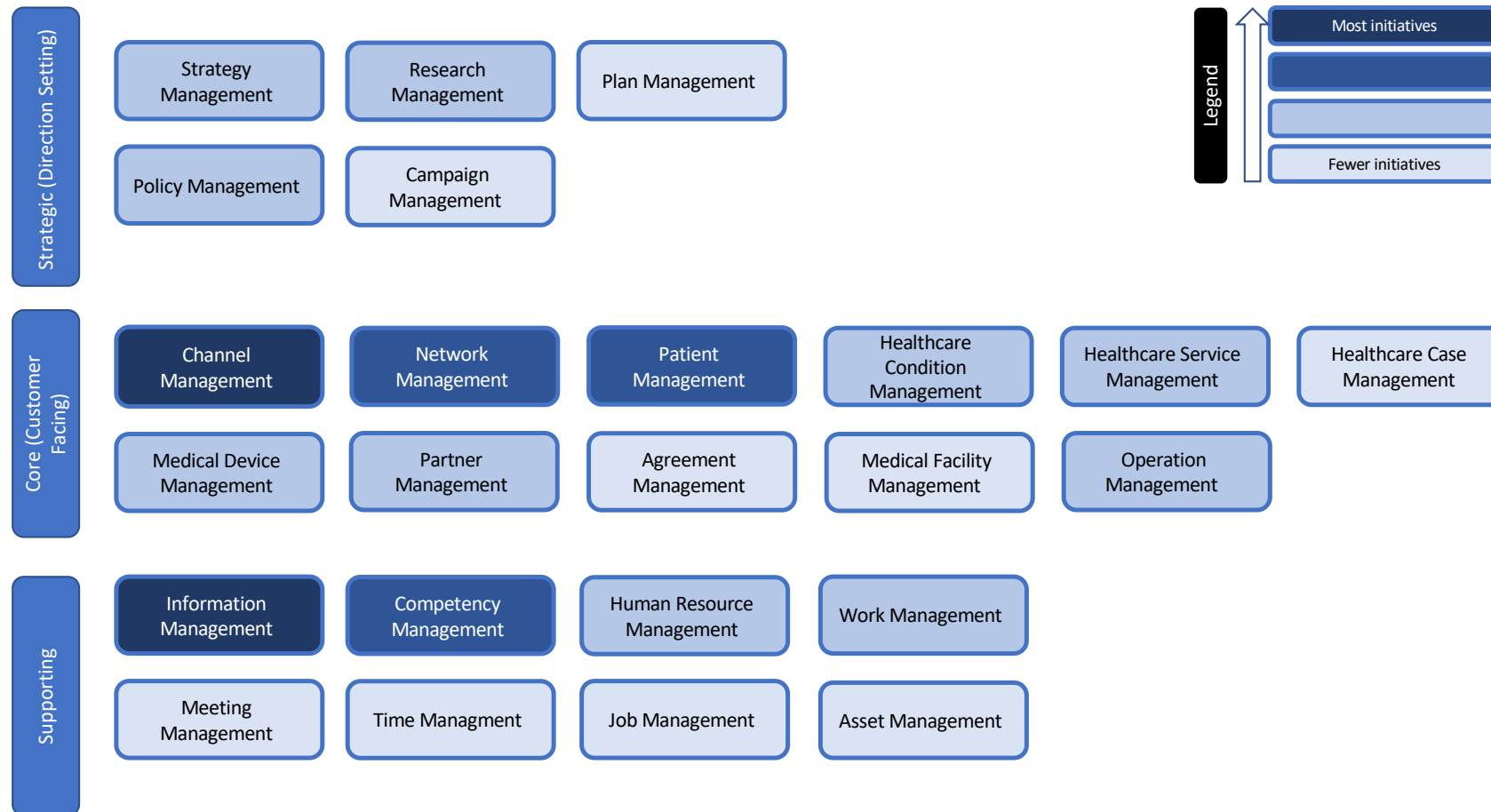


Figure 3 - Shortlisted Must-Execute Capabilities

The strategic plans referencing these capabilities has been mapped to indicate hotspots of strategic impact, to aid in identifying those areas warranting the most focus of investment and effort.

For example, the objective “*For all to have easy access to and manage the right information*”, depends on the system’s ability to:

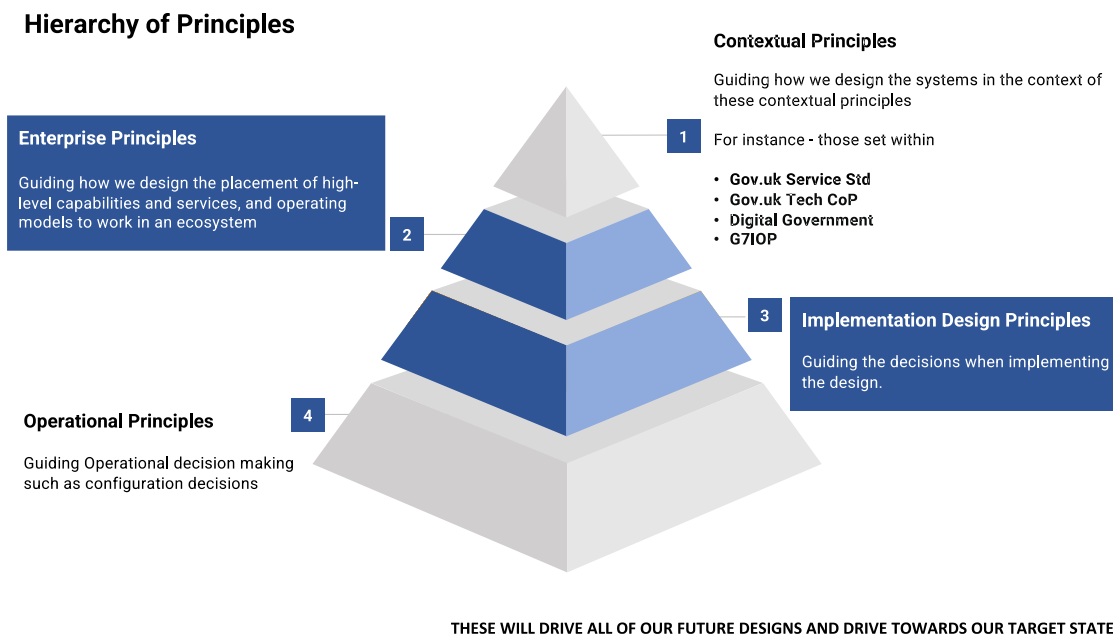
- Control, predict, process, organise, present, and analyse all information, documents, preferences, experiences, and history related to an individual that is a recipient or beneficiary of healthcare services, as part of **Patient Management**
- Ability to establish, and utilise a digital, or physical conduit through which related healthcare services, data access or communications are delivered or received, including the Internet, phone, postal delivery service, satellite, radio, or physical means, as part of **Channel Management**.

Further illustration of the linkages between goals and capabilities can be found in Appendix C – Linking Objectives to Business Capabilities, along with their definitions in Appendix D – Business Capabilities definition .



## 5. Core Principles

There are several core principles that have been agreed to govern the development of the target architecture. These operate at different decision-making stages, starting with the principles that guide early ideation, through to the implementation and operational stages. These are important to adhere to as they ensure consistent decision making to move towards the target architecture.



**Figure 4- Hierarchy of Principles**

These principles are designed for use by architects and service designers working for health and social care in England.

### 5.1. Contextual Principles

Contextual principles guide any organisation, or endeavours, in a context that applies, such as across all public services, including those offered by England's Health and Care participants.

As such it is expected that they are understood and abided to, but they are not repeated here, as to do so would be redundant. Examples of contextual principles include:

- [Gov.uk Service Standard](#)
- [Gov.uk Technology Code of Practice](#)
- [Digital Government](#)
- [G7 Open Standards and Interoperability for Healthcare](#)

### 5.2. Enterprise Principles

The following Enterprise Principles were agreed to aid the understanding of purpose, and aid with placement of services and capability the National Level.

NHS England will only provide services and products where following quadruple aims are fulfilled, namely that national provision, as opposed to local or regional provision, leads to:

- Better health and care outcomes
- Better patient or clinician experience
- Improved population health
- Value for money and reduction in costs per capita

Keeping the above in mind, NHS England will be the Single Central Service Provider where the following criteria come into play:

**1. Scale and visibility are critical at a national level**

The national scale helps to see things and act quickly (e.g., cyber security, supply chain). The purchasing power of the NHS as a whole can be leveraged – commodity or cross-industry products and processes (e.g., N365, contact centres, cloud)

**2. Standardisation nationally is critical for patient care, safety, experience, and cost optimisation**

The interoperability and insight across ICS boundaries are critical to patient safety (e.g., PDS, Summary Care Record, GP Connect, Child Protection Information Service, and national and regional data platforms). A consistent citizen experience is needed (e.g., NHS Login, booking and referral standards, NHS App).

## 5.3. Implementation Principles

### Key Implementation principles

1	NHS Number is the primary patient identifier
2	Adopt international standards and engage with the community to mature these
3	Validate data at the point of entry
4	Data is mastered where it is collected.
5	All data should be discoverable and accessible via well-defined APIs
6	Data privacy and security are first-class citizens
7	Data should be captured, stored and shared with a view to the needs of the wider system
8	Maintain public trust and confidence

Figure 5 - Key implementation Principles

#### 1. NHS Number is the primary patient identifier

The NHS Number allows us to identify individual patients uniquely and nationally. It is assigned from birth and stays with most patients all their lives. Having a single consistent identifier allows us to aggregate together information about individuals as they travel across the health and care landscape.

#### 2. Adopt international standards and engage with the community to mature these

We will work with international standards where they already exist to ensure that we leverage the development of these standards and make it easy for system suppliers to build for wider markets than just England. Where we use international standards, it may be necessary to anglicise these to ensure they are the best fit for use in England. Where we do so we will work with standards bodies to reflect changes back into the standard.

#### 3. Validate data at the point of entry

We will set a policy that all data should be validated on input to systems at the source. We will require all national systems to validate the data they capture or that they receive to ensure that we place checkpoints at the exchange of data. This will help us to drive up data quality from the start of the process rather than at the end.

#### 4. Data is mastered where it is collected.

We expect data to reside close to its point of capture and where data is captured remains the master source. Not only does this reduce duplication and the potential issues associated with maintaining integrity across multiple copies, but it also enables data controllers to be more confident in exercising

control over access. We prefer code and algorithm to be taken to the data, rather than transport the data to the code, to minimise data movement. There will of course be cases where certain types of data need to persist elsewhere for example, in regional shared care records or national services. When this is the case, the reasoning must be clearly articulated.

#### **5. All data should be discoverable and accessible via well-defined APIs**

Although keeping data stored close to where it is created is an important principle, it is equally important that the data is discoverable when required, along with its origin and any changes that have been made to it to satisfy the four use cases can also be described. This will require the collection of robust metadata from the point of origin showing the lineage of the data, along with metadata reflecting all changes that have been made to it through any collection, pipeline, and aggregation process.

#### **6. Data privacy and security are first-class citizens**

The right to control how their information is viewed and used, whilst being confident that suitable security protection against threats or danger is in place, is key to the success of adoption and acceptance of digital solutions, and in turn effect on operational effectiveness and efficiency. These aspects are to be given as much consideration as functional requirements.

#### **7. Data should be captured, stored, and shared with a view to the needs of the wider system**

Care pathways often involve the delivery of care across care settings where data needs to follow the patient. Hence, it is important for care providers to play their part in the wider system by making their data accessible across care settings. Each care provider is expected to capture data and appropriate metadata to support integrated care pathways, and to make data available through appropriate mechanisms and terms as set out in the target architecture.

#### **8. Maintain public trust and confidence**

Maintaining public trust and confidence in how we collect and use data is critical. We must design privacy in at the outset, recognising the expectations and rights of individuals and the legal frameworks within which data may be shared.

### **5.4. Operational Principles**

Operational principles apply to the decisions made during the operational life-cycle phase post-implementation, these affect the decisions and behaviours of administrators, end-users, and those involved in continuous improvement activities such as training, process review, or configuration changes.

As this phase is not the scope of this document, principles of this sort have not been included.

## 6. National, regional, and local services - conceptual model

The conceptual model consists of three geographically scoped layers supported by a set of common foundation services, as illustrated in the diagram below.

The granularity of data should increase as the geography becomes smaller meaning that locally there should be the maximum amount of information captured and at the national level the data is maintained to support national uses of the data and supporting care outside usual place of residence or disconnected systems. The movement of the data required at regional or national consolidation for legitimate purposes with required information governance policy applied with access controls. The diagram below shows spectrum of national support mechanisms spanning a high level of national accountability through to complete local autonomy. This will include nationally provided services, national commercial frameworks and buying support, national standards and where our role is to be community facilitators.

	National Accountability			Shared Accountability		Complete Autonomy	
	Nationally Provided Services			National Commercial Frameworks and buying support		National Standards	Community Facilitators
	Single Centrally Provided Service	Central Preferred Service + other options	Other Useful Services aka Backstop	Procurement Framework Rationalisation	Broad selection		
Type							
Principle	Where there is national level scale or standardisation is critical.	Where there is national level scale and standards available to deploy equivalent solutions.	Where there is national level scale and the ICSSs /Providers have no solution in place.	When leveraging national buying power gets us the best deal/adherence to critical standards or central purchasing skills are required.		When consistency to national standards is crucial and a network benefit.	Where Solutions are specific to locality. Typically systems of innovation and differentiation.
Description	Centrally buy, build and run Service, platforms and digital offerings which should be used.	Centrally buy, build and run Service, platforms and digital offerings which are recommended to be used.	Centrally buy, build and run Service, platforms and digital offerings which could be used.	Central price negotiation or centrally negotiated catalogue of suppliers or central support on negotiations, contracting and best practice, funding accelerators.		Set national standards and provide support to help local adoption.	Local autonomy and flexibility. We help signpost and connect local entities with shared goals and outcomes through communities.

\* current scope of document is NHSE//D

**Figure 6 – Spectrum of National Support Mechanisms and Accountability**

National-level services need to:

- Enable access to data across regions and local services in support of delivery of the four use cases.
- Avoid duplication and provides efficiencies in data management.
- Provide a single front door for patients and a consistent user experience.
- Enable controls for data standards and enhanced data quality required at a national level e.g., NHS Number.
- Enables greater reuse of components and services that have common requirements across regions.

The regional services need to focus on:

- Supports ICBs in meeting their legal responsibilities.
- Represents sub-national structures which could be one or more ICS.
- Supports the population health and service provision/improvement by the ICS
- Adheres to national standards but leaves autonomy within an ICS to meet user needs and ensure that data can be made available at a boundary in a standard format

Most of the information is captured and used at a local level. Services at this level should:

- Recognises that most data flows will be local and managed by the local data systems.
- Utilise national standards for broad use across local, regional, and central actors, but leaves autonomy within a provider organisation for where they implement these standards.
- Adhere to national standards but leaves autonomy within a provider to meet user needs and ensure that data can be made available at a boundary in a standard format.

## 6.1. Persistence of data

A general principle for the target state is that data should reside as close to where it is created. Most data will be created within local systems such as EPRs, administrative systems, pathology laboratories, imaging departments and local authority client management systems. Ideally, they would remain in these systems and be retrieved on demand via services such as the record locator. There is however a need to copy some elements of data to regional or national stores to support interoperability across regions. This may be for several reasons such as:

- Cost – regionally or nationally the cost of standing up a service to retrieve information can be born to avoid local expenditure especially when the volumetrics are unknown.
- Processing – pre-processing data from multiple sources regionally or nationally enables faster access as it avoids collection from multiple sources, de-duplication, cleansing, coding etc.
- Latency – the speed of access to vital information is faster when the information is held in a single location.

It will be necessary to consider each type of data on a case-by-case basis to determine whether there is a need to hold data elsewhere. There are some types of data that would benefit from being held nationally.

Data	Description	Rationale
Inter-organisational Documents	Documents such as discharge summaries, outpatient letters and A&E attendance notes are generated as part of the transfer of care. They typically contain an account of the encounter including structured data.	Holding these documents in a national store reduces the burden on local systems to make them available externally and host a service to do so. Typically, these documents are sent directly to GPs and no further access is available to them. Community and social services would often benefit from access which would be enabled both through a national API and via the national care portal. They could also be made available to patients via the NHS App.

Pathology	Data including pathology test requests and the results of those tests.	Holding these data nationally would enable quick access to test results from wherever they were undertaken. Currently, there is little sharing between care settings within an ICS and even less between ICSs. Making these data available nationally would reduce the duplication in tests, save time for treatment and provide a better patient experience.
Medications	Data on current and past medications.	Medications are a key set of data that is generated at a number of encounters and is used in all encounters. Often patients may not recall all their medications or may not be in a position to provide any information. Holding this in a single place would enable quick access to the fully structured data on medications.
Vaccinations and immunisations	Data on vaccinations and immunisations whether provided by the NHS or privately	Vaccinations and immunisations are a key part of a patient's record. During the COVID-19 pandemic, information on all vaccinations for COVID and flu were held centrally (in addition to where they originated). This proved invaluable for direct care purposes, to support cohort selection and for the COVID-19 passport. Other use cases exist which have struggled to collate this information from across providers such as child health who require access to information on the vaccinations delivered during childhood.

## 6.2. Conceptual Target Architecture

To support the 4 uses of data including direct care, population health, service improvement and research, the target architecture needs to consider the following factors -

**Applications** - The kind of applications and capabilities which are needed to underpin the core functions which support the delivery of the four use cases. This construct utilises the data, and it is sourced from the data systems available in 3-layered architecture.

**Data Systems** – This construct represents the data aggregation repositories or clinical, workforce and care systems which are the sources of the data.

The conceptual Target Architecture diagram below describes data systems and applications in the target state.



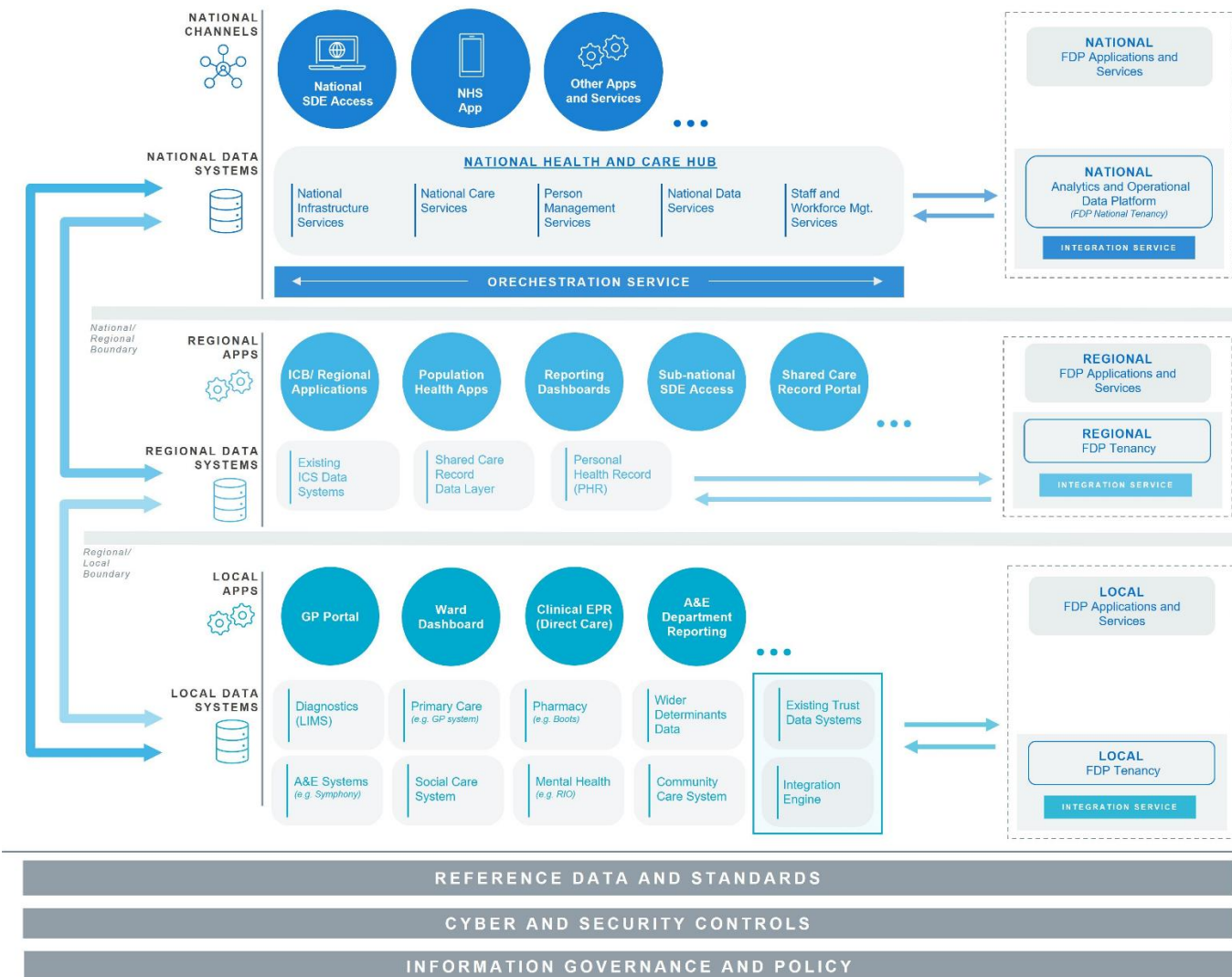


Figure 7 – Conceptual Target Architecture

### 6.2.1. National Layer

The national layer includes important components as:

1. National health and care hub – a collection of strategic national platforms and services provided by NHS England from the legacy of NHS Digital. The hub provides authorised consumers and producers of the system with access to the data. The hub includes an orchestration service which will support access and exchange of data to and from national systems. The orchestration Service is an abstraction layer that sits on top of the national services, it will take NHS number in an API call and will make multiple calls to hide complexity from the user. The orchestration service will utilise existing strategic national services e.g., National Record Locator service which will be enhanced to support the target architecture.
2. National Analytics and Operational Data Platform - the collective for the analytical landscape available at the national level including Federated Data Platform national tenancy.
3. The NHS App and other National Apps and Services– uses services present in the Health and Care Hub to present data, transactional services, and advice and guidance for the person.
4. National Secure Data Environment – the national data collections contain decades worth of patient level data describing interactions with the service throughout their lives. This data is valuable for operational and research value. However, for this data to be used for the four use cases the technologies, platforms and processes are required to assure that they can be safely used whilst preserving patient privacy and safety. This is the purpose of the National Secure Data Environment. The service is made up of robust governance processes, data minimisation and secure data access technology.
5. Federated Data Platform National Tenancy – the platform is elastically scalable infrastructure capability that will host the Data Platform, Analytical Solutions and Platform Applications at the national level. The national tenancy will not have any identifiable data. FDP Integration Services components support ingress and egress of data in a secure and adaptable way. FDP will integrate with existing national data collection services e.g., Data Processing Service. For more details on FDP, please refer to section 6.

### 6.2.2. ICS / Regional Layer

At the regional level, several data systems and applications may exist. These aggregate and support the flow of information within the geographical boundary which they cover. The regional layer includes important components such as:

1. Regional Data Systems including:
  - a. Existing ICS Systems – there are several existing ICS data systems used as secondary data stores within ICSs and regions. Consideration will need to be given to these services on a case-by-case basis to determine how they will evolve. This is delegated to the regional teams to define.
  - b. Shared Care Record – at a regional level, an ICS or collection of ICSs may have a shared care record used to support the provision of information to care professionals delivering care to patients.
  - c. Personal Health Record (PHR) – Some ICSs have implemented PHRs within their region to provide digital access to health information, and to capture information from the person. Consideration will need to be given as to what information will be available natively through the NHS App over time, and how that impacts what will need to be provided at a regional level.
4. Sub-National Secure Data Environment – Regional collaborative to drive efficient use and consolidation of similar research services within a region. Targeting a population of approximately 5 million will be the default access point for research. The primary difference

compared to the national SDE will be its ability to respond to regional research requirements that the national SDE cannot or will not be able to provide. These will provide researchers with access to multimodal, real-world data under the operational oversight and governance of NHS organisations working across multiple ICSs and linked to regional geographies. In the picture, the access component is shown as the regional channel with data storage in ICS data systems as the data aggregating point from different data sources.

5. Regional apps- These include regional/ICB apps, population health apps, reporting dashboards and shared care record portals.
6. Federated Data Platform Regional Tenancy – The platform is elastically scalable capability that will host the Data Platform, Analytical Solutions and Platform Applications at the regional level. It is intended that the National SDE and FDP will be complimentary, and that solutions and data will be shared (under strict information governance) to maximise value for money and avoid unnecessary duplication.

### 6.2.3. Provider / Local Layer

At the local or at provider level, local data systems exist as the system of record and authoritative data source related to patient care is stored in most granular and updated in the real time.

The local layer includes important components as:

- Local apps- These include several apps e.g., GP portal, ward dashboards, clinical EPRs and A & E department reporting.
- Local Data Systems- These include several systems e.g., GP systems, mental health, and community systems etc.
- Federated Data Platform Local Tenancy – The platform is elastically scalable capability that will host the Data Platform, Analytical Solutions and Platform Applications at the local level. This will integrate with the local systems at the trust level.

### 6.2.4. Foundation Layer

Reference Data and standards – The use of reference data and standards will enable the various applications that provide end users with the functionality they require and will interact with the data systems through a comprehensive set of appropriate standards

Information Governance and Policy – Information Governance is an important element to enable the tiered architecture and using the data for the 4 use cases when the data is collected or captured for primarily to provide direct care.

Cyber and Security Controls – These are the guardrails supported by the standards and tools provided by the national team to all layers in the architecture.

## 6.3. National Health and Care Hub

### 6.3.1. Why a Hub

At a national level, the merger of NHS Digital and NHS England and NHS Improvement (NHSEI) will create an opportunity to make the most of NHS data while maintaining safeguards. The public and staff have confidence that data is safe and being used appropriately by health and care staff and patients alike. The hub will provide one place to collect, store and manage the data with required

safeguards to support the patient care e.g., use of NHS App as well as provide support to the ICSs to function in cross regional care pathways.

### 6.3.2. What is the Hub

The hub is the data system with a collection of services and components which work together to orchestrate the data to support the national applications including the NHS App, Clinical care portal for the health and care staff, repository to support the statutory reporting, safe haven to use data for research and innovation.

### 6.3.3. Hub use cases

The hub is needed to support the recovery of NHS services after the pandemic, provide a data backbone to create the demographics master, collections, and availability of data for statutory reporting and commissioning, address waiting list backlogs via provisioning the patient cohorts and support staff, all while driving forwards an ambitious agenda of digital transformation and progress.

One use case which makes the hub important is to connect providers of data to the consumers and abstract the complexity involved in using the data. The hub provides a set of services which enables applications to help health and care staff to care for the patient out of home geography or where a single patient record view is not yet mature. This is made possible with the use of the NHS number as a single identifier and patient records created by data exchange using different patterns made possible by the orchestration layer. The same data is then used for analytics and for research purposes within the boundaries of information governance and data access authorisation management.

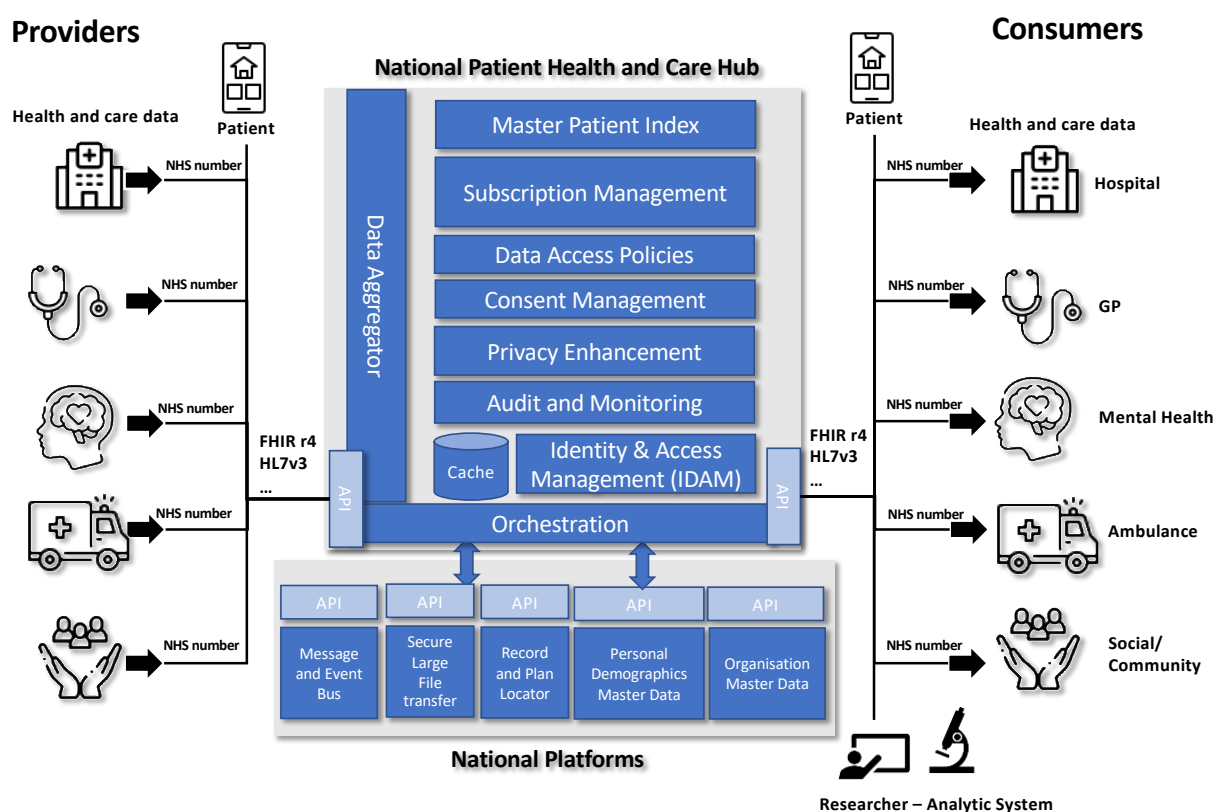


Figure 8 – National Patient Health and Care Hub

Use Case	Description
Direct Care	<p>Recording the Vaccination and Immunisation records, and this record is available to health care worker and service user through health and care portal without much administrative overhead.</p> <p>Enabling the clinician to retrieve data about the at times of emergency and when the patient is visiting to the new location other than his home area.</p> <p>Providing consistency in availability of the pathology test results and other diagnostic results at the point of interaction with the health care professional and patient.</p>
Population Health and proactive care	<p>Providing APIs and enabling access to all national and regional data repositories in a clear or deidentified format using secure mechanism. These repositories would also be available for any authorised users to assist in improving population health.</p> <p>Providing ICS analysts, the cohorts of the patients to enable planning of the services efficiently.</p> <p>Enabling the master index with flags for all users of the system as one place to have list of health and care system users in the population.</p>
Planning Oversight and Service Improvement	<p>Providing organisations with data to assist their capacity city and demand management. The data would be delivered securely and help the organisation manage capacity, improving productivity.</p> <p>Where available, staff data could be exchanged (using orchestration service) between organisations to aid workforce planning and ensure appropriate staff levels are known to deliver safe, high-quality care to patients.</p> <p>Provide ways to add the flags of interest to the patient record to enable better care by the clinical care staff in health and social care context</p>
Research and Innovation	<p>Data would be made available to SDE through data transfer from regional care records from national data collection services with authorisation controls.</p> <p>Providing standards for the data sharing for research and innovation to help in efficient and secure data sharing using PET</p>

### 6.3.4. Components of the Hub

The target architecture describes a “National Health and Care Hub” - a collection of all the national products and services that will be available to support systems implementation, across all the uses of data described earlier in the section.





**Figure 9 – Components of National Health and Care Hub**

The health and care hub is split into 5 component groups:

1. **National infrastructure services** - National Infrastructure services include communication services, networking, data processing and storage, platforms through which National NHS bodies can share information, content and media, knowledge management, systems, and applications. Most importantly, infrastructure services provide vital National NHS services for all Health and Social care organisations, locally and regionally.
2. **National care services** - The national care services consist of a set of services that provide access to clinical information held nationally which supports the delivery of care. Within these services, the information is typically persisted at a national level to support rapid access to key information normally held across the health and care estate.
3. **Person management services** – The Person Management Services are a grouping of services that a citizen/patient/service-user can utilise directly themselves via an appropriate user experience, such as the NHS App, NHS Website or a third party-provided digital service.

The data they provide, or services they access, are related to a single citizen, not a cohort of patients or service users. They are accessed by the person themselves, or a delegated person such as a child or parent. In some cases, they will also be accessed by health and care professionals.

4. **National data services** – The national data services are a set of services to enable data submission by the NHS providers to national bodies including NHS Digital and NHS England, cohort management for patient shielding, immunisations, clinical trials etc., managing the secure data environment for research, managing data access with deidentification tooling and other tooling managing data within the national bodies.
5. **Staff and workforce management services** – These are a set of services to capture data about the health and care workforce, integrating the staff rostering systems to the clinical systems and Improving staff movements with rapid provisioning of access to systems. This service includes using staff authentication services that support Identity and Access Management policies pan health and care system

For details of each of the component of the national health and care hub, see Appendix B.

## 6.4. Federated Data Platform

NHS England intends to go to market to procure a Federated Data Platform which will be an essential enabler to transformational improvements across the NHS.

### 6.4.1. Why FDP?

The NHS has demonstrated through the pandemic how data tools are critical to transforming operational services.

- Providing frontline staff, the information they need to provide the best possible care for patients.
- Securing insights to put patients, citizens and population health at the centre of service design.
- Enabling more effective care coordination.
- Providing the right people with the right access to information for strategic and operational planning.
- Increasing transparency and patient understanding of how data is used positively.
- An effective FDP has the potential to deliver £3.6bn benefits over 10 years.

### 6.4.2. FDP Use Cases

The FDP will be built on the five use cases outlined below. Note, although the use cases below support two of the primary use cases referenced at the start of this document (population health management and operational service improvement) they are FDP programme specific and refer to a lower level of detail:

- Population health and person insight
- Care coordination (ICS)
- Elective recovery (Trust)
- Vaccines and immunisation
- Supply Chain

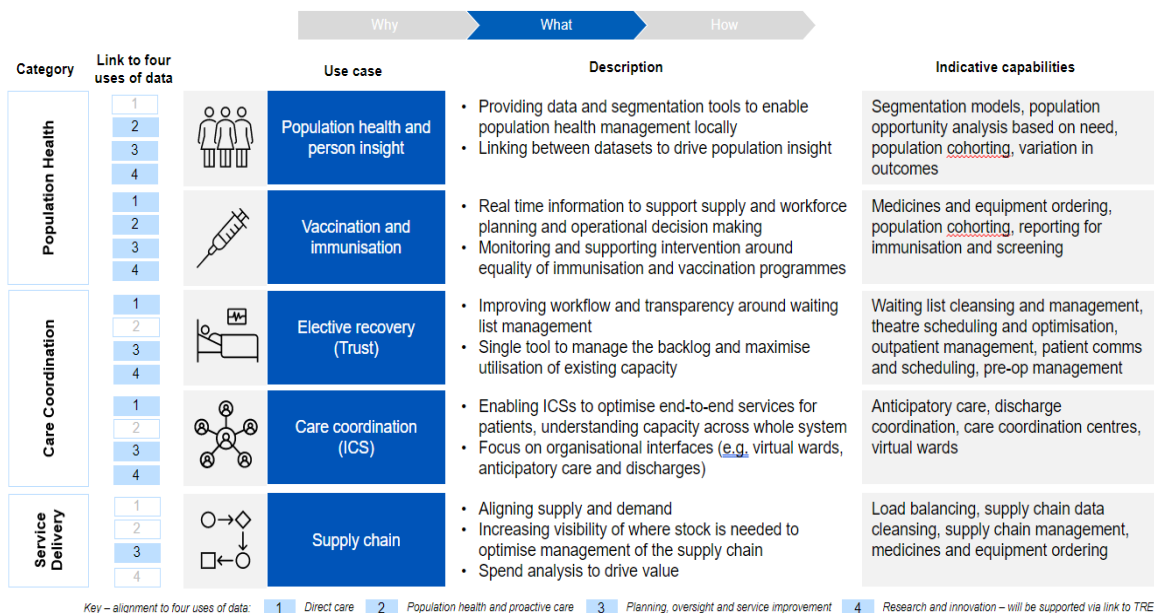


Figure 10 – FDP Use Cases

### 6.4.3. Major components of FDP

The FDP will be an ecosystem of technologies and services implemented across the NHS in England. The diagram below presents the key components which make up the FDP ecosystem.

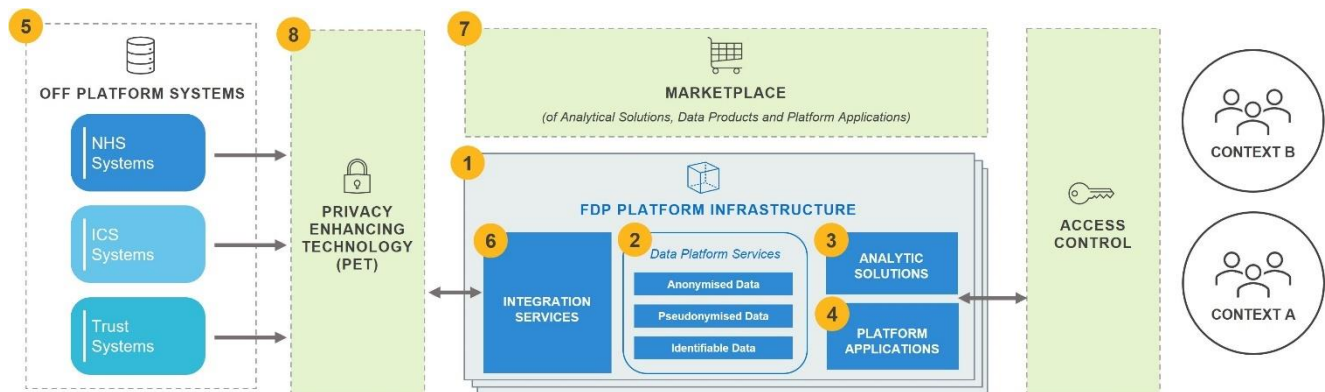


Figure 11 – Components of FDP

The major components in the Federated Data Platform architecture include:-

**FDP Platform Infrastructure:** an elastically scalable infrastructure capability that will host the Data Platform, Analytical Solutions and Platform Applications.

**Data Platform Services:** the core data platform which will process structured, semi-structured (e.g., JSON), unstructured (e.g., PDF), and binary data (e.g., Image). It will host the data models, data engineering pipelines, data privacy workflows and orchestration.

**Analytical Solutions:** solutions built upon the Data Platform using low code / no code tooling and fulfilling analytics and reporting use cases.

**Platform Applications:** solutions built upon the Data Platform using low code / no code tooling and fulfilling operational business software use cases.

**Off-Platform Systems:** existing and future software applications used by the ecosystems of NHS organisations and providers to run their day-to-day healthcare operations. Unlike Platform Applications, Off-Platform Systems are not and won't be hosted on the FDP infrastructure.

**Integration Services** components to support ingress and egress of data in a secure and adaptable way. The solution must support queue-based messaging services that support different policies according to the type of data to ensure appropriate processing and protect data from loss.

**Marketplace:** a component to showcase Analytical Solutions and Platform Applications that have been built upon the Federated Data Platform. The objective is to enable easy identification and sharing of existing applications across many organisations within the NHS, promoting re-use, innovation, and scaling with low incremental cost of adding new organisations.

**Privacy Enhancing Technologies (PET):** will process data to apply privacy mechanisms such as pseudonymisation, anonymisation, and / or re-identification. It will treat ingress data in transit to ensure a high level of privacy as the data enters FDP. PET will implement the governance and privacy controls agreed in advance of any use of data. PET will be a separate concern from the data platform to enhance data governance.

### 6.4.4. Multi-Tenant Architecture

The FDP will be implemented as a multi-tenant architecture.



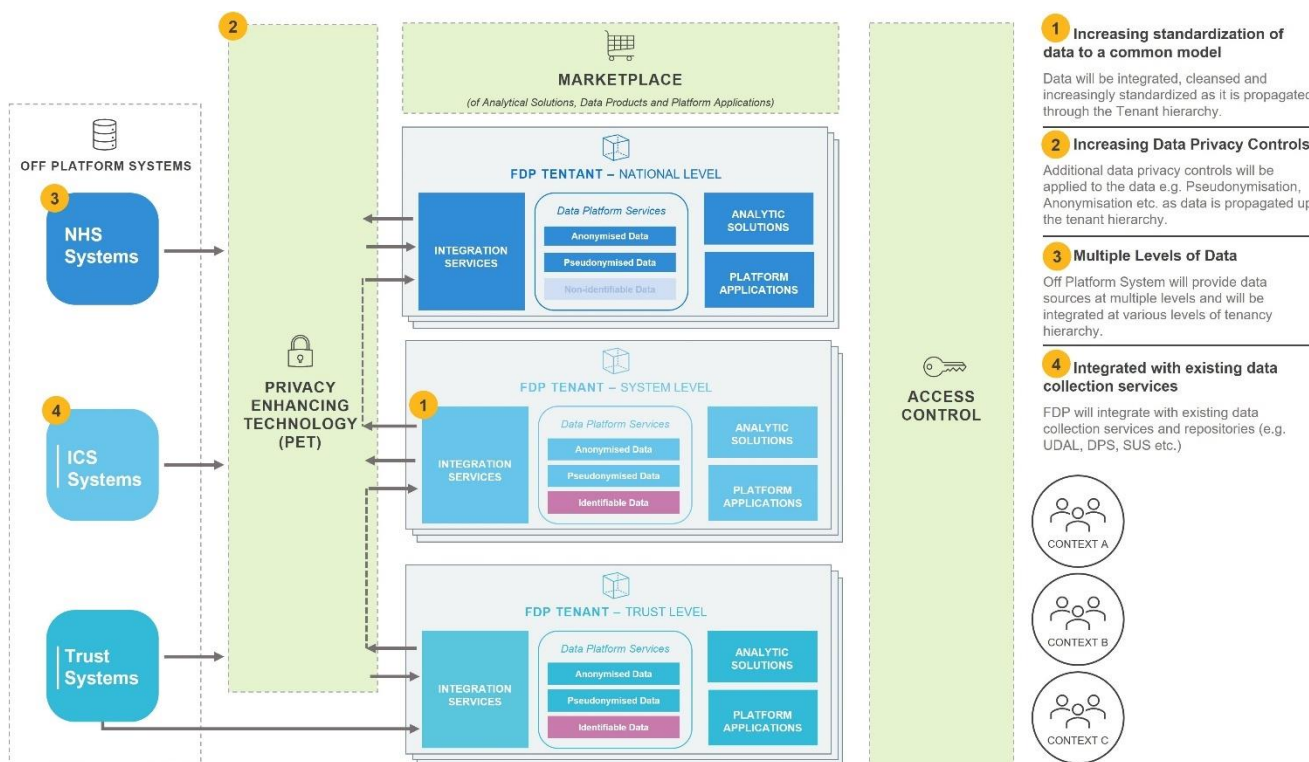


Figure 12 – FDP Multi-Tenant Architecture

This will allow for development at a local (Trust), Regional (ICS) or National level, while respecting Data Privacy, Data Security and Data Ownership constraints at every level.

#### 6.4.5. How could FDP be Adopted by ICSs?

The FDP solution can be implemented in part or in whole and with an equitable distribution of implementation support. ICSs vary considerably in their digital maturity, with some ICS's having existing feature rich integration and analytics capabilities.

FDP will be available to ICSs in the following configurations:

- As the primary Data Integration, Data Application and Data Analytics Platform for the ICS
- To be used alongside existing ICS systems, complementing current functionality with new use case focussed capabilities (Population health, Care Co-ordination etc)
- Minimal usage, with most capabilities continuing to be provided by existing feature rich systems. In these cases, ICS's may still choose to integrate with FDP when beneficial.

The flexibility built into the architecture and consumption options allow ICSs to make strategic choices regarding their existing estates and future developments.

### 6.5. Secure Data Environments

#### 6.5.1. Why are SDEs needed?

Data helps our clinicians make better decisions in delivering care and allows researchers to discover life-changing new treatments. SDEs are the strategic means by which:

- This data will safely be made available for research and analysis.

- The Government's plans to harness the potential of health and care data to find new treatments, improve outcomes, and accelerate the growth in high quality research being undertaken in the UK.

The use of Secure Data Environments to provide access to health and social care data for research and analysis is backed by academic and industry leaders who are experts in deriving insights from data driven research. Both the Goldacre Review and HDRUK Green Paper indicate wide support for the benefits of moving to this model. The implementation of Secure Data Environments was also a core commitment in the data strategy for health and social care ([Data Saves Lives: reshaping health and social care with data](#)).

### 6.5.2. What are SDEs?

Secure Data Environments (SDEs), as the name suggests, are secure data storage and access platforms designed with features that enable organisations to have greater control and oversight over their NHS Health and Social Care data. They are constructed to the highest standards of privacy and security to allow approved users to view and analyse data without it having to leave the environment. SDEs are the means by which the NHS in England and the Department of Health and Social Care are making a strategic move away from processes that rely on data sharing to a model of data access.

### 6.5.3. Delivery of SDE

In September 2022 the [Secure Data Environment Policy Guidelines](#) were published and set out the expectation that Secure Data Environments will become the default way to access and use NHS health and social care data for research and analysis. It also listed 12 guidelines that outline the minimum requirements that organisations and individuals looking to host and use NHS health and social care data will need to adhere to. They are organised around the "Five Safes" framework developed by the Office for National Statistics (ONS), which is widely regarded as representing best practice in data protection.

It also communicated the intention to establish a model of oversight to ensure that the storage, access and use of NHS health and social care data is lawful and secure. This will also ensure that organisations and individuals continue to meet our requirements and will provide the public with assurance about how their data is stored and used.

The Policy Guidelines were developed with public and patient panels and provides a plain English, non-technical summary of the policy so that everyone can understand what and why. Work with technical and industry experts have also been carried out to define the minimum technical capabilities that will be required of NHS Accredited Secure Data Environments.

In terms of delivery, the Data for R&D Programme is working toward implementing the vision for an interoperable system of SDEs that include the National and Sub-National SDEs.

### 6.5.4. NHS Digital's (NHSD) National Secure Data Environment

NHS Digital is the current safe haven for NHS health and care data. Commissioned and overseen by NHS England's Data for R&D Programme, NHS Digital has built a MVP national secure data environment, which provides approved researchers from trusted organisations with timely and secure access to NHS health and social care data. This national environment currently supports the work of over 200 users from across the NHS, academia, industry, charity sectors, and the Departments of Health and Social Care. Organisations using this include British Heart Foundation and DATA-CAN.

NHSD have planned enhancements to this environment including a significant upgrade to AWS and Databricks SAAS, with further upgrades planned throughout 2022 and beyond. This will include expanding the pilot to accommodate users with the aim that all data held nationally is managed through a secure data environment when used for research and planning purposes. In summer 2022,

the Department of Health and Social Care took a decision to use the NHS Digital SDE as their own SDE, rather than building their own. Partnership agreements are in the process of being drawn up.

### **6.5.5. Sub-National Secure Data Environments**

The ambition of the Data for R&D Sub-national Secure Data Environment programme is to provide researchers and analysts with access to NHS Health and Social Care data at a significant regional scale, maintain patient confidentiality, and make sure connectivity to local communities and NHS care teams.

Regional SDEs will complement rather than compete with the National SDE, providing deep, multimodal, and near-time data whereas National SDE provides a high-volume of broad, nationally recognised coded data.

During 2021/22 NHS England's Data for R&D Programme invested in four localities to scope and define how NHS-owned secure data environments might work best at a regional level. These investments covered London, Wessex, Greater Manchester and the Thames Valley.

### **6.5.6. FDP and SDE**

SDE and FDP will be complimentary, and that solutions and data will be shared (under strict information governance) to maximise value for money and avoid unnecessary duplication. FDP will enable, and must apply, secure data environment policy for any use of NHS health and social care data beyond direct patient care. In future, the FDP may be a key data source that feeds the SDEs at national and sub-national levels.

## 6.6. Standards and interoperability

Standards provide consistency across care settings and types of data and enable us to develop solutions quickly that will also enable the market to develop and innovate.

International standards will be adopted where they exist to support developers in increasing the speed and ease at which solutions can be developed. It may be necessary in some cases to extend or specialise standards which will always be done using approved mechanisms from standards development organisations. Examples of this include inclusion of a flag to indicate that a prescription is a repeat.

Currently, within the UK, each devolved administration operates independently in terms of its development and approval of standards. This results in duplicate effort and inconsistency across our borders. The establishment of a UK-wide standards board for data and technical will enable better cross-border communication, the ability to better leverage supplier capacity within the UK and reduce the amount of time required to develop new standards. The UK-wide board will align the specific powers within each of the home countries.

### 6.6.1. Core standards

The core standards to be implemented need to be more clearly articulated. This will form a core part of the standards and interoperability strategy which will set out some of our core standards to be adopted. These are defined standards and require programmes to develop requirements and drive implementation.

Some of the core standards are:

Standard	Description	Next steps
NHS Number	A single consistent identifier for patients across health and care.	A programme to understand utilisation internally within hospital systems and between health and social care transfers.
SNOMED CT	The terminology of choice to represent clinical concepts such as diagnoses, procedures, and test results.	A programme to drive adoption across secondary care and the remaining areas of primary care.
Dictionary of medicine and devices (dm+d)	The dictionary of medicines and devices uses SNOMED codes to provide definitions for medications and medical devices.	A programme to embed dm+d in secondary care and hospital pharmacies.
FHIR (Fast Healthcare Interoperability Resources)	The latest HL7 standard for messaging.	Definition of the UK FHIR Core, policy on all new standards including use of FHIR and analysis of the existing messaging estate.

There are also standards that need to be defined centrally once.

Standard	Description	Next steps
Health and care data model	A single definition of a data model covering structure and vocabulary content.	A programme to develop the data model has been initiated and will publish its roadmap as part of the

		standards and interoperability strategy.
Identity standards	<p>There are a number of identity standards that will be supported:</p> <ul style="list-style-type: none"> <li>• Department for Digital, Culture, Media &amp; Sport (DCMS) UK Digital Identity Framework</li> <li>• Good Practice Guide (GPG) 45/44 assurance standards</li> <li>• Multi-factor authentication standards (e.g., National Institute of Standards and Technology/Fast ID Online/Biometric)</li> <li>• Identity management protocols (OpenID Connect , OAuth2)</li> </ul>	<p>A programme exists to:</p> <ul style="list-style-type: none"> <li>• Development of IAM strategy, policies and standards for national and local actors</li> <li>• Support for local adoption of IAM, onboarding and provisioning</li> <li>• Market engagement for Identity and Access Management (IAM) capabilities</li> <li>• Roadmap for national IAM services</li> </ul>
Workforce standards	<p>There are a number of workforce standards that will be supported:</p> <ul style="list-style-type: none"> <li>• Professional Record Standards Body (PRSB)'s Workforce Information Model</li> <li>• Statutory and Mandatory Training schemas</li> <li>• Occupational Health &amp; Immunisation/Vaccinations</li> <li>• Workforce data sets for Electronic Staff Record (ESR)</li> <li>• Workforce equality data standards</li> <li>• DCMS UK Digital Identity Framework and NHS Pre-employment Checks</li> <li>• W3C Verifiable Credentials</li> <li>• W3C Decentralized Identifiers</li> </ul>	<p>A programme is being developed to:</p> <ul style="list-style-type: none"> <li>• Endorsement and publication via Standards directory</li> <li>• Market engagement and support</li> <li>• Commercial and policy levers to drive adoption</li> <li>• Further development of workforce information model to support Business Services Authority (BSA) and NHSE programmes</li> </ul>

The forthcoming Standards and Interoperability strategy will set out in detail what the next steps in standards development and adoption in much more detail.

By setting a clear target for the release of standards and setting out intentions for subsequent uplifts, we begin to engage the supplier community.

### 6.6.2. Data model for health and care

A major challenge over the past years has been the absence of a common semantic model of health and care data. As a result, suppliers have interpreted high-level information requirements into their own data structures. Consequently, the task of mapping data structures from one supplier's application to another has become cumbersome and potentially prone to errors.

We will therefore describe how standards can support health and care practitioners to integrate their working practice by sharing their records with other practitioners, carers, and the people receiving their care. These portable care records will be independent of any system's internal design. It is not anticipated that systems will use the portable format internally.

While each IT system maintains its own physical data store, there is increasing consistency of how records are maintained. Organisations including National Institute for Health and Care Excellence (NICE), Professional Records Standards Body (PRSB) and Royal Colleges have described business requirements for care records. These follow the document-centric approach adopted in ISO 13606-1 and its derivative reference model from the openEHR foundation<sup>7</sup>. This structure was adopted in the design of the HL7 V3 GP2GP specifications.

We anticipate transactional systems will retain their existing data structures using the standards we have already published. In addition, we will work with national and international partners to create a representation of care records, based on international standards, designed to use SNOMED-CT effectively and to work with FHIR. We will select either ISO 13606-1 or openEHR for the structure of the care record, following consultation with wider stakeholders. We will pilot translating care records from several care record systems or shared care record systems into this care record structure and explore creating the International Patient Summary from the care record.

The care record will include:

- A consolidated electronic health and care record for a person in a consistent structure
- The meaningful content of the care record is held within care record entries. Each entry will provide a discrete clinical statement, such as a statement of the person's condition, a risk, an investigation, or a treatment. These entries will hold the detailed content, in the form of record elements with semantic data. Entries may be clustered together where appropriate.

To establish common semantic models for clinical and workforce data it is recognised that a co-design approach is needed that is inclusive of multiple stakeholders to ensure broad awareness, input, and endorsement of the models.

When business requirements for care records are described by organisations such as NICE and PRSB each organisation is required to configure their record management system to create template record structures for populating by the record author.

The reusable record structures are known as templates within the general practitioner setting, archetypes in ISO 13606 / openEHR environments and case report forms within the clinical trials sector. These are also referred to as 'Record Standards'. The term "form" is used in the rest of this section.

The initial configuration of an electronic care record management system is a resource-intensive process. Sharing these forms across an integrated health and care system will reduce the cost and variability in the initial configuration and lead to greater consistency of record-keeping practice.

As with the work on the care record itself, we shall select one or more standards for cataloguing and representing these forms. The standards being considered are the health-specific standards, openEHR, ISO 13606-2, HL7 FHIR's questionnaire resource specification and the general IT standard ISO 19763-13.



We will establish a national library for these forms and extend our open-source metadata catalogue to enable local organisations to maintain local forms libraries.

Common semantic models can be used by specific delivery programmes to develop schemas, FHIR profiles and API specifications to support data flow between actors.

An important enabler and partner for the development of information models is the Professional Records Standards Body (PRSB) which provides a neutral and authoritative framework for coordinating input, feedback, and endorsement from a network of royal colleges, professional bodies, and suppliers.

## 6.7. Information governance and access control

Fundamentally there are two approaches that can be taken when handling patient data, either purely providing technology/systems/services, or by taking some kind of ownership of the data. There are examples of *information systems* such as GP Connect or NHS App, whereby patient data passes through systems for the purposes of the data provider and the data consumer. The alternative is a *Data Collection* of the patient data and become Data Controller (such as happens with hospital activity data), and the data can then be used for the new Data Controller's purposes. *Data Collections* can have purpose limitations (e.g., data collected under the Covid-19 Public Health Directions should only be used for a Covid-related purpose).

The health system saw a major change in handling patient data during the Covid pandemic, largely using the COPI Notices. This enabled the sharing of confidential patient information in response to the crisis. These powers, however, were temporary, and cannot continue to be used. However, NHS Digital has powers in law outside of the COPI Regulation to require/request confidential patient data. The release of confidential data by NHS Digital can be set aside for certain statutory reasons (such as a Court Order, or a specific COPI Notice for the release of data) but is most often met when the data is for direct care or is activity covered by section 251 support from the Health Research Authority's Confidentiality Advisory Group (HRA CAG).

Some of the biggest issues with data sharing are the ethical basis, the applicability of data sharing preferences (national data opt-out), and public trust. There are occasions where it would be legal for NHS Digital to collect confidential data from healthcare providers, but there is strong sentiment against that data sharing (the collection of GP data is an example). There are also concerns around the confusing array of opt-outs and how/when they are applied (a "Type-1 opt-out" to prevent GP patient records from being shared for any secondary use, the national data opt-out being applied if the flows is under section 251 support, etc.), and how a mixture of uses could result in either a patient's wishes not being respected (data used for direct care and secondary use despite an opt-out), or a lower quality of care (an opt-out being respected but missing out on direct care). The public has a certain level of mistrust in large-scale government use of data, and in commercial companies accessing their data (even if under contract to an NHS organisation), and there is a risk that people will act in fear to put in place additional opt-outs, and maybe also have a reluctance to engage with the health system (resulting in clinical risk to individuals, and maybe public health).

IG next steps/future work:

- Gain a consensus on IG models across sectors, once the Patricia Hewitt review of integrated care systems has completed
- Build public engagement and trust in the central-regional-local approach to how the NHS operates
- Work with expert groups (National Data Guardian, Confidentiality Advisory Group, ICO, Caldicott Guardian Council, etc.) and public/patient/privacy groups (Understanding Patient Data, medConfidential, etc.) to establish what is reasonable in the field of health and social care data sharing.

## 7. Governance

### 7.1. Overview

Target Architecture will evolve over time, both in response to new and emerging requirements, and potentially new technological advances.

With this in mind and against a background of organisational merger and portfolio consolidation, a review of the governance process in places across NHS Digital (NHSD), NHS England (NHSE) and Health Education England (HEE) is underway.

Therefore, a set of governance processes are required that are cohesive and navigable which provide effective end-to-end alignment across architectural, programme portfolio and investment assurance and governance for all new and impacted pieces of work. NHS England will oversee the system-level arrangements for this.

This will not only promote agility and empowerment for work being conducted, but also offer appropriate control mechanisms, within a series of guardrails, to ensure solutions are delivered quickly, scalable, and resilient and meet current and future needs.

### 7.2. Key elements

The target architecture proposed within this document is expected to be developed further and iteratively over time. The version within this document will first be proposed to the Architectural Design Board and then other forums before being baselined and then be subject to Enterprise Architecture change control processes.

With respect to the target architecture, the revised governance processes being developed are specifically designed to:

- Ensure that no NHS England business case, project, programme, or architectural change can be approved without a formal assessment which confirms the change initiative aligns to the target architecture. This includes Product Development.
  - The target architecture should be embedded within the organisation's decision-making processes.
  - This should prevent duplication or conflicting initiatives.
- Enable all existing NHS England programmes and portfolios to check their alignment against the target architecture and advise if and how current programmes of work should pivot.
- Allow for enforcement of all NHS England programmes, portfolios and Product Development against the target state architecture to ensure they align.

The target architecture should be embedded within NHS England's decision-making processes, and this should prevent duplicating or conflicting initiatives.

The principles of ownership, production, maintenance, and decision making are at the core of this approach, alongside the adoption of the Principles, Policies, Patterns and Standards (PPPS) that technology programmes and products should adhere to.

As part of this, exception handling in the form of processes and decision making for requesting and allowing exceptions to PPPS will be set out.

As part of the commitment to reducing technical debt, change control/decision making processes will be put in place to pay down the technical debt of the system as a whole. The way in which proposals and/or commissioning changes to live products and services or creating new ones where this is needed will be fully defined and enacted.



Enforcement, compliance, and escalation will be handled via interfaces with other governance processes that programmes, and product/service teams are subject to in order to provide a foundation for the guardrail process, including the consequences of failure to comply and routes for resolution.

By addressing these key elements, a combination of new processes, ways of working, artefacts, and formal bodies, which complement each other and provide an end-to-end user journey, will be required. A key part of the work will be identifying the user needs and the appropriate combination of the above elements, addressing each of them (rather than a one size fits all approach) that will empower programme and product teams, provide the right level of transparency and assurance, and enable agile working.

As well as engaging with end-users within the system, there is a need to ensure that suppliers are adequately represented and engaged with in consistent manner.

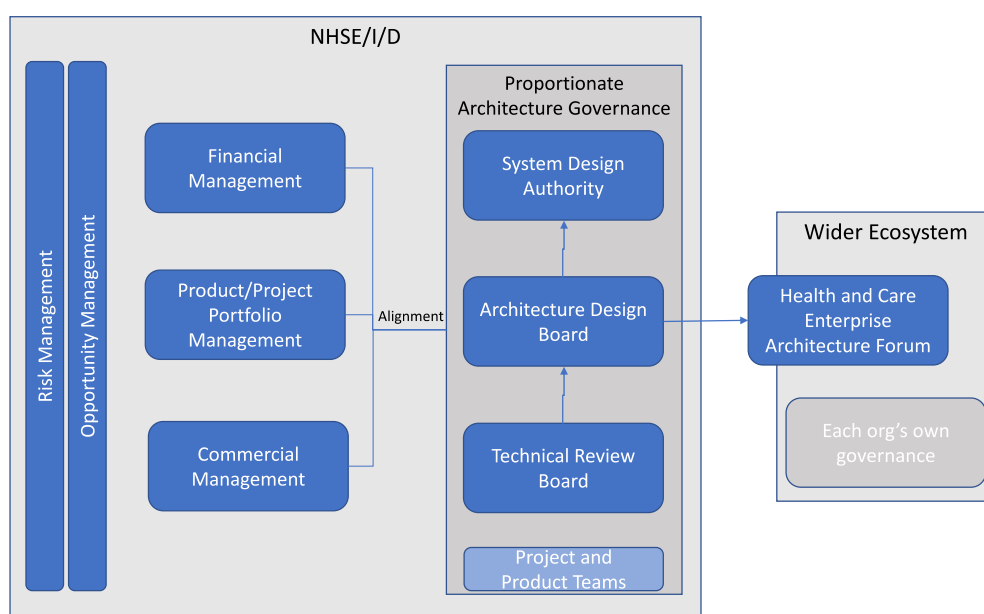
From a governance body perspective, it is envisaged that in terms of a formal governance body at system level, a System Design Authority will be put in place which will report into the NHS England board, thereby ensuring that there is a strategic view of technology at the highest level. The SDA will have system-wide representation from a cross-section of colleagues working at local and regional level.

Reporting into the SDA (including formal escalations of unresolved issues and risks) will be an Architecture Design Board (ADB) which will provide high level assurance and alignment on the overall design of solutions across the new NHS England (when NHS Digital and Health Education England formally merge). The board will provide assurance of the high-level architectural design as well ensuring alignment of architectural principles, patterns, policies and standards. The ADB will also have a two-way reporting line into a Health & Care Enterprise Architecture Forum which will act as a community of practice to share and disseminate best practice.

The Technical Review Board will provide technical review and governance around minor change requests to Enterprise Architecture, assess compliance and produce guidance against the EA principles, strategies, standards and technical policies and review/raise technical risks, issues and dependencies for programmes to manage.

The diagram below shows (in the shaded boxes) the alignment between the management and assurance processes and what is in scope of the architecture governance process described above.

#### Governance



**Figure 13 – Target Architecture Governance**

## 8. Next steps

- Review and iterate the target state architecture based on feedback from NHS England senior stakeholders, ICSs stakeholders including CIOs and suppliers. Release a version on Future NHS for feedback from ICSs along with the Who Does What publication.
- Develop and publish transition states (12 months, 24 months, and 36 months) based on associated roadmaps that will drive how the target state will be achieved.
- Mapping of capabilities to applications to identify gaps and duplication for national services and national and ICSs services.
- Maturity assessment of the current national services based on core capabilities that are required. The maturity assessment will provide a RAG status based on current and future needs and will consider people, process, and technology maturity to serve ICSs.

ICSs are, therefore, kindly requested to:

- Review and adopt the target architecture and similarly embed the principles within their organisation's decision-making processes for change initiatives and engage with national teams to outline the priorities for the roadmaps.
- Propose developments of the target architecture specifically required capabilities that are aligned to their business needs. The governance processes themselves need to be iterative to complement the evolving target state architecture.

## Appendix A –Threats, risks, and assumptions

Across the full NHS system for the four primary use cases there are many risks. **A small number of fundamentally key risks are summarised below** together with some general considerations for the wider environment (PESTLE) of this work.

No attempt has been made to consider risks against individual care setting as these will be considered at the point of implementation.

Item	Risk	Mitigation
1	Maintaining public trust and confidence in how we collect and use data is critical otherwise sentiment and resistance will prevent data sharing. This is equally applicable to professional bodies representing Health Care Professionals also having confidence in how data be used.	<ul style="list-style-type: none"> <li>Actively engagement of key stakeholders including health care professional bodies, ICSs, expert groups and system suppliers.</li> <li>Build public trust and support for the benefits of controlled data sharing across the four uses cases – starting with clear statements that health care professional needs access to up to date patient records.</li> <li>Maintaining public trust and confidence in how we collect and use data is critical. We must design privacy in at the outset, recognising the expectations and rights of individuals and the legal frameworks within which data may be shared.</li> </ul>
2	There is a risk about local systems cannot apply to CAG for S251 clearance to use of data and that significant changes in the Information Governance Policy will be necessary to implement the changes proposed within this document.	<ul style="list-style-type: none"> <li>(New) NHS England to define in detail any changes required to Information Governance Policy and issue guidance to the ICSs.</li> </ul>
3	There is a risk if data is copied in the national data repositories, it may be out of sync with the source systems.	<ul style="list-style-type: none"> <li>The data requirements for each primary use cases will be documented in detail, so the latency required is clearly understood, specifically where real time is required.</li> <li>Detailed architecture designs will be prepared ensuring use case data requirements are met.</li> </ul>
4	There is a risk that the target architecture is not aligned with future operating model as this is still under development.	<ul style="list-style-type: none"> <li>The target architecture team to work with the NHSE target operating model team to ensure there is alignment between these two pieces of work.</li> </ul>

Across the wider NHS there are wider threats and risks and a summary of these by PESTLE category is given below.

<b>Risk Category</b>	<b>Key considerations</b>
<b>Political</b>	<ul style="list-style-type: none"> <li>Governmental policy change during horizon of this architecture may disrupt timelines or direction</li> </ul>
<b>Economic</b>	<ul style="list-style-type: none"> <li>Future levels of investment in Gov Spending on Health and Care</li> <li>Cost of living increases and responses redirects available budget into other focus areas and away from delivery of transformation</li> </ul>
<b>Social</b>	<ul style="list-style-type: none"> <li>Historic and current attitudes and perception to sharing of data and the understanding of how it'll be used and by whom restrict the aspirational belief this can be achieved</li> <li>The vision may fall short of the expectations of stakeholders/public regarding the accessibility of digital health and care</li> <li>Mass migration of people within and across borders</li> </ul>
<b>Technology</b>	<ul style="list-style-type: none"> <li>Some software vendor's present attitudes to open data and systems are required to achieve the goals of the vision</li> <li>Differing levels of digital maturity and literacy mean varying opinions as to how easy or ready to move to this architecture</li> </ul>
<b>Legal</b>	<ul style="list-style-type: none"> <li>Information governance challenges are large and numerous and the scope of this work up to date is that these challenges will be detailed as follow-on work.</li> </ul>
<b>Environmental</b>	<ul style="list-style-type: none"> <li>Drive to NetZero and Energy Costs may compete for skilled resources required to deliver this architecture</li> </ul>

## Assumptions:

- The pathology data store or document store and similar data stores will have non-functional requirements for the specific use cases they are supporting. These non-functional requirements will drive the availability of data as a copy repository or event driven to source data in real time from the data source.
- This report details the what and why but not the how. Many sections have significant implications e.g., proposing capabilities or services that do not currently exist. Confirmation required from Architecture Design Board that this is the foundation / assumption against which this report is being considered.
  - It is recognised that transitional architectural states and options considering implementation options as a follow-on piece of work.

## Appendix B – Health and Care Hub details

### National infrastructure services

National Infrastructure services include communication services, networking, data processing and storage, platforms through which National NHS bodies can share information, content and media, knowledge management, systems, applications. Most importantly, infrastructure services provide vital National NHS services for all Health and Social care organisations, locally and regionally.

#### How do these services relate to the four use case types?

Use Case	Description
Direct Care	<p>It provides up-to-date clinical data to healthcare professionals to enhance patient care. The national orchestration service (NDOS) would collate the patient data from various locations using record locator services and improve the data to where it is required.</p> <p>Updates to the patient record would also be made available to lawful organisations using an event management service to enable healthcare professionals to make accurate decisions regarding care. The national data-sharing agreements service would manage all data sent and accessed by organisations.</p>
Population Health and proactive care	<p>Centrally provided APIs through the National Orchestration Service would enable access to all national and regional data repositories in a clear, secure manner. These repositories would also be available for any authorised users to assist in improving population health.</p> <p>The national orchestration service would also enable the data to be available to the relevant systems, whether to aid the prevention of illnesses or to provide a screening service.</p>
Planning Oversight and Service Improvement	<p>The national orchestration service will provide organisations with data to assist their capacity city and demand management. The data would be delivered securely and help the organisation manage capacity, improving productivity.</p> <p>Where available, staff data could be exchanged (using orchestration service) between organisations to aid workforce planning and ensure appropriate staff levels are known to deliver safe, high-quality care to patients.</p>
Research and Innovation	Data would be made available to SDE through data transfer from regional care records from national data collection services where lawful

#### NIS1 - API management

Is a service to provide a “front door” for health and care APIs for the NHS in England, including nationally owned APIs and also “third party” APIs, for example GP systems. Includes features for API consumers, such as access management and rate limiting, and features for API producers such as alerting and monitoring, delivery guidance and support.

It will provide access to NHS platforms and services is difficult for providers and consumers to develop, maintain, and access. The API platform provides a front door for health and care APIs and provides a consistent experience for API consumers and producers, making integration easier. , The goal is to provide a one-stop shop for all our APIs, old and new. To provide centralised API

documentation and coding standards, to create a national centralised API management strategy. To bridge different styles of national services and expose them via a single API.

Our national infrastructure services accelerate the digital transformation of the NHS by unlocking the potential of our technology platforms, improving access to data and driving the growth of a diverse, innovative and competitive digital health and care sector.

Connecting platforms and applications to support efficient and effective health and care delivery enables the development of digital services that support patients, help clinicians access, analyse and share information, and provide the public with relevant and timely health and care information.

### **NIS2 - Record locator service**

Enables authorised users to find specific patient records that are held on different health care systems. The Record Locator Service is a national index of pointers to patient records. It enables an authorised clinician, care worker and/or administrator, in any health or care setting, to access a patient's information to support that patient's direct care. To make sure a record can be located, a provider organisation adds a pointer, or bookmark, to the NRL when the patient record is created at that organisation.

NRL is not a central data store for patient records. It is an index that provides the location of records, the technical means to retrieve them, underpinned by an Information Governance (IG) framework to safely support sharing on a national scale.

### **NIS3 - Directory of services**

Maintains services reference data for onward referral, manages what service can do clinically (clinical profiling), manages and maintains business rules for onward referral processes – commissioning rules, clinician skillset rules, manages and maintains when services are available. Also provides Service Discovery capability (as direct APIs or application functionality) – i.e., includes the service search capability.

### **NIS4 - Data movement**

Service for sending computer-readable messages to known endpoints with guaranteed delivery (used for integration) which will securely transfer healthcare messages and large files across health and social care organisations, whether national or local, any data to be transported securely must conform to national data security guidelines.

### **NIS5 - Record Aggregator Service**

Make patient information available to all appropriate clinicians when and where they need it, to support direct patients care, leading to improvements in both care and outcomes.

Allow authorised clinical staff to share and view clinical information and data between IT systems, quickly and efficiently. Remove the need for patients to provide a detailed account of their previous medical history. Enable safer prescribing by providing by access to the patient's current and past medication, allergies and adverse reactions. Improve continuity of care for on-going medical condition. Preserve the usability of rich data accumulated in patient records across the NHS.

### **NIS6 - National data sharing agreements**

Provides a central repository for data sharing agreements and our new simplified DSA template. Allows organisations to update their information governance (IG) assurance status and check those of other organisations e.g., against the DSPT. Allows organisations to seek sign local sign-offs. Allows organisations to run reports e.g., review dates of data sharing agreements, local or national overview of which third party providers are being used throughout the health and care system. Allows organisations to publish their DSA, a summary of it, or keep it private. Allows organisations to make minor dynamic edits and to attach supporting documentation.

For all health and care organisations, including third party providers, such as system suppliers, but with the ability to add organisations from other sectors e.g., if sharing with police.

There is a need to provide a national approach to standardise and digitise the Data Sharing Agreement process. Currently people are having to use multiple solutions or different data sharing

agreements depending on who they are sharing data with, which creates confusion and additional burden. It will remove the issues of version control, as a single point of truth with the most up to date version always on the system and available to all parties as required.

Whilst local systems are sometimes already in place across certain areas, providing a national approach would create consistency and allow organisations to share more effectively outside their area. We need national oversight of third-party providers to ensure due diligence and accreditation is in place universally.

### **NIS7 - National event hub**

Pub / Sub event management. This service works with other interoperability services including the Record Locator Service which allows authorised users to find specific patient records that are held on different health care systems.

EMS has been designed to allow the sharing of healthcare information without having to know the recipient(s) as long as there is a lawful basis for them to receive it. Healthcare providers send the information as event messages to EMS - they are known as event publishers. The messages relate to specific events. They are commissioned to fulfil a particular use case.

Publish and subscribe to patient-centric healthcare event messages - a one to many events notification. There is a need to register events relating to a person's health and care which can be used to trigger actions across the health service. Typically, events such as discharge may affect multiple parties, and there is a need for a distributed mechanism for sharing that events have happened, and potentially orchestrating actions based on the events.

### **NIS8 - NHS pathways**

NHS Pathways is a clinical decision support system (CDSS) supporting the remote assessment of callers to urgent and emergency services. It is used in the following settings England: NHS 111 - 999 - Integrated Urgent Care Clinical Assessment Services - NHS 111 Online

The Integrated Urgent Care Service Specification outlines the steps that commissioners must take to deliver a consistent service across the country, moving from an 'assess to refer' to a new 'consult and complete' model of service delivery.

To assist in the management of patients presenting to urgent care or emergency departments The product is embedded in core supplier systems used for patient management.

### **NIS9 - National Data Orchestration Service (NDOS)**

Providing access and exchange of data to and from national systems, taking siloed data from multiple external data storage locations, combining, and organizing it, and making it available to where it is needed - this can be to a clinical frontline, decision support, administrative systems, and analytical systems, to enhance internal systems too including the Health and Care Hub.

Hides the complexity from the user – Single End point into multiple systems that people can connect to which brokers into the Record Locator Service, the Patient Demographic Service, the National Document Store, the Event Management Service, and other services.

This service sits on the border of the health and care hub acting as the gateway which provides access to nationally provided services such as the Patient Demographic Service, the Record Locator Service, the Event Management Service, and the National Document Store.

NDOS API is an abstraction layer that sits on top of services, takes NHS number at API call – if we have 10 pointers goes to all of them rather than people sending 10 calls to the Record Locator Service go get 10 records. What orchestration service is doing is hiding that complexity from the user and taking one call on API and getting the whole record from various pointers.

Data is not persisted with in the data orchestration service other than that to facilitate auditing.



National data orchestration services include:

- Real time event data stream processing Service to process continuous event driven data streams whilst in transit to onward consuming systems for real time decision making.
- Near real time data processing service to process data streams whilst in transit to onward consuming systems that require additional processing such as enrichment or transformation
- Data workflow service engine to provide and orchestration business process routines on inbound data.
- Data transformation Service to transform message structure types for consuming system including as [FHIR](#) structure to [JSON](#) structure.
- Data enrichment Service to enrich the message data in process with external data sources.
- Data validation Service to check the message and data structure, quality and integrity of inbound responses against standards and value sets.
- Data endpoint contract management by providing a visual front end management interface to build and manage the data contracts between the source and consuming systems. The visual interface provides authorised users such as Information Governance leads to approve or reject data contracts.
- Data Discoverability service to provide access to the metadata and business definition of the data available in data repositories.

This is a new service as currently there are a set of disparate national capabilities and a number of recognised gaps and a number of potential gaps which required further investigation as to their value.

## National care services

The national care services consist of a set of services that provide access to clinical information held nationally which support the delivery of care. Within these services, the information is typically persisted at a national level to support rapid access to key information normally held across the health and care estate.

### How do these services relate to the four use case types?

Use Case	Service
Direct Care	<p>Vaccinations recorded and the record is provided to health care worker and service user without much administrative overhead</p> <p>Enabling the clinician to retrieve data about the at times of emergency and when the patient is visiting to the new location other than his home area.</p> <p>Provide consistency in availability of the pathology test results and other diagnostic results at the point of interaction with the health care professional and patient</p> <p>Provide most up-to-date data from different systems to create a patient care record view to enable health and care services provided to the patient</p>
Population Health and proactive care	Provide ICS the cohorts of the patients to enable planning of the services efficiently

Planning Oversight and Service Improvement	Provide ways to add the flags of interest to the patient record to enable better care by the clinical care staff in health and social care context
Research and Innovation	Provide access to the GP data for use of variety of use cases including direct care, population management, service improvement and research

The national care services will consist of the elements listed below.

### **NCS1 - National Document Store**

The document store at the national level will provide an option for provider organisations to keep patient documents to deliver healthcare services and to provide up-to-date information to the clinicians on demand using a document store in conjunction with the record locator. With a high volume of patients to care for and multiple clinicians contributing to each patient care, it's vital that the storage of health records is managed in the most efficient way possible.

The document store will always be slightly behind the source system or system of capture and therefore the creation of the document store is the best source available in absence of any other information available to the clinician. The event management service may help the clinician at the end point to source the data directly from the source system if that capability exists at the local provider level systems, otherwise the fall back is the document store to access the stored documents.

Organisations who have capability to manage their own document store may opt to manage them locally with the appropriate pointer added to the NRL. Those who do not currently have capability or wish to make use of the nationally provided service may. The NRL is the key entry point for retrieval of documents and should be used whether documents are held locally, regionally, or nationally.

### **NCS2 - GP data access service**

The use of GP patient information (also known as GP data) has the power to transform our understanding of what causes ill health and, importantly, what we can do to prevent or treat it and provide better care. We will develop a new, more secure and more efficient way to provide controlled access to the GP data to provide care services across the NHS.

### **NCS3 - Pathology data service**

Currently, across many regions, it is not possible to access test results unless you are the requestor of those tests. This leads to duplication of tests being undertaken increasing cost, time to treatment and patient experience.

This service stores a copy of all pathology requests and responses made across care settings. It then provides access via an API to records using the NHS Number as the key identifier. The data held can also be de-identified to provide resources to support analytics.

### **NCS4 - Patient demographics service**

The patient demographic service helps healthcare professionals to identify patients and match them to their health records. It also allows them to contact and communicate with patients in several ways, including by text and email. This national service will support other services by providing the patient demographics as master data source and acting as demographic master on behalf of the system.

### **NCS5 - Cohorting service**

This service helps to identify people that need direct care by creating population health cohorts (groups) based on specific health criteria. This service has created cohorts for the Influenza and COVID-19 vaccinations for autumn and winter 2022–2023. This service will be expanded to cohorts as per requests from the ICS and national analytical teams.

**NCS6 - Electronic prescription service**

The electronic prescription service allows prescribers to send prescriptions electronically to a dispenser (such as a pharmacy) of the patient's choice. This makes the prescribing and dispensing process more efficient and convenient for patients and staff.

**NCS7 - Medication devices information service**

This service will provide more information about medical device used within the NHS. The information about the device will be collected and shared to identify risks of specific devices. This will allow patients and clinicians to discuss any necessary interventions, prevent harm and keep patients safe.

**NCS8 - Flagging service**

This service will be sitting along with the patient demographics service to add the additional information to be used by the health and care delivery team.

**NCS9 - National diagnostic imaging service**

This service will include both central collection of detailed information about the diagnostic imaging tests carried out on NHS patients by care providers and comprehensive national standards and codes for the imaging procedures.

**NCS10 - National immunisations and vaccinations data service**

This service includes the following capabilities to support the immunisations and vaccinations across the NHS users:

Sending national initiatives as letters, emails or SMS messages to invite and remind individuals to book their vaccinations or immunisations.

Providing a national support and improving immunisation uptake service using operational data to show uptake, and analysis using data such as age, deprivation and ethnicity and identifying outliers.

Providing an outbound call centre, which uses analysis gathered by the immunisation uptake team on vaccination data from NIMs, identifies areas of low uptake and makes follow-up outbound telephone calls to those who haven't been vaccinated.

**NCS11 - National clinical portal**

The national clinical portal is an electronic record of clinically relevant patient information including, information from GP medical records and other data sources. They can be seen and used by authorised staff in other areas of the health and care system involved in the patient's direct care irrespective of the care settings and organisational boundaries.

**NCS12 - Child protection information service**

The child protection information sharing service helps health and social care professionals share information securely to better protect children with looked after status and those who have a child protection plan as well as expectant women who have an unborn child protection plan

## Person management services

**PMS1 - Person data aggregation service**

This service needs to deliver a single holistic view from data about the person across primary, secondary, and tertiary providers, some of which may not be within the ICS or region. Unlike clinical access to a person's record, any information in the record that may be deemed damaging to the person or other related parties will be redacted before being passed to the person through this service

**PMS2 - Person generated data management**

Data recorded by the patient and used in decision making by health and care decisions needs to be retained for medical-legal reasons. This service provides a store of data generated by the person themselves for use by themselves and shared by them with their health and care providers, to inform

the care they need. Examples include blood pressure readings taken at home, blood glucose readings, PROMS and PREMS scores.

### **PMS3 – Data usage consent management**

Data is processed for secondary uses at local, regional, and national levels. This service provides a single source of truth for data consent given by the person for use by systems using data for secondary usage purposes (note data can be shared for direct care under the existing legal basis for sharing). Holding this information nationally allows for access by all three levels of organisation.

### **PMS4 - Person preferences management**

This service provides a person that ability to specify their preferred methods of receiving communication from health and care providers. It also enables a person to specify any help and assistance they require when interacting with health and care services. (e.g., interpreter, deafness, aphasia etc)

### **PMS5 - Person proxy management**

This service enables people with a legitimate right to access a person's data and act on their behalf. There is a need to prove legitimate access, manage access and revoke access if it is no longer needed or deemed desirable by the person. This service facilitates the lifecycle of managing to act on behalf of the person (including digitally) for cases where the person is not able manage themselves, or wishes a third-party (e.g., parent, spouse, child) to have access to information on their behalf.

### **PMS6 - Person registration management**

This service enables a person to prove their identity digitally to be able to access digital services available from health and care providers.

This service enables a person to register for NHS provided services (such as with a GP) digitally.

### **PMS7 - Person authentication management**

How does a digital service in this service group know that the person requesting the resource (or access to the service) has a legitimate right to access it? This service supports requests from interested digital parties to validate whether a person's digital identity is valid.

### **PMS8 - Person digital service registry**

This service provides a record of the digital health and care services that a person has registered to use or is using.

### **PMS9 - Digital service eligibility registry**

This eligibility service is a digital resource which can identify the national, regional, and local digital health and care services an individual could use. These services could be used for both wellness and prevention and treating illness.

### **PMS10 - National booking service**

This service provides a national capability for advertising availability of, and booking into, services such as immunisation and screening provided at national, regional, or local levels.

## **National data services**

### **NDS1 - National data collection service**

A set of submission technologies that allow health bodies and organisations to submit data for inclusion in National Data Collections. These technologies allow the use of APIs, portals, batch mechanisms and record level data entry to be used for submitting data to National Data Services.

These data are then aggregated into national data collections that can be used by internal and external users for various purposes

### **NDS2 - National cohort management systems**

A set of services providing the ability to create cohorts of patients for a variety of purposes (such as shielding, immunisation, trials or screening) and then to manage interactions with those patients.

**NDS3 - National secure data environment (SDE)**

Service to allow the safe use of NHS held patient data for research and operational purposes. Also allows the combination of datasets with external data, whilst keeping analytical and research activities within service boundaries and allowing safe use of the data.

**NDS4 - Privacy enhancement service**

A suite of technologies that are used to clean, tokenise and anonymise patient data so it can be safely used for analysis, research and other secondary uses.

**NDS5 - Data services developer portal**

A portal providing interested parties with the correct permissions, access to documentation, test data and API specifications so that they can build services that utilise the National Data Collections. This is dependent on a robust metadata solution

## Staff and workforce management services – PHIL S

The new Workforce, Training and Education directorate (WTE) is establishing a People Digital vision along with a digital portfolio that defines what will be delivered at the national level and by ICBs and local providers.

The main themes of the People Digital vision are:

- To capture more detailed and accurate data about the workforce
- For national, ICB and local workforce systems to exchange workforce data to support the four use cases and the specific needs of frontline staff and of workforce managers and leaders
- Use of common target architecture services and infrastructure to support the sharing of both clinical and workforce data
- Ensure workforce systems such as rostering have appropriate access to clinical system APIs to support effective use of staff and delivery of care
- Improving staff movements and rapid provisioning of access to systems, using staff passport and authentication services that support Identity and Access Management policies

The need for sharing of workforce data between the three tiers mirrors that for the sharing of clinical data and highlights the need for a common approach. The delivery of a common approach and architecture would benefit patient care through better resourcing and deployment of staff to meet operational needs and predicted demand, and also enable managers and leaders to be equipped with more in-depth information to make decisions in relation to the workforce.

For instance, the ability to analyse patient acuity data alongside skills and workforce data is important for operational, planning and research purposes. An operational use case is an Acute unit with 6 operating theatres whose clinical leaders are intent on re-design of care pathways to improve patient throughput across the 6 theatres and so reduce waiting lists. Where implementing the re-design of theatre services success to reduce waiting lists depends on access to workforce data to deploy staff to meet roster requirements with the required skills, at scale, at the right time.

With the merger of Health Education England into NHS England and the renewal of staff pay and pension services by NHS BSA the national level expectations include:

- Delivery and management of staff training and development
- Planning of skills and resources to meet the demand for care
- Enabling staff movements, and starters and leavers

- Interoperability of rostering, job planning, and workforce optimisation tools to maximise workforce capacity and reduce agency spend of £7.1 billion.
- Delivery of staff apps and self-service portals to complete routine tasks that improve staff experience and reduce the admin burden.
- Collaboration with NHS BSA on delivery of staff payroll and workforce financial planning and management.

The main expectations of ICBs are:

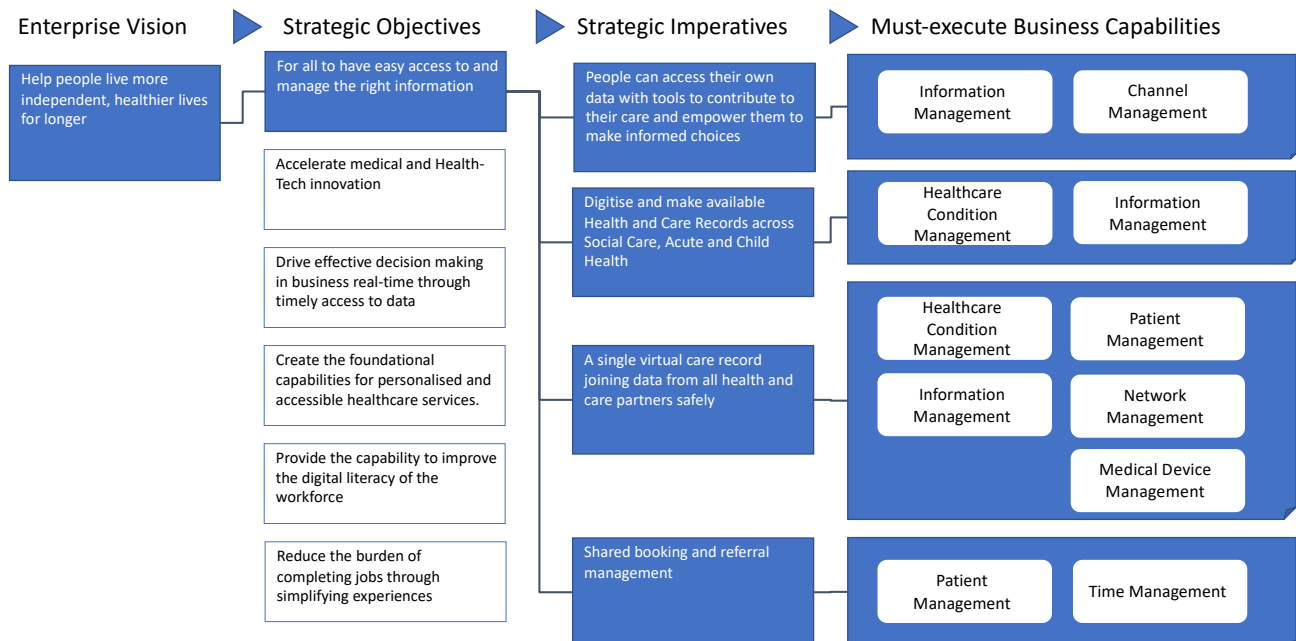
- Operation of interoperability and data orchestration services for workforce data exchange with local providers
- Operation of clinical networks and collaborative banks to support workforce deployment using the above interoperability infrastructure
- ICS wide procurement of local workforce systems that comply with interoperability standards and guidance, and which enable workforce redesign and productivity improvements
- Use of workforce and patient data analytics to support decision making and skills and workforce planning



# Appendix C – Linking Objectives to Business Capabilities

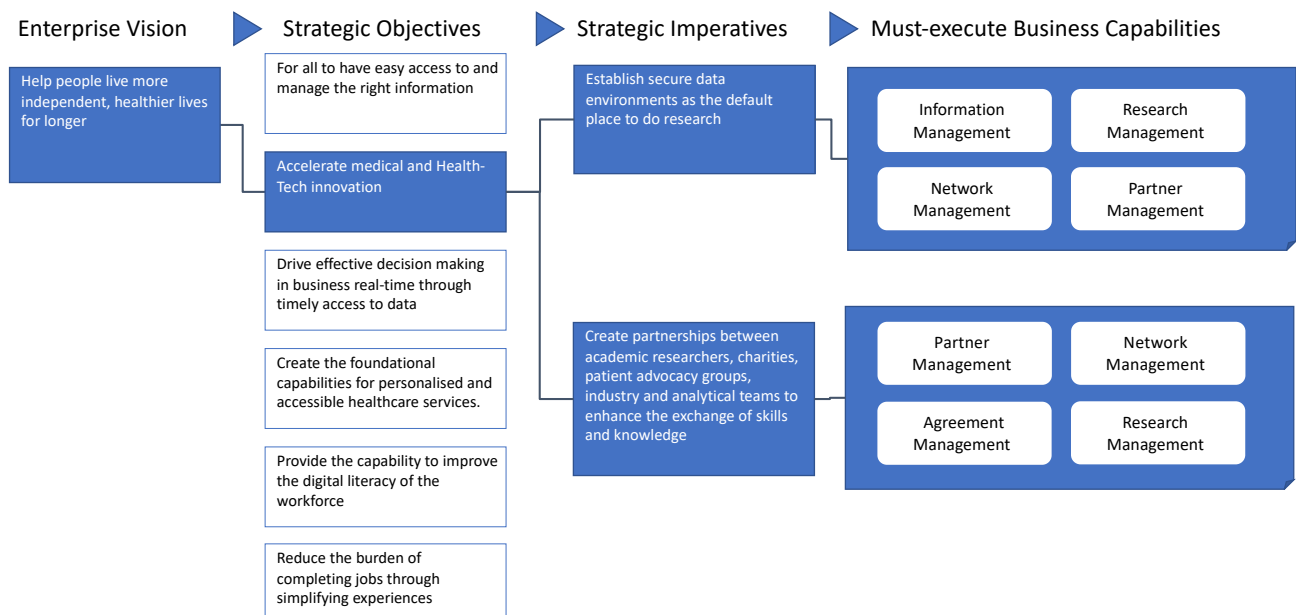
For all involved in direct care to have easy access to manage the right information

## Aligning Target Architecture to Ecosystem Strategy



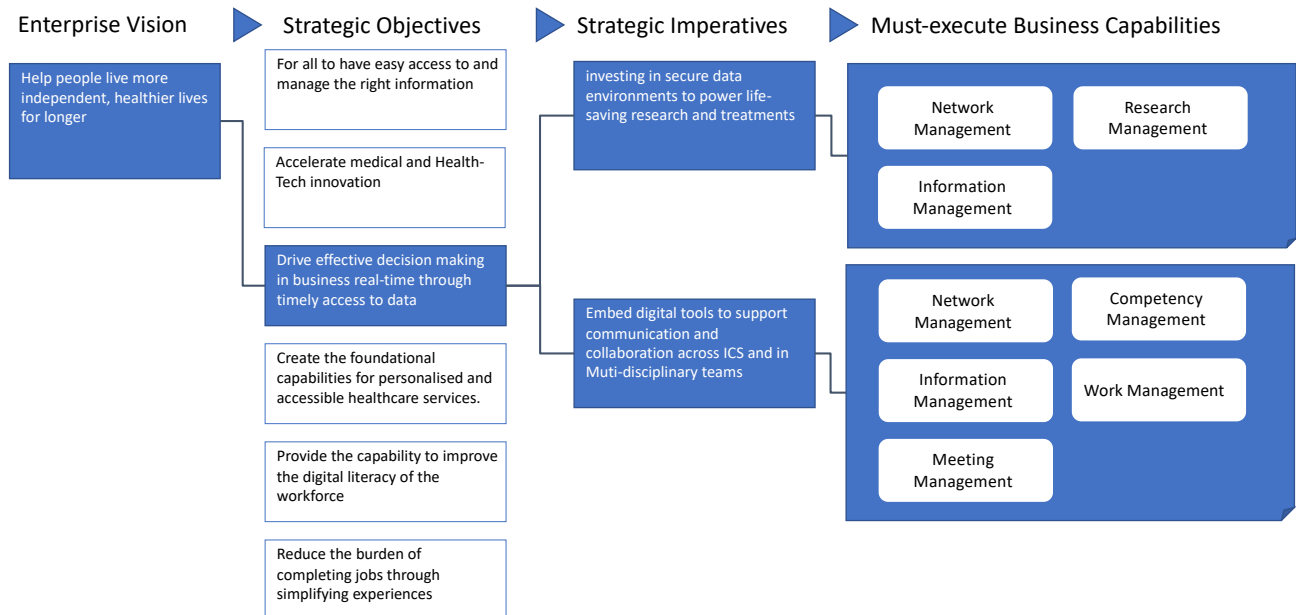
## Accelerate medical and HealthTech innovation

## Aligning Target Architecture to Ecosystem Strategy



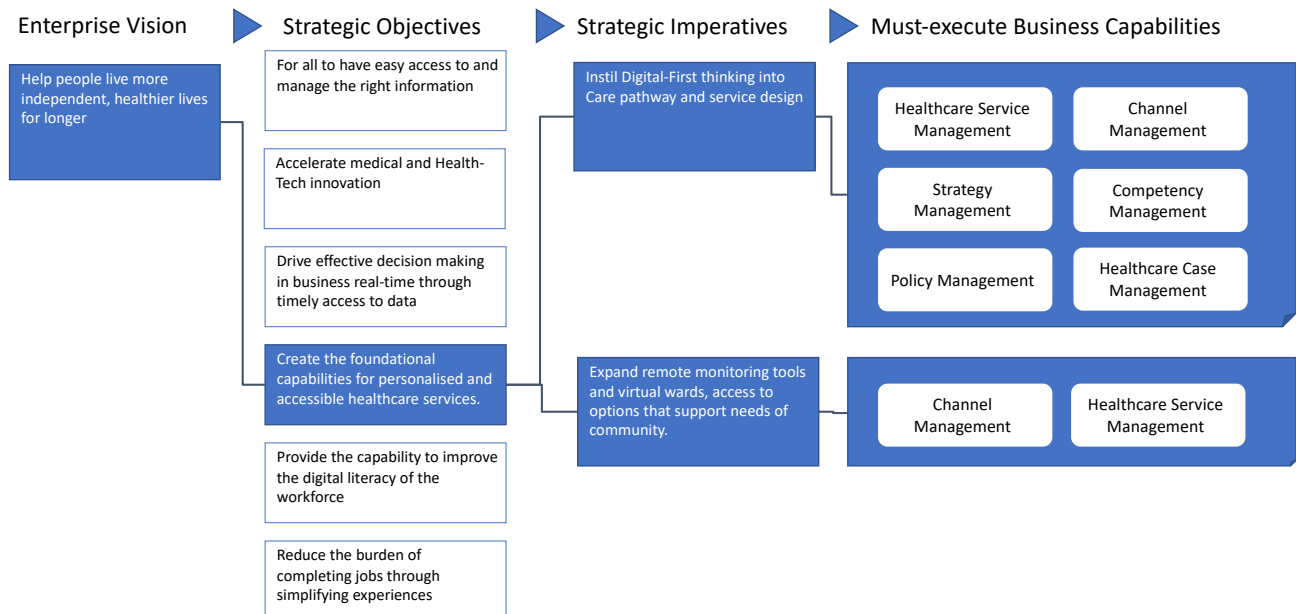
## Drive effective decision making in business-realtime through timely access to data

### Aligning Target Architecture to Ecosystem Strategy



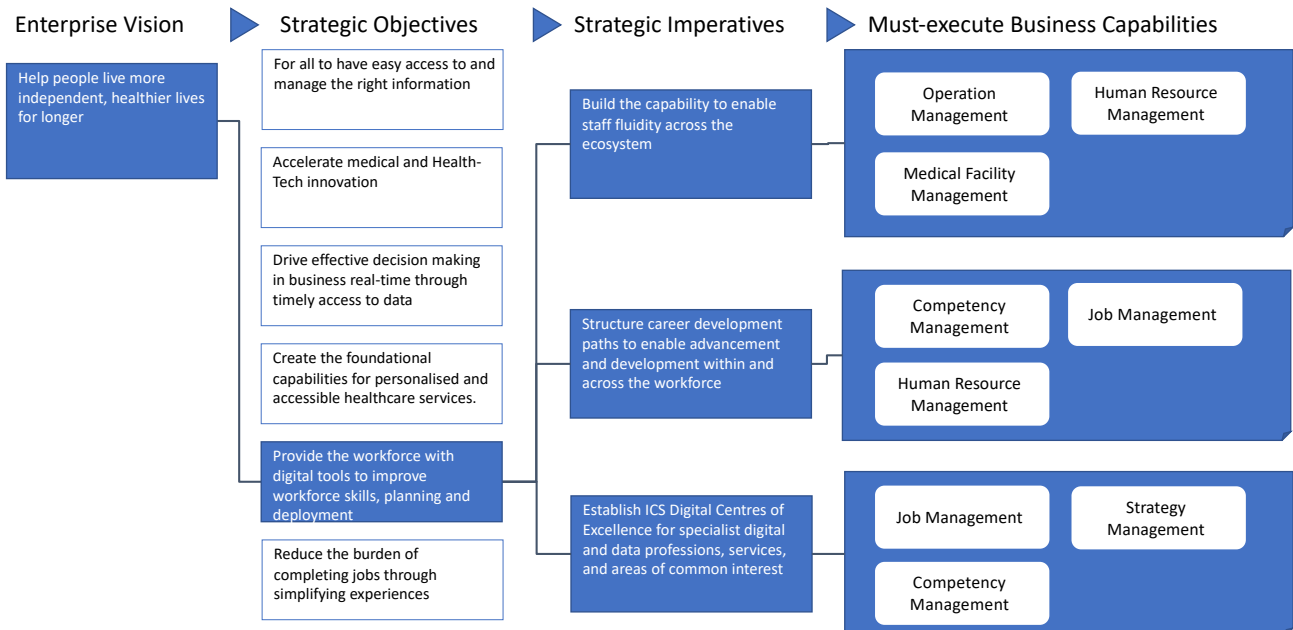
## Create the foundational capabilities for personalised and accessible healthcare services

### Aligning Target Architecture to Ecosystem Strategy



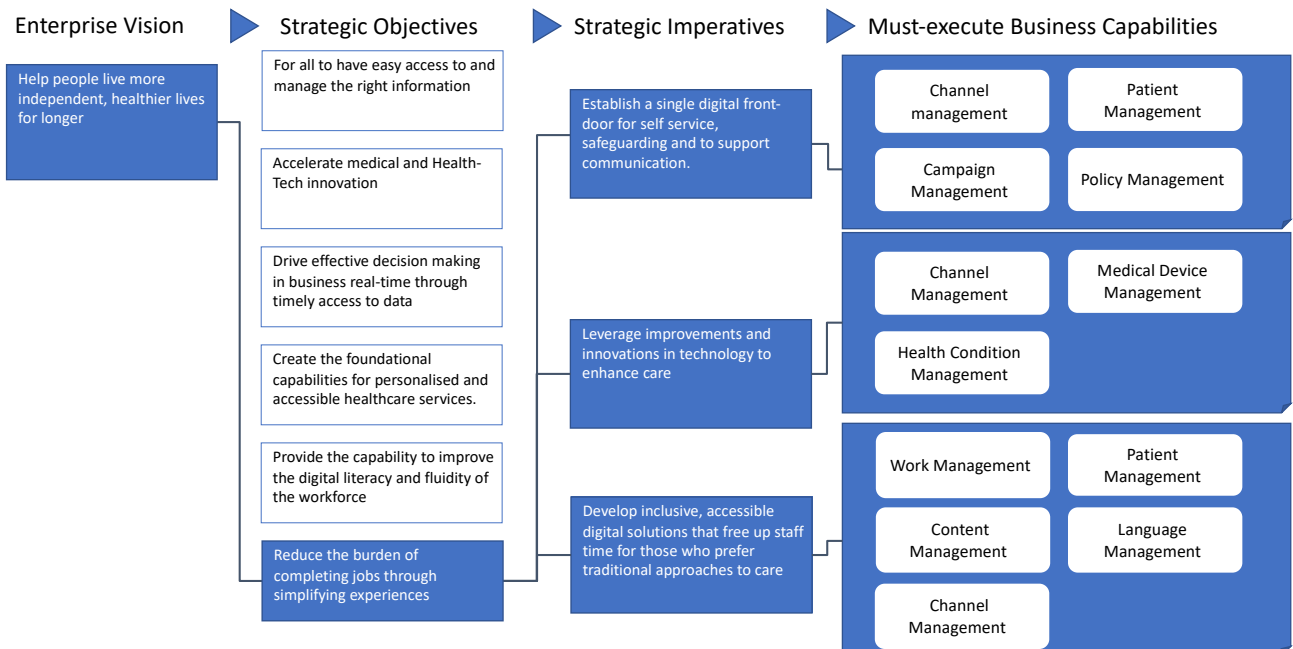
## Provide workforce with digital tools to improve workforce skills, planning and deployment

### Aligning Target Architecture to Ecosystem Strategy



## Reduce the burden of completing jobs through simplifying experiences

### Aligning Target Architecture to Ecosystem Strategy



## Appendix D – Business Capabilities definition

Capability Name	Definition
Strategy Management	Ability to define and disseminate an integrated pattern and perspective that aligns an organization's goals, objectives, and action sequences into a cohesive whole.
Policy Management	Ability to establish, maintain, comply with, and administer a course or principle of action adopted or proposed by an organization.
Plan Management	Ability to define, develop, validate, maintain, and coordinate a set of activities to achieve a result.
Research Management	Ability to conduct systematic investigation into materials and sources in order to establish facts and reach conclusions that comprise a result.
Campaign Management	Ability to identify the need for, plan, design, execute, and measure the effectiveness of an outreach activity that targets a specific population; for example, customers, human resources, partners, and patients, to achieve a certain goal, such as marketing awareness, hiring activities, and health awareness.
Channel Management	Ability to establish, analyse, and utilize a digital, analogue, or physical conduit through which related healthcare services or communications are delivered or received, including the Internet, phone, delivery service, satellite, radio, or physical means.
Network Management	Ability to plan, direct, monitor, organize, control, and report on a set of connected arcs and nodes that may be associated with infrastructure, assets, locations, and other business objects.
Patient Management	Ability to control, predict, process, organize, present, and analyse all information, documents, preferences, experiences, and history related to an individual that has, plans to have, or has had a legally binding agreement with the organization, or otherwise is a recipient or beneficiary of the organization's healthcare services.
Healthcare Condition Management	Ability to plan, research, monitor, track, evaluate, and act upon issues, such as disease, injury, mental disorder, malnutrition, pregnancy, birth, or other pathology that impact the well-being of all living things including human beings and bio-organisms.
Healthcare Services Management	Ability to define, create, maintain, deliver, and administer a set of offerings, either directly or indirectly, to support the diagnosis, treatment, and prevention of health conditions.
Healthcare Case Management	Ability to define, diagnose, treat, resolve, or otherwise address an identifiable instance of a condition or conditions, associated with a specific patient, within a defined timeframe, through the application of healthcare services.
Medical Device Management	Ability to acquire, track, monitor, and dispose of machines, contrivances, implants, or in vitro reagents that are recognized, identifiable, and catalogued by the appropriate regulatory agency as aiding in the provision of medical care.
Partner Management	Ability to control, predict, process, organize, present, and analyse all information, documents, preferences, experiences, and history related to an individual or other legal entity, including healthcare provider, that has, plans to have, or has had a legally binding agreement with the organization with the intent to exchange monetary and/or non-monetary value in the provisioning of assets, healthcare services, or other means of assistance in the course of doing business.
Agreement Management	Ability to establish, organize, analyse, administer, and report on all aspects of a set of legally binding rights and obligations between two or more legal entities.
Medical Facility Management	Ability to define, describe, and administer any physical structure at a given location where healthcare services are delivered, or healthcare-related business is conducted.
Operation Management	Ability to define, instantiate, run, monitor, report on, control, secure, terminate, and evaluate an orchestration of work to achieve a specific objective constrained by time and location.
Information Management	Ability to define, organize, structure, secure, protect, and disseminate facts, statistics, attributes, and other types of data about an organization's set of business objects.
Competency Management	Ability to define, design, profile, rate, and validate the skills and knowledge necessary to do something.
Human Resource Management	Ability to assess, mentor, compensate, terminate, and otherwise coordinate individuals who have, plan to have, or have had a legal agreement with the organization, which includes compensation and other benefits on a temporary or permanent basis.
Work Management	Ability to capture, organize, prioritize, route, interpret, disseminate, assign, and administer tasks, inbound requests, schedules, events, and related decisions.
Meeting Management	Ability to establish, use, sustain, disseminate, and analyse a gathering of two or more persons at a determinable time and place, including physical and virtual engagements, conferences, or related gatherings.
Time Management	Ability to define, establish, articulate, and monitor a point or duration, in the past, present, or future.
Job Management	Ability to identify, define, assign, and manage named category of accountabilities, whether remunerative or non-remunerative, associated with an assigned, specific, and accountable organization duty, role, or function that can be executed by a human or non-human resource.
Asset Management	Ability to create, track, report on, and dispose of tangible or intangible property.

## Appendix E - Mapping Application Services to Capabilities

Each business capability is underpinned by a composite of resources including people, process, data, and technology. Below is shown the sets of national technology and data service groups being proposed in this target architecture and how they related to each capability.

