

Interoperability Handbook

NHS England INFORMATION READER BOX

Directorate

Medical
Nursing
Finance

Commissioning Operations
Trans. & Corp. Ops.

Patients and Information
Commissioning Strategy

Publications Gateway Reference:

0

Document Purpose Guidance

Document Name Interoperability Handbook

Author NHS England, HSCIC, South, Central and West Commissioning Support Unit

Publication Date 3rd September 2015

Target Audience CCG Clinical Leaders, Chief Clinical Information Officers, Chief Information Officers, Directors IMT

Additional Circulation List

Description In line with Five year Forward ambitions, the Interoperability Handbook is the first in a series of guidance to aid local organisations in procuring and implementing interoperable solutions as part of their local digital roadmaps. It has been developed in conjunction with national and local organisations such as the Pioneers/Vanguards.

Cross Reference https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/442832/Work_Stream_2_1.pdf (appendix C).

Superseded Docs
(if applicable)

Action Required Guidance to support local organisations

Timing / Deadlines
(if applicable) N/A

Contact Details for further information Inderjit Singh
NHS England Patients and Information Directorate
Quarry House, Quarry Hill, Leeds, West Yorkshire

LS2 7UB

Document Status

This is a controlled document. Whilst this document may be printed, the electronic version posted on the intranet is the controlled copy. Any printed copies of this document are not controlled. As a controlled document, this document should not be saved onto local or network drives but should always be accessed from the intranet.

Document Title: Interoperability Handbook

Version number: 1.0

First published: 3rd Sept 2015

Prepared by: NHS England; HSCIC; South, Central and West Commissioning Support Unit

Classification: Unclassified

The National Health Service Commissioning Board was established on 1 October 2012 as an executive non-departmental public body. Since 1 April 2013, the National Health Service Commissioning Board has used the name NHS England for operational purposes.

1	Introduction.....	5
1.1	Strategic context.....	5
1.2	Audience	6
1.3	Scope	6
	Section One: Business Context.....	7
2	What is interoperability?	7
2.1	The National Information Board Interoperability Strategy	8
2.2	The local context	11
2.3	Point-to-point interoperability	11
2.4	Hub and spoke interoperability	11
2.5	Hybrid models	12
3	Your interoperability journey	13
3.1	Establish your vision and scope	13
3.2	Review the current interoperability landscape	15
3.3	Define your interoperability journey	16
3.4	Establish your vendor engagement strategy	16
3.5	Formally establish your programme	17
3.6	Procure your solution(s)	17
3.7	Agree your information governance (IG) approach	18
3.8	Deliver against your prioritised list.....	19
3.9	Measure outcomes, lessons learnt.....	19
	Section Two: Technical Context	20
4	Architecture patterns to support interoperability	20
4.1	Application sharing	21
4.2	Document exchange.....	24
4.3	Data sharing	29
5	Interoperability decision tree.....	34
6	Interoperability in the real world.....	36
6.1	Example processes (high level use cases).....	36
6.2	Case Studies – interoperability in action.....	40
7	Standards, policy and guidance	42
7.1	Interoperability framework: layers.....	42
7.2	Information governance resources	44
7.3	Identifier resources	46
7.4	Codes and terms	47
7.5	Document headings.....	48
7.6	Data structures	50
7.7	Messaging structures	51
7.8	Communication patterns.....	54
7.9	Technical transports	55
8	Supporting capabilities	58
9	Appendix A: Mapping current standards to the interoperability framework.....	63

1 Introduction

1.1 Strategic context

The Five Year Forward View recognises the need for the NHS and social care to harness the information revolution to meet the fundamental challenges facing us - the health and wellbeing gap, the care and quality gap, and the funding and efficiency gap.

To help bridge these gaps and address the lack of integration across care services – GP, hospital, community and home, clinical and social care, formal and informal settings - the National Information Board's 'Personalised Health and Care 2020' framework outlined a system-wide approach that would exploit the potential of information, technology and data, adding a Government commitment that 'all patient and care records will be digital, interoperable and real-time by 2020'.

As a result, providers and commissioners will need to:

- recognise successful local examples of interoperable, digital working
- understand where and why local areas have not managed to fully harness the potential of interoperability
- share and build on examples of best practice at a local level

In June 2015, the National Information Board published a number of roadmaps, including the Interoperability Strategy – see section 2.1 - and also confirming the key digital standards – see section 7 - we will look to adopt across all settings, with the commitment that at a national level all available commissioning levers would be used to drive these.

Progress is expected to be made in all settings in line with this strategy and local digital roadmaps will be the basis for planning and monitoring how this is to be achieved, enabling person-centred care with information able to flow across organisations.

As part of local digital roadmaps, local decisions will be needed about how existing and new information systems can be made more open and interoperable to support existing and new models of care.

At the same time, there has been significant progress made at a local level on information sharing through the work of Integration Pioneers, Vanguard, Prime Minister's Challenge Fund and other local communities. It is against much of these developments that the national direction on interoperability across health and social care has been set. Created in conjunction with leading localities, a number of specific tools are now being developed and aimed at providing practical "here and now" guidance to local organisations in taking forward their local decision-making whilst aligning to this national direction. These have taken input from health and social care organisations.

This interoperability handbook is the first of a number of resources developed to assist local organisations in procuring and implementing local interoperable solutions. Further resources being developed include the open APIs specification of the key

interfaces expected from supplier systems and the Starter Output-Based Specification (OBS), to aid localities during procurement.

The guidance contained within this handbook will evolve to reflect national policy as it is developed (such as on matters of consent and patient preferences) and emerging areas of focus such as Personal Health Records. As a result, local organisations need to also remain aware of changes to such policy and reference this guidance appropriately.

1.2 Audience

This document is aimed at commissioners, provider organisations, and health and social care economy wide partnerships attempting to deliver local interoperable solutions that will support the NHS's strategic integrated care model.

Specifically it is aimed at Programme Directors, Chief Information Officers (CIOs), Information Technology Directors and Chief Clinical Information Officers (CCIOs) who are responsible for delivering digital enablers and information solutions in order to achieve system-wide interoperability.

Readers will benefit from some previous knowledge of interoperability issues and standards.

1.3 Scope

The handbook describes some approaches and solutions to support the journey towards fuller interoperability and answers many of the frequently asked questions about interoperability standards and their implementation.

This interoperability handbook will:

- ✓ define **interoperability**
- ✓ remind you of the **architecture patterns** that you can use
- ✓ highlight areas that you need to consider as part of your **interoperability journey**
- ✓ provide **case studies and examples** of where integrated care records are supporting existing and emerging models of care
- ✓ identify **technical standards, policy and guidance** to support your work

The interoperability handbook is split into two overall sections:

Section 1 explores interoperability from a business context: Chapters 2 and 3.

Section 2 explores interoperability from a technical context: Chapters 4 - 9.

This interoperability handbook has been developed as a joint piece of work across national organisations, such as NHS England and HSCIC, and in conjunction with local organisations, including the Bristol Connecting Care team, to bring together national direction and local implementation experience into one resource.

Section One: Business Context

2 What is interoperability?

This section will:

- ✓ define **interoperability**
- ✓ summarise the National Information Board **Interoperability Strategy**
- ✓ describe **point-to-point interoperability**
- ✓ describe **hub and spoke interoperability**

You may find this useful if you need a reminder of what interoperability you are a:

- Chief Clinical Information Officer (CCIO)
- Chief Information Officer (CIO)
- Information Technology Director

You might also like to read this if you would like to have more knowledge of interoperability and the National Information Board Strategy and you are a:

- Programme Director
- Programme Manager

Interoperability refers to the ability of two or more systems to share, communicate and co-operate. Systems can refer to any number of entities including Organisations, Businesses, People and IT systems. For the purposes of this document, “system” refers to IT applications, solutions and components.

The IEEE Computer Society defines interoperability as *“the ability of two or more systems or components to exchange information and to use the information that has been exchanged.”*

Achieving interoperability in this context can be considered as two problems that need to be solved:

i. **Technical interoperability – the “how”**

This is the process of moving data between two systems. It is not dependent on the type of the information being moved or the distance between systems; it is concerned with the orchestration of a reliable delivery of information between systems.

ii. **Semantic interoperability – the “what”**

Semantic interoperability is the process of ensuring the each system can understand the information received from the others. It must ensure that information can be used and interpreted without ambiguity. Critical to this is the need for aligning both data models as well as terminology. This involves the use of specific coding and messaging schemes and is at the core of health and social care integration. It also requires storing information using a common way of organising the stored data – often referred to as a “data

model”. Semantic Interoperability is core to the success of health and social care interoperability programmes.

However, whilst technical considerations are important, we need to move the discussion on “interoperability” out of just the technical domain and into the key functionality that we are looking to deliver; the benefits enabled and how they can support how we provide citizen-centred care. Furthermore, the term “interoperability” can itself be an opaque and overly complex term. The “business capabilities” shown in Figure 1 outline the business functionality that interoperable solutions can provide. These can be used by local organisations when discussing key local priorities and in non-technical language.

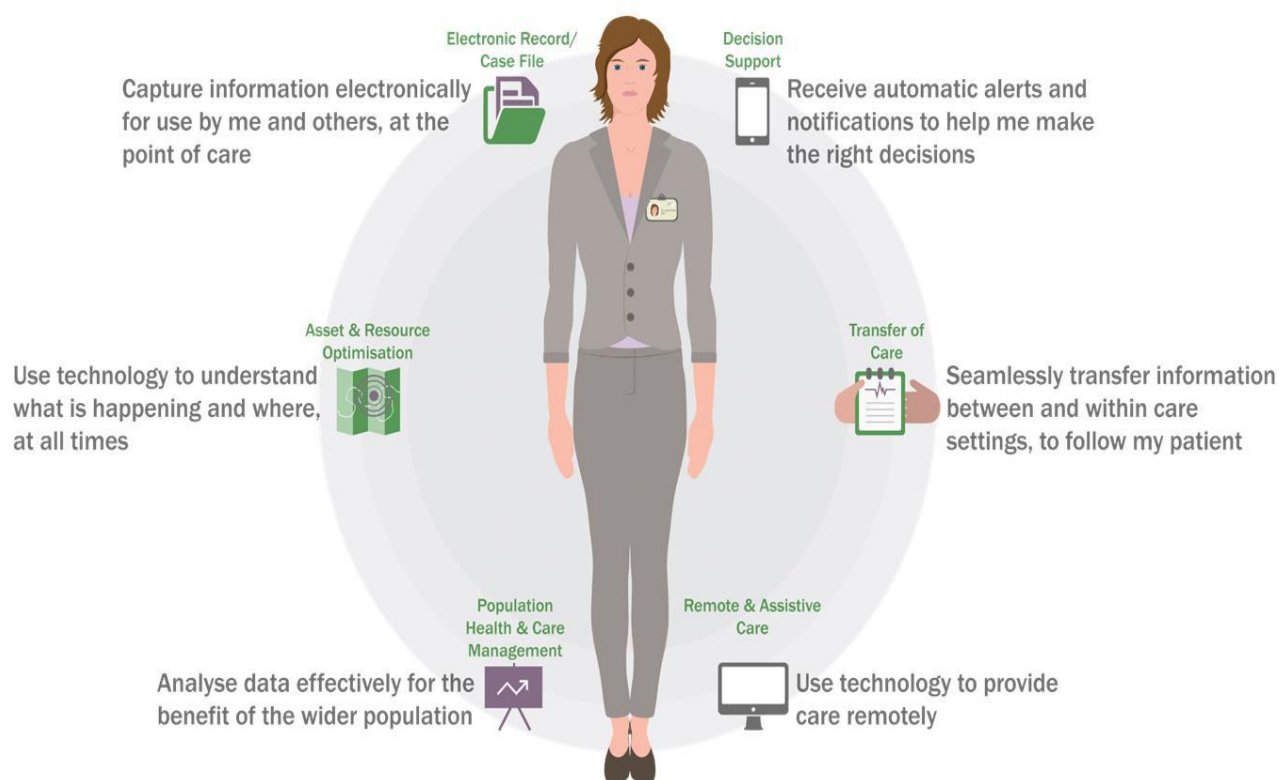


Figure 1: Interoperability business capabilities

2.1 The National Information Board Interoperability Strategy

Local health and care economies will be required to produce their local digital roadmaps by April 2016. The health and social care economies will need to self-assess their progress using the Digital Maturity Index. Together these will provide a view of “where am I going?” and “where am I now?” as shown in figure 2.

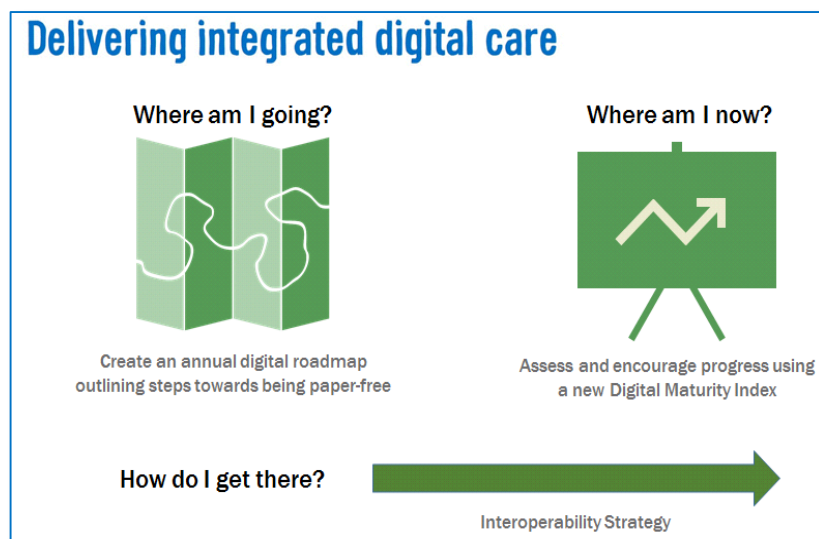


Figure 2: the digital maturity model

The National Information Board Interoperability Strategy will then support commissioners and providers in the local health and care economy in articulating how they answer the “how do I get there?”. Importantly, this strategy is not about dictating how a specific local initiative must be delivered but aims instead to set out the framework for interoperability from which local health and care economies can take their local direction, whilst still adhering and aligning to the overall national direction of travel and key underpinning standards.

The focus of the strategy is to enable the development of an open environment for information sharing to support emerging models of care based on open APIs and underpinned by key open standards shown in figure 3.

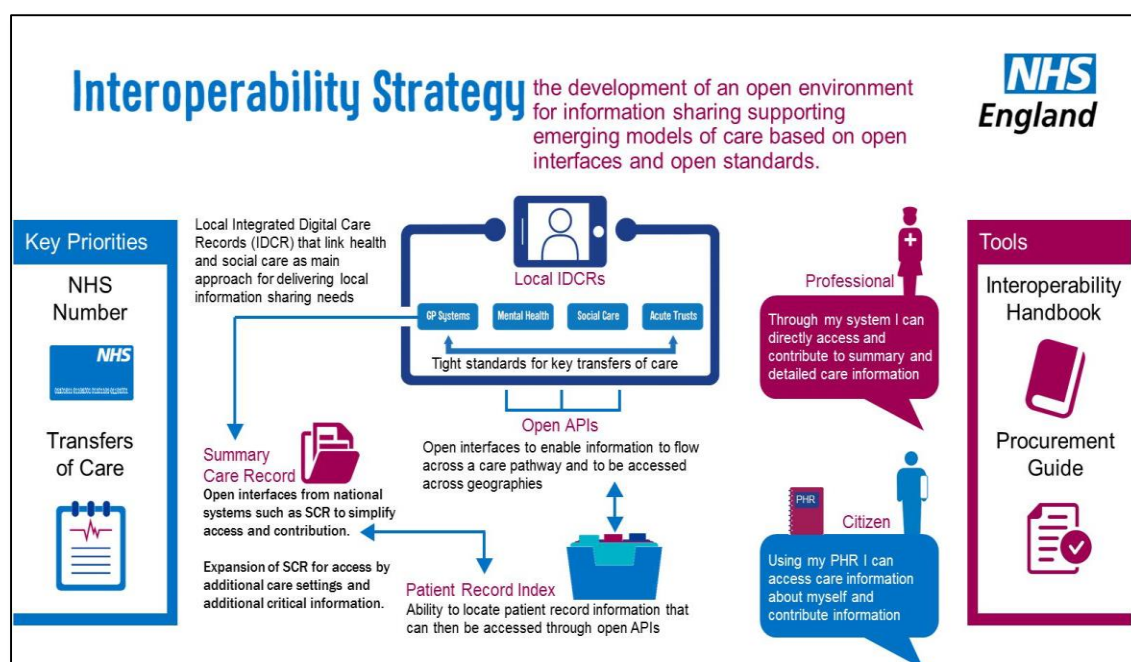


Figure 3: interoperability strategy

The interoperability strategy is based upon the following key building blocks:

- ✓ **Ensuring adoption of the NHS Number as the primary identifier when sharing information.** Use of a consistent identifier across health and care is fundamental to enabling information to flow across a care pathway.
- ✓ **Establishing regional interoperability communities** to deliver their integrated digital care record solutions. In recognition that complex care co-ordination and its clinical leadership is at local level, this will be the main approach to delivering care-coordination across local care settings and organisations. Local examples already exist e.g. Leeds Care Record, Bristol Connecting Care, Hampshire Health Record.
- ✓ **Enabling open interfaces within and between integrated digital care records (IDCRs)** to facilitate access to care information from local systems through open and standard interfaces. The intention is to define a standard list of open interfaces that suppliers should provide. This will also help to avoid vendor lock-in. All IDCRs would be expected to expose this set of common and open Application Programming Interfaces (APIs) so that information can be accessed as a patient/citizen moves along their care pathway irrespective of organisation/geography.
- ✓ **Prioritising the uptake of fundamental digital standards as ratified by the NHS England Board**, such as NHS Number, Transfers of Care and SNOMED, to provide the basis for effective information sharing between different care settings and across locally and nationally delivered solutions. These will underpin the Open APIs.

NHS England recently confirmed the priority digital standards for 2015/16 and future priorities in the digital standards pipeline for 2016-2020. In addition, that it would use all available commissioning levers to drive these forward.¹

- ✓ **For key transfers of care, specifying, introducing and adopting tight and consistent digital standards** across care settings, such as admissions, discharges and referrals. This will remove the current unnecessary and variant ways in which the same information is shared by organisations, as well as enable the move from sharing unstructured to sharing structured and coded information. These will be aligned to the Professional Records Standards Body headings to provide a consistent definition based upon clinically endorsed headings.
- ✓ **Creating a national patient record locator service** to complement regional and local indices. This would act as a national index to support users wishing to locate and retrieve the records that exist for a patient/citizen using Open APIs from local and national care record solutions, (such as the Summary Care Record).
- ✓ **Extending the use of the summary care record.** We need to build on the momentum and coverage of the existing national assets we already have. The

¹ <http://www.england.nhs.uk/wp-content/uploads/2015/03/item9-board-260315.pdf>

important point being to use these as a complimentary tool to local IDCRs, and where appropriate. For example, extending access of the Summary Care Record into care settings such as Ambulance and Community Pharmacy where there is a universal need for access to a core set of information but, at the same time, a less mature local digital estate. Also, the inclusion of additional critical information, such as end of life care preferences, from primary care for access across care settings, and the use of key flags such as whether a patient has a learning disability, so that citizens only have to provide their information once.

2.2 The local context

Whilst the interoperability strategy outlines the key national components and the key national standards to be taken forward, the delivery of the local integrated digital care records themselves will be dependent on the local landscape. The use of the national standards and national components, as outlined above, is an important part of this local decision-making. Furthermore, it is important that local decision-making should avoid serving a tactical need now that may later result in a 'cul-de-sac', or more complexity, down the line. The following examples highlight some of the common initial interoperability approaches taken and the issues that these can raise.

2.3 Point-to-point interoperability

In a point-to-point architecture, every system is connected to every other system. This has the advantage of having no central bottleneck or single point of failure. When used in the context of linking one system to a single other system, a point-to-point architecture is efficient and simple to implement. The major disadvantage of this technique when integrating several systems is the number of distinct interfaces needed to integrate even a small number of different systems, see table 1. Without significant standardisation, each system potentially needs an adapter to talk to every other system and each is likely to need some knowledge of the other systems included in the integration. It is also more difficult to implement any kind of centralised activity monitoring in this kind of environment.

Number Of Systems	2	10	100
Connections Required	1	45	4950

Table 1: Number of connections required in a point-to-point architecture

2.4 Hub and spoke interoperability

A hub and spoke architecture reduces the number of connections needed to link several systems by linking them all through a central hub. Each system to be integrated needs a single adaptor to connect it to the hub and enable it to connect with every other system connected to the hub.

One major disadvantage of the hub and spoke architecture is that the hub is a single point of failure. The hub itself handles the processing and routing of data passed to it

by connected systems. The hub becomes complicated as the number of connected systems increases and needs to have knowledge of every system.

When a new system is to be added, the hub needs to be modified to support it. However, a major advantage over the point-to-point architecture is that, if a system needs to be removed or replaced, it can be done so with no effect on other systems connected to the hub.

Examples of a hub in a hub and spoke architecture are an integration engine or a shared data repository.

2.5 Hybrid models

In practice, a combination of point-to-point and hub and spoke models are often used across local infrastructures due to information systems not being fully flexible and interoperable, and to ensure that communications are as efficient as possible.

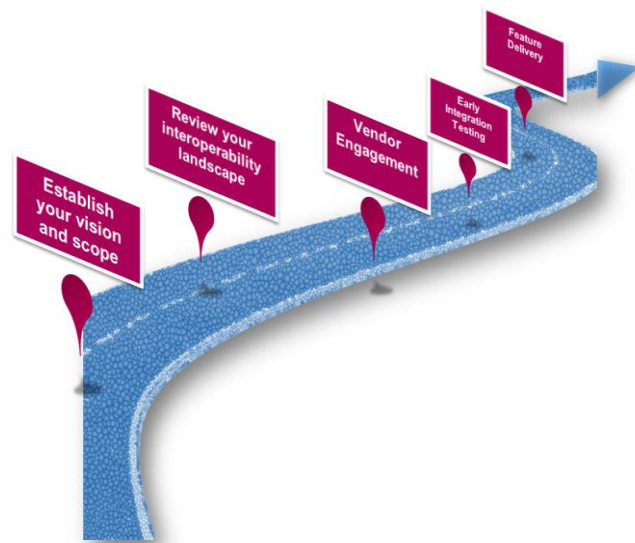
The requirements for interoperability are obviously avoided if all of the relevant care professionals are able to work within common information systems with common databases. With emerging delivery models to support person-centred treatment and care, this is unlikely to be the case.

The remainder of the interoperability handbook provides guidance on the delivery of local integrated digital care records solutions.

3 Your interoperability journey

This section will:

- ✓ help you **consider and plan** some of the key activities that will be required to get your interoperability programme established
- ✓ inform your **strategic vision** and enable you to focus on any gaps
- ✓ understand where you have **further work to do**
- ✓ help your **partnership feel confident** about your technical plans to support your chosen models of care



You may find this useful if you want a list of steps to go through to establish and kick off your interoperability programme and you are a:

- Programme director for an interoperability programme

You may find this useful if you are responsible for delivering digital enablers and information solutions and you are a:

- Chief Clinical Information Officer (CCIO)
- Chief Information Officer (CIO)
- Information Technology Director

3.1 Establish your vision and scope

- 1) Create a **documented vision about how data and information** will support your services/organisation/partnership
 - Identify what business drivers and problems you are trying to solve. Support commissioning activity and planning of services? Improve the efficiency of the work processes? Improve the quality of service and experience for the citizen? Reduce the cost of data handling?
 - Identify any technical problems you are trying to solve. Solve connectivity issues?
 - Decide on the information you want to record and share to support integrated working in your health and social care settings. What are the priority use cases that your health and care professionals and citizens really need?
 - Document your high-level priority use cases. This should not just be “we need a shared-record”, but more specific in terms of the functionality and clinical benefit you want to enable e.g. medicines reconciliation, access and contribution of end of life care preferences.

- What level of detail of information do you want to share with clinicians and practitioners? Is it the same level of detail for all of the IT system users?
 - Agree and document your approach to information lifecycle management e.g. retention and purging.
 - Are you planning to expand and build incrementally or is there a single use case?
 - Is your Information and IT landscape stable and fit for purpose? Are any of your IT systems due for renewal/replacement and how will this affect your information vision and the order and speed of implementation?
- 2) **Establish your partners** within the programme and document and understand your **shared goals** and areas where your **vision is aligned**
- 3) **Test your vision with patients/citizens**, consider their views and refine your vision as necessary
- Ensure that professionals and citizens are engaged in developing the vision and then throughout the design of the approach so that the solutions meet their needs and enable their proactive involvement in their care.
- 4) Determine what **level of standards compliance** you aspire to at different stages of your interoperability journey
- Review the national standards, policies and guidance regarding interoperability.
 - Use the sign-posted guidance in section 7 on key standards, policies and guidance to help you agree building blocks towards meeting relevant standards with your partners.
 - Use relevant national and international standards where appropriate to avoid re-inventing the wheel.
 - Ensure that you are compliant with existing Information Standard Notices and existing contractual requirements e.g. use of NHS Number for all clinical correspondence as per NHS Standard Contract.
- 5) Understand the **cultural challenges**
- Will there be resistance to sharing data from some partners?
 - Will care pathways, business processes and information workflows need to be modified as a result of the programme and is there agreement for this?
- 6) **Assess and record** the care pathways, business processes and information flows that you want to **support and communicate**
- Prioritise and establish which are essential and which would be nice to have.
 - Understand how these will support your business drivers and problems.

7) Define a **prioritised order** of delivery

- Determine what parts of your shared vision can be completed quickly to help mobilise and build the partnership.
- Ensure that attention is given to those areas of maximum business benefit or where there are known quality or clinical risk/safeguarding issues.

3.2 Review the current interoperability landscape

1) Review the **systems which will need to interoperate**

- How interoperable are they currently; how flexible, open and cheap/expensive are the suppliers in providing changes to support interoperability?
- Consider listing your suppliers and reviewing if their APIs are open, standard or proprietary? Understand how the APIs are licensed.
- Do they conform to existing Open API guidance i.e. the Open API policy? ²
- How well does your current landscape support patient/citizen identity, record management and data quality? Will you need an additional Master Person Index (MPI) to support your programme?
- What type of information are you trying to exchange?
- What standards, if any, do the existing systems have in common?
- How can you best use existing national assets? (such as the Summary Care Record)

2) What are the **dates for renewal of licences and contracts** with your suppliers?

- These may affect your ability to introduce new requirements on your suppliers and their willingness to be flexible.
- If you have plans to replace systems this may affect the order and delivery of your interoperability solutions.

3) What **sharing model/models fit your requirements** best?

- Do you need a solution that is rapid to implement? Are you trying to create a solution that will suit a wide range of uses?
- Will you need to use architectural patterns that allow the systems to support information flows and provide updates to each other?
- Test your thinking against a range of suitably complex business problems to ensure that the proposed information solution(s) and architectural patterns are fit for purpose.
- Refer to section 4 in this document for further guidance on patterns.

4) Review the **technology and network landscape**

² <http://www.england.nhs.uk/wp-content/uploads/2014/05/open-api-policy.pdf>

- Will your user connectivity and data transfer cross network boundaries, for example N3, PSN and private and public networks?
- How will you bridge different networks?
- Do you need to consider managed hosting options?
- What other supporting capabilities might you need to implement your preferred sharing model? Consider authentication, authorisation, data security, encryption, audit etc.
- Do any of your existing systems provide capabilities that could be re-used/extended?

3.3 Define your interoperability journey

- 1) How will you **get to your vision**?
 - Do you need to streamline and reduce existing systems to maximise effectiveness?
 - Are you implementing “Big Bang” style, or taking incremental steps? Do you need to implement any transitional architectures?
 - Are you piloting solutions to be refined before rolling out more widely?
- 2) Establish which **interoperability pattern(s)** most suit your landscape
 - Are you recording and updating information?
 - Are you supporting workflow, care pathway and business processes? Do you need static or transactional (and workflow) systems?
 - Are you sharing information and documents from one system to another?
 - What skills do you have/are you able to deploy to support your proposed interoperability patterns/solutions?
 - Refer to Section 4 in this document for further guidance.
- 3) Start to **establish your interoperability requirements**, utilise section 7 and other resources sign posted in this document
 - Agree minimum standards for authentication, authorisation, data and cyber-security, encryption, audit etc. with your partners.
 - Understand and agree which standards you expect your suppliers to comply with, now or by a certain date.
 - Use relevant national and international standards where appropriate to avoid re-inventing the wheel.
 - Implement existing Information Standard Notices and existing contractual requirements e.g. use of NHS Number for all clinical correspondence as per NHS Standard Contract.

3.4 Establish your vendor engagement strategy

- 1) Decide how important it is for you to **utilise vendors with open source systems, open APIs or proprietary solutions**.

- 2) Understand which IT supplier(s) have signed up to and have committed to the **Tech UK Interoperability Charter**.
- 3) Initiate **links with vendors** and share your plans.
- 4) **Engage with vendors** and update your high-level business requirements & roadmap following feedback on market capability.
- 5) Understand how well **vendors align to your development methodology** and approach you wish to take e.g. agile or waterfall?

3.5 Formally establish your programme

- 1) Establish your **governance structure** and agree **funding** and **resources** from services/partners.
- 2) Undertake any required **recruitment**.
- 3) Ensure **legal agreements are put in place** to support any partnership and joint working arrangements for the programme.
- 4) Agree your **programme approach** and project/programme **methodology**.
- 5) Agree how you will **engage with stakeholders** including patients/citizen groups.

3.6 Procure your solution(s)

- 1) Write your **outcome based specification** (OBS) – use OBS from similar programmes as a starting point.
- 2) Ask your IT supplier(s) to sign and commit to **the Tech UK Interoperability Charter**.
- 3) Ensure that you **involve patients/citizens** and health and social care **professionals** in collating and agreeing your specification.
- 4) Agree your **procurement strategy**
 - Review the suitability of national frameworks (<https://www.gov.uk/government/organisations/crown-commercial-service>)
 - Review the suitability of digital market place (<https://www.gov.uk/digital-marketplace>)
 - Review existing frameworks such as the SBS Healthcare Clinical Information Systems Framework
- 5) Select your **vendor** and undertake your procurement.

3.7 Agree your information governance (IG) approach

In terms of the overall context for Information Governance as part of these information sharing initiatives:

- Organisations seeking to **share detailed care records with a wide variety of organisations** on a local and national basis need to be assured that sharing solutions allow for the reasonable expectations of citizens, and the DPA responsibilities of data controllers, to be fully met.
- Providers of solutions should be contracted to deliver **choices and controls** deemed by the organisations and data controllers as sufficient to ensure legal compliance and meet policy aims and to commit to develop these to remain aligned with evolving national policy & guidance.
- Areas considering data sharing arrangements should **specifically address the challenges and equity of service across borders**. Information governance policy and technical implementation of sharing solutions should not have an adverse impact on the quality or safety of care, or the ability to share appropriate information to support care for patients who elect for care outside a 'data sharing' collective, or from any similar impact on patients from outside the said area wishing to be treated inside an area with established data sharing arrangements.

In this context, the following practical steps should be taken:

- 1) Take a **privacy-by-design approach** and produce a Privacy Impact Assessment.
- 2) Agree your **approach to data sharing** and record this in a Data Sharing Agreement.
- 3) Produce a **security policy and IG statement**
 - Consider carefully any standards that will apply to your information systems/solutions that are used across multiple organisations/the partnership. Which and whose standards will apply?
 - Take explicit note of cyber-security considerations to ensure that you have robust cyber-security measures in place.
- 4) Clarify and agree the mechanism to **agree IG issues** throughout the programme
 - To agree who is the data controller/processor.
 - To agree roles and responsibilities of data controllers/processors.
 - To agree if you need to inform patients/citizens about your programme, what you are doing with information about them, and any procedures for opt out.

3.8 Deliver against your prioritised list

- 1) Start to **deliver against your prioritised list** of business needs.
- 2) Consider **“quick wins”** to build and mobilise the partnership within the programme so that you can gain professional buy-in quickly and build on this.
- 3) Update your **vision and roadmap** as you implement your programme
 - However, stay true to the overall business vision and strategy.
 - Avoid changing scope unless there are new business drivers and priorities.
 - Be prepared to stop unsuccessful projects.

3.9 Measure outcomes, lessons learnt

- 1) **Before you implement** your programme
 - Ensure you record a baseline to enable benefits to be tracked post implementation.
- 2) Once new **interoperability channels** are in place measure the **change benefits** it brings e.g.:
 - Consider the different types of benefits:
 - *Patient/citizen satisfaction (tell story once, increased confidence in level of care being received, personalised care)*
 - *Efficiency (e.g. reduction in letters, phone calls & faxes, carrying out triage and analyses, reduced referrals, reduced assessments, reduced tests and orders)*
 - *Improved efficiency in the care pathway (e.g. admissions and re-admissions, discharge planning and care planning)*
 - *Quality of care (patient wishes including end of life)*
 - *Safety – safe transfers of care, medicines reconciliation*
 - *Improved safeguarding*
 - *IG benefits (reduction in data loss and improvements in information handling).*
 - *Cost of legacy infrastructure and systems*
- 3) Based on **pilots and early adoption**, consider **refining or re-defining** manual and system processes and procedures

Section Two: Technical Context

4 Architecture patterns to support interoperability

This section will:

- ✓ provide information on **architecture patterns** for application sharing, document sharing and data sharing
- ✓ highlights **areas to consider** before you choose which pattern(s) are appropriate to support your integrated digital care record(s)
- ✓ help you understand where you have further work to do to **design your interoperability journey**
- ✓ help your partnership feel **confident about your technical plans** to support your chosen models of care

You may find this useful if you are responsible for delivering digital enablers and information solutions and want a list of items to consider in creating your interoperability journey:

- Chief Clinical Information Officer (CCIO)
- Chief Information Officer (CIO)
- Information Technology Director
- Programme Director for an interoperability programme
- Enterprise Architect supporting an interoperability programme

A “pattern” is a formal way of documenting a general, reusable solution to a commonly occurring problem within a given context – in this case sharing clinical and care information between systems. Patterns are not mutually exclusive and many real solutions will use more than one pattern, often evolving over time from simpler to more complex patterns as more mature capabilities are implemented in systems.

In The Open Group Architecture Framework (TOGAF)³ “patterns are considered to be a way of putting building blocks into context; for example, to describe a re-usable solution to a problem. Building blocks are what you use: patterns can tell you how you use them, when, why, and what trade-offs you have to make in doing so.”

This section describes the patterns relevant to three different types of information sharing:

- Application sharing
- Document exchange
- Data sharing

Health and social care organisations and partnerships need to consider all three aspects alongside each other to determine the most efficient and cost effective overall design.

³ <https://www.opengroup.org/togaf>

4.1 Application sharing

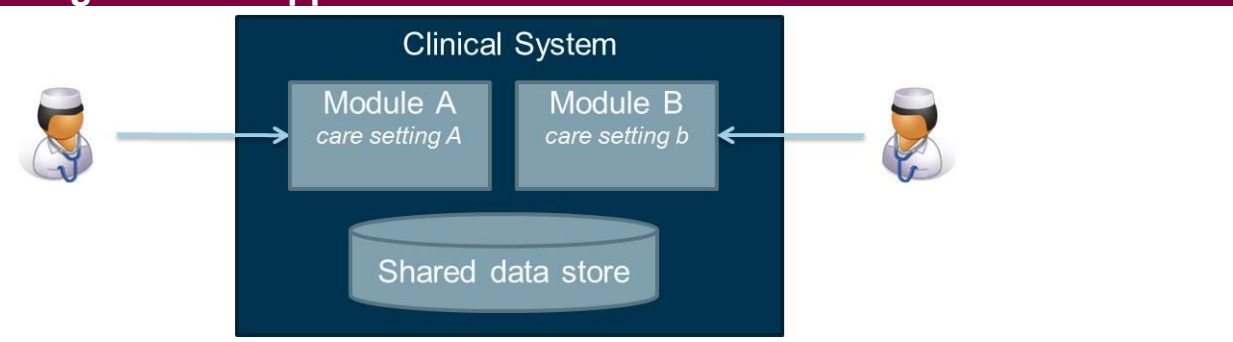
Sharing an application between multiple groups or organisations is a simple way of achieving interoperability. It solves the technical interoperability problem, as information does not need to be shared outside of the application in which it is recorded.

Keeping data within the same application also means that the Semantic Interoperability⁴ problem is greatly reduced, as information does not need to be mapped to a different model.

How data are viewed within different organisations and care settings will still need to be considered. Data needs to be presented in a way that supports recording of clinical and professional practice, including analysis and diagnosis, and to underpin any workflow activity across health and social care.

For application sharing patterns you also need to consider who the data controllers/ data processors in common are; who the data processors are, and agree their roles and responsibilities. You may also need to put data sharing agreements in place where they do not already exist.

Single shared application



- Single shared applications are **typically modular** – using modules tailored for each care setting's pathways and business processes and workflows.
- Data are shared via a **common data store**.
- Before choosing this pattern consider:
 - the maturity of the software provider to support multiple care pathways and business processes and workflows
 - if multiple modules are required
 - which care setting will be responsible for the accuracy and timeliness of shared data
 - how different care settings and organisations will access the application – especially if organisations are on different networks (e.g. N3 and PSN)
- A single **shared application will work** when:

⁴ https://en.wikipedia.org/wiki/Semantic_interoperability

- an existing clinical/health and social care system is already in place and is used across a number of services and organisations. In this case, it may be logical to make use of this shared system to share citizen information across further services in that community
- professional groups will be following common processes, interact on the core care pathway and/or transfer care frequently
- Examples where a single shared application could be used include **community teams** using the same system as GPs, **reablement teams** using the same system as social workers, **mental health crisis teams** using the same single shared application as out-of-hours duty teams.

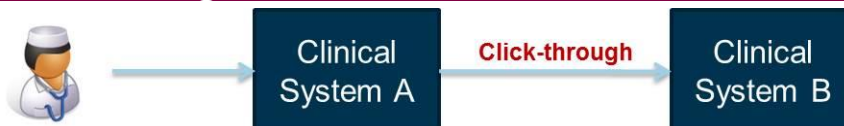
Benefits

- Where a good proportion of the care settings in the locality already use a shared system, this can **very quickly allow for sharing of records** across those care settings.
- By using an existing known system, the training, **deployment and IG effort may be reduced**.

Concerns

- Scaling beyond a local health and social care community is **difficult using this approach** as it relies on all services using the same system.
- It is very unlikely that all care settings wanting to access to patient/citizen information will be using a **single shared system** already; this may disenfranchise those who are told they have to use a new system.
- **Granting access to others not already using the shared system may be difficult.** (It may be possible for other care settings to use a record “viewer” to provide a read-only view of the record.)
- Updates to other EPRs would probably be **manual**, and any **updates to the shared information would need to be fed back** to a team with full access to the shared clinical system. This duplication could lead to inaccuracies and conflicting information across systems.
- Can lead to **vendor “lock-in”**.

Click-through



- The Click-Through pattern can provide a **simple mechanism** for allowing a user to view the contents of another system launched as a new “tab” or window from their own system.
- This is typically achieved using a **simple web address** (URL) to allow the remote application to be opened with a specific citizen context.

- Before choosing this pattern consider:
 - the maturity of the software provider(s) to support this model
 - how much synergy/commonality there is in the citizen records
 - how different care settings and organisations will access the application – especially if the organisations are on different networks (e.g. N3/PSN)
- The Click-Through pattern will work when:
 - an existing clinical/health and social care system is already in place and is used across a number of services and organisations. In this case, it may be logical to make use of this shared system to share citizen information across further services in that community
 - professional groups will be following common processes, interact on the core care pathway and/or transfer care frequently
- Examples where a Click-Through pattern could be used include an **out-of-hours GP service** viewing an individual GP practice's information system, **health visitors** viewing a council's early help/early intervention information system, a **specialist small hospital** viewing a regional hospital's information system.

Benefits

- Can provide a **simple way of quickly providing a view of information** in a remote system e.g. an HTML rendered view.
- **Read-only access is most common**, though there are scenarios where update is supported in this way.

Concerns

- In order to work effectively, a **shared mechanism for authenticating users** (Single Sign-On) would ideally be required, or some other approach for sharing authentication context between systems.
- Patient/citizen context between systems also needs to be addressed to ensure **good usability for the users** of the solution.
- Managing updates can be difficult.
- Information from the remote system **is never integrated** into the local record.
- As the information is presented by a different application, it **may not “look” like the application the clinician/professional normally uses**, which may cause confusion.

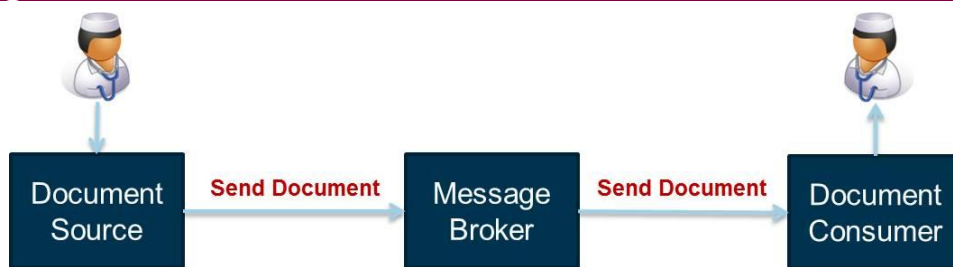
4.2 Document exchange

Exchanging pre-formatted documents is, whilst more technically complex, a more flexible approach to integrating digital care records than application sharing. Whilst it is important for the exchange solution to know some details of a document, e.g., what type it is or who published it, it is not necessary for the contents of the document to be understood outside of the relevant IT systems. The basic information required is often exchanged using document “metadata” which is provided alongside the document itself.

Complex document exchange solutions can introduce greater semantic interoperability by using standard structured formats for documents such as Clinical Document Architecture (CDA) – in this form the solutions closely resemble the data sharing patterns outlined in the next section.

For document exchange patterns, you also need to consider who the data controllers/data controllers in common are, who the processors are, and agree their roles and responsibilities. You may also need to put data sharing agreements in place where they do not already exist.

Message broker



- An example of a “**Hub and Spoke**” architecture.
- In order to **simplify the process of connecting multiple systems** to one-another a message broker (a.k.a. middleware/ integration engine/ enterprise service bus) may be used.
- This may provide **message routing and transformation**.
- It may also allow more advanced **orchestration, workflow & event control, security** and other features including exception handling.
- Before choosing this pattern consider:
 - how consistent the care pathways and business processes, workflow and event management are across the settings
 - how and where the message broker can be hosted to provide a robust service
 - how different care settings and organisations will exchange documents with the message broker– especially if the organisations are on different networks (e.g. N3/PSN)
- The Message Broker will work when:
 - there are defined documents with agreed metadata that need to be shared on a frequent basis

- Examples where a Message Broker could be used include exchanging **e-discharge letters** between hospital teams and GPs, and **e-referrals** between services.

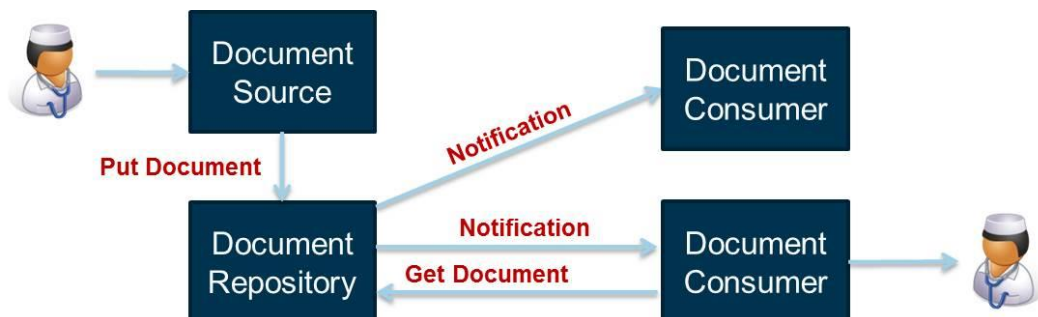
Benefits

- Provides a **robust way to map** between different, incompatible system interfaces.
- Provides a **consistent and reliable delivery** of messages between systems.
- When implemented correctly, **reduces the amount of re-work** required when a single system is replaced.

Concerns

- Can be a **single point of failure**.
- Is an **additional piece of software** to support and maintain in addition to the main user systems/connected systems.
- Requires **specialist skills** to ensure reliable mapping and delivery of messages.

Store and notify



- When a new or updated document is created, the document source **sends the document into a document repository**.
- The document repository then **sends out notifications** (with a “pointer” to inform other parties that new or updated information is available).
- Document consumers would then be **able to store the “pointer”** to the information, and **add a flag to the appropriate patient / citizen record** to indicate that the information is available.
- The document consumer may then **retrieve the document electronically**; either immediately or when it is required for display.
- Before choosing this pattern consider:
 - how consistent care pathways and business processes, workflow and event management are across the settings
 - how and where the repository can be hosted to provide a robust service
 - how different care settings and organisations will exchange documents with the document repository – especially if the organisations are on

different networks (e.g. N3/PSN)

- The Store and Notify pattern will work when:
 - there are defined documents with agreed metadata that need to be shared on a frequent basis
 - consumers want to choose if they want to see the document
 - there are potentially multiple consumers for each document
- Examples where a Store and Notify could be used include advising that an updated care plan exists between **crisis teams and GPs**, between **end-of-life support teams** and **ambulance services**.

Benefits

- It is **proactive**. Systems subscribed for updates find out immediately when information changes.
- Allows for **varying levels of maturity** in document consumers – at its most basic a consumer could simply add a flag to indicate information exists with contact details. Migration to click-through and electronic retrieval can follow.

Concerns

- In order to scale beyond a few systems, **some form of subscription mechanism** would need to be put in place.
- **Does not provide a mechanism to find information** for those not already subscribed to notifications.
- Sharing policies (data sharing agreements) **may be more complex**, and must be agreed by all parties.
- **Governing the use of the metadata** about entries in the repository may be difficult, especially if the metadata itself contains items that could be sensitive.

Shared repository



- In **large organisations and partnerships** with multiple systems, a single shared repository is sometimes used to provide a central point for sharing information (typically documents). This generally performs two key roles:
 - provides a “registry” or index of the documents that are held about each citizen
 - provides a “repository” of the information/documents, and a means to add, update and delete

- Before choosing this pattern consider:
 - how consistent care pathways and business processes, workflow and event management are across the settings
 - how and where the repository can be hosted to provide a robust service
 - how different care settings and organisations will exchange documents with the message broker – especially if the organisations are on different networks (e.g. N3/PSN)
 - the information lifecycle of documents added to the repository
- The Shared Repository pattern will work when:
 - there are defined documents with agreed metadata that need to be shared on a frequent basis
 - consumers want to choose if they want to see the document
- Examples where a shared repository could be used include **a large regional hospital** that wants to share documents across all of its internal services, a shared social care service that is provided across council boundaries.

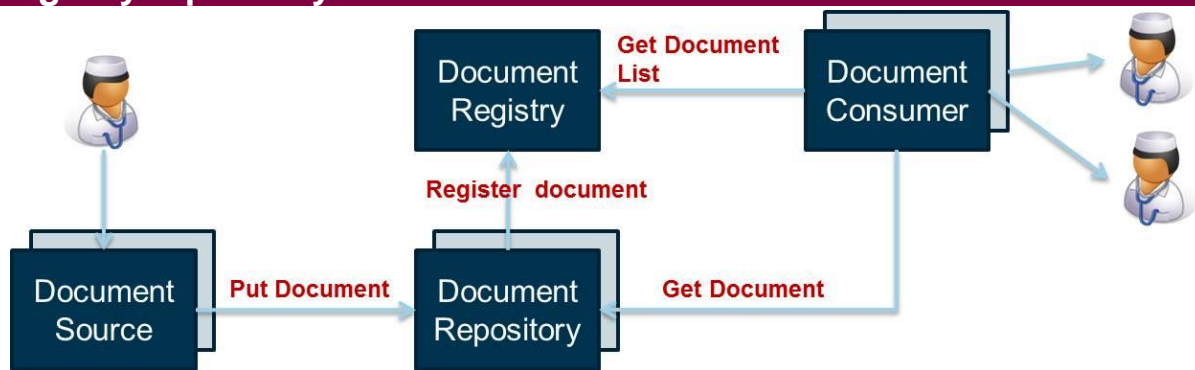
Benefits

- **Allows updates** to be made in any system, but with a robust mechanism for ensuring that changes can be disseminated to all systems as required.
- Does not remove the possibility of conflicting updates, but makes this **much less likely** than in an ad-hoc or manual solution.

Concerns

- **Would not easily scale** beyond a local health and social care community unless the central repository became a regional/national shared repository. A shared registry could potentially be used to allow regional repositories to be linked up (see the registry repository pattern in section 4.2).
- Could potentially **hamper system performance** as a result of having to query a remote system whenever shared information needs to be accessed.
- Sharing policies (data sharing agreements) **may be more complex**, and must be agreed by all parties.
- **Governing the use of the metadata** about entries in the registry may be difficult, especially if the metadata itself contains items that could be sensitive.

Registry repository



This is an **evolution of the shared repository pattern** in which the “registry” and “repository” components are separated.

- This allows a **single registry to provide indexing and querying** of information and documents held across multiple repositories.
- This **can be implemented in a variety of ways** – the repository can initiate the creation of the registry entry, or it can be done directly by the Document Source.
- Before choosing this pattern consider:
 - how consistent care pathways and business processes, workflow and event management are across the settings
 - the maturity of the metadata
 - how and where the registry and repository can be hosted to provide a robust service
 - how different care settings and organisations will access the registry – especially if the organisations are on different networks (e.g. N3/PSN)
 - how information lifecycle management will be managed
- The Shared Repository pattern will work when:
 - there are defined documents with agreed meta-data that need to be shared on a frequent basis
 - consumers want to choose if they want to see the document
- Examples where a shared repository could be used include a **large regional hospital** that wants to share documents across all of its internal services, a shared social care service that is provided across council boundaries.

Benefits

- **Allows updates** to be made in any system, but with a robust mechanism for ensuring that changes can be disseminated to all systems as required.
- Does not remove the possibility of conflicting updates, but makes this **much less likely** than in an ad-hoc or manual solution.

Concerns

- **Would not easily scale** beyond a local health and social care community unless the central repository became a regional / national shared repository. A shared registry could potentially be used to allow regional repositories to be

linked up (see the registry repository pattern in section 4.2).

- Could potentially **hamper system performance** as a result of having to query a remote system whenever shared information needs to be accessed.
- Sharing policies (data sharing agreements) **may be more complex**, and must be agreed by all parties.
- **Governing the use of the metadata** about entries in the registry may be difficult, especially if the metadata itself contains items that could be sensitive.

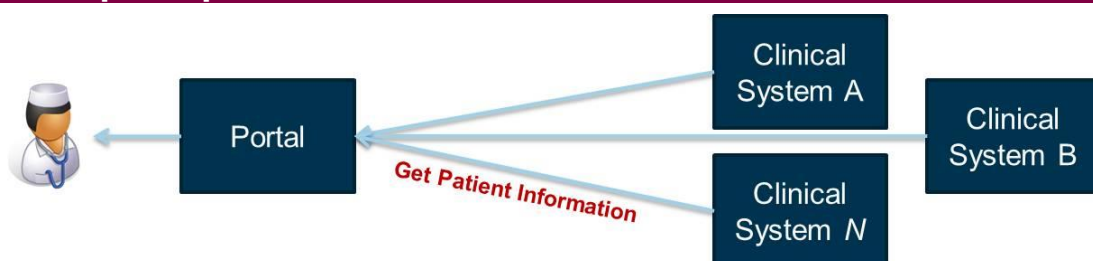
4.3 Data sharing

Patterns for sharing data closely resemble those for sharing documents. The solutions are technically and semantically more complex as the sharing solution needs some knowledge of the use and meaning of individual data elements from each system. This “interpretation” can be handled by an integration engine, and greatly simplified by the use of standard data models and messaging e.g. OpenEHR and FHIR.

Some of these complexities can be further reduced by using a portal that can be configured specifically for the sharing use case to show a shared record instead of sharing data items directly into individual systems. In this scenario, the portal element can be considered as just another system to share data into – albeit one that is specifically designed to present data from multiple different systems. These portal systems are normally initially read only views of the data.

For data sharing patterns you also need to consider who the data controllers/data controllers in common are; who the processors are, and agree their roles and responsibilities. You may also need to put Data Sharing Agreements in place where they do not already exist.

Point-to-point portal



- Clinicians and practitioners **view a summary of information** extracted from multiple systems via the portal/information hub.
- Integration between the portal and the relevant IT systems may be managed on a **case-by-case basis**.
- Typically provides a **read-only view of data**, but can also be used to provide

write-back capabilities.

- In a federated model **no data are stored in the portal**, data and documents are retrieved “live” from source systems when they are needed.
- Before choosing this pattern consider:
 - how consistent care and business processes, workflow and event management are across the settings
 - how and where the portal can be hosted to provide a robust service
 - how different care settings and organisations will access and send data to the portal – especially if the organisations are on different networks (e.g. N3/PSN)
 - which interfaces are available from systems to provide data in a reliable format
 - how often data should be exchanged e.g. as a live feed or as a batch extract
 - whether data needs to be pushed out from systems or pulled in

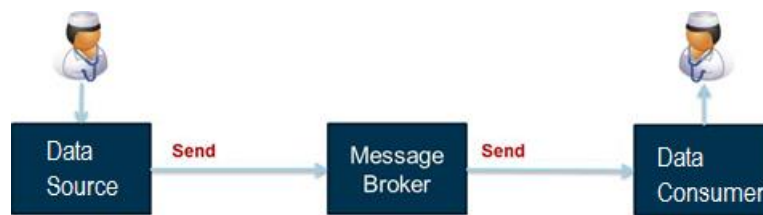
Benefits

- Portals typically try to present the **information in a consistent fashion**, and provide a single known point to find information regardless of which local system it is held in.
- Once information is exposed via a portal, it can potentially be **extended to allow viewing from other services**, or even by the patient/citizen.

Concerns

- Information extracted from the individual systems **may vary from implementation to implementation**.
- Often depends on **the capability of the systems** with which it integrates (see discussion of open APIs earlier in this document).
- Information presented in the portal is **generally read-only**, so changes still need to be made in the relevant clinical system (possibly via a “click-through”).
- If each clinical system exposed via the portal is an individual point-to-point interface, it is **unlikely to scale beyond a small number of organisations**. Where possible a portal solution should be supported by a message broker to ensure that it is future proof.
- Can end up in an **integration cul-de-sac** if you have not ensured that the Open APIs exist to and from the source systems that populate the portal so that you can transition to being able to directly integrate to the end-user systems.

Message broker



- An example of a “**Hub and Spoke**” architecture.
- In order to **simplify the process of connecting multiple systems to one-another**, a message broker (a.k.a. middleware/integration engine/ technical information exchange/enterprise service bus) may be used.
- This may provide **message routing and transformation**.
- It may also allow more advanced **orchestration, workflow & event control, security** and other features including exception handling.
- Can **include a portal** to assist in allowing access to data.
- Before choosing this pattern consider:
 - how consistent care and business processes, workflow and event management is across the settings
 - how and where the broker can be hosted to provide a robust service
 - how different care settings and organisations will exchange data with the message broker – especially if the organisations are on different networks (e.g. N3/PSN)
 - which interfaces are available from systems to provide data in a reliable format
 - how often data should be exchanged e.g. as a live feed or as a batch extract
 - whether data needs to be pushed out from systems or pulled in
- The Message Broker (to support data sharing) can also provide:
 - transformation of messages required between systems
 - orchestration and control of data flows required between systems
- Examples where a Message Broker could be used include, sharing a large number of common information/data streams across a **large number of health and social care organisations** to provide a view-only portal, or **pre-populating forms** across services/settings from previous referrals, assessments and reviews from earlier interactions on the care pathway.

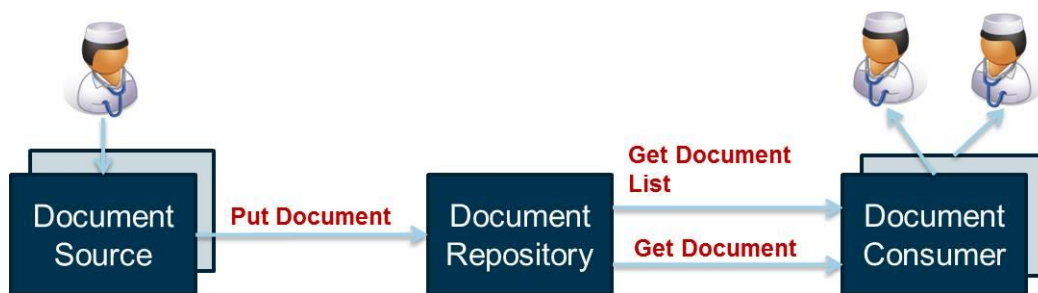
Benefits

- Provides a **robust way to map** between different, incompatible system interfaces.
- Provides a **consistent and reliable delivery of messages** between systems.
- When implemented correctly, **reduces the amount of re-work required** when a single system is replaced.

Concerns

- Can be a **single point of failure**.
- It is an **additional piece of software** to support and maintain in addition to the main user systems connected systems.
- Requires **specialist skills** to ensure reliable mapping and delivery of messages.

Shared repository



- In large organisations and partnerships with multiple systems, a single shared repository is sometimes used to provide a **central point for sharing information**. This generally performs two key roles:
 - provides a “registry” or index of the data that is held about each citizen
 - provides a “repository” of the information, and a means to add, update and delete information
- Before choosing this pattern consider:
 - how consistent care pathway and business processes, workflow and event management are across the settings
 - how and where the repository can be hosted to provide a robust service
 - how different care settings and organisations will exchange documents with the message broker– especially if the organisations are on different networks (e.g. N3/PSN)
- The shared repository pattern will work when:
 - there is defined information with agreed metadata that need to be shared on a frequent basis
 - consumers want to choose if they want to see the information
- Examples where a shared repository could be used include a **large regional hospital** that wants to share documents across all of its internal services, a **shared social care service** that is provided across council boundaries.

Benefits

- **Allows updates** to be made in any system, but with a robust mechanism for ensuring that changes are disseminated to all systems as required.
- Does not remove the possibility of conflicting updates, but makes this **much less likely** than in an ad-hoc or manual solution.

Concerns

- Would **not easily scale** beyond a local health and social care community. A shared repository could potentially be linked up (see the registry repository pattern in section 4.2) through an index.
- Could potentially **hamper system performance** as a result of having to query a remote system whenever shared information needs to be accessed.
- Sharing policies (data sharing agreements) **must be agreed by all parties**.

5 Interoperability decision tree

This section will:

- ✓ provide information on the **level of maturity for each architecture pattern** for application sharing, document sharing and data sharing provides
- ✓ highlight the **key questions that need to be answered** before choosing a specific pattern
- ✓ help your **partnership feel confident** about your technical plans to support your chosen models of care

You may find this useful if you have one of the below roles or if you are responsible for delivering digital enablers and information solutions and want a list of steps to consider when designing your interoperable roadmap:

- Chief Clinical Information Officer (CCIO)
- Chief Information Officer (CIO)
- Information Technology Director
- Programme Director for an interoperability programme
- Enterprise Architect supporting an interoperability programme

As described in section 4, there are a number of different patterns that can be used to support an interoperability solution. These patterns are not mutually exclusive. Many real solutions will use more than one pattern, often evolving over time from simpler to more complex patterns as more mature capabilities are implemented in systems. For example, the use of a registry repository model for the retrieval of documents as needed with a persistence model for key events and their metadata.

The decision tree is not designed to help you to choose a pattern to solve all of the issues a programme intends to answer. It is designed to ensure that at any starting point within a programme a specific and immediate need can be met.

The patterns are ordered on the tree in order of maturity and are designed as “stepping stones” towards a full programme solution. The top of the tree can provide more immediate benefits but a solution should progress down the tree as it matures, with each step complimenting the previous pattern. It is highly likely that a complete solution will contain elements from all patterns regardless of where on the tree it started, and that the decision tree will be used as new requirements arise.

Patterns on the lower part of the tree will provide richer functionality and business value in the longer term. In particular, they are more likely to reduce data handling costs; saving time and reducing transcription errors, and support secondary usage of data to support service planning and improvement.

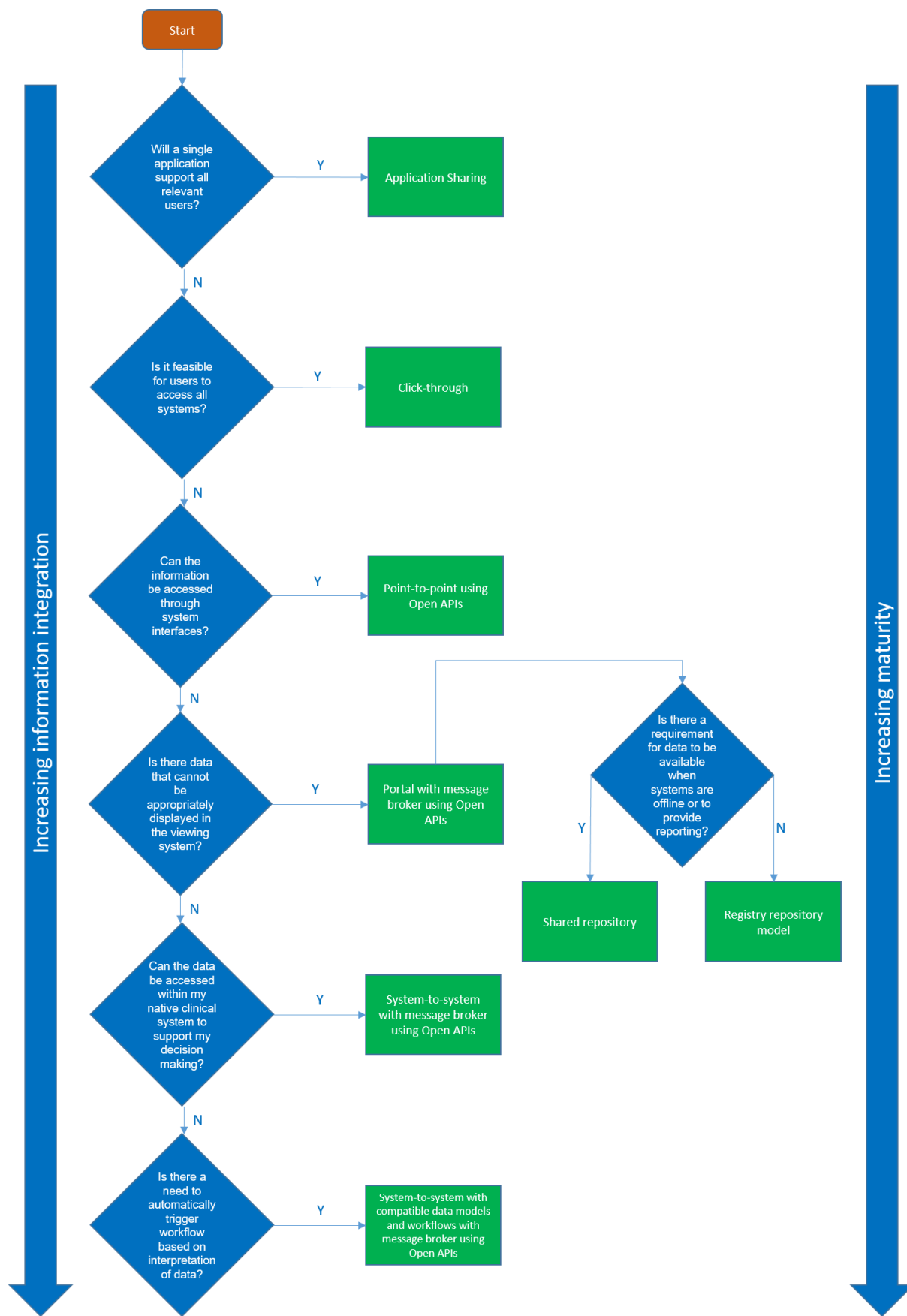


Figure 4: Interoperability decision tree

6 Interoperability in the real world

This section will:

- ✓ provide some **example business processes** where you may require flexible and interoperable information solutions
- ✓ highlight how **business processes align** to the business capabilities
- ✓ consider how the business processes and business capabilities can be **mapped to the architectural patterns** discussed in section 4
- ✓ provide **example case studies** of interoperability in action

You may find this useful if you have one of the below roles and / or are beginning the business case to secure approval and funding to support your interoperability journey:

- Chief Clinical Information Officer (CCIO)
- Chief Information Officer (CIO)
- Information Technology Director
- Programme Director for an interoperability programme

6.1 Example processes (high level use cases)

A local interoperability journey to support a local health and social care community is likely to include a number of steps to utilise a range of architectural patterns for different integrated working and information sharing scenarios. One approach to start determining the steps in the roadmap is to consider the business needs and capabilities that the solution is required to support.

The table below sets out some considerations in relation to how different architectural patterns might support different business needs and capabilities. They are not intended to be prescriptive, but may be useful to support the business case for the development of a local health and social care economy roadmap:

Table 2: How different architectural patterns might support different business needs and capabilities

Business Capability	Process Examples	Pattern Considerations
Integrated Care Records, assessments and support plans	<p>Accessing core demographics and details of the citizen record</p> <p>Accessing diagnoses/conditions and classification of need</p> <p>Enabling single and multi-agency: triage, assessment and support plans</p> <p>Accessing summaries of the citizen health and social care episodes</p>	<p>Detailed Care Records are likely to be held in a number of clinical systems across a locality. In order to bring these records together to provide a holistic picture, suitable patterns might be:</p> <ul style="list-style-type: none"> • Portal • Shared repository • Registry repository • Shared application <p>If a portal is used, the click-through pattern could be used to allow users that need to update data to access the relevant source system in order to do so.</p> <p>Integrated Support and Care Planning may require multiple parties to be regularly reading and updating information. A portal may need to be supported by a shared application that supports clinical and practitioner process and workflow</p>
Decision support: alerts and notifications	<p>Being alerted to:</p> <ul style="list-style-type: none"> • Safeguarding, corporate hazards and flags • Events on the care pathway • Citizens with specific diagnoses or conditions or classification of need • End-of-life plan • Hospital admissions • Discharge-ready patient 	<p>A notification capability could be added in addition to a solution that uses any pattern, but the store and notify pattern could provide a simple approach for this.</p>
Transfers of Care,	Making a referral to another service	These information flows are typically implemented as a

ordering services and tests, pathway communications	<p>Ordering tests and services e.g. radiology</p> <p>Closing an episode e.g. hospital discharge, closure of social care case</p> <p>Summarising an event e.g. A&E, mental health, domestic violence</p>	digital version of a traditional paper process, with some form of document being sent. This would be an example of the simple point-to-point/message broker , store and notify , shared repository or registry repository patterns.
Remote (monitoring) and assistive care	<p>Alarms</p> <p>Telemonitoring</p> <p>Teleconsultation</p> <p>Telecoaching</p>	<p>Often the information held in remote care solutions is quite specialised, and requires views or visualisations, which are specific to the technologies and devices used. This would often be a case where a single shared application could be used, potentially with some form of click-through from other clinical systems in order to view the information.</p> <p>Other supporting interactions around remote care might use other patterns. For example, referrals into these services might be done using a point-to-point message broker or store and notify pattern.</p> <p>Summaries of information held in these systems might also be exposed in the form of a single shared repository, a registry repository, through a portal, point-to-point or via a message broker.</p>
Patient Activation (Citizen access and engagement)	<p>Accessing diagnostic results/health conditions/classification of need</p> <p>Requesting a service/self-referral</p> <p>Contributing patient generated information to</p>	<p>Providing a broad range of information to the patient to support citizen access and engagement is likely to require information to be pulled from a wide range of sources. In this case, suitable patterns might be:</p> <ul style="list-style-type: none"> • portal • registry repository

	the care record e.g. core demographics, contact information, emergency /carer details, self-test results, social care service reviews, and customer feedback.	<ul style="list-style-type: none"> • shared repository <p>These patterns allow the information to remain in their respective system/repositories and collated for presentation to a citizen/advocate. The registry repository pattern could then potentially support updates from the system the patient/ citizen is using (e.g. a PHR) into the relevant source system(s).</p>
Population health/care management (Risk management/case identification)	<p>Identifying citizens:</p> <p>At high risk of health condition/classification of need</p> <p>At high risk of readmission</p> <p>High risk mums-to-be cases where early intervention required</p> <p>For safeguarding and wellbeing support</p>	<p>Identifying patients/citizens through some form of predictive analysis (e.g. risk stratification) would typically require that a rich set of data are brought together in a single shared repository or single shared system, allowing algorithms or other statistical analyses to be performed.</p> <p>In some cases, simple point-to-point sharing or message broker of data to a co-ordinating professional, for example in an urgent care clinical dashboard, could also support human assessment and identification of patients/citizen requiring further interventions.</p>
Service planning (and modelling)/insight	<p>Identifying current capacity</p> <p>Modelling future demand</p> <p>Scenario modelling</p> <p>Identifying process and workflow efficiency</p>	<p>Analysing and modelling data would typically require that a rich set of data be brought together in a single shared repository or single shared system to allow algorithms or other statistical analyses to be performed. In the case of secondary uses of data, this is often done via periodic extracts rather than real-time interoperability.</p>

6.2 Case Studies – interoperability in action

The following examples show a selection of case studies. They show how it is possible to consider an interoperability initiative in relation to the layers of the **interoperability framework** described in the next section of this document. They show implementations of a few of the interoperability patterns in particular.

6.2.1 The Hampshire Health Record⁵ - data repository with portal

The **Hampshire Health Record** (HHR) was one of the first regional integrated health records in England. It combines primary care information from 80 percent of the GP practices in Hampshire as well as information from the main hospital trusts. Information is gathered from separate IT systems in these organisations and a copy held locally for presentation in the HHR as shown in figure 5.

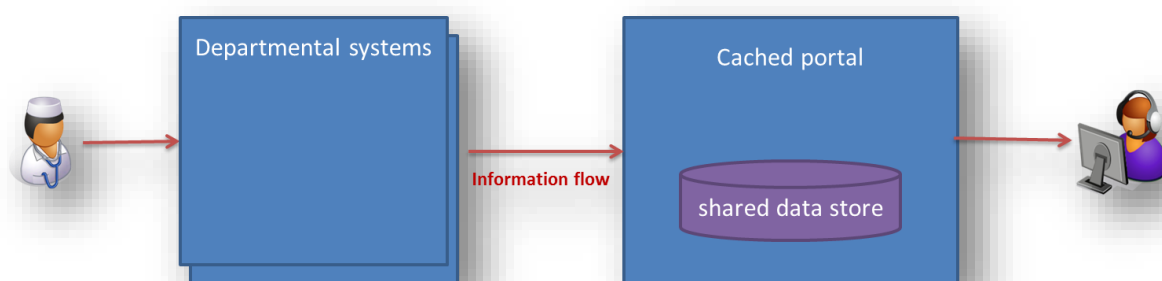


Figure 5: HHR record sharing

Key features of the implementation are:

Information Governance:	<p>The programme is moving from an explicit to an implied consent model.</p> <ul style="list-style-type: none">a) GPs currently have implied consent for their patients;b) Health workers currently require explicit consent but will be moving to implied consent;c) Social workers will continue to require explicit consent. <p>The programme has a very clearly defined offer for patients/citizens to submit Subject Access Requests (SARs) on the website.</p>
Identifiers:	<p>The programme is widely using the NHS Number, including Social Care that utilises it.</p>
Codes and Terms:	<p>READ2 is currently used in the HHR feeds.</p>

⁵ <http://www.hantshealthrecord.nhs.uk/>

6.2.2 The Lancashire Health Record – Regional Registry Repository

The **Lancashire Health Record** (LHR) is a new initiative still under development, currently focusing on sharing information between GP practices, district nursing and social care teams. Information in systems at each of these domains is indexed and, while the data remains in the local system, the central index (the registry) provides an ability to search for patient/citizen records and a method to retrieve desired records from the local systems (the repositories) in real time. It is an example of an electronic health and social care record based on a registry/repository pattern.

In addition to implementing a registry/repository pattern the programme plans to include a central portal to view information. This will allow for **click-through** from other clinical systems see figure 6 to view information about a patient/citizen retrieved from those source systems.

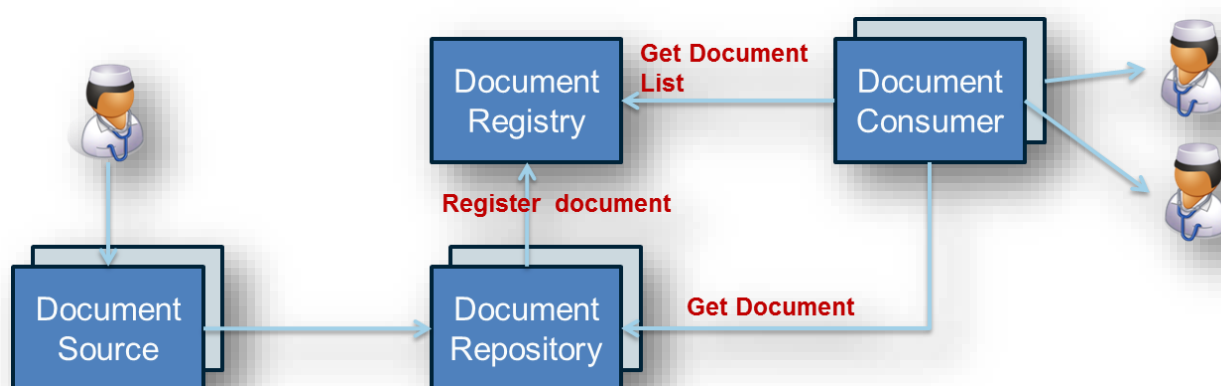


Figure 6: The Lancashire health record

Key features of the implementation are:

Information Governance:	<p>The consent model in Lancashire is still to be finalised, but the intention is to utilise an implied consent model along with suitable marketing material to inform patients of their right to opt out of information sharing.</p> <p>Each care setting will have single sign on to their local system.</p> <p>There will be data sharing agreements in place between the relevant organisations.</p>
Identifiers:	Patient/citizen record identity is likely to be managed by a central patient/citizen identity management service based on the IHE PIX standard.
Codes and Terms:	There is a terminology working group that will define what codes and vocabulary will be used. This is likely to be assessed on a case-by-case basis rather than using a single approach for all communications.
Messaging standards	A number of messaging standards are being used to integrate with the various clinical systems, including DICOM (from the PACS system), HL7v2 (from the acute and community) EPRs, and HTML (from GPs via the MiG). See section 7.

7 Standards, policy and guidance

This section will:

- ✓ provide sign-posting to **national guidance, policies and standards** to support interoperability programmes

You may find this useful if you have one of the below roles and / or are discussing your interoperability journey with other technical colleagues:

- Chief Clinical Information Officer (CCIO)
- Chief Information Officer (CIO)
- Information Technology Director
- Programme Director for an interoperability programme

7.1 Interoperability framework: layers

To ensure that an interoperability programme is successful, an organisation will need to consider a number of topics across a number of layers. Interoperability framework layers:

- provide an underpinning structure for developing **interoperability strategies, guidance, policies and standards**; and
- provide a structure for **analysing, comparing and assessing the maturity** of various interoperability solutions or proposals.

The framework achieves this by dividing the interoperability discourse into three discrete layers with each layer focusing on a particular aspect of interoperability:

- The **governance layer** provides the overarching policy that ensures the exchange and use of information is safe, secure and lawful
- The **interpretation layers** enable the meaningful use and display of exchanged information
- The **exchange layers** enable the exchange of information between sending and receiving systems

The aim of the framework is to associate each layer with a set of relevant guidance, policies and standards as described in this document. Most standards are associated with only one layer; however, some cover more than one albeit for distinctly different purposes. There will also be dependencies between different layers. Table 3 sets out these aspects.

You may also refer to Appendix A in Section 9: Mapping current standards to the interoperability framework.

Layer	Interoperability Aspect	Further Information
Governance	Information Governance	References standards, policies and guidance responsible for ensuring quality, security and lawful use of information shared between systems.
Interpretation	Identifiers	Used for the unique identification of: patients and service users; NHS and non-NHS organisations, services, workers and locations; and other physical and non-physical entities requiring unique identification, e.g. physical products and communication endpoints.
	Codes and Terms	Used to assert the precise meaning of data to enable the consistent recording, querying and interpretation of information.
	Document Headings	Standard headings for organising data for entry and display particularly structuring free text contents which in turn can convey the clinical and business meaning in a human readable form.
	Data Structures (logical)	Used to create consistent data definitions that can be re-used across different implementation standards or technologies.
Exchange	Message Structures (physical)	Used to create implementation specifications that define how data are realised by different implementation standards and/or technologies.
	Communication Patterns	Describes the re-usable architectural approaches for sharing health and social care information.
	Technical Transport (physical)	Interface mechanism by which data are exchanged between sending and receiving endpoints.

Table 3: Interoperability framework layers

The remainder of this section references some of the resources available for enabling interoperability at the various layers.

7.2 Information governance resources

Organisations looking to implement appropriate security solutions can refer to a number of general purpose resources however there are some specific IG and security expectations for health and social care organisations. Resources are flagged as either a **Standard**, as **Guidance** or as **Policy**.

Resource	Further information	Link to resource	Resource Type
The IG Toolkit	The IG toolkit is an online assessment that allows NHS organisations to assess themselves against the Department of Health's Information Governance Policies. It is a pre-requisite for all NHS bodies that handle patient data.	https://www.igt.hscic.gov.uk/	S
The Interoperability Toolkit (ITK) Trust Operating Model	<p>The Interoperability Toolkit (ITK) trust operating model is an IG resource that supports NHS organisations who are implementing any of the NHS ITK standards.</p> <p>The documentation is available on a national shared document location known as TRUD⁶. Users will need to register on the TRUD website to gain access.</p>	https://isd.hscic.gov.uk/trud3/user/guest/group/0/pack/30	G
Spine EIS ⁷ : Spine Security Broker (national service)	The External Interface Specification (EIS) describes the interface to the national services (including those on the Spine and Choose and Book). It includes two chapters describing how to use the national identity management services such as the national smart card.	Available to suppliers on the Spine Technical Integration Forum or on request from: spine2@hscic.gov.uk	S
Information Governance	A set of documents and tools including sample data sharing agreements have been synthesised from a	In the process of development	G

⁶ Technology Reference data Update Distribution

⁷ External Interface Specification

Alliance	number of data sharing agreements implemented by the national integration pioneers. It provides a template for the creation of data sharing agreements between NHS organisations.		
The Information Governance Review ⁸	The Information Governance Review outlines a number of carefully considered recommendations on how to implement good IG while still allowing clinicians suitable access to the health and social care record. It should be used to guide all interoperability initiatives.	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/192572/2900774_InfoGovernance_accv2.pdf	G
NHS Information Governance Guidance on Legal and Professional Obligations	<p>The NHS has guidance on legal and professional obligations.</p> <p>These are documented in the NHS Information Governance Guidance on Legal and Professional Obligations - 2007</p>	http://systems.hscic.gov.uk/infogov/codes/lglobligat.pdf	G
NHS Code of Practice	<p>The NHS has a documented Confidentiality Code of Practice – 2003.</p> <p>The NHS has a documented Information Security Management Code of Practice – 2007.</p> <p>The NHS has a documented Records Management NHS Code of Practice – 2006.</p>	<p>http://systems.hscic.gov.uk/infogov/codes/confcode.pdf</p> <p>http://systems.hscic.gov.uk/infogov/codes/securitycode.pdf</p> <p>https://www.gov.uk/government/publications/records-management-nhs-code-of-practice</p>	S

⁸ Also known as the Caldicott2 review

7.3 Identifier resources

In order to share data in a reliable manner, systems need to be able to identify and reference key entities reliably. Of particular note is the need to identify citizens and organisational entities uniquely. The following resources support this activity. Resources are flagged as either a **Standard**, as **Guidance** or as **Policy**.

Resource	Further information	Link to resource	Resource Type
NHS Number	The NHS Number should be used as the primary identifier for all correspondence and to track all patient activity within organisations.	http://systems.hscic.gov.uk/nhsnumber/staff/guidance http://systems.hscic.gov.uk/nhsnumber/staff/guidance/tracingv1.2.pdf http://www.isb.nhs.uk/library/standard/191 http://developer.nhs.uk/library/identifiers/nhs-number-client/	S
Organisation Data Service codes and guidance	All NHS organisations should have an ODS code which uniquely identifies them as a legal and operational entity in the NHS. They are maintained by the Organisation Data Service and should be used wherever possible to uniquely identify organisations taking part in interoperability. ODS codes are currently retrieved as comma separated value (CSV) files. ODS codes are also traceable using the Spine's SDS service.	http://systems.hscic.gov.uk/data/ods http://systems.hscic.gov.uk/data/ods/guidance http://developer.nhs.uk/library/identifiers/organisational-practitioners/	S
SDS identifiers via the Spine External Interface Specification	Access to spine services requires the use of ODS codes as specified in the Message Implementation Manual. Searching for and retrieval of these ODS codes can be performed via the Spine Directory Service. The interface for this service is in turn described in the Spine External Interface Specification.	Requested via the Spine Technical Integration Forum contact	S

7.4 Codes and terms

In order to communicate the accurate meaning (the semantic interpretation) of information in a message⁹, sets of codes and terms must be agreed. Key relevant standards are referenced below. Resources are flagged as either a **Standard**, as **Guidance** or as **Policy**.

Resource	Further information	Link to resource	Resource Type
SNOMED CT ¹⁰	SNOMED CT is an internationally recognised clinical terminology. Although not yet comprehensively adopted it is the strategic terminology set for the NHS in England ¹¹ . Most new interoperability initiatives should consider SNOMED CT for terminologies.	https://isd.hscic.gov.uk/trud3/user/guest/group/2/home http://www.ihtsdo.org/	S
Dictionary of medicines and devices (dm+d)	The dm+d is a set of codes based on SNOMED CT that are used for the describing of medicines and devices intended for use throughout the NHS. Health and social care organisations, system suppliers and pharmaceutical companies must utilise the dm+d by 30 June 2017 but new interoperability projects should consider utilising the code set immediately if possible. dm+d codes are used by national services such as ETP ¹² on the Spine.	https://isd.hscic.gov.uk/trud3/user/guest/group/0/pack/6	S

⁹ Codes may also be used to code unstructured content using natural language processing.

¹⁰ SNOMED CT stands for the 'Systematized Nomenclature of Medicine Clinical Terms'

¹¹ SNOMED CT is specified as the single terminology to be used across the health system in "Personalised Health and Care: A Framework for Action". 2020 is the target date.

¹² Electronic Transfer of Prescriptions.

7.5 Document headings

The use of formally agreed headings helps structure health and social care data. In particular, they are used in document centric communications. Their primary purpose is to support human readability and they may be used to help organise any combination of unstructured (i.e. text) or structured data. Resources are flagged as either a **Standard**, as **Guidance** or as **Policy**.

Resource	Further information	Link to resource	Resource Type
Professional Record Standards Body (PRSB): Clinical Record Headings	The PRSB ¹³ was formed to extend the work of the Royal College of Physicians on the development of standard headings for clinical communications across all health and social care settings. The headings currently cover referrals, admissions, handovers, outpatient letters, discharge summaries (transfers of care) and communications between the ambulance service and other settings. They should be used to structure interoperable communications to enable semantic interoperability. They make no assumptions about the format of those communications, but they are being developed by the Health and Social Care Information Centre (HSCIC) into interoperable data structures and message specifications to be published on the HSCIC Technology Reference Data Update Distribution site as they appear.	https://www.rcplondon.ac.uk/sites/default/files/standards-for-the-clinical-structure-and-content-of-patient-records.pdf	S

¹³ Phase 1 developed the headings and definitions for admission, handover and discharge records for hospital patients; phase 2 developed standard headings for outpatient documentation, principles for record keeping standards and core clinical headings; and the final phase, which was published in April 2013, developed standards for referrals, piloted the outpatient headings, and reviewed the headings to ensure suitability for implementing on electronic health records.

Professional guidance on ambulance records

NHS England sponsored a project commissioned through the HSCIC to develop national professional guidance for the structure and content of the clinical records of ambulance patients. The project was led by the ambulance services and relevant professional bodies, supported by the Health Informatics Unit (HIU) of the Royal College of Physicians, and the HSCIC.

The information that ambulance care professionals record about their patients is an important clinical record. As the development and implementation of integrated digital health records gathers pace across health and social care services, the ability to integrate ambulance information with secondary and primary care patient clinical records becomes increasingly important.

<http://www.england.nhs.uk/wp-content/uploads/2014/12/ambnlnc-rec-guid.pdf>

S

7.6 Data structures

Data structures are structured definitions of discrete data entries within care records that are commonly shared. Data structures ensure that data entries that are determined to have the same logical meaning are represented consistently. Resources are flagged as either a **Standard**, as **Guidance** or as **Policy**.

Resource	Further information	Link to resource	Resource Type
OpenEHR	<p>OpenEHR is a health record standard prevalent in research and used in provider systems in a number of countries. It utilises a reference model that extends the ISO 13606 reference model as well as archetypes to model care record data structures. These archetypes may then be constructed into templates (to represent datasets) which provide the basis for storing and exchanging electronic health records.</p> <p>A programme of work to collaborate with local organisations on defining data structures for national publication is currently underway within HSCIC. This includes work on the development of Discharge Summary interoperability standards.</p>	http://www.openehr.org/	S

7.7 Messaging structures

Messaging Structures define the shape and content of messages that pass between systems in the process of sharing data. Every information flow that moves between health and social care organisations will need an agreed message structure, whether this is proprietary or based on a recognised standard. Your decision about whether and which standard to use may affect the cost and flexibility of your solution. Typically, using a standard will aid future growth and connectivity of your systems but may require a greater initial outlay in terms of familiarisation and development effort. Resources are flagged as either a **Standard**, as **Guidance** or as **Policy**.

Resource	Further information	Link to resource	Resource Type
Health Level 7	<p>Health Level 7 is the most widely used international healthcare standard. (Version 2 is still the most widely used at a local level while Version 3 is used on national communications and increasingly at a local level.)</p> <p>The HL7v3 standard provides a complete interoperability design lifecycle (HDF¹⁴) including a RIM¹⁵ and a method for refining the RIM into abstract data structures.</p> <p>OpenEHR archetypes have been selected by the Interoperability Board for the description of data structures.</p> <p>HL7v3 should be used cautiously for defining data structures for new interoperability initiatives.</p> <p>The majority of current national services interfaces are</p>	http://www.hl7.org.uk/	S

¹⁴ HL7 Development Framework

¹⁵ Reference Information Model

	<p>designed utilising data structures defined in HL7v3 and outlined in the MIM (see below).</p> <p>Various local messaging scenarios have also been designed around HL7v2 and HL7v3 data structures as part of the NHS Interoperability Toolkit programme and can be found on the TRUD website (see below).</p>		
Interoperability Toolkit: payload profiles	<p>The Interoperability Toolkit provides guidance and profiles of standards¹⁶ at many layers of the interoperability architecture framework. It includes a number of implementations of recognised standards for local communications including their serialisation as messaging structures. It includes specifications utilising both HL7v3 (e.g. Discharge Summaries) and HL7v2 (e.g. for ADT). A reference implementation of the interfaces can be found on the NHS 'Health Developer Network'.</p>	<p>http://systems.hscic.gov.uk/interop/itk</p> <p>http://systems.hscic.gov.uk/interop/itk/specs</p> <p>http://developer.nhs.uk/library/interoperability/nhs-interoperability-framework/</p>	S
Message Implementation Manual (MIM) (national services)	<p>The NHS Message Implementation Manual is an English NHS implementation of HL7v3 (see above). It describes the interactions and message structures that are sent to and from the Spine and other national services. The specifications are available on the TRUD service.</p>	<p>http://systems.hscic.gov.uk/interop/itk/specs</p>	S
HL7 FHIR	<p>HL7 FHIR is a recent prodigy of the HL7 standard, which is focussed on practical message creation and is commonly considered a more readily implementable</p>	<p>http://wiki.hl7.org/index.php?title=FHIR_Statement</p>	S

¹⁶ The description of a specific implementation of a standard is sometimes called a profile.

	<p>solution. HL7 FHIR borrows concepts from REST¹⁷ and utilises the concept of information ‘resources’ from which a message is constructed. FHIR is the standard selected for strategic use at the messaging structure layer in the NHS for non-document centric communications. FHIR should be considered as a viable communication standard for new interoperability initiatives. A section of the HL7 website is dedicated to a FHIR starter tutorial and associated specifications for FHIR.</p>	http://www.hl7.org/implement/standards/fhir/	
DICOM	<p>DICOM is the de facto standard for interoperability of radiology systems and defines a serialisation and associated metadata for radiology images. DICOM is likely to be a consideration for procurement and integration of PACS and RIS systems.</p>	http://dicom.nema.org/	S
GS1	<p>GS1 is used in healthcare to enable ‘Automatic Identification and Data Capture’ (AIDC). It is primarily used for barcodes and RFID. It includes a system of codes for: patient identification, medical record tracking, sterile services, pharmacy and asset management.</p>	http://www.gs1.org/healthcare/standards	S

¹⁷ Representational state transfer (REST) is an architectural style used across the World Wide Web.

7.8 Communication patterns

Most integration programmes will utilise one or more of a number of clearly definable ‘architectural patterns’. Understanding these patterns greatly aids in strategy, planning and procurement of interoperability solutions. Your decision about which of these patterns to adopt will affect the trade-off between initial costs, future costs and an initiative’s ability to evolve and include further data sharing partners. Resources are flagged as either a **Standard**, as **Guidance** or as **Policy**.

Resource	Further information	Link to resource	Resource Type
Interoperability Architecture Framework: Interoperability patterns guidance	<p>A number of sample information sharing patterns have been outlined by HSCIC and are available on the developer network.</p> <p>These are also outlined in Section 4 of this document.</p>	http://developer.nhs.uk/library/architecture/integration-patterns/	G

7.9 Technical transports

The Technical Transports layer includes a number of sub layers all of which contribute to the communication of information between two parties. Sub layers include:

- transport standards
- middleware infrastructure
- network infrastructure

Resources are flagged as either a **Standard**, as **Guidance** or as **Policy**.

Every interoperability initiative will need to consider what transport technologies are used. Even where these elements are being provided by a private supplier using proprietary standards, some understanding of these layers is advisable. They will affect a solution's ability to evolve its data sharing capabilities and will significantly affect the ease with which future system replacement can take place.

Any interoperability initiative will need to consider the network connectivity options, particularly where social care connectivity is involved. Most social care organisations are currently on the PSN network.

Resource	Further information	Link to resource	Resource Type
Integrating the Healthcare Enterprise (IHE) XDS ¹⁸ patterns	The Integrating the Healthcare Enterprise provides profiles ¹⁹ on various messaging standards. It is widely used internationally in the radiology domain. Among its standards is the highly respected XDS standard, which is the most prevalent implementation of the Registry/Repository pattern and is based on the ebXML Reg/Rep standard. The profile includes the specification of ebRegRep metadata for the retrieval of documents listed in the registry. Those looking to implement a	http://wiki.ihe.net/index.php?title=Cross-Enterprise_Document_Sharing http://www.ihe.net/Technical_Frameworks/#IT	S

¹⁸ Cross-Enterprise Document sharing

¹⁹ A profile describes a specific implementation of a standard.

	registry/repository might consider utilisation of this standard.		
	IHE has a wiki and a number of standards specifications for XDS.		
ebXML ²⁰ MS (message service specification)	The ebXML standard is developed by the open standards organisation OASIS. The ebXML MS provides a reliable messaging standard that is used on the national NHS services ²¹ and referred to in the Spine EIS.	https://d9db56472fd41226d193-1e5e0d4b7948acaf6080b0dce0b35ed5.ssl.cf1.rackcdn.com/committees/ebxml-msg/documents/ebMS_v2_0.pdf	S
Interoperability Toolkit: distribution envelope	The Interoperability Toolkit provides guidance and profiles of standards ²² at many layers of the interoperability architecture framework. The ITK 'distribution envelope' provides a standardised wrapper for messages that can be used to improve interoperability at the transport layer.	http://systems.hscic.gov.uk/interop/itk http://systems.hscic.gov.uk/interop/itk/specs http://developer.nhs.uk/library/interoperability/nhs-interoperability-framework/	S
National middleware			
Data Transfer Service (DTS)	The Data Transfer Service provides a national store and retrieve mechanism. Client systems place files for a recipient in their 'inbox'. The files are then delivered to the recipient DTS Client machine automatically. It is widely use to transfer pathology, as well as other information.	http://systems.hscic.gov.uk/addressing/registrations/dtsaddrform	G
Spine TMS (national services)	The national Spine service includes a data sharing service known as TMS. This service is utilised for sending information to and from national services and	Requested via the Spine Technical Integration Forum contact	G

²⁰ Electronic Business using eXtensible Markup Language

²¹ The EIS can be considered a profile of the ebXML, as well as other, standards.

²² The description of a specific implementation of a standard is sometimes called a profile.

for mediation on services such as GP2GP. Additionally a number of TMS trunk services (such as the HL7v3 Common Content message) allow TMS to be used as a secured channel for inter-regional communication.

NHS Mail	NHS Mail provides a secure transport that can be used for patient identifiable information. This is best used for person led, ad hoc communications of data where more mature, high volume interfaces are not available. Through email (SMTP) automation can be used for automatic communications such as notifications to clinicians/professionals.	http://systems.hscic.gov.uk/nhsmail	G
----------	--	---	---

Infrastructure

NHS N3 Network (N3)	The N3 network provides connectivity between organisations in the NHS, connectivity to national services as well as a number of optional services. All NHS organisations are currently connected to the N3 network, either directly or via a local network. Social care organisations may not be connected to N3; and are likely to be on the Public Services Network (PSN).	http://n3.nhs.uk/	G
Public Services Network (PSN)	The PSN provides a commercial framework for network supplies to provide accredited networks to public bodies. These private networks are further connected via a PSN hub allowing communication across public bodies.	https://www.gov.uk/government/groups/public-services-network	G

8 Supporting capabilities

This section outlines some thinking on **supporting capabilities**.

You may find this useful if you have one of the below roles and / or if you are discussing your interoperability journey with other technical colleagues:

- Chief Clinical Information Officer (CCIO)
- Chief Information Officer (CIO)
- Information Technology Director
- Programme Director for an interoperability programme

A “supporting capability” in the context of this document, is a piece of functionality that can support implementation of specific interoperability patterns. The capabilities outlined here are “logical” – they may be separate services, but may also be built into other systems. Not all capabilities are necessarily required to successfully implement individual patterns, but they will generally aid wider scalability of the patterns. Some capabilities exist nationally, although their use may be limited to specific services (e.g. Spine messaging). These will be identified below.

Table 4 below summarises some supporting capabilities that should be considered to allow any systems to interoperate.

Table 4: Supporting capabilities for consideration to allow interoperability

Category	Capability	Description
Connectivity	Network Connectivity	<p>In order for two systems to interoperate, some form of network needs to be in place. This may be a secure network (such as N3 or PSN), or potentially a public network (such as the Internet). Where multiple private networks need to be connected together, there may be a need for some form of broker or proxy to support this and control access to services.</p> <p>National Capabilities:</p> <ul style="list-style-type: none"> • N3 Network • PSN Network
Identity/ Directory Services	User Directory	<p>In order to identify individual staff members – for example to record authorship, route messages to individual's task lists, support authentication, authorisation, data security etc. some form of user directory is typically required.</p> <p>National Capabilities:</p> <ul style="list-style-type: none"> • Spine Directory Service (SDS)
	Organisation Directory	<p>In order to identify organisations consistently, for example to support consistent recording/classification, and reporting and addressing of electronic messaging, an organisation directory is used.</p> <p>National Capabilities:</p> <ul style="list-style-type: none"> • Organisation Directory Service (ODS) • Spine Directory Service (SDS) • Spine Legitimate Relationships (LR)
	Business Services Directory	<p>When there is a need to identify a particular type of service, for example to support referrals, or to direct a patient/citizen to a suitable local service, some form of business services directory would typically be used.</p>
	Master Person Index	<p>An authoritative identity is required in order to reliably access the records of a citizen across systems that are interoperating - managed with a single Master Person (Patient) Index.</p> <p>National Capabilities:</p>

Choose an item.

Discovery	<ul style="list-style-type: none"> Personal Demographics Service 	
	Endpoint Directory	<p>If a system wishes to send a message to another system, it needs to have some way of identifying the specific address (e.g. URL) to send the messages. This would typically be achieved using a directory of endpoints; allowing an endpoint to be identified based on the organisation the sender wishes to send the message to, and the type of message it wishes to send.</p> <p>National Capabilities:</p> <ul style="list-style-type: none"> Spine Directory Service (SDS)
Security	Registry	<p>When a system wishes to identify which other systems hold information about a specific citizen, a shared registry can be used to provide this “index”, and allow it to be searched using various criteria. This would then allow the system to make subsequent calls to the systems where the required information is held (see the ‘Registry Repository’ pattern earlier in section 4.2)</p>
	Authentication	<p>Providing a shared authentication capability – linked with a shared user directory can provide Single Sign-On functionality, allowing common user credentials to be used across systems that are interoperating. This is especially important when implementing patterns such as the Click-Through pattern.</p> <p>National Capabilities:</p> <ul style="list-style-type: none"> Care Identity Service (CIS aka Smartcards)
	Authorisation	<p>Once authenticated, users will need to be authorised for access to specific systems, functionality and information. A shared authorisation capability can support consistent role-based access controls (RBAC) which can simplify administration and minimise the amount of system-specific controls required.</p> <p>National Capabilities:</p> <ul style="list-style-type: none"> Care Identity Service (national RBAC) Spine Directory Service (SDS)
	PKI	<p>In addition to user access controls, interactions between systems also need to be secured.</p>

Choose an item.

		<p>Each system must be able to trust the system it sends messages to, and be able to encrypt all traffic so it cannot be intercepted. This typically requires a shared Public Key Infrastructure (PKI) to hold certificates for all end-points that are interoperating.</p> <p>National Capabilities:</p> <ul style="list-style-type: none"> • Spine 2 PKI
Messaging	Messaging Standards	<p>In order to interoperate, each system must establish a common “language” through the use of common messaging standards.</p> <p>National Capabilities:</p> <ul style="list-style-type: none"> • Terminology Reference Update Distribution (TRUD)
	Reference Data Management	<p>As well as having common message formats, the information carried in messages will often contain identifiers and codes to allow recipient systems to transform and process content and make use of it in a more intelligent way. This requires common reference data (such as common coding schemes, classifications, vocabularies for fields, etc.) that are held somewhere accessible by both sides.</p> <p>National Capabilities:</p> <ul style="list-style-type: none"> • Terminology Reference Update Distribution (TRUD) • SNOMED-CT • dm+d • Messaging reference data
Notifications	Subscription Service	<p>In order to allow systems to register their interest in receiving notifications or alerts about specific topics or specific patient/citizen cohorts, some form of shared subscription capability may be used.</p>
Information Governance	Relationship Service	<p>Information about individuals should only be accessible to users or groups that have a legitimate relationship with the individual. These relationships may be established within a number of systems. Having a shared relationship service allows this to be shared with other systems. This reduces the need for each system to individually attempt to identify if/how the user has a relationship with the individual. For example, the care planning system allows the clinician/practitioner to see the citizen’s care plan because it can see that the citizen is under the clinician/practitioner’s care as part of a team caring for the child, adult or family.</p>

Choose an item.

Consent Service	Access to client level information is subject to some form of consent control. Individual systems can separately manage the consent process (which types of information can be shared with which other clinicians/practitioners /groups/organisations under what circumstances), or this could be held in a shared consent repository/service and queried by all systems wishing to interoperate.
Data Sharing Agreement Repository	Any sharing of data between different departments and organisations requires that a data sharing agreement is in place (often, across a region this may mean that there are a large number of agreements covering different combinations of organisations, data, and usage of that data). Providing a shared repository of these agreements enables programmes to identify if a specific purpose of sharing the data and information is documented and agreed. It also supports interoperability programme decision making and risk management.

9 Appendix A: Mapping current standards to the interoperability framework

The following summarises the major standards available for use in health and social care integration projects today. It provides an indicative view of the levels in the interoperability framework that the major standards (primarily) support.

Table 5: Mapping of current standards to interoperability framework layers

	HL7v2	HL7v3/PCDA	FHIR	OpenEHR	IHE	ITK	ebXML	READ	SNOMED	NHS Number	ODS
Information Governance											
Identifiers										✓	✓
Codes and Terms								✓	✓	✓	✓
Document Headings (PRSB)		✓	✓	✓		✓					
Data Structures (logical)		✓	✓	✓	✓						
Message Structures (physical)	✓	✓	✓	✓	✓	✓					
Communication Patterns			✓		✓	✓	✓				
Technical Transport (physical)	✓	✓	✓		✓	✓	✓				