Great North Care Record Technical Vision

Author	This vision document was written by GE Healthcare Finnamore on behalf of the Connected Health Cities North East and North Cumbria executive team after wide consultation in the Health, Social Care and Academic sectors in the region
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Version	Final

Supporting the Great North Care Record

CONNECTED HEALTH CITIES NENC / The Great North Care Record
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GE Healthcare Finnamore

Connected Health Cities (CHC) for the North East and North Cumbria and the Great North Care Record would like to thank GE Healthcare Finnamore for conducting the consultation process and producing this report.

Contents

Executive Summary

This document summarises the work undertaken by GE Healthcare Finnamore (GEHCF), acting as a vendor neutral independent advisor, in conjunction with the North East and North Cumbria Connected Health Cities (NENC CHC) project team, and its wide range of stakeholders, to develop a preferred architecture and set of requirements for a Shared Record and Analytics Platform known as the Great North Care Record (GNCR).

The GNCR seeks to initially integrate data across primary, secondary and social care as well as the universities of the North East. In addition, data will be made available more widely across the region, with appropriate safeguards and sharing agreements, for analysis by health and social care organisations and for university and clinical research. This will eventually enable a more complete analysis of patient journeys along NHS care pathways, enabling investigation of not only what is happening but also why, and how the issues could be addressed with actionable insight. This will help close the information gaps between commissioning, audit, public health intelligence and research, supporting systems to learn routinely.

In order to develop a preferred architecture and set of requirements for the GNCR, the GEHCF team:

- Reviewed over 140 documents from health, social care and academic organisations
- Undertook semi-structured interviews with 75 stakeholders from across the North East
- Ran four requirements workshops, focussed on systems architecture, information governance, digital care records and research and analytics, with over 80 people in attendance across the four sessions
- Undertook an options appraisal workshop with over 20 people.

The key outputs from these activities were as follows:

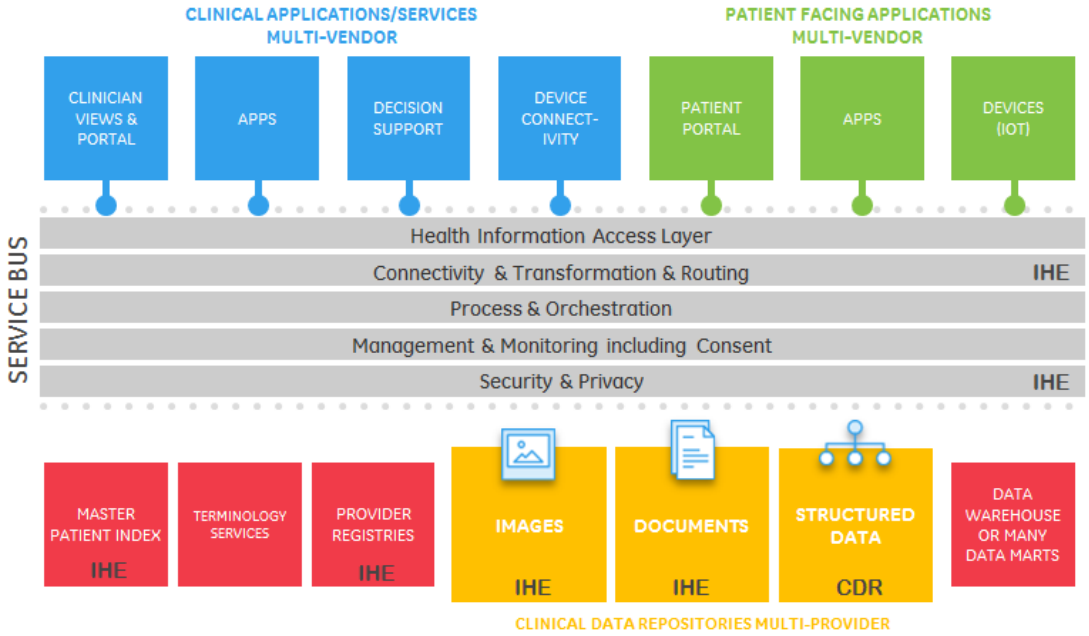
- Agreement on seven categories for Guiding Principles for development of the GNCR (as outlined in Section 2.1 of the document)
- Agreement on five clinical care and four research / analytics use cases that will primarily be used to ensure that the GNCR meets the needs of its wide range of stakeholders (as outlined in Sections 2.4 - 2.7)
- Development and agreement on a generic Health Information Exchange (HIE) reference architecture and a preferred architecture model for GNCR that supports (as a minimum) the agreed set of use cases (see section 3.1.4)
- Agreement on the 'Publish and Subscribe' and 'Gateway Services' models that will enable the GNCR to appropriately support the wide range of data sharing requirements identified by stakeholders (Section 3.1.5)
- Agreement on a preferred data management model for GNCR and a description of how it would support both STP based localities and regional providers of health and care services (Section 3.5)
- Preferred commercial strategy for procuring the GNCR (Section 4.1), an agreed set, guiding principles for vendor selection (Section 4.2) and a core set of required capabilities from the supplier community (Section 4.3.1)

- A high-level assessment of 18 potential suppliers against a series of agreed criteria (Section 4.3.2), leading to a range of likely costs for GNCR implementation based on supplier responses to requests for information (Section 4.3.3)
- A high-level assessment of the benefits to be delivered by implementing GNCR (Section 5)

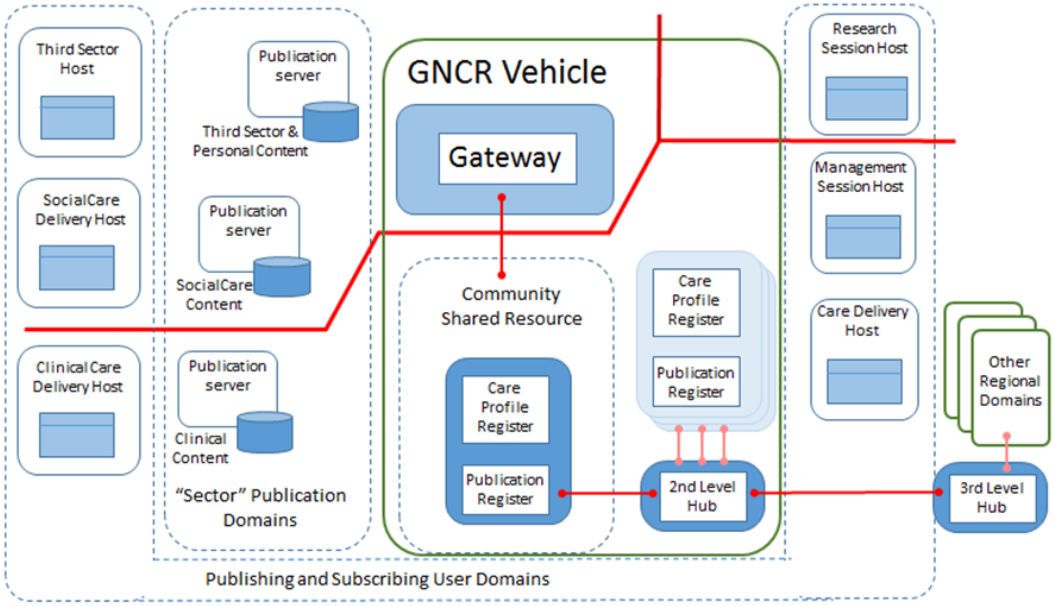
- Preferred option for the Governance and Service Management arrangements of the GNCR, including the proposed Delivery Vehicle for implementation and on-going 'Business as Usual' support (Section 6.2)
- A high-level project plan outlining the proposed project workstreams and the timelines for implementation (Section 7).

In summary, this report recommends:

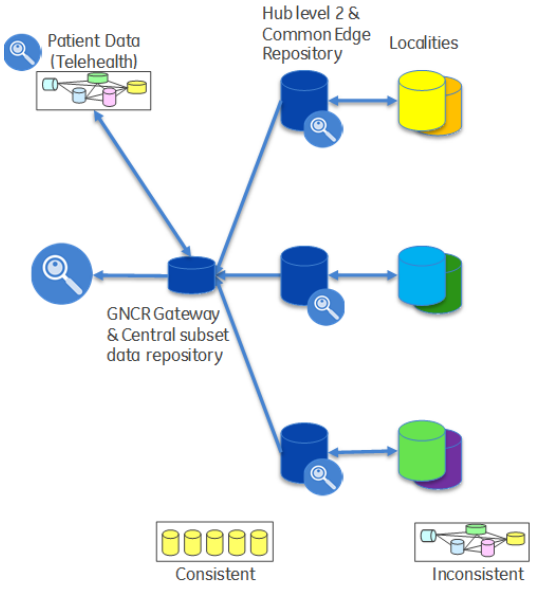
- The adoption of the following preferred architecture approach (or similar) for GNCR:



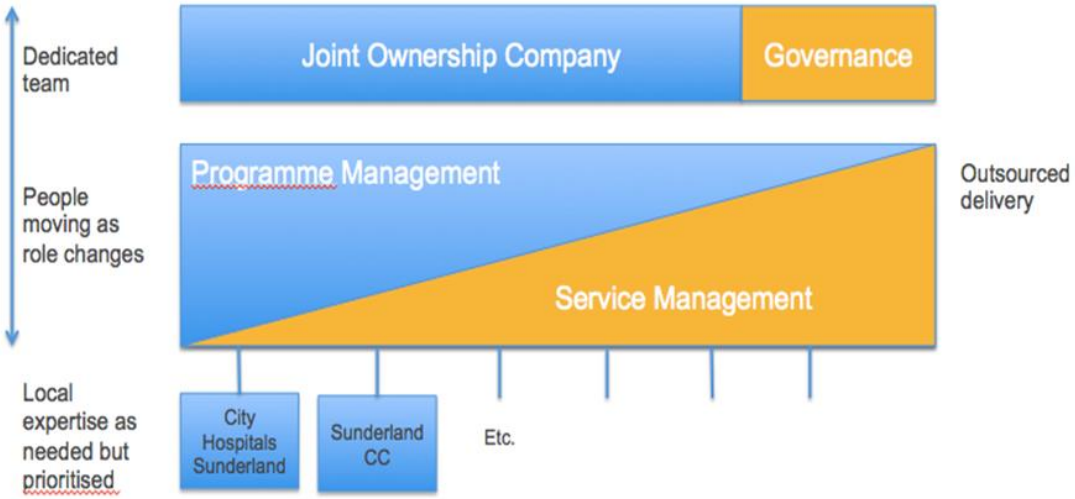
- Adoption of the Gateway Services Vehicle for 'Publish and Subscribe' Services as outlined below:



- Adoption of the following hybrid data management approach for GNCR as outlined below:



- A single, central GNCR procurement, with a single lot structure and one prime contractor for the GNCR responsible for all subcontractors and the delivery of the GNCR as a fully managed service, noting that this is primarily for the Gateway and that the Ark may require a different supplier
- Provision of between £36m - £56m to fund the programme over a 10-year period, of which supplier costs for the GNCR Gateway Platform as a Service element would be between £5-15m
- The following proposed delivery vehicle for the implementation and on-going service management of GNCR:



1 Introduction and Background

This document summarises the work undertaken by GE Healthcare Finnamore (GEHCF), acting as a vendor neutral independent advisor, in conjunction with the North East and North Cumbria Connected Health Cities (NENC CHC) project team, and its wide range of stakeholders, to develop a preferred architecture and set of requirements for a Shared Record and Analytics Platform known as the Great North Care Record (GNCR).

1.1 Project Background

The CHC Programme seeks to initially integrate data across primary, secondary and social care as well as the universities of the North East. In addition, data will be made available more widely across the region, with appropriate safeguards and sharing agreements, for analysis by health and social care organisations and for university and clinical research. This will eventually enable a more complete analysis of patient journeys along NHS care pathways, enabling investigation of not only what is happening but also why, and how the issues could be addressed with actionable insight. This will help close the information gaps between commissioning, audit, public health intelligence and research, supporting systems to learn routinely. Achieving this goal will require a sustained effort from all parts of the CHC (and its NHS Local Delivery Partners), significant investment in facilities and personnel, as well as forward-thinking and ambitious strategic planning.

Many partners of the CHC already have electronic patient records with a substantial wealth of clinical information stored electronically, while others are working towards this goal. To exploit the current and future data fully for both patient care and research purposes clinical data from multiple sources will be integrated and securely made available in real-time for patient care. In addition, these records will be pseudonymised and integrated with other sources of structured and unstructured data that are of interest to researchers (e.g. very large variable imaging and biomolecular (including genomic) datasets, external and internal patient registry data, epidemiological and other societal datasets).

To support the integration of digital health and care records to underpin frontline care delivery, and provide an analytics platform that can support future health and care planning, the NENC CHC is developing the Great North Care Record (GNCR). This aims to:

- Deliver an individual's important healthcare information, at the point of care, from whichever relevant organisations are involved in their care, irrespective of organisational boundaries
- Provide better information for clinical audit, service redesign and commissioners of care, so that health care systems can be transformed and improved, and run more effectively
- Provide data for health and care research in a research environment trusted by the citizens of the North East and Cumbria.

During this project, it became evident that the primary objective was to gain consensus on what the GNCR should enable, how it should be architected, structured and governed from the wide range of stakeholders so that an accelerated regional procurement could move forward. This report reflects the common views achieved during the project.

1.2 Project Definition

The GEHCF team have consulted with key stakeholders and developed this report that covers the following:

- Definition of the core, "must have" clinical, analytical and IG requirements for GNCR
- Identification of the key systems which need to interoperate through the regional platform
- Identification of the candidate architectures for a regional information exchange platform, and specification of potential platform architecture and infrastructure requirements
- Identification and assessment of a shortlist of current market offerings available, including open source candidates
- Identification of the high-level costs and benefits of the GNCR
- An outline project plan for securing the funding, buying and implementing the GNCR.

A separate presentation has also been developed, which is aimed at NHS and University senior leaders to help the CHC Executive team and regional stakeholders communicate the vision for the GNCR going forward.

1.3 Project Scope

The scope of the work covers NHS organisations, local authorities and universities across the North East and North Cumbria (NENC) Academic Health Science Network (AHSN) area.

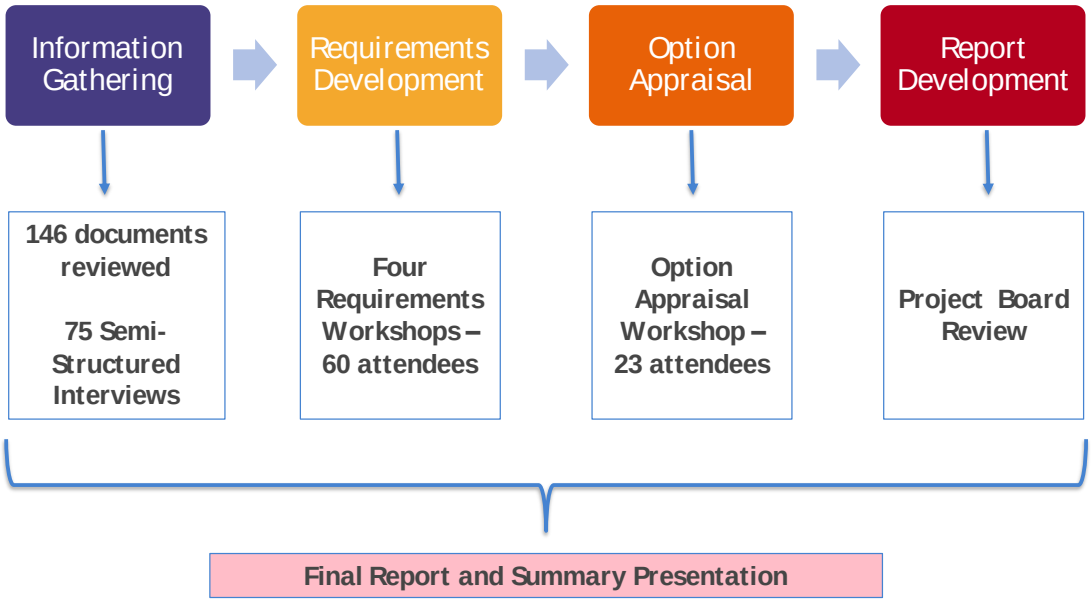
The requirements gathering and definition work was limited to the following four workstreams:

- Digital Care Record
- Analytics and Research
- Systems and Infrastructure
- Information Governance.

1.4 Project Approach

The project was undertaken over four phases, which are illustrated in the diagram below:

Figure 1 : Summary of Project Phases



1.4.1 Phase 1 - Information Gathering

In this phase, documentation provided by CHC stakeholder organisations was collated and reviewed to gain a better understanding of the current status of shared care record developments across NENC, and to help prepare for project interviews (see below). Requested documentation related to the four key project workstreams:

- Digital Care Record
- Analytics and Research
- Systems and Infrastructure
- Information Governance (IG).

A summary of the documents received from stakeholders for this work can be found in Appendix 1. In total, 146 documents were reviewed.

In this phase, we also undertook three days of 1-2-1 and small group semi-structured interviews (covering the full range of stakeholders) in the following localities:

- Newcastle and North of Tyne (including Gateshead and North Cumbria)
- Sunderland and South Tyneside
- Durham and Tees.

Several mop-up telephone interviews were also conducted for those people who could not attend one of the pre-arranged interview days. In total, 75 people were interviewed during this phase (see Appendix 2 for the full list of names).

The purpose of the interviews was to elicit requirements, constraints and priorities from key stakeholders (including CCIOs, CIOs, CCG representatives, Local Authorities and Universities). This informed the content of follow-on workshops to reach an agreed set of requirements and common future architecture of the GNCR.

1.4.2 Phase 2 - Requirements Definition

We ran four workshops with stakeholders (one for each major project workstream) to capture requirements and discuss and agree a preferred architecture model for the GNCR.

The list of CHC stakeholders who were engaged in the workshops can be found in Appendix 3. 60 people in total attended the four workshops.

We also conducted telephone interviews with several suppliers who were potentially able to meet the overall requirements for this project. A summary of the commercial organisations that were engaged as part of this phase of the project are outlined in Appendix 4. In total, we spoke with 18 different suppliers.

1.4.3 Phase 3 – Options Appraisal

We ran an Options Appraisal workshop to assess the list of potential options for several key elements of the CHC GNCR programme to enable it to move towards procurement of a platform that delivers clinical, analytical and research requirements.

The key objectives of this workshop were to develop a:

- Series of guiding principles for vendor selection
- Preferred architecture option
- Preferred option for GNCR delivery vehicle (for both front-line care record sharing and a region-wide analytics platform), governance and service management
- Preferred option for the Commercial Strategy
- Preferred option of the GNCR funding model.

The list of attendees for the Options Appraisal workshop can be found in Appendix 5. 23 people in total attended the session.

1.4.4 Phase 4 - Report and Presentation Development

In the final phase of the project, we brought together the outputs of the previous phases into this report, and produced a high impact summary presentation, based on the report, that can be used with senior stakeholders to gain buy-in to the next stage of development of the programme.

1.5 Project Board and Approval Process

The Project Board for the project consisted of the following members:

- Nick Booth, CHC CIO and Project SRO
- Mark Walsh, CHC Director of Operations and Project Lead
- Joe McDonald, CHC Director
- Graham Evans, Chief Information and Technology Officer, North Tees and Hartlepool NHS FT and Durham, Darlington, Teesside, Hambleton, Richmondshire & Whitby STP CIO lead
- Mark Thomas, Director of Health Informatics at Northumbria Healthcare NHS FT, Northumberland, Tyne and Wear and North Durham STP CIO lead, and chair of the North East and North Cumbria CIO Network.

The Project Board was responsible for reviewing and signing off the interim and final deliverables for the project.

1.6 Structure of the Document

The rest of the document consists of the following sections:

- Section 2 outlines the high-level requirements for the Great North Care Record as identified through the stakeholder interviews and the requirements workshops, including the project use cases -
- Section 3 introduces a series of potential architecture models for the GNCR, reviews their appropriateness to meet requirements, and recommends a preferred architecture for future procurement
- Section 4 outlines the proposed commercial strategy for procuring the GNCR, the guiding principles for vendor selection and a high-level assessment of the potential vendors that were engaged as part of this project
- Section 5 provides a high-level assessment of the planned benefits arising from the GNCR deployment
- Section 6 outlines the proposed delivery vehicle, governance and service management arrangements for taking forward GNCR at scale and pace
- Section 7 summarises the high project plan and developmental roadmap for the next steps in procuring and deploying the GNCR.

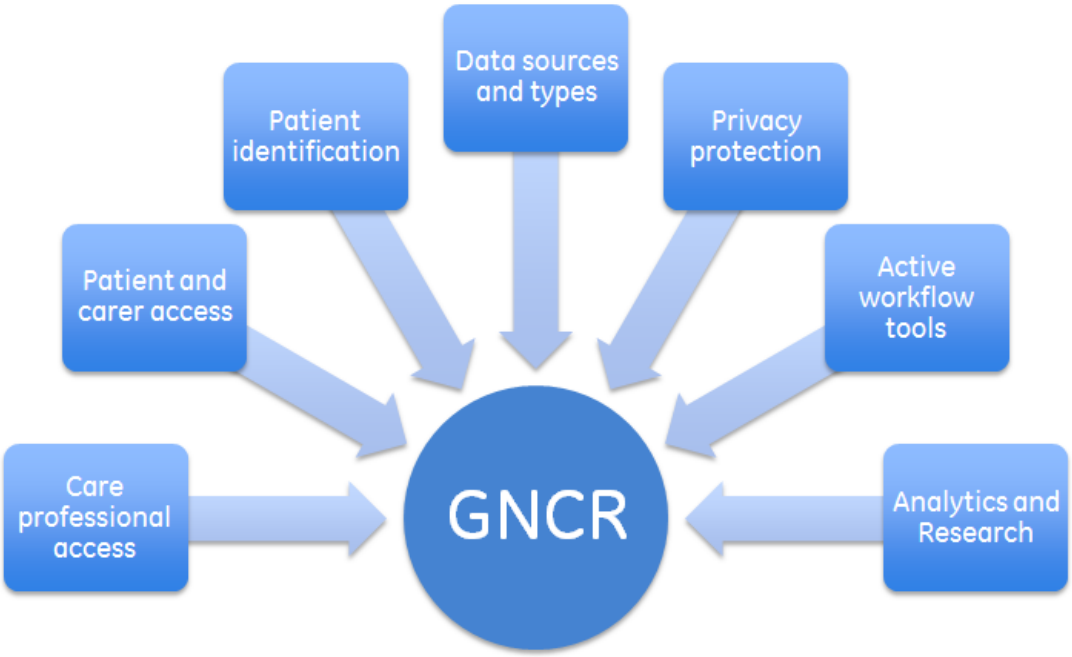
2 GNCR Requirements

This section of the document outlines the high-level requirements, guiding principles, for the Great North Care Record as identified through the stakeholder interviews and the requirements workshops.

2.1 Guiding Principles

- The overarching Guiding Principles that underpin the requirements for the GNCR for clinical and analytical use have been categorised into seven areas:

Figure 2 : Guiding Principles for Clinical and Analytical Use



2.1.1 Care Professional Access

The GNCR should:

- Be easy to use and quick to access and respond to information requests
- Support read/write of information – not just view only
- Be integrated into existing clinical systems where possible
- Present relevant information to the user in a digestible, summarised and relevant format
- Use a template/form based design
- Support role-based access and ensure legitimate patient relationships
- Be context aware in its operation, presenting data in an intelligent and context sensitive manner
- Support mobile formats
- Allow for detailed searches and data extracts/queries (where authorised) to ensure IG compliance (e.g. a cohort of similar patients to review treatment and outcomes).

2.1.2 Patient and Carer Access

The GNCR should:

- Provide a portal for patients to access their own information, taking into consideration national tools that provide patient access
- Manage support for carer/family access to record, whilst providing appropriate safeguards
- Allow patients to manage their consent matrix
- Allow patients to manage their appointments
- Allow patients to send and receive secure email.

2.1.3 Patient Identification

The GNCR should:

- Be reliable, secure and safe to use across all care settings
- Be NHS number based where this is known and used (or sought, confirmed and added where not known or used)
- Enable connection to the planned national patient/citizen identity service.

2.1.4 Data Sources and Types

The GNCR should:

- Contain high quality, validated clinical information from the health, social care and third party sectors that can be shared with confidence
- Support identified and agreed clinical need for information (not just provide access to what is easy to share)
- Allow full use of coded as well as free text information, graphics and diagrams
- Support access to scanned documents, images and other unstructured documents, including shared documents from multiple sources into an integrated view
- Contain patient generated health and care data from a variety of sources
- Support tagging and other metadata for documents and images
- Contain provenance of data sources (authorship, dates etc.)
- Contain information that is structured, accurate and up to date
- Link primary, secondary, mental health and social care data for longitudinal patient/citizen pathway studies (for example).

2.1.5 Privacy Protection

The GNCR should:

- Be compliant with all relevant information governance legislation (e.g. GDPR, Section 251) and be flexible to changes in legislation
- Provide a clear, dynamic and usable mechanism for managing patient consent for both direct patient care and for research purposes
- Provide a clear, dynamic and usable mechanism for managing information sharing agreements
- Provide a secure and robust mechanism for managing access to information
- Contain an audit trail to check who has accessed the system, and for what purpose. This would include pro-active alerting of access to the patient where patients have particular concerns
- Support 'for your eyes only' functionality based on data sharing agreements and patient consent guidelines
- Enable privacy officers and patients/citizens to be notified of any breaches in privacy, in particular where any 'breaking the glass' function has been used
- Enable better engagement between clinician and patient
- Be easy to use and understand for clinicians

2.1.6 Active Workflow

The GNCR should:

- Support messaging, alerts and flags to support patient workflow across different providers of care while preventing alert fatigue
- 'Push' and 'Pull' data (documents and elements of documents like blood pressure) where appropriate, but be mindful of information overload
- Enable workflow and other applications to be easily developed by the care organisations and not require significant 3rd party support
- Allow for choice of design models for passive reading vs push alerts
- Present information within the local system and eventually Integrate guidelines, e.g. NICE, into the clinical workflow.

2.1.7 Analytics and Research

The GNCR should:

- Support the differing needs of research, service planning and analytics users, including both hypothesis driven and non-hypothesis driven research. This should include a modular framework to facilitate extension or modification of analytics functionality as needs evolve
- Support improved interactions between researchers and clinicians to develop the translational medicine agenda across the North East
- Collect patient data from most/all health and non-health settings, and link together data sets so it is possible to trace a patient through the care system (via NHS Number ideally), track their outcomes, and investigate 'cause and effect' of interventions.
- Supports data collection from the patient themselves via a variety of media (e.g. phone text, app, web, wearable device), thereby allowing the patient to use a range of interfaces to suit their preference and access limitations, which helps bridge the digital divide on patient engagement
- Provide longitudinal real time access to health and care data for analytics development and delivery
- Support the ability to gain new insights into the data, rather than simply using the system to test new ideas or formulate new hypothesis'
- Be quick to access, accurate and up to date, but with the ability to present historical trends in a graphical form
- Provide alternative routes to analysis enabling differing "strengths" of Information governance control to be applied in an appropriate-context specific manner
- Provide clear and concise information on the provenance of all data sources
- Support operational analytics with rapid feedback to inform management decisions, and business intelligence for future service planning

2.2 Scope

The GNCR should:

- Work across the whole of the North East and North Cumbria (as defined by the three NE STPs), and not just at sub-regional level
- Be scalable, extensible and reconfigurable to support future organisational change

- Support multi-way sharing of health and care records from multiple providers at the point of care in multiple care settings
- Have the option for inclusion of richer datasets at local level without losing integrated view, including the linking of research data sets
- Support linking of data based on geographical location

- Support NHS Digital's in-development Target Architecture and ensure interoperability with other regions of the UK.

2.3 Non-functional Requirements

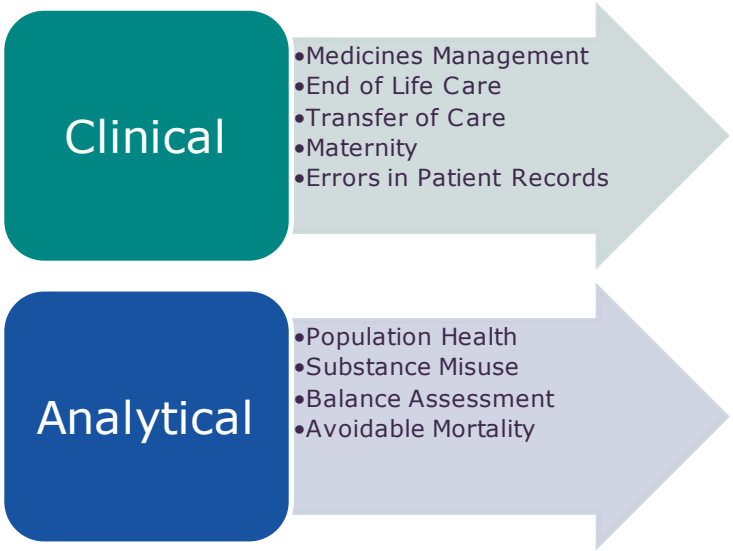
The GNCR should:

- Work in near real-time
- Be resilient and reliable
- Supports out of hours operations, e.g. 7 day services
- Ensure staff confidence in its use (through data quality and training)

2.4 Use Cases

As part of the project, several clinical and analytical / research use cases were developed that the GNCR would need to support in addition to the three featured care pathway projects already associated with the CHC (Dementia and Frailty, Smart Interventions for Vulnerable Families (SILVER) and Forecasting Emergency Unplanned care[1]). These use cases were not meant to be exhaustive in any way and are designed to give a few examples of how the GNCR would be used to deliver care and research, with the patient at the centre, across provider and other health and wellbeing organisations. The GNCR will need to support an ever-growing list of use cases with supporting business cases. The use cases discussed during the project are summarised in this section of the document and the diagram below:

Figure 3 : Summary of Use Cases identified through the project



The use cases are split into two sections:

[1]https://www.connectedhealthcities.org/connected-health-cities/cumbria-and-north-east-england

- Primary use cases are the ones that were developed in detail during the workshops, and any future solution must support these particular use cases as they are likely to be the first operational projects arising from implementation of GNCR
- Additional use cases were not developed in detail as part of this project, but were deemed to be important by stakeholders as future uses of the GNCR beyond the initial go-live of the system.

The use case examples provided are specific but are meant to cover a wider need that cover more than once care domain and application.

2.5 Primary Clinical Use Cases

2.5.1 Medicines Management

As an example of the Medicines Management use case, both GPs and mental health practitioners may prescribe antipsychotic or antidepressant medication. Mental health treatments can have potential impact on other physical health treatments (e.g. kidney and liver failure), and may also work less effectively over time due to treatment resistance. Current guidelines state that a specialist review should take place after 4 treatments, but if GP and Mental Health records are not shared, then the number of treatments between reviews may rise to 7 or even 8 with say 4 from the GP and 3 from Mental Health practitioners, which is unsafe.

Changes in medication by the GP or the Mental Health practitioner need to be communicated and acknowledged by both parties to manage alongside any other physical or mental health medication, e.g. to take account of negative interactions.

Who needs access to this information?

- The patient, family members, friends, carers and neighbours
- All care providers: primary, secondary, tertiary, community, pharmacies (community + hospital), etc.
- GPs, mental health practitioners, community nurses, ambulance, police, urgent care, out of hours, prison, addiction services, probation services, housing, etc.
- What information is needed?
- Patient's status: including medication, housing, income/benefits, etc.
- Details of the prescriber: GPs, psychiatrists, etc.
- Dispenser: pharmacists (community + hospital)
- Administrator and monitor: carer, CPN, community nurse, laboratory, etc.
- Drug information: dose, quantity, frequency, date of dispense, prescriber with contact information, adverse allergy information; who started treatment/why; whether changing/stable; need for review; notification; response to treatment. Different layers of information will be available and accessed subject to consent model and role based access rules.
- Contact details of services involved

Why is this information needed?

- To offer current and correct information in direct patient care
- To remove unwanted variations
- To reduce waste: medications, time, duplication, efficiency
- To standardise, optimise and review best practice to reduce risk of harm due to adverse reaction
- To create a "boundary of care"; a single management plan with the patient aware of the plan; to support decision making (via prompts)
- To inform the patient of alternative treatments/pathways

Where is the information to be accessed?

- Within the patient's home
- All care settings including social care, ambulance, police, pharmacy - i.e. anywhere (mobile and nationwide) where care is provided or patient can present

When can the information be accessed?

- Should be accessible 24/7
- Needs to be available in Real time, at the Point of care/Point of prescribing

2.5.2 End of Life Care

Lack of communication around end of life care leads to distress and patient choices not being respected.

- Even a simple flag would alert urgent care services that a patient is on an End of Life Pathway
- Improved sharing of the End of Life plan with social care would also improve effective delivery
- Patients may wish to revise choices, and again these could be better communicated

Who is involved in this user story?

- Mavis (patient), a 98-year-old frail lady with mild dementia; recurrent urine infections resulting in hospital admissions via unscheduled care, A&E and paramedics. Visually impaired, lives in Spennymoor. Has expressed an explicit wish to die outside of hospital.
- Next of kin: daughter in Nottingham, niece lives locally, estranged son.

What information is needed?

- Capacity for decision to be made; to express (record and communicate) wishes and values, taking account of legal and safety factors; respect power of attorney where appropriate.
- EHCP, DNACPR, DoLS, Advance Decision to Refuse Treatment (ADRT)

Why is this information needed?

- Provide the ability to change information (may change daily by Mavis and/or her carer). Easy to update by people with appropriate authority. Available for relevant people to see the correct, up-to-date information to avoid unnecessary treatment, etc.
- To show respect for Mavis when she lacks capacity – previous autonomy
- To enable personalised care, while offering efficiency savings, meeting family needs and simplifying service delivery into a single management plan.
- Communicate special circumstances between clinicians but not necessarily to the patient and family (e.g. life expectancy).

Where is the information to be accessed?

- From all care settings (domiciliary, acute, GP practice, care home, social work team centres, community nursing centres, etc.) but particularly available to paramedic, A&E and out-of-hours providers.

When can the *information* be accessed?

- Needs to be 24/7 and up-to-date (at least within 24 hours).

2.5.3 Transfer of Care

Currently, the tertiary centre can receive PACS images from a referring secondary care trust but not test results or other patient notes electronically, which are provided on paper.

Data requirements for the tertiary centre under this use case are:

- Access to orders and results – many duplicate tests are taken as the team lacks access to the results from secondary care
- Current medication lists from primary care as well as referring secondary care organization
- Past medical history
- Co-morbidities
- Other relevant clinical record content

Data requirements for the acute trust receiving the patient back from the tertiary unit are:

- E-discharge summary (this is already sent to primary care but not secondary care)
- Relevant clinical letters, including specialist notes and care plan
- TTO medication
- Test results.

Who needs access to this information?

- The patient
- Primary, Secondary and Tertiary Care clinicians involved in the patients' care

What information is needed?

- Orders and results from secondary to tertiary care; current medication from primary and secondary care; past medical history, co-morbidities, other relevant clinical records
- From tertiary to secondary care: E-discharge summary, relevant clinical letters
- Discharge advice to the patient: care plans, specialist notes. TTO medication, test results, next steps, follow up medications

Why is this information needed?

- To prevent duplication, reduce waste, reduce errors
- To prevent loss in confidence from patient, reduce renew episodes, mitigate against unnecessary reviews

Where is the information to be accessed?

- Tertiary provider, secondary provider, primary care

When can the information be accessed?

- Available 24/7
- Information sent: at the point of triage, referral, discharge
- Discharge planning

2.5.4 Maternity Care

An example use case concerns safeguarding around teenage mothers. This includes:

- Alerts around patient and staff risks
- Better exchange of substance (mis)use information
- More timely and routine communication between health and social care regarding admission to maternity

Who needs access to this information?

- The pregnant woman
- Community midwives, antenatal, GPs, obstetrics, A&E, out of hours, health visitors, MH, child protection, police, social services (adoption services, etc.), family, multi-agency (MARAC), research, planning, mother-to-be's school

What information is needed?

- Medical, social (domestic violence) and family history, including past obstetric history
- Current medication, pregnancy status/stage.
- Care plan (delivery planning)

Why is this information needed?

- Keep patient and baby safe
- Keep clinicians aware of information
- Likelihood of emergency situation - early labour/delivery

Where is the information to be accessed?

- Local, regional but nationally accessible

When can the information be accessed?

- Presentation to delivery
- Postnatally, providing relevant history
- 24/7 – either out of hours or in hours.

2.5.5 Addressing Errors in Patients' Records

It was agreed that addressing errors in patients' records was both sensitive and relevant to all the stakeholders in the workshop across all the provider, commissioner and research organisations. The workshop consensus was that improving data quality was an important use case and the below Mental Health example is used solely to illustrate the requirement.

A Mental Health practitioner notes an error or a potential issue in a patient's record. He/she needs to be able to inform the GP about this and receive an acknowledgement of it being read along with a response.

Currently this is resolved by phone and letter, which is inefficient (unless both parties are users of SystmOne, whereby it can be achieved via SystmOne tasks).

Who needs access to this information?

- Access will depend on the purpose of the error reporting. There is a wide spectrum of possible purposes ranging from quality improvement through to, at the extreme, whistle-blowing
- The Error Identifier - the individual and/or organisation raising the query and highlighting the query raised in the record
- The Data Controller/quality team to whom the query is directed
- Relevant supervisory body for resolution, supervision (who may need to look for common themes and risks)
- The Patient (also able to highlight errors)

What information is needed?

- "Right click" – ability to highlight an error
- A conversation/message rather than one-way message
- Risk associated with the error and possible recourse
- Labels (anonymous, level of risk)
- Must be simple, intuitive and reusable for different use cases where the Error Identifier wants to communicate with the Data Controller

Why is this information needed?

- Safety, decision making, for self-mending, quality improvement

Where is the information to be accessed?

- Initiated either within the Error Identifier's local EHR or directly within GNCR

When can the information be accessed?

- Raised 24/7
- Resolution – appropriate time frame, provided there is a flag.

2.6 Additional Clinical Use Cases

Other ideas put forward for potential use case development included:

- Whole System Flight Deck
  - Currently there is analytics software to support re-routing of ambulances from real time information from local ED departments for emergency care. This could be extended to cover:
    - Bed state across the whole system

- Non-urgent referrals (e.g. patient choice and information on the shortest wait times)

- Fictitious Illness or Incorrect Professional Diagnoses
  - Identifying inconsistent constellations of ill health in individuals which might arise from a variety of causes including Munchausen Syndrome (fictitious disease) or flawed professional diagnoses. This will be easier to identify / track through a shared care record
- MDT Reviews
  - For a child with learning difficulties, this may include CAMHS, SLT, Educational Psychology, GP, school health etc.
  - Currently can't pull info together electronically from different sources into a single view – this should help
- Community Treatment Orders (CTOs)
  - Currently these are handwritten with copies for patient and various health professionals
  - Poor management of compliance to treatment and CTO. Shared records will help.

2.7 Primary Analytics and Research Use Cases

2.7.1 Population Health

Transformation across an STP footprint will deliver a shift towards improving 'population health' - moving from fragmentation to integration in care delivery, but also tackling the wider determinants of the health and wellbeing of local populations. Working together across health and care systems will enable a focus on early intervention and prevention, integration, reconfiguration of hospital based services, and technology.

Who needs access to this information?

- Commissioners
- STP Footprint teams
- Health and social care providers
- The third sector
- Researchers and evaluators
- Town / environmental planners

What information is needed?

- Acute, community, mental health and social care activity and workforce information
- Demographic growth information
- Disease incidence information

Why is this information needed?

- To help determine the location and type of health and care services to provide holistic care to individuals in the short, medium and long term future
- To address the wider determinants of health and put in place prevention and self-care services to reduce the burden of acute services

- To support development of healthy new towns / smart cities through integrating healthy options into the built environment as a key prevention strategy for health and social care going forward.
- When can the information be accessed?
- As part of on-going service planning and service re-design activity
- Real-time information not required.

2.7.2 Substance Misuse

Understanding the determinants and effects of substance misuse in the wider population in the North East can help with the development of prevention, treatment and post treatment support services that span across the whole spectrum of public service provision. By linking together health and social care data with housing, education and criminal justice data, longitudinal analysis can be performed on historic data at the individual level, consent allowing, which can inform algorithms for risk stratification to target future services on those with most need and/or most future risk.

Who needs access to this information?

- NHS and social care commissioners, NHS and social care providers, local authority housing and education functions, third sector service providers
- General public (high level overview only)

What information is needed?

- Demographic, educational, social care, criminal data (police, prison)
- Health interventions and outcomes (emergency, inpatient, outpatient, primary, community, mental health etc.), Primary and acute care; mental health
- Third sector data.

Why is this information needed?

- To answer questions such as:
  - "Are we spending a high proportion of our resources on a small cohort of people?"
  - "What is the link between educational attainment / participation and likelihood to become addicted?"
  - "What is the link between substance misuse, clinic interventions and future offending rates?"
- To support existing research projects related to care pathway improvements, specialist service provision, service redesign and integrated care planning.

When can the information be accessed?

- Real-time tracking of all interactions with the health system and services by consented individuals.
- Longer term analysis of patterns to identify gaps in service delivery.

2.7.3 Balance Assessment Service

Balance assessment and rehabilitation services, often hosted by Trust Audiology departments, provide assessments and follow up services for patients with balance issues, often following an ENT consultation.

The reasons for loss of balance are often complex, and therapy services can be put in place to help individuals who have previously been subject to unexplained falls, or are at high risk of future falls following ENT assessment.

Reduction in the number of falls, particularly in the elderly population, can help reduce ED attendances and subsequent admissions, and therefore on-going demand on acute and community services.

Who needs access to this information?

- GPs
- Adult social care
- Acute – ENT and ophthalmology services
- Community services
- NEAS

What information is needed?

- Age (e.g. Filter to 50+)
- Datasets:
  - Disability;
  - ENT
  - Ophthalmology
  - Occupational Health
  - Health check/wellness clinics
  - ED attendance and admissions;
  - Ambulance
  - Telecare datasets on falls
  - Social inclusion following fall.

Why is this information needed?

- Support falls prevention service planning through investigation of trends in incidence and likely causes
- Reduce repeat admissions

When can the information be accessed?

- GP referrals
- Acute discharge planning
- Community service planning
- Public health advertisements/promotion
- New service planning
- Service / pathway re-design
- Integrated care commissioning

2.7.4 Avoidable Mortality

Nationally around 9,000 people die in hospital each year through avoidable deaths. The North East is committed to reducing the avoidable mortality rates across its acute providers through root cause analysis and openness and transparency of the causes of death and the lessons learnt from each individual case. This work will take full account of, and work side-by-side with any formal legal or confidential enquiries involving avoidable deaths.

Who needs access to this information?

- Healthcare providers
- Researchers
- Public
- Political/ policy makers
- Family/ informal carers.

What information is needed?

- Acute clinical records for patients who die in hospital for avoidable reasons
- Incident review information
- Lessons learnt information

Why is this information needed?

- To investigate the causes and put in place action plans to reduce the number of avoidable deaths in future
- To enable clinicians to review previous cases for on the job learning and CPD accreditation
- When can the information be accessed?
- Acute Settings for clinical case review
- Public website for public scrutiny.

3 Potential Architecture Assessment

There are multiple technical models that can provide the functionality needed to meet the guiding principles and support the use cases outlined in Section 2, although each has its own strengths and weaknesses. The purpose of this report and study has not been to develop a prescriptive detailed architecture, but rather to achieve region-wide consensus on a common approach that can then be further refined by a selected vendor.

This section presents some guiding principles and reference models for architecture. It then introduces a series of potential architecture models for the GNCR, reviews their appropriateness to meet requirements, and recommends a preferred data architecture for procurement.

3.1 Guiding principles for architecture

3.1.1 International standards compliance

All models are assumed to support the set of required standards (HL7/FHIR, XDS, SNOMED CT for coding etc.) for seamless and consistent sharing of healthcare data across systems at the appropriate granularity level. These standards (or at least their predecessors) have been the enablers for the many existing point-to-point interfaces currently in use.

3.1.2 National interoperability – NHS Digital Target Architecture

In addition, consistency with the national draft Target Architecture, "Outputs from the Interoperability and Population Health Summit", will ensure national interoperability as other regions adopt similar, compatible platforms. The project team was given access to a draft of the national Target Architecture for the purposes of this project, and following review of this "to be published" document, ensured that the guiding principles and potential architectures proposed here are fully in-line. The population size for the GNCR also fits well within the proposed region size of 2-5m (the North East has a population of 3.7m). The Target Architecture also proposes a useful reference set of purposes which can inform the GNCR architecture choice. These have been extracted from the draft national document which may change on final publication and can be summarised with some additions and changes from the workshop as:

Direct Care – "Interoperability" the ability to:

- exchange uncoded and coded data at point of care, access normalised "longitudinal record"
- share views at point of care for professionals and citizens and enable decision-support
- Enable patient to be an active participant in own record and to enable transactional services

Direct Care – Precision Medicine and Case Finding, the ability to:

- compare an individual against a population for more precise intervention
- identify individuals at risk and provide personalised intervention alerts

Intelligence – Commissioning for Service Planning

- ability to provide a view at a whole population level from data garnered from multiple provider systems to understand demand and enable effective planning of service provision across providers

Intelligence – Payment, Regulation and Service Evaluation, the ability to:

- process data in support of payments for services
- understand conformance of organisations to regulatory requirements
- provide national benchmarking of providers and understand the effectiveness of services

Research – use of data for clinical and other research, the ability to:

- make de-identified data available in an unrestricted legally compliant manner excepting for where citizen permission is required
- use data as part of consented trial or consented observational studies
- use data for clinical risk prediction / clinical decision support
- use data to undertake research on the effectiveness of treatments
- Ensure potential for interoperability with research data sources which are themselves passing through a rapid period of structural, ontological, and formatting change.

3.1.3 A learning health and care system

One goal of the GNCR is to provide the platform for the enablement of a Learning Healthcare system. Friedman et al[2] outlined a "Learning Health and Care" system in terms of "the fundamental properties of a highly participatory rapid learning system that can be developed from use of electronic health records. Secured and trusted use of these data, beyond their original purpose of supporting health care of individual patients, done transparently and with high quality information for the public about the use of their data, can speed the progression of knowledge from the lab bench to the patient's bedside and provide a corner stone for healthcare reform.'"

A Health Information Exchange (HIE) allows care professionals and patients to appropriately access and securely share a patient's medical and other information electronically and its role in a learning health and care system has been summarised[3] as:

[2] Friedman, Wong & Blumenthal, Achieving a Nationwide learning System, Science Translational Medicine, Nov 2010

[3] Learning from Health Information Exchange Technical Architecture and Implementation in Seven Beacon Communities by Douglas B. McCarthy *Commonwealth Fund*, dm@cmwf.org

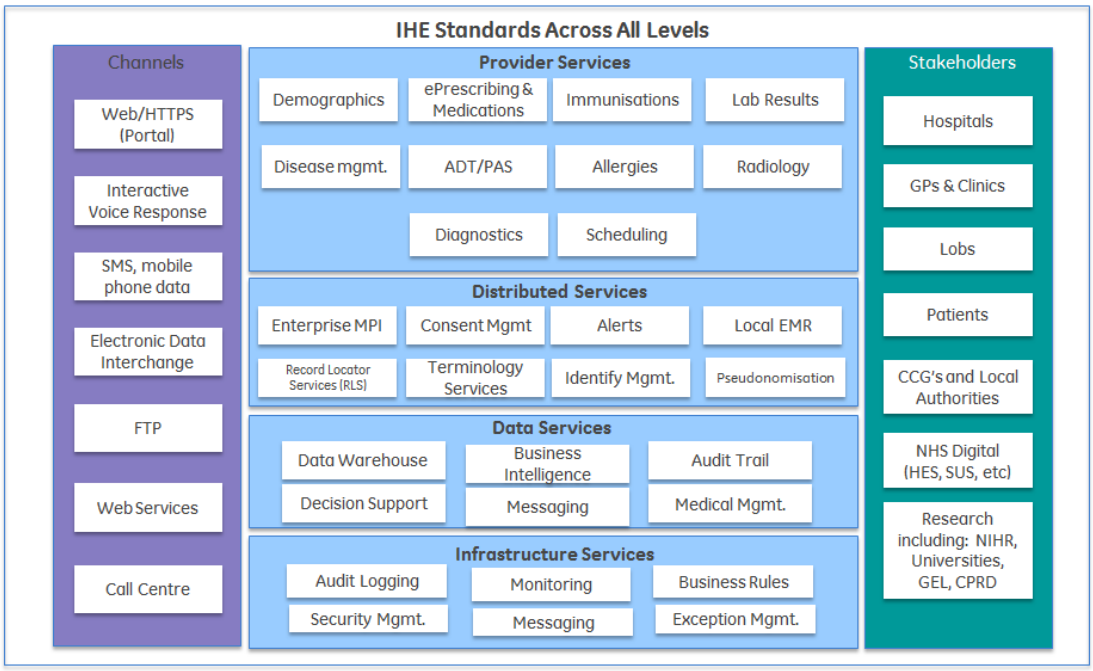
- A clinical data exchange to support care transitions and referrals, typically using Web-based portals and secure messaging services to exchange patient information (e.g., laboratory test results, medication histories, hospital discharge summaries)

- The ability to deploy the analytic capabilities necessary for delivery system and commissioning reforms and support a broader array of "use cases" (e.g., quality improvement, population health management, research and evaluation).

3.1.4 Reference architecture

A useful reference Health Information Exchange (HIE) architecture used during the workshops is shown in Figure 4, covering the communications channels and typical toolkit of services required to support the stakeholders. While not an exhaustive list, it covers many services required to deliver the GNCR. It also reflects the services offered by the short-listed suppliers covered in Section 4.

Figure 4 : Reference HIE Architecture



The revised architecture in Figure 5 below was developed based on:

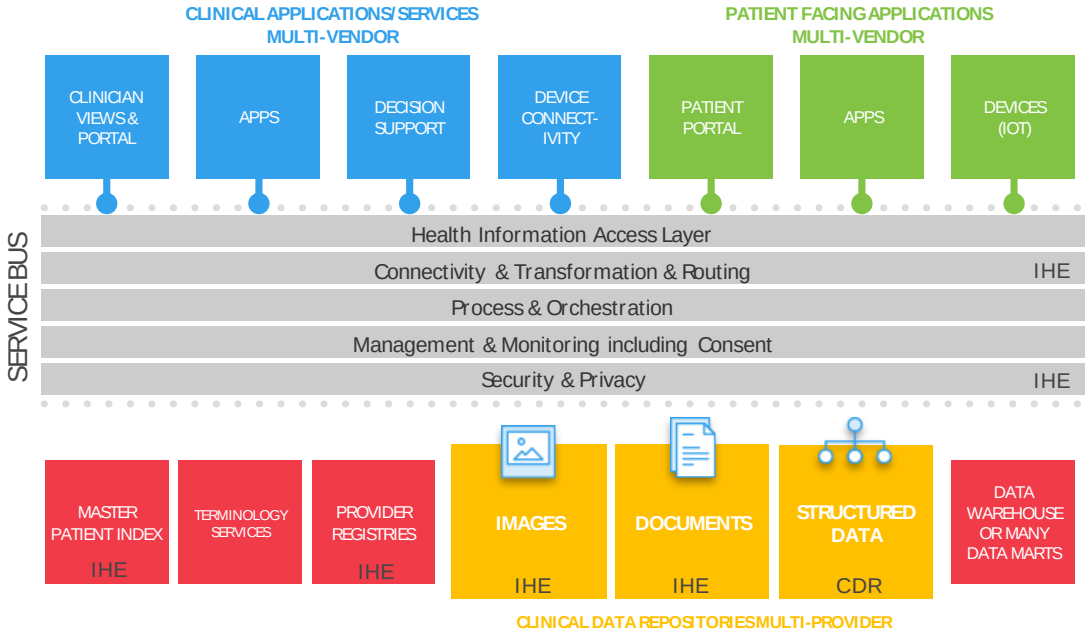
- Feedback from the workshops and follow up discussions
- A desire to represent where the IHE[4] standards best fit -

[4] IHE is an initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information. IHE promotes the coordinated use of established standards such as DICOM and HL7 to address specific clinical needs in support of optimal patient care. Systems developed in accordance with IHE communicate with one another better, are easier to implement, and enable care providers to use information more effectively. - www.ihe.net

- The ability to share images and documents (e.g. an XML/CDA transfer of care)
- The need for a clinical data repository (CDR) to manage normalised data for care, research and analytics as a source of quality harmonised data for the Ark.

- The need for a CDR with normalised or harmonised patient data was seen as key to enabling the GNCR as a HIE to support the research and analytics use cases. Both reference architectures include consent management functions and the complexity of the information governance challenges was highlighted during the workshops.

Figure 5 : Revised Architecture



3.1.5 Publish and subscribe

A common theme in the use case workshops and provider and supplier interviews was for the ability to receive 'push' notifications when some items of data change or an event occurs (e.g. a client on a social worker's caseload is admitted to hospital). This model can be generalised to a wider interoperability principle of conversations between a publisher and subscriber, which will also enable data and event interchanges between care record services at national level.

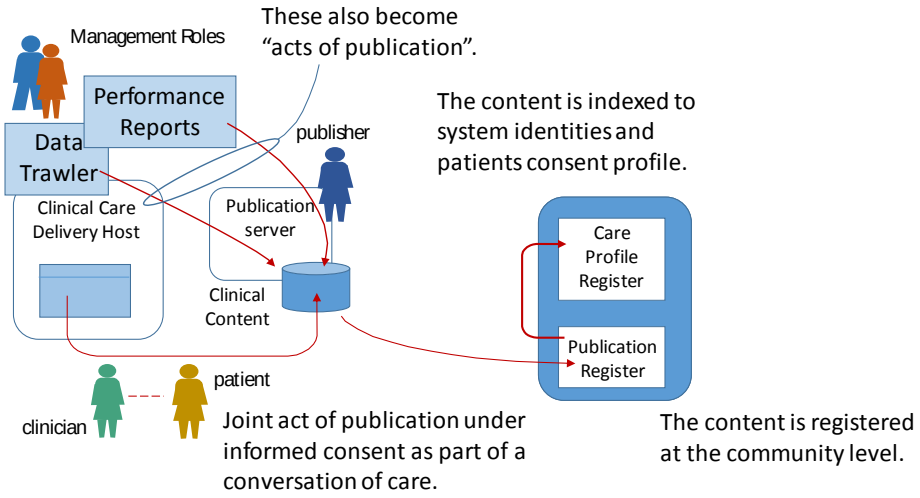
A "Publisher" is defined as an organisation or service that provides data and a "Subscriber" is defined as an organisation or service that expresses an interest in accessing a type of data or set of data items for a cohort of patients. The GNCR is ultimately a data management service that operates by accepting published data, normalising it to a standardised format and standard terminology (SNOMED CT) and storing on behalf of the publishers. Subscribers gain access to the data for an individual patient or cohort or patients based on an information sharing agreement.

The vision for the GNCR is a managed information service which curates and brokers clinical and social care content generated and published from many different sources and used in many different contexts.

Curation is the process of harmonising the data and implies the responsibility to protect, organise and maintain all content in the interests of its subjects (the people it is about and for who's' benefit it has been generated and is used). Brokerage involves the stewardship and support of the interests and operations of both the sources (publishers) and the users (subscribers) of this content.

The following diagrams outline how the "publish and subscribe" services would need to work in support of the GNCR, providing a managed service independent of where the data is ultimately curated and stored. These diagrams were developed by Professor Mike Martin and Professor Rob Wilson from Newcastle University, in the context of their role as critical friends to the CHC programme and their participation in the workshops.

Figure 6 : Publication Services

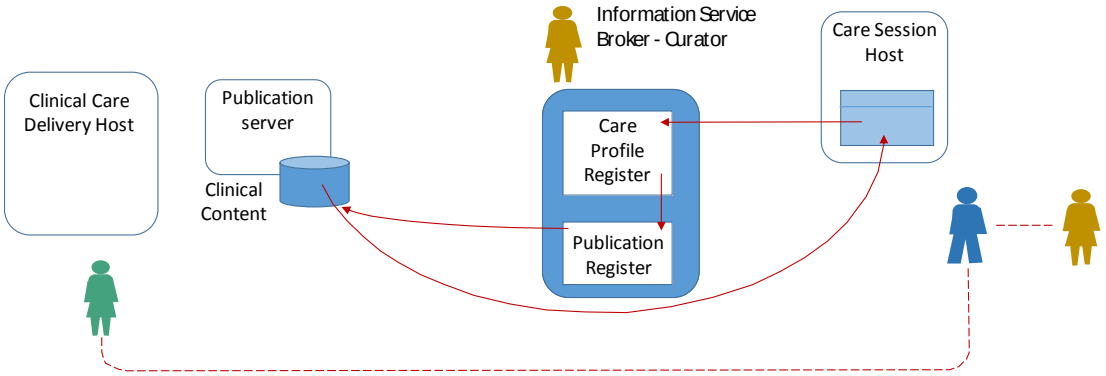


Publication Services managed by the Publication server:

- Place the content that is being published in a space that may be accessed by an intended audience in the future
- Require data to be registered in a space that is logically central to the federation (a group of communities that make up a locality). Thus, based on a person's identification and role (security level), they get the same response no matter where they are or where the data is from
- Must include a process of centrally indexing published content against patient identities using a Care Profile Register and Publication Register for the community.

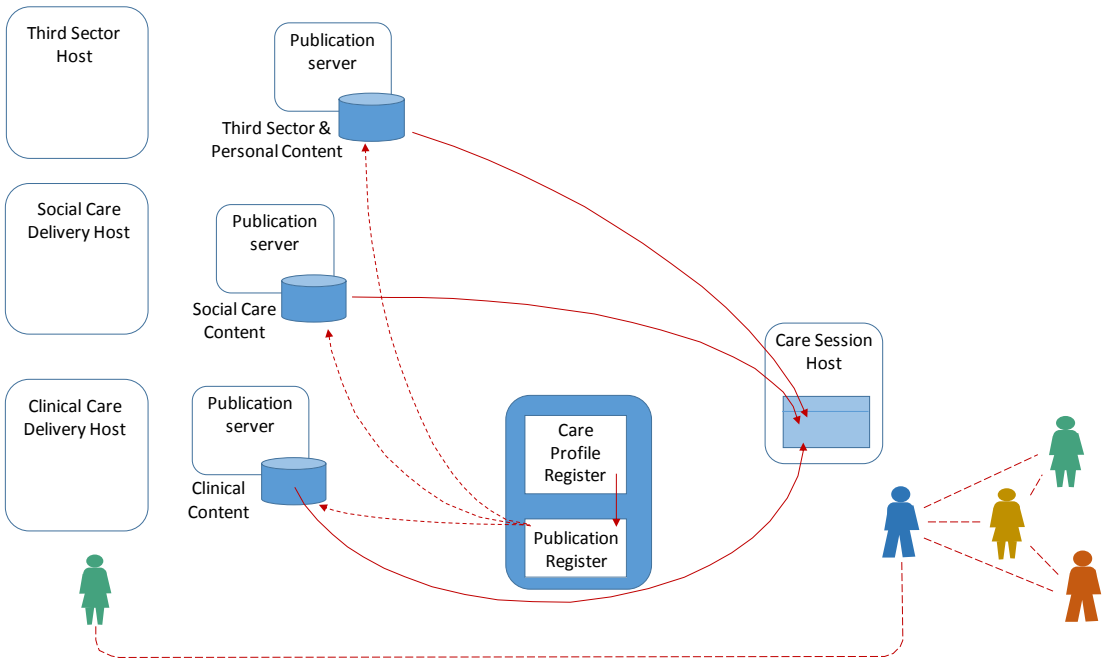
In Figure 6, the Data Trawler and Performance Reports are services provided by North East Commissioning Support (NECS) based on existing access to relevant data. This is only representing a small part of what NECS provides and is used for illustrative purposes in the context of the publisher and subscriber relationship.

Figure 7 : Subscription Services



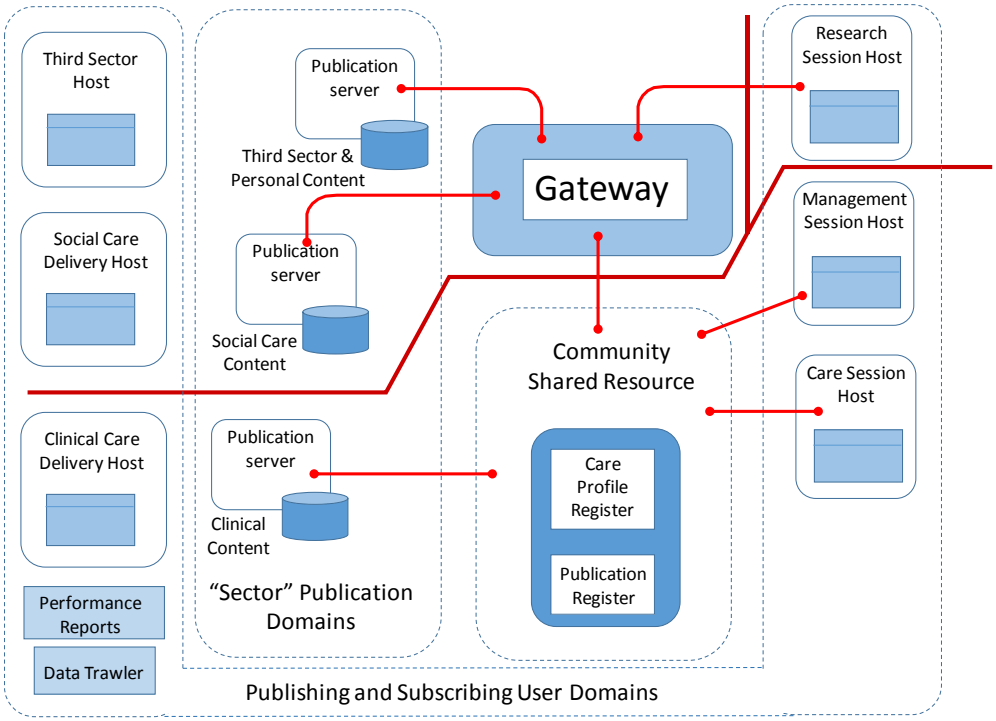
A session (a secure data request from a secure user through the Care Session Host) is the initiative which connects to the central Information Service Broker to make the required secure connection to access the published data. This is how the MIG works today with one index and one register.

Figure 8 : Syndicated Subscription Services



However, the uses cases clearly demonstrate that there are multiple Publishers so syndication is required to create a session (Care Host Session) from multiple publishers (Publication Servers) through the central Information Service Broker, as illustrated in Figure 8.

Figure 9 : Central Gateway Services Overview



New models of care require coordination and data sharing across traditional boundaries, thus a Central Gateway is required to ensure privacy and consent is managed across a wide range of data publishers and subscribers.

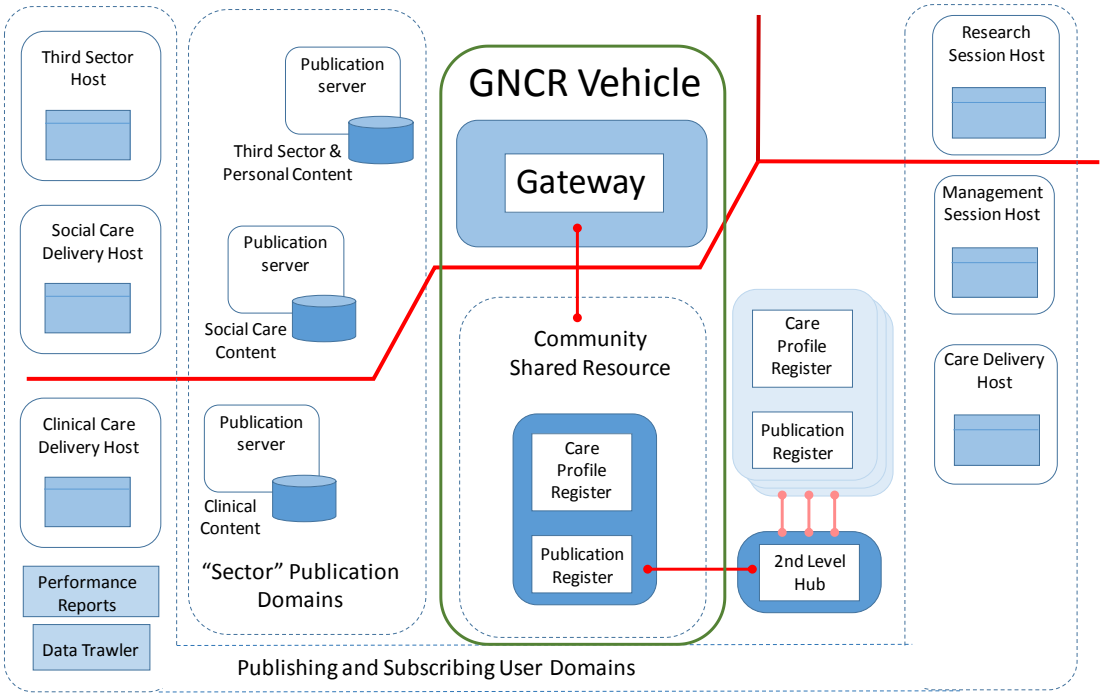
In Figure 9, current health and care operations are represented below the red line and must be securely managed. This is where:

- Many existing information governance agreements already exist
- NECS currently operates to deliver performance reports and a wide range of analytics services to the NHS today, and will benefit from higher quality near-real-time data in the future to deliver current and new services to health and care partners.

Above the redline and to the left is where community, third party and patient Publishers and Subscribers are managed to ensure a more complex set of IG regulations are adhered too.

Above the red line to the right is where Research is further separated from the data to ensure the additional security and consent requirements are met (e.g. patient opt in for a clinical study).

Figure 10 : GNCR Vehicle in the Gateway Services Model

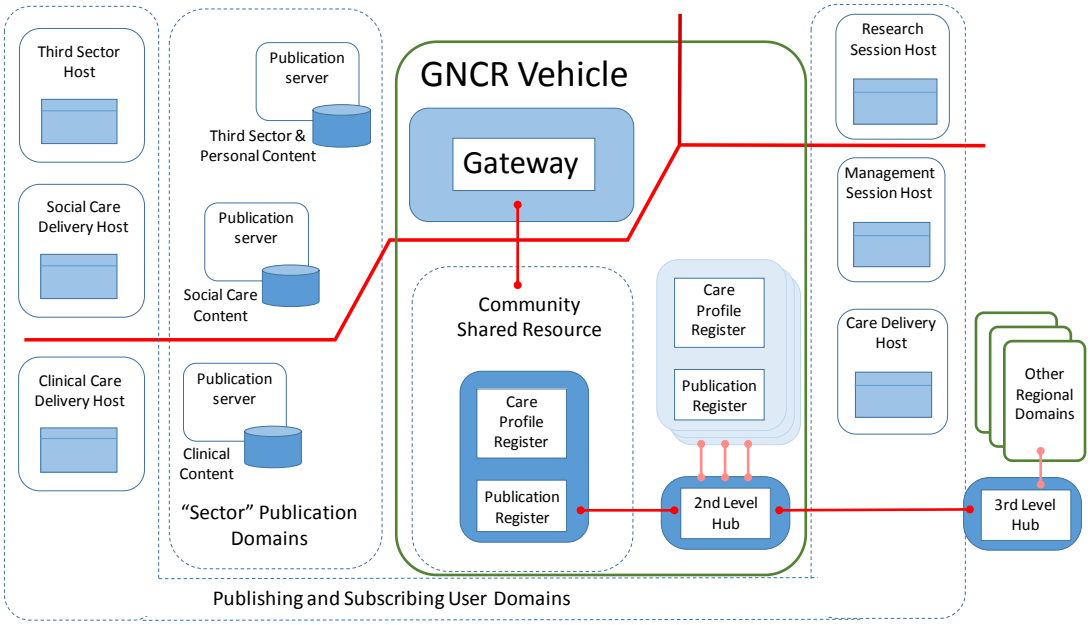


It was the consensus of the workshops that as a minimum, the GNCR represents the vehicle to centrally manage the Gateway as a community shared resource (as shown by the green line in Figure 10). This is covered in more detail in Section 6.

Additionally, while the desired state of the GNCR is for one Gateway for the NE covering the full 3.6 million people, it was understood that funding, timing and other issue may make this challenging, and thus a second level of Hubs may be required for each of the local communities (Localities) to ensure they can move forward at pace based on local needs and capabilities.

Each of the second level Hubs would ideally be provided by the same vendor and support the same Clinical Data Repository (CDR) described in Section 3.2. However, if this is not possible, each second level Gateway Hub must adhere to the same IHE standards agreed by the centrally managed GNCR to ensure interoperability across the NE region.

Figure 11 : GNCR as the Gateway Services Vehicle



Finally, it was understood that a third level of Gateway Hubs must be supported. These represent the other regional domains and would ensure the GNCR is interoperable with the rest of the UK. This is illustrated in Figure 11.

3.2 Potential Models for Data Management

In addition to the agreed need for the GNCR to have a central Gateway to manage the Publish and Subscribe relationships between the various stakeholders, there was also a need to address the options around data management (including curation and storage) in terms of locations, replication and data persistency.

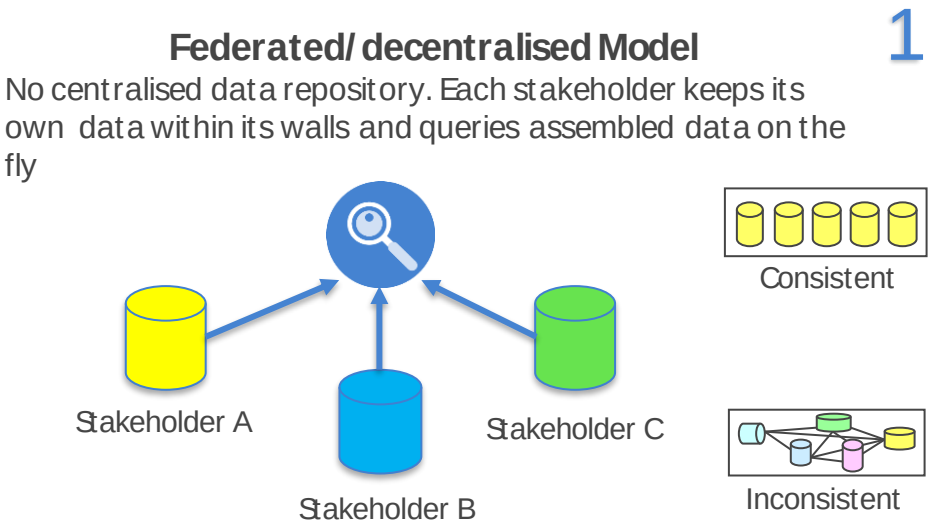
The following sub-sections outline the core options considered.

3.2.1 Federated vs Centralised

The Federated model presents a pure integration approach where data is requested and results are assembled in real time. This is essentially the approach taken now by the North East wide Medical Interoperability Gateway (MIG) solution[5] and the Health and Social Care Information Exchange (HSCIE)[6] Proof of Concept project in Sunderland and South Tyneside. It can be effective for clinical care record / real time care portal views, but presents challenges for reporting aggregated data as this could be slow and pose high demands on repeated accesses of source systems in real time. Although central storage is avoided, a consistent view of the data must be created rapidly from a disparate set of source databases. Integrating further systems requires a full "point-to-point" integration each time.

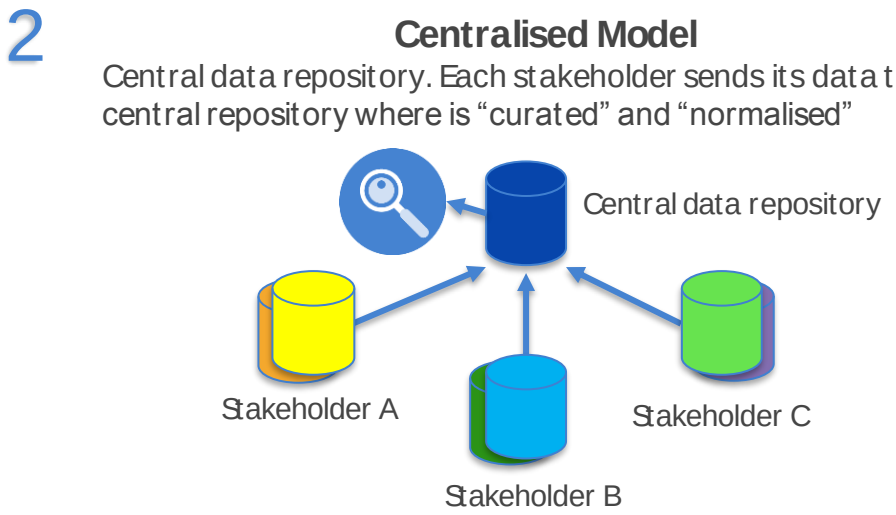
[5] http://healthcaregateway.co.uk/services/detailed-care-record/
[6] http://www.necn.nhs.uk/wp-content/uploads/2016/03/HSCIE-South-TynesideCCG.pdf

Figure 12 : Federated/decentralised model



The Centralised approach involves feeding all data into a common, central repository. This provides a consistent "curated" data model, and allows simpler and faster aggregated reporting and research. However, the centralised approach cannot guarantee that the data is as up-to-date as the Federated Model, depending on how frequently the central repository is synchronised back to the source systems. Writing back updates can also therefore be impacted by the synchronisation timing, but there are well established technical methods to manage this.

Figure 13 : Centralised Model



Some high-level pros and cons of these two approaches are summarised in Table 1.

Table 1 : Pros and cons of Federated and Centralised Architecture Models

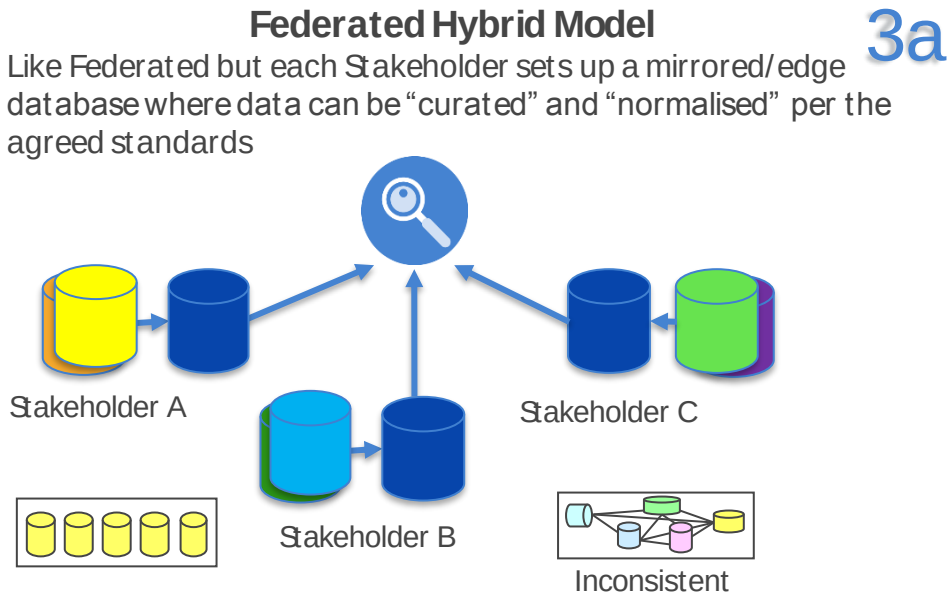
Model	Pros	Cons
Federated	Live data transferred on the fly One view of data as there is no duplication Data is always up-to-date	Inconsistent data models within each system therefore difficult to view aggregate data When systems are offline no data is available Authentication more difficult due to multiple logins Delays may be experienced due to performance demands in real-time querying across multiple systems Performance may degrade for operational (direct) users of feeder systems as the systems try to also handle concurrent live care record queries
Centralised	If a feeder system is offline, data can still be viewed in the centralised database Consistent data model allows simplified aggregate views and reporting	Data could be out of date depending on synchronization timing Risk of data duplication from multiple copies, may include inconsistencies which must be explicitly resolved if there is to be a single central representation of those data Central storage adds additional IG and information security implications as an additional data processor, which needs to ensure IG is managed in near real-time across the source systems Central storage adds additional costs and resources

3.2.2 Hybrid Models

Given the strengths and weaknesses of the federated and centralised models, hybrid approaches attempt to retain a blend of the benefits of both centralised and de-centralised, while appropriately addressing their shared and differing challenges.

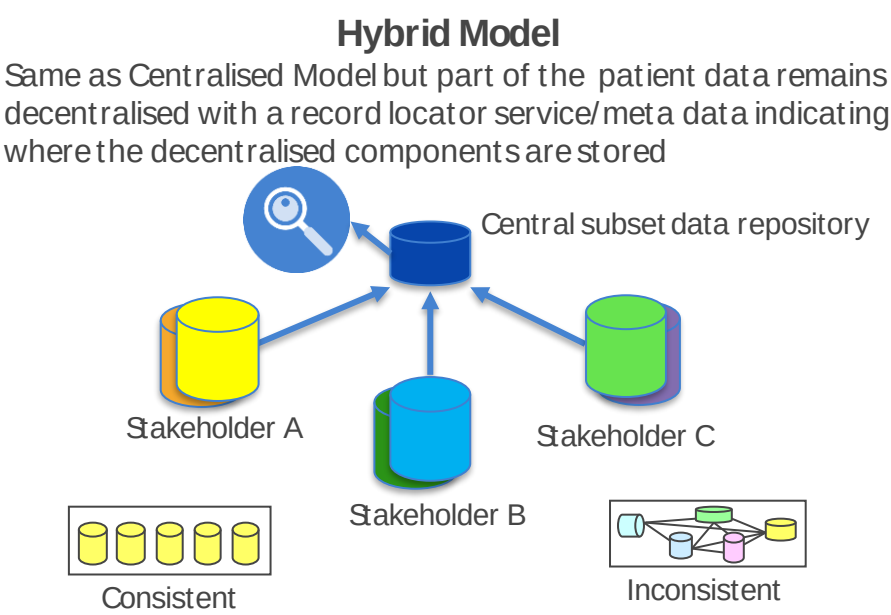
An extension of the Federated Model, Model 3a, maintains a mirrored database with each source system to reduce load on the system, while allowing the data model to be more consistent and hence easier to aggregate and faster to query. No central repository is used.

Figure 14 : Federated Hybrid Model



Model 3b presents a true hybrid of Models 1 and 2, with only a partial central repository and other (more real-time) data items remaining in source systems. If well designed and the data items optimised for the best balance of timely data and consistency/centralisation, this can offer an effective compromise.

Figure 15 : Hybrid Model



3.3 Data Architecture Model Comparison

The table below is meant to be high level and summarises some of the different attributes of each model.

Table 2 : Comparison of Key Attributes of various Potential Architecture Models

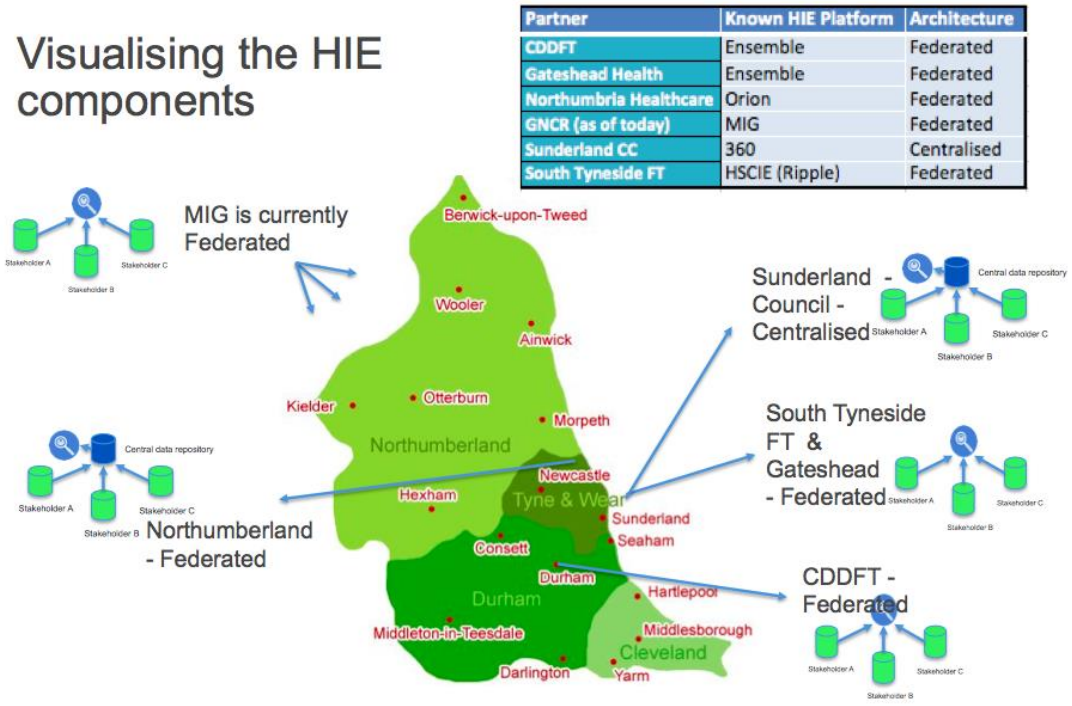
Attributes	Federated (1)	Centralised (2)	Hybrid (3a/b)
Organisational Governance	Participating organisation retains control over their healthcare information	The GNCR responsible organisation has control over the healthcare information	The responsible GNCR organisation shares control with the participating organisations
Stakeholder Governance	Stakeholders retain data locally and the responsible GNCR organisation acts as a facilitator and convener, setting policies and regulations. The responsible GNCR organisation creates the environment for existing data providers (Hospitals, GP's, Patients, Social Care, etc.) systems to publish and subscribe	Stakeholders decide what data to share and place it the central GNCR repository. The responsible GNCR organisation allows data providers (Hospitals, GP's, Patients, Social Care, etc.) connect to the GNCR and manage the publish and subscribe relationships	Stakeholders decide what patient data to share, and if it is held locally or centrally. They collectively determine information governance structures and rules for the overall system and maintain full custodial control of the data up to the point they leave the

	to the data repository		edged database for analysis or integration
Data Security (data security issues are different but complex under all three models)	Data security is less complex however where there may be more flexibility in what might ultimately be pulled together, there is more risk of inferential disclosure arising from unexpected combinations of data items in certain subjects	Data security may be more complex but could provide better control due to the central point of control	Data security is more complex than Federated and allows for the ability to manage a large percentage of data requests centrally
Data Stored	Locally but may use a form of Record Locator Services (RLS)	Centrally – requires new initiative	Local & Central - leverages existing / local initiatives
Analytics	Difficult with limited support, but approaches are actively being developed	Easiest	Easier
Performance and scalability	Slowest performance of the three but most easily scalable with respect to data quality, staff resources, technical requirements (e.g. hardware, network bandwidth) based on the ability to focus on the point of need in the network	Fastest performance but could be harder to scale due to the need to manage data quality, staff resources, technical requirements (e.g. hardware, network bandwidth) based on competing needs and impact on multiple stakeholders	Medium performance and scalability allowing for the distribution of resources based on need and availability

3.4 Models currently in use

The diagram below shows some example Health Information Exchange models already being used between partner organisations or across localities within the GNCR region.

Figure 16 : Examples of Data Sharing inthe North East Region



In addition to those HIE models outlined in Figure 16, there are other in-house developments within the NE region. For example, Northumberland, Tyne and Wear (NTW) NHS FT hold the social care data locally and display the information they receive directly in RiO (using a one-click view system like the MIG). Northumberland Council make RiO data available from within their SWIFT social care system, whilst Newcastle Council display the RiO data in a web portal.

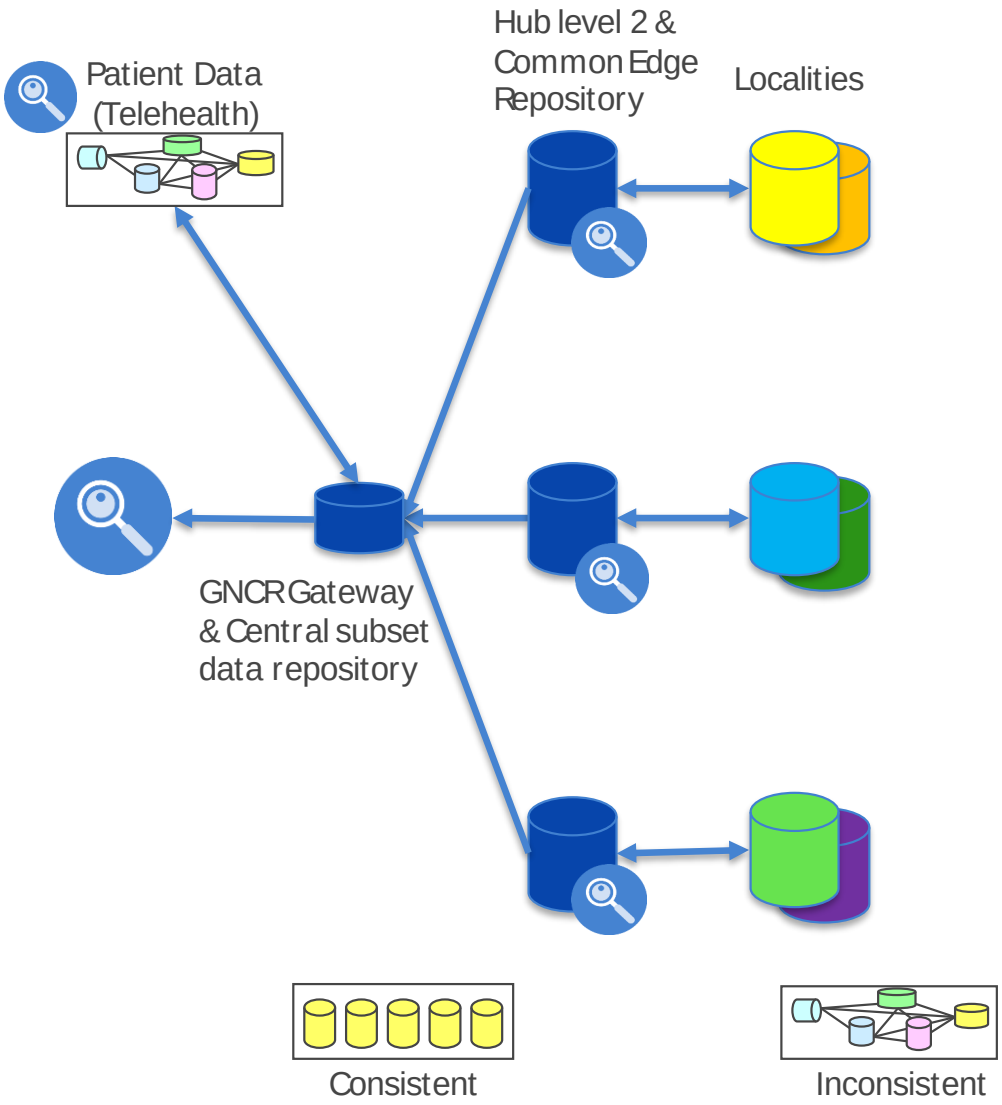
Although current local data sharing examples feature single or small clusters of local organisations, these architectures share the same principles that could be implemented as a larger regional deployment as part of the GNCR.

3.4 Preferred architecture – the model "3c"

It is evident from the workshops and public documentation that in almost every domain of comparison, all the models present a range of different benefits and challenges but their relative "difficulties" are less easy to quantify. This heterogeneity is an excellent reason why the workshop felt the need to develop another option, which enables a blend of the benefits of all models while simultaneously allowing their respective challenges to be addressed appropriately. On balance, considering the above, a hybrid approach provides a blend of the benefits from both alternative models '3a' and '3b'. This preferred model was known as Model '3c', and combines smaller, local "edge" databases for each locality (the federated hybrid approach from '3a') with a common data model combined with a larger centralised repository (as used in the hybrid model '3b').

This model offers flexibility to centralise data that is less dynamic, retaining more real-time data closer to source. However, it also allows data model consistency by including standardised edge repositories.

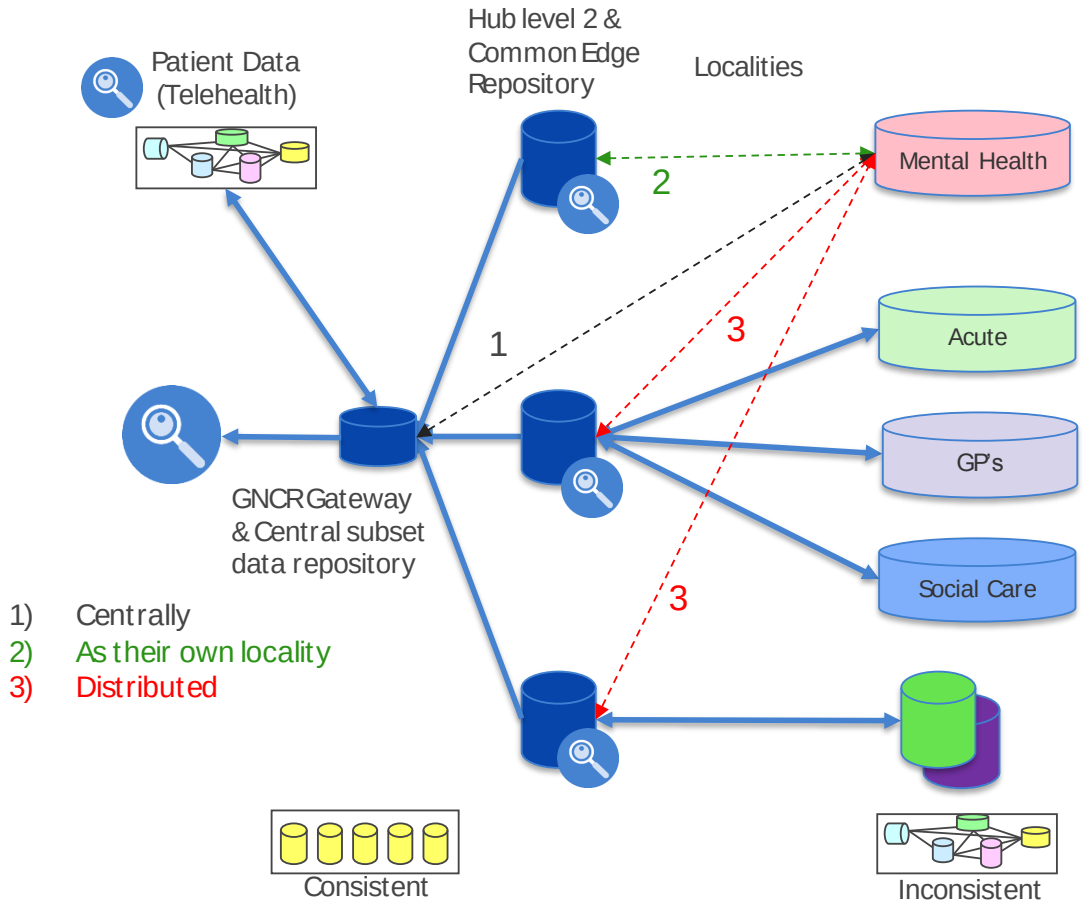
Figure 17 : GNCR Preferred Architecture Model



The preferred option, 3c, will need to consider the likelihood that the GNCR may initially be developed at each of the localities in parallel based on different priorities, resources and use cases, under the governance of the wider GNCR programme.

Based on this, early GNCR decisions will be required to determine where to manage the data for the patient and regional provider organisations that operate across all the localities e.g. NTW and NEAS. Three initial options for consideration are: 1) centrally, 2) as their own locality or 3) distributed. These options are shown for Mental Health only in Figure 18, and not all potential provider organisations are represented.

Figure 18 : Regional Provider Options



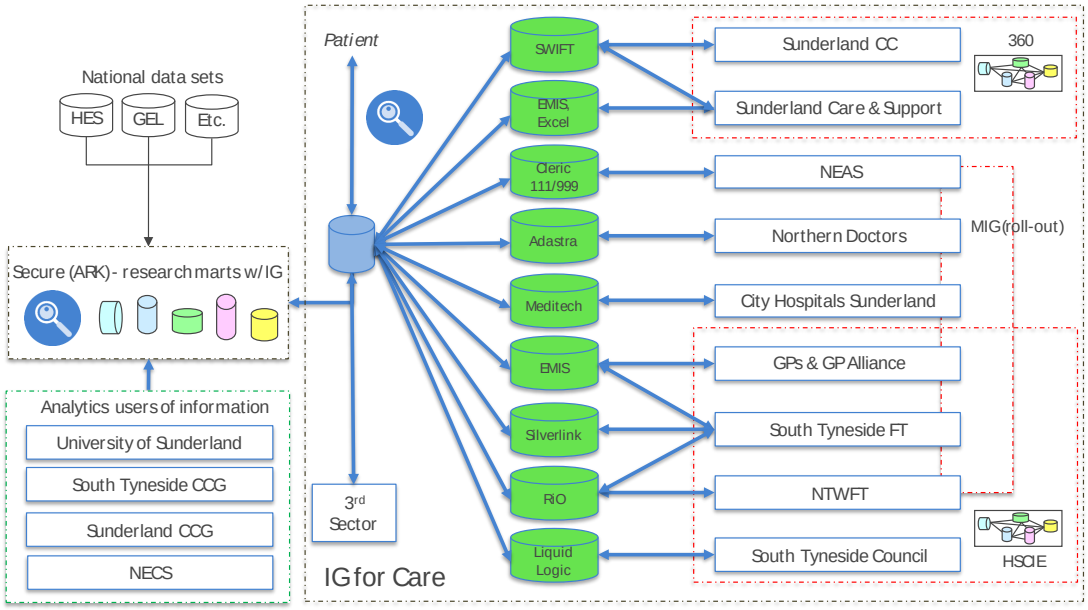
3.5.1 Locality model in practice

Each locality[7] may operate the same edge repository at a second tier or Hub, (as outlined in Section 3.1.5), providing faster local access for real-time care record interaction, and for locality-specific analytics such as supporting operational planning and performance monitoring.

By way of illustration, the Figure 19 shows how the preferred model architecture would apply to the Sunderland and South Tyneside locality including the existing data sharing programmes; 360, MIG and HSCIE. This is based on more detailed work undertaken in By way of illustration, the Figure 19 shows how the preferred model architecture would apply to the Sunderland and South Tyneside locality including the existing data sharing programmes; 360, MIG and HSCIE. This is based on more detailed work undertaken in Sunderland and South Tyneside but is illustrative and could change based on the wider GNCR priorities and plan. In this example, NTW and NEAS are operating in the distributed model (Option 3 in Figure 18). This does not mean this is the best or preferred option for regional providers since no discussion or decision has been made, however this is something the GNCR governance function will need to resolve before any locality based projects can start.

[7] The definition of a locality can be fairly loose for the purposes of the GNCR, but it would represent a community or cluster of partner organisations where there is a need to share data locally in higher volumes and with more flexibility than could otherwise be provided at a wider level. The natural localities within GNCR seem to correlate to the STP areas, and this is consistent with Local Digital Roadmap (LDR) plans.

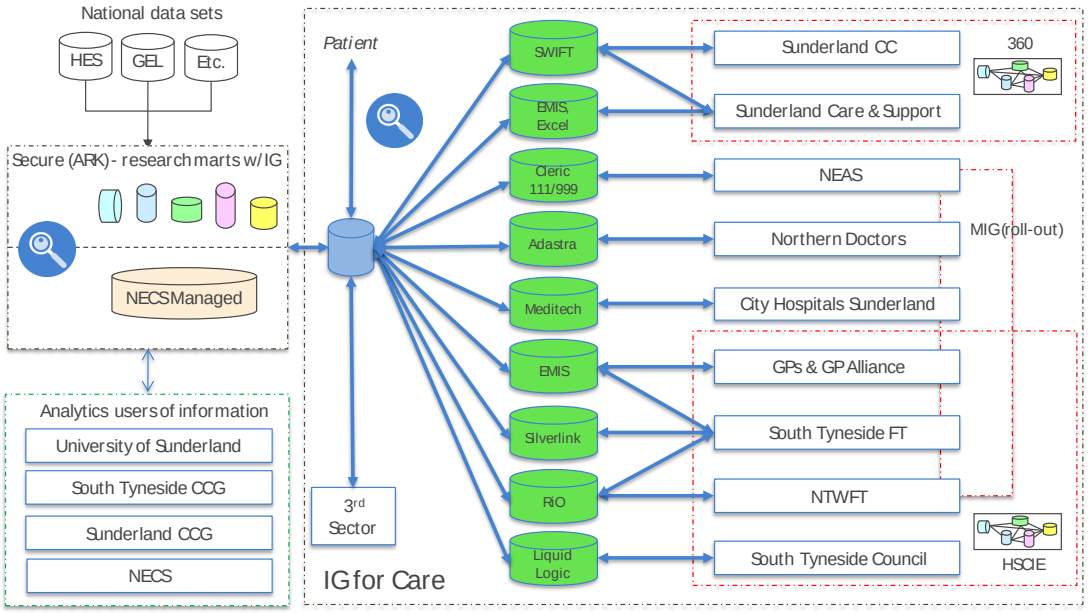
Figure 19 : Preferred Architecture Model as implemented in one of the North East localities



This locality features a mix of local integration models and feeder systems. The diagram also includes some of the features of practical implementation supporting research and analytics, based on the principle that there will not be one centralised data warehouse for analytics and research and that multiple suppliers and use case specific data marts will be fed from the GNCR Gateway.

Figure 20 represents an alternative approach to the Ark based on the current NECS service and capabilities, and the potential for NECS to become a community interest company owned by the members of the STP's or future ACS. In this option, NECS manages the Ark and evolves its current data warehouse and data management services to include data from the GNCR gateway to provide services directly to the care and academic organisations as well as to other suppliers in support of a secure ecosystem for all parties.

Figure 20 : Alternative locality based Preferred Architecture Model



3.6 Research and Analytics considerations

The project workshops and interviews arrived at a clear consensus for a physical "ARK" to provide research and analytics services. This model can be well supported by the preferred "3c" architecture, as users of aggregate data will be have access to a rich, secure and consistent data model drawn from the localities and their respective care records.

Two broad levels of analytics can be considered:

- Tactical / operational analytics – short time horizon with near-to-real time alerting that can support short term service delivery and planning.
- Research analytics – this typically has a longer time horizon and may cover a broader more diverse set of source data.

3.7 Information Governance

The conclusions from the IG workstream in this project have been that the GNCR presents an opportunity to assist compliance with future legislation and guidelines. There was also a strong willingness to share data within a safeguarded framework. If designed appropriately, the GNCR could streamline administration of consent and provide much greater clarity and control to the patient/consumer.

3.7.1 Consent management

The agreed approach to consent is to provide easy to use and clear functions via the web and apps for patients to directly access the GNCR portal and manage their own consent settings whilst being explicit about the purpose of obtaining the consent. This functionality would be provided alongside other relevant patient-facing features rather than creating a separate service with different look and feel.

The architecture will need to support patient consent management at a sufficiently granular level, propagating updates across all access points and systems as patients make changes to their preferences.

3.7.2 Consent approaches

Consent types may include:

- Consent for contact (other care professionals to be aware who is in contact with)
- Consent for records to be shared for care delivery purposes (although this could be implicit, the GNCR could make this clear)
- Consent generally for secondary use of any kind
- Consent specifically for research use, which patients may have different concerns with.

A patient portal approach would support setting safe defaults, providing choices and clear information regarding risks available to the patient, and would allow the patient to change their mind over time to reflect new and future uses of their data. However, once a patient consents to provide their data for research or a trial, it will be challenging to remove that data. This will need to be clearly communicated in the consent communication programme.

3.7.3 Privacy assurance

The architecture must be able to manage consent in accordance with the patient's preferences. However, it must also be able to support breaches ("glass breaks") and allow full audit trail of those cases, showing who, when, where and why. The appropriate Privacy Officer in the source data's organisation will need to be informed and can alert the patient if requested.

3.7.4 Information Sharing Agreements

Sharing for Care purposes will likely already be covered by the existing Information Sharing Agreements (ISAs) in place between partner organisations. However, the GNCR presents an opportunity to develop a common ISA template and to support the management of this. This work could potentially build on the Information Sharing Gateway (ISG) used to manage ISAs for the MIG. In addition, in relation to future data sharing for research analytics, it will be possible to draw on existing local experience in managing data access to major national/international cohort studies for compliant data sharing.

3.7.5 Readiness for up-coming legislation

- GDPR (General Data Protection Regulation)[8] being introduced in 2018 will place greater rigour on the granularity, usability and understandability of patient consent. Without a tool such as the GNCR, this would place a high burden on data controllers (often in practice the care professionals themselves) to explain and offer choices to the patient. Audit trails and history of accesses made will also be required and could also be provided to the patient via the GNCR portal. This presents an opportunity for the GNCR to support the region in compliance with this new legislation when it arrives.
- Caldicott 3 guidance was announced in 2016[9], with the key development of an "opt-out" rather than opt-in approach to patients consenting to their data being used beyond their direct care. The guidance leaves some exclusions such as disease registers and statutory functions, and creates some grey areas for researchers. For GNCR purposes, the architecture should be able to provide for opt-in or opt-out defaults and will allow transparency for the patient that would otherwise not be possible with conventional disparate systems.

3.7.6 Governance arrangements for IG

A clear theme in all interviews and workshops has been the need for an appropriate governance structure to be in place. This must avoid adding bureaucracy where possible but ensure that there is clarity between roles at regional, locality and individual partner levels. This is addressed in Section 6.

[8] https://ico.org.uk/for-organisations/data-protection-reform/overview-of-the-gdpr/introduction/
[9] https://www.gov.uk/government/publications/review-of-data-security-consent-and-opt-outs

3.8 Architecture Interfaces to additional services

The platform must also be able to interface at the 'Search box' level to wider third party technologies such as publishing and subscribing to/from HealthVault, Genomics England etc.

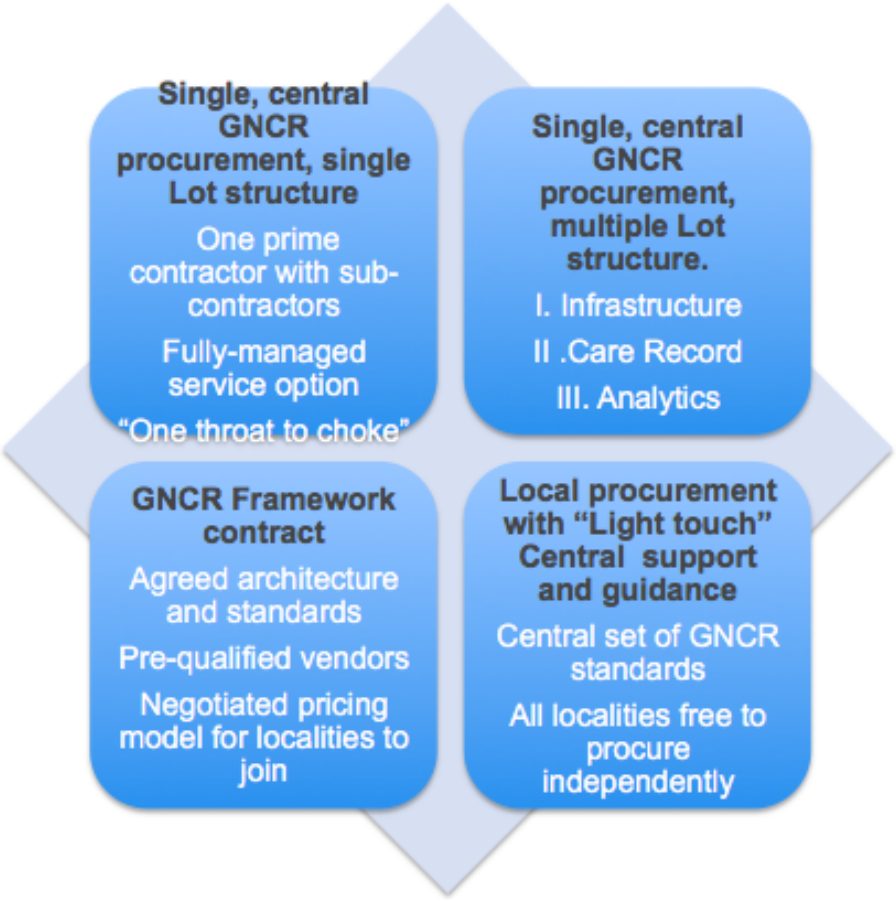
This can be achieved with APIs and standards adherence as outlined in earlier sections, but will also have implications for patient consent preferences and authentication for data security.

4 Potential Supplier Assessment

4.1 Commercial Strategy

Four basic routes to procurement were considered as part of the Options Appraisal workshop session:

Figure 21 : Potential procurement approaches



From these, the proposed option to achieve the GNCR is for a single, central GNCR procurement, single lot structure, with one prime contractor for the GNCR responsible for all subcontractors and the delivery of the GNCR as a fully managed service for additional infrastructure/services to allow information exchange between existing systems/services for managing the 'publish and subscribe' relationship in a consistent manner for sharing data across the region. An alternative and viable option is for the HIE Gateway and

Ark to be split and procured separately as long as the suppliers provided a clear approach to interoperability and data sharing between their platforms.

Additionally, it was clear from those that attended the workshop that the GNCR should not be a traditional procurement where a long set of detailed requirements are pre-known, and will therefore need more of a developmental relationship. The consensus was that detailed requirements would not differentiate the proven vendors or improve the selection process, but would just serve to delay procurement. Consequently, a partnership which should include some form of investment or risk share relationship along with the agreed high-level guiding principles (see Section 4.2) should be used for primary supplier selection.

An innovative approach will be sought from suppliers which allows for a limited competition, exploratory requirements and co-design with potential future IP sharing. In recent years' innovation of procurement has become more closely aligned with relevant EU legislation and schemes, supported by AHSNs in terms of developing partnerships and helping such procurement schemes move forward at a regional level. Currently there are four main schemes available to NHS organisations that can be used to support procurement of innovation. These are:

- Pre-Commercial Procurement (PCP), which focuses on procuring innovation R&D and shares the risks and benefits of doing this between the procurer and the supplier
- Public Procurement of Innovation (PPI), which focuses on supporting early adopters of innovation and helping them bring these products to market quicker
- Innovation Partnership, which is effectively a combination of PCP and PPI into a single scheme enabling the procurement of research, development and service delivery through a single procurement. This was believed to be the mostly likely option during the workshop discussion.
- Normal NHS procurement routes, which can be used to purchase innovation that is already well proven in the marketplace.

Such schemes are critically important to overcome many of the barriers to procuring innovation which include the separation of design and implementation stages, lack of incentives, restrictive and complicated regulations and lack of procurement skills.

In addition, several discussions have been held informally with potential vendors to establish the viability and interest in potential models and options. These vendors are listed later in this section.

4.2 Guiding Principles for Vendor Selection

The table below highlights some guiding principles that will inform vendor selection.

Table 3 : Summary of principles for Vendor Selection

Vendor Selection Principle	Description
Open culture	The culture and approach of a suitable vendor should be characterised by an open approach. This does not necessarily mean open source, but at least the supplier must demonstrate a willingness to interoperate, to collaborate and to embrace open standards throughout.
Support an Ecosystem	The Vendor should provide a commercial and technical ecosystem at a future point in time,

	allowing: • Innovative start-ups / SMEs / researchers to build and share apps on the platform with optional revenue models • Provide easy access to consented patient data to enable App development support, SDKs tools etc.
Agile	The Vendor should be adaptable and offer a scalable business model / service model to match the technology platform. There could be a lead vendor heading a consortium of several delivery partners as it is believed no one vendor can meet the full needs.
Portable and repeatable	Wider than just the current region, the vendor should allow for national replication and align with the current NHS Digital reference architecture which was under development at the time of this report.
Track record	The Vendor must have a reputable track record. In addition, they: • Should be able to show delivery in similar settings • May not be from "the usual suspects" (could offer international experience) • Should be able to demonstrate delivery within the available budget envelope • Should be willing to consider risk sharing and commercial innovation.
Patient as a stakeholder	Patients should be able to access, annotate and enhance their data, including consent, as a core part of GNCR. In addition, patients should be considered part of the stakeholder partnership and therefore the Vendor must be able to show ability to or experience with consumer-friendly design and service provision, including consumer consultation on design.
GNCR as a Service	The GNCR Service must be able to pull together and deliver the current in process and new innovative programmes starting from year one on an architecture that ensures basic requirements like N3 and HSCN connectivity, along with the ability to deliver the vision of a data Arc that supports multiple consent driven data safe havens for a wide variety of research and analytics use cases.
Willingness to invest	In the spirit of a partnership, the vendor should be prepared to consider an investment to fund / co-own the solution and deliver the service as part of a risk share model.

4.3 Insights from potential suppliers

4.3.1 General approach

Potential suppliers offer significant differences in approach, ranging broadly from 'traditional proprietary' models that tend towards creating large, centralised data stores, through open source models building on the OpenEHR platform, to pure integration models based on Integrating the Healthcare Enterprise (IHE) standards extending the concept of an Integration Engine or Portal to cover a large geography and set of organisations.

It was agreed that in addition to the guiding principles, suppliers needed to support the following core set of capabilities to be considered as a potential primary partner to deliver the GNCR service:

- Support a hybrid federated architecture
- Support a wide range of Open API's based on IHE (www.ihe.net) international standards such as FHIR, DICOM, XDS and CDA
- Use a common consent architecture that is compliant with Caldicott 3, ICO Guidance on Consent and GDPR recommendations, which operates consistently and in real-time no matter who, when or where the patient data is being accessed
- Provide a consent enabled normalised supplier neutral clinical repository for research, analytics and other secondary use in adherence to Caldicott 3
- Demonstrate existing analytical applications, such as Population Health
- Demonstrate openness through the ease of integration with any another supplier's platform
- Support at a minimum the following services components:
  - Record and Document Locator
  - Identity and Role Management
  - Master Patient Index
  - Master Demographics Services
  - De-Identification Engine
  - Terminology services with support for standards like SNOMED CT
  - Data Landing and Curation Services to ensure normalised data for research and analytics
  - Data Extraction Services with prebuilt capabilities to securely integrate research platforms like TransMart[10]
  - Alert Engine
  - Rules and Workflow Engines that can incorporate guidelines like those from NICE
- Provide a Platform as a Service that:
  - operates on the Health and Social Care Network (HSCN)
  - Ensures that identifiable data for care is managed separately and securely from de-identified data for secondary use in the Ark

[10] http://transmartfoundation.org/

- Scales beyond the 3.6 million people in the North East with sub second response time across all clinical care use cases.

4.3.2 Supplier summary assessment

Due to the large number of suppliers that offer Health Information Exchange (HIE) and Research and Analytics solutions, and the available time for this work, we focused our research and interviews on suppliers that:

- Met the guiding principles and core capabilities outlined above
- Offered innovative approaches or technology that might be lacking from other suppliers
- Have a relevant footprint in the region
- Have significant UK or global references.

Table 4 represents the long list of the suppliers with whom we engaged as part of this work. It is not meant to be an exhaustive list and represents an initial long list of potentially relevant suppliers based on the above criteria, our previous experience and publicly available information. In addition to the suppliers in Table 4, there are many others with a proven track record (such as Patients Know Best (PKB) for patient engagement and collaboration and Aridhia and for analytics and research) that can provide value added services as part of a secure and open eco-system operated by the Primary supplier.

The short list of suppliers has been determined based on those that meet most of the guiding principles and core capabilities and are likely to be able to enter in a partner relationship including investment and/or risk share. In some cases, a supplier was shortlisted because their solution can be offered by a partner or consortium lead who was not on the long list (such as the large System Integrators). The shortlisting process is not meant to replace a more detailed supplier selection process as would be undertaken during procurement, rather to give the CHC an indication of the suppliers who would most likely respond positively to further requests for pre-procurement activities.

Table 4 : Summary Supplier Assessment

Supplier Organisation	GNCR Relevance	Interviewed	Short Listed (Primary)
AIMES Grid Services CIC	• Working on the NW CHC program with notable success delivering analytics • Proven experience deriving data services to the NHS and beyond	Y	N
Arjuna	• Standards based middleware solution that incorporates distributed consent management • POC in process in the NE	Y	N
Caradigm	• A comprehensive population health management platform • Platform includes core services like Identity Management in use across the NHS	Y	N
Cerner	• Provides a globally proven HIE and	Y	Y

	Population Health Platforms • Large UK customer base including a GDE in the NE region		
Endeavour Health / Discovery	• Provides a supplier neutral data access service that is designed to enable access to data by other systems and suppliers access being under the direct control of local NHS organisations that own and share the intellectual property of the technologies within the service • Discovery is under development in collaboration with East London NHS Organisations	Y	Y
Graphnet	• Provides a shared care record solution for use by patients and clinicians with the ability to support analytics such as population health • Large UK only customer base with several GNCR like programmes in process	Y	Y
IBM	• Able to support IHE standard HIE partnership with ForCare, combined with robust research and analytics platform • A varied set of references available that are relevant to GNCR	N	Y
InterSystems	• Provides a globally proven HIE and Analytics Platforms • HIE component services in wide use across the UK including the NE	Y	Y
Marand	• Provides a high-performance solution designed to store, manage, query, retrieve and exchange structured electronic health record data based on the latest release of openEHR, a Vendor-neutral structured clinical data repository (CDR) • Several GNCR size international references, starting to gain traction in	Y	Y

	the UK with several POC's underway		
Microsoft	• Provide vendor agnostic cloud hosting services and the ability to give the patient control of their data on a local, regional and national level including patient generated data • Can meet the wider HIE and Analytics requirements through partnership with some initial UK examples	Y	Y
MphRX	• Provides a globally proven HIE and Analytics Platform • Proven in the US and new to the UK market, distributed by NTT Data	Y	Y
Oracle	• Provides a globally proven HIE and Analytics Platform • Limited UK references with global references at the scale of the GNCR	N	Y
Operon System	• Provides a cloud hosted implementation of the emerging UK open architecture standards for Electronic Health Records (EHRs) • Focused on smaller providers and would need a strategic partner for the GNCR	Y	N
Orion Health	• Provides a globally proven HIE and Analytics Platform • Several UK NHS Trust customers including one in the NE	Y	Y
Quicksilva	• Provides systems integration and messaging services • Strong capability around Spine services including in the NE, could support GNCR suppliers	Y	N
Stalis	• Specialists in Electronic Integrated Care Records and NHS Data Migration • CareInform solution is based on CareXML (data extraction, data integration, data quality assurance and data transformation)	Y	N

Synapps + Alfresco	• A system Integrator working with several open source suppliers • UK references are focused primarily on document sharing	Y	Y
Tiani Spirit	• Provides a globally proven open HIE and Analytics Platform • Proven global customer base with several UK references and partners	Y	Y

4.3.3 Implications for GNCR

The GNCR represents the digital platform required to enable a learning healthcare system across the North East and provide interoperability with the rest of the UK. The delivery of the GNCR is a complex programme that will take several years to deliver and is made up of many different stakeholders with a myriad of different requirements, digital maturity, expectations and capabilities. Like all digitally enabled transformation programmes the more moving parts (like the number of systems and vendors), the more complex the delivery becomes, along with greater costs and risks to achieve success.

The challenges of programmes like the GNCR has been well documented through many articles and white papers of similar programmes throughout the world, and the costs of such programs are as varied as the approach. Table 5 represents a few similar non-U.S. programmes to give an idea of the scale and cost of effort required to transform care with an enabling digital platform.

Table 5 : International Examples of Region Wide Shared Care Record Programme

Country	Program	Costs	Source
Australia	My Health Record (previously known as the Personally Controlled Electronic Health Record (PCEHR))	It was budgeted to cost AU $466.7m but had surpassed this to AU $766m before the actual launch date with the final figure still to be calculated • £285 million • 5 million people in the initial go live of a 23 million population • Scope is a subset of GNCR	Greenwood, Stephen. Political capital: The electronic health record challenge. AJP: The Australian Journal of Pharmacy, v.93, no.1103, Apr 2012, p.18-19 (ISSN: 0311-8002) Hilvert, John. NEHTA shrugs off health records patent threat. itNews, 14 February 2013 https://myhealthrecord.gov.au/internet/mhr/publishing.nsf/content/home
Singapore	National	SGD 117 million as of	https://www.moh.gov.sg/content/

	Electronic Health Record (NEHR)	2011 • £67 million • 5 million people • Scope like GNCR	moh_web/home/pressRoom/Parliamentary_QA/2010/Update_on_the_National_Electronic_Health_Records_System.html
Sweden	Swedish health IT project - national patient data access	A cost of SEK 628 million to keep the platform going • £56 million • 10 million people • Scope like GNCR	https://skl.se/download/18.3a347c0515aeb6522634dc08/1490345825715/Bilaga+6+-+Inera_arsrapport_2015.pdf
Slovenia	Moving HIS applications to central eHealth platform	By 2023, the total investment was expected to grow to 133 million Euro • £113 million • 2 million people • GNCR scope is a subset of the program	https://joinup.ec.europa.eu/community/epractice/case/slovenia-moving-his-applications-central-ehealth-platform

The GNCR's population of 3.6 million cover a wide geography with a highly fragmented and diverse number of existing suppliers, several of whom can fulfil the primary supplier role, resulting in no clear or obvious choice. Ultimately the costs, willingness to invest and partnership structure will be key to selecting the primary supplier.

The true cost of the GNCR is difficult to estimate at this stage of the process due to the following factors:

- The supplier interviews, information provided and market research highlights the many ways suppliers price their offering, making a comparable calculation impossible
- Integration will be one of the most complex and costly factors of delivering the GNCR and that effort goes beyond the scope of this report

Considering the limited supplier pricing available at this stage of the process, and extrapolating from public information and our experience with other similar programmes, we believe the total cost for the GNCR over a 10-year period would be between £36 million and £56 million based on a cost of £10 to £15 per person respectively, which would average out to £3.6-5.6 million annually (though there would be more implementation costs in the first three years). This costs includes not only the GNCR platform but the wider programme management, governance, change management and wider costs to deliver and operate the GNCR Service in support of the STP's and emerging MCP, ACO & ACS models, underpinning the overall transition to value or outcome based healthcare.

Estimated pricing from the suppliers that did respond were in the range of £5 million to £15 million for the GNCR platform as a service over a 10-year period which would average out to £500,000 to 1.5 million annually (though there would be more costs in the first three years due to one-time implementation and integration costs). The actual costs are expected to be at the high end of the range based on similar programmes internationally.

This cost estimate does not include all the additional suppliers that will be able to connect to the GNCR over time for a wide range of additional use cases that will require their own business case, some of which cannot even be imagined today,

5 Benefits Assessment

The following non-exhaustive list summarises the GNCR benefits identified form the process of interviews and workshops carried out in this project. Additional benefits have been identified from a brief review of the Local Digital Roadmap plans across the North East, and it is clear from an analysis of local STP plans that the development of Accountable Care Organisations or Systems (ACOs / ACS') cannot be delivered without the GNCR platform.

Table 6 : GNCR Benefits Summary

Benefit description	Use case	Kind	Scope
Prevention of wasted home visits by being notified that service user has been admitted	Care record	Efficiency	Locality / region-wide
Fewer wasted tests upon patient transfer through improved transfer of care process with real time information sharing	Care record	Efficiency	Locality / region-wide
Reduction in costs for items like stamps in support of the current manual paper based process	Care record	Efficiency	Locality / region-wide
Avoidance of medication errors and over-prescribing by improved medicines management across all care providers	Care record	Patient safety, efficiency	Locality / region-wide
Faster discharge process from acute to social care reducing length of stay and increasing flow	Care record	Efficiency	Locality / region-wide
End of life care pathway that better respects the patient's preferences	Care record	Service improvement,	Locality / region-wide

		efficiency	
Reduced errors in patient records by streamlined and transparent process for flagging and correcting	Care record	Patient safety, efficiency	Locality / region-wide
Improved detection and reporting of potential abuse through sharing of risk flags	Care record	Patient safety, efficiency	Locality / region-wide
Reduction in delays to patients receiving treatment in an emergency	Care record	Patient safety, efficiency	Locality / region-wide
Improved access to the full care record of the patient, independent of the setting of care, to improve clinical decision making	Care record	Patient safety	Locality / region-wide
Reduced hospital admissions through access to previous patient history, including diagnostics	Care Record	Patient safety, efficiency	Locality / region-wide
Improved patient experience through not having to repeat clinical and demographic details	Care Record	Patient experience	Locality / region-wide
Better support for integrated care and long term condition management (joint assessments etc.)	Care Record	Patient safety, efficiency	Locality / region-wide
Access to larger and more up-to-date datasets for research	Analytics	Service improvement	Region-wide
Ability to record link information from routine information systems to more detailed specialist research data (e.g. from cohort studies) will produce much richer (as well as larger and more-up to date) data for research	Analytics	Service improvement	Region-wide
Reduced avoidable mortality through predictive analytics	Analytics	Service improvement, efficiency	Locality / region-wide
Improved demand management for ED services through near-real time analytic monitoring of leading indicators	Analytics	Service improvement, efficiency	Region-wide
Improved population health planning	Analytics	Service improvement	Region wide
Improved risk stratification of patient cohorts for targeted interventions including clinical trials	Analytics	Service improvement, efficiency	Locality / region-wide

Reduced costs of record integration compared with piecemeal approach	Care Record / Analytics	Cost improvement	Locality / region wide
improved economic prosperity derived from local impact on industry directly through participation and indirectly by better care management and availability for work	Care Record / Analytics	Service improvement, patient experience	Locality / region wide

5.1 Principal beneficiaries

Beneficiaries include:

- Patients and carers / families
- Care professionals in all settings and roles
- Care provider organisations in terms of efficiencies and patient / client safety improvements
- Care commissioners in efficiencies and improved outcomes
- Research community, in terms of improved quality of data and potential for greater impact.

5.2 Quantifiable benefits

Measurable benefits are difficult to quantify due to the lack of mature examples of similar systems and lack of details around the scale of GNCR footprint. Once some assumptions can be made for numbers of patients, levels of activity and numbers of organisations included, then substantial levels of efficiencies and savings should be quantifiable.

6 Governance and Service Management Arrangements

This section considers the required governance arrangements for the platform going forward in terms of ownership, setup and on-going service management, delivery vehicle and governance arrangements.

6.1 Options considered

Several possible governance models were considered in terms of:

- Custodianship - who will be responsible for the care record service, system and data?
- Service management – who will manage the underpinning architecture and the service associated with delivering the shared care record?
- Delivery - how will the service be delivered and supported in practice? In particular, "Who do you call" when there is an issue?

- Governance - what will be the data and service governance arrangements in terms of performance management against SLAs, its funding, legal aspects, and Information Governance responsibilities?

Options under each of these factors were considered against a set of criteria in an Options Workshop, and options were eliminated where they failed to meet the criteria.

However, as the factors are closely inter-related, rather than select a preferred option against each factor, a single preferred solution was agreed at the end of the workshop.

6.1.1 Ownership options

Ownership options considered were:

- A new joint-ownership vehicle such as a limited company or social enterprise
- A hosted entity within an:
  - existing NHS organisation
  - existing local authority organisation
  - academic institution
  - other existing local body (such as the AHSN).
- A vendor-owned service
- Existing national organisation, such as NHS Digital.

6.1.1.1 Ownership criteria

The workshop concluded that the optimum ownership model needs to possess the following characteristics:

- Ability to procure directly to reduce delays
- Legislative compliance (carry legal authority as an entity), including IG and Data Handling
- Ability to mandate that all partner organisations sign up
- Able to start quickly, avoid delays due to disputes and undue bureaucracy, and has sufficient authority / mandate to start the programme
- Not for profit to avoid public misconception.

6.1.1.2 Ownership options eliminated

A vendor-owned entity was eliminated as this could face public perception issues as a 'for-profit entity'. A national organisation may not be 'ready to start', although could eventually take over the ownership of the service.

6.1.2 Service management options

Service management options considered were:

- Fully in-house service
- Partially managed service (small central function)
- A fully managed service such as an outsourced partner.

6.1.2.1 Service management criteria

The service management function will need to cover the following:

- A minimum skillset at the core to act as an "intelligent customer" for a partial or fully managed service.
  - Ability to pull-in seconded NHS skills where needed
  - Outsourcing contract management
  - Set standards
  - Manage the development and service roadmap.
- Ability to act as the Design authority, covering:
  - Principles
  - Standards
  - Frameworks.
- Communications, ensuring consistency of message
- Data protection, legal and compliance, including insurance / Indemnity
- Carry responsibility for (even if delivery outsourced):
  - Infrastructure
  - Applications
  - Data.

6.1.2.2 Service management options eliminated

The fully-managed option was eliminated as the need to retain skills and oversight in-house were considered by the workshop attendees to be too important. The fully in-house model was also considered unlikely to be able to meet all the requirements for specialist skills and experience.

6.1.3 Delivery model options

Delivery models considered were:

- Multiple local NHS Organisations
- Single NHS Organisation (Hosted)
- NHS Shared Service (Hosted)
- NHS Owned Joint Ownership Company
- Outsourced third party.

6.1.3.1 Delivery model criteria

The delivery model must:

- Be an agile vehicle, suited to disruptive innovation
- Ensure appropriate governance arrangements
- Can deliver the set-up / transformation programme
- Offer efficient and effective delivery of on-going "business as usual" (BaU) services.

6.1.3.2 Delivery model options eliminated

Delivery by multiple organisations was eliminated as this approach would be unlikely to mobilise efficiently or offer the required agility. Delivery by an incumbent organisation was felt unlikely to bring the required disruptive innovation. The Innovator's Dilemma[11] demonstrated that well-performing incumbent organisations are rarely best placed to drive the level of disruptive innovation that the GNCR will introduce.

6.1.4 Governance options

Governance arrangements considered included:

- Single NHS organisation's Board
- Partnership Board (e.g. CHC, AHSN)
- Federation Board
- Joint Ownership Company Board
- Standards Body ("light touch" only).

6.1.1 Governance option criteria

Governance arrangements must:

- Show and use clear lines of accountability
- Provide adequate assurance of governance over the service management arrangements to meet the requirements of members
- Must be resilient to change as new members join and others withdraw over time
- Provide assurance of equity towards all members' requirements
- Allow for eventual de-commissioning.

6.1.4.2 Governance options eliminated

The light-touch standards body would be unable to meet the requirements which extend far beyond simple standards assurance. A single NHS organisation's board, while appearing to offer a ready-made solution, would not be perceived as equitable to all members (especially to local government and academic stakeholders) and would in practice be unlikely to be able to offer capacity for the function in addition to its existing duties.

6.2 Preferred solution

Following discussion, it was clear that the options identified had a high degree of interdependence and therefore a combined solution was proposed.

6.2.1 Preferred ownership model: a joint ownership vehicle

The consensus preferred ownership model was for a joint-ownership vehicle to be formed for the dedicated purpose of leading development of and overseeing the delivery of the GNCR. This vehicle would be owned by the stakeholder / member organisations, and would have appropriate articles of association, policies, procedures, management controls, indemnities and safeguards in place to meet statutory requirements.

[11] "Innovator's Dilemma: When New Technologies Cause Great Firms to Fail", Clayton Christensen 1997

This company could take the form of a social enterprise or similar structure. Whatever the legal structure, it was agreed that this should be a not-for-profit entity to avoid both public misconception and possible tax liability.

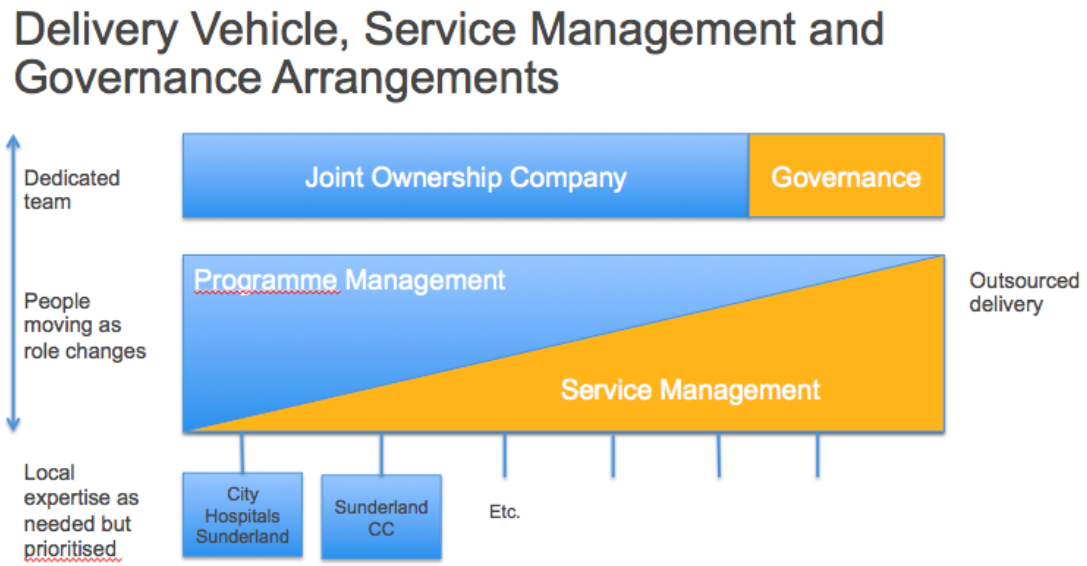
It was noted that the Academic Health Science Network could assume this role, although its membership currently does not include all the GNCR stakeholders.

6.2.2 Preferred Service management and delivery solution

The joint-ownership company would operate as a partially outsourced service retaining its core central functions and governance.

The diagram below illustrates how the activities and resources of the delivery vehicle will evolve from an initial development programme to a service management model as the service becomes operational and shifts to Business as Usual (BaU) over time.

Figure 22 : Summary of the proposed Delivery Vehicle arrangements



During the setup and transformation phase, the delivery vehicle will focus on Programme Management, using a Programme Management Office (PMO) to drive delivery via temporary teams with appropriate technical, business change and commercial procurement skills and experience.

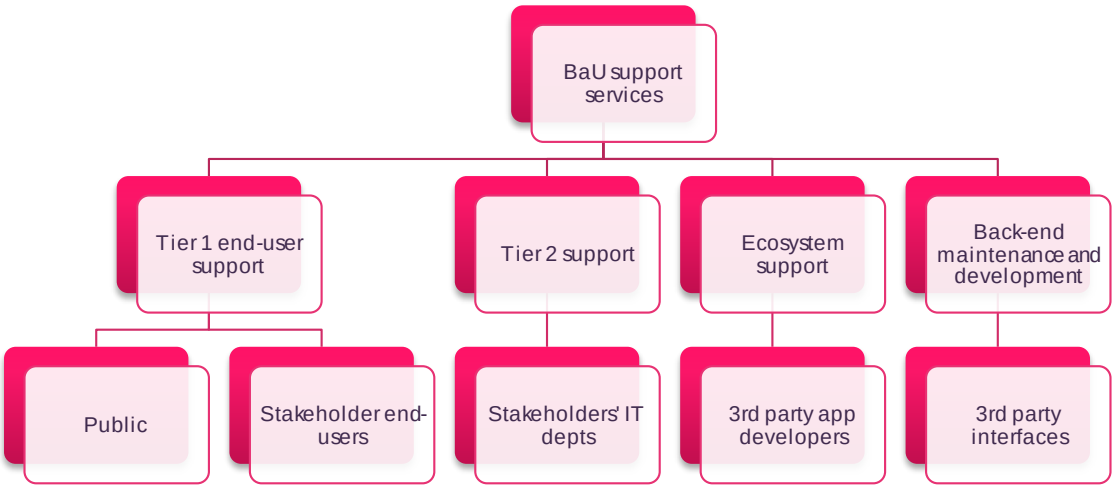
Once the service is operational, a "business as usual" or BaU service management capability will be required. This would cover:

- End user support, which would need to be "tier 1" (customer facing) for end users directly using the GNCR tools (i.e. care professionals and researchers)
- A "tier 2" service to the individual stakeholder organisations' in-house ICT support teams for matters concerning GNCR being accessed through or integrating with local systems
- Public user support for patients directly accessing the GNCR portal
- Back-end maintenance, system administration, development, upgrades and testing
- Interfacing to new feeder systems and third parties

- Supporting the ecosystem such as app developers building on GNCR APIs.

The diagram below illustrates this model.

Figure 23 : Proposed Business as Usual Service Management Model



6.2.3 Resourcing

The delivery vehicle could be resourced by a combination of outsourced specialists (especially during the setup and transformation phase) with expertise from the local stakeholder community as required, either on a secondment or a consultative basis.

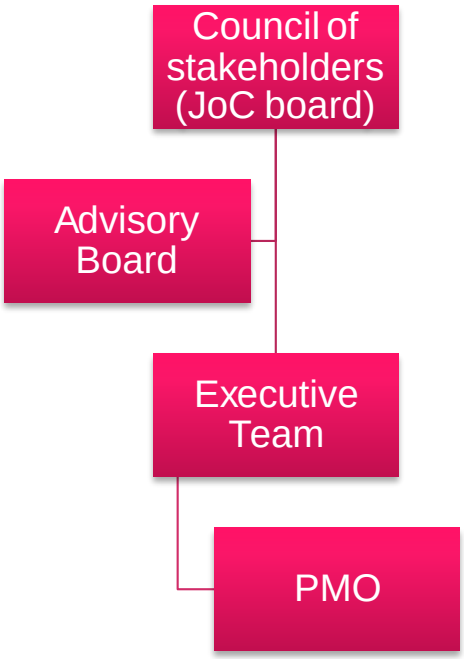
Resourcing for BaU operations can either be outsourced to the selected vendor partner or built as an in-house team. This decision can be made as part of the commercial workstream during the setup and transformation phase.

6.2.4 Preferred governance arrangement

The Joint Ownership Company Board would act as the statutory group for governance, but this would take the form of a Partnership Board style of operation along the lines of the CHC and the AHSN.

The Options Workshop proposed a more detailed governance structure. The diagram below summarises this initial structure, which would evolve as the service is developed and moves into BaU:

Figure 24 : Proposed initial GNCR governance structure



- The Council of Stakeholders would set the direction, with a clear vision and benefits realisation strategy.
- The Advisory Board could bring academic, clinical, technical and commercial expertise to support strategic planning
- The Executive Team would be empowered with the autonomy to act and report back to the Council
- The Programme Management Office (PMO) would lead project and programme management, so that the service setup and transformation is delivered to ensure benefits are realised in line with the benefits realisation plan.

6.3 Potential funding arrangements

At present, funding sources could either be central or local (i.e. "top-down" or "bottom-up"). Individual STPs may be able to fund local care record developments although the timescales and budgetary challenges make this option unlikely.

Various central funding options may be available for CHC to "kick start" the GNCR, but again these options carry risks and uncertainty around timing and budgets which would present major constraints and dependencies on the GNCR moving forward.

The recommended funding route therefore would be to seek vendors willing to finance the programme directly. Various shared business models can be explored, either with full or part repayment over the lifetime of the contract, or via shared IP and replicable sales of the co-designed solution nationally and internationally.

This route does not preclude the local or central funding models to also contribute, but ensures that momentum is not lost.

7 Project Plan

This section recommends a high-level roadmap for the next two years to set up and implement the GNCR. The suggested approach is based on a proven process used in numerous large-scale collaborative innovative development programmes.

However, GNCR alone will not drive efficiencies and improvements to care without being underpinned by a well-coordinated change programme. This will position GNCR to become a key enabler of the wider transformation programme in support of the delivery of the aspirations of the five-year forward view and new models of care delivery.

7.1 Workstreams overview

To simplify programme management, activities in the first two years can be grouped under the following four recommended workstreams:

- Governance: Establishing the new legal entity, setting up the programme management office (PMO) and mobilising the procurement process
- Commercial: Including pre-commercial supplier engagement to support selection of a strategic partner, and developing a joint business model to finance the development and roll-out of the GNCR
- Implementation: Starting with a Design Authority, this will involve co-designing the technical platform with the lead supplier through a series of agile "sprints" to develop, test and deploy in a measurable and incremental process
- Communications and engagement: To ensure buy-in from data controllers (especially in primary care) as well as the public and other key stakeholders, including the third sector.

Each workstream will require a different skillset and can comprise a mix of core team plus seconded staff from stakeholder organisations and bought-in expertise as needed.

It should be noted that Information Governance is a cross-cutting theme that will impact on all four project workstreams, and will be incorporated into the relevant workplans of each workstream as required.

Figure 25 : Summary Project Plan for GNCR development

GNCR Roadmap v1	2017-18				2018-19			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Governance								
Initiation								
Monitoring								
Review								
Commercial								
Business case								
Procurement								
Contract negotiation								
Monitoring								
Implementation								
Design								
Development								
Roll-out								
Communications								
Mobilisation								
Delivery								
Monitoring								

7.1.1 Governance workstream

The governance workstream will contain the following activities:

7.1.1.1 Initiation

Governance will start with an Initiation phase in Q1 and Q2 2017/18. This will cover:

- Appointing a Programme Director to oversee programme delivery, and Workstream Leaders for each of the four workstreams
- Establishing the Programme Board, with stakeholder-representative membership, appropriate Terms of Reference, Benefits Realisation Plan and a Programme Definition Plan.
- Establishing a Programme Management Office (PMO) to run and co-ordinate day-to-day activities
- Legal preparation towards the new delivery vehicle
- Establishing the Joint Ownership Vehicle.

7.1.1.2 Monitoring

Once operational, from Q3 2017/18 onwards, the Governance workstream (via the PMO) will perform regular monitoring of the overall programme against budget, timescales and quality metrics.

7.1.1.3 Review

From Q3 2017/18 onwards, the Governance workstream will measure progress against the Benefits Realisation Plan.

7.1.2 Commercial workstream

The commercial workstream will consist of the following activities:

7.1.2.1 Business case

Regardless of whether central funding can be identified or if a vendor may be willing to finance the GNCR, a full business case is necessary to ensure an auditable process has been followed. Even with central or vendor funding, each stakeholder organisation will incur direct capital and revenue costs as well as needing to allocate staff resources to the design and implementation phases. A solid business case will ensure that appropriate staff time and money are allocated.

A Strategic Outline Case will need to be prepared and approved firstly by the Programme Board, which in turn will need to seek authority from the stakeholder organisations to go ahead.

Following approval, an Outline Business Case (OBC) can be quickly prepared based on the work in this study to demonstrate the strategic, economic, financial, commercial and management cases for the full investment required. This can be used by each stakeholder organisation for approval through its respective executive team, board and appropriate finance committees. If required, this can also be passed to NHS Improvement (NHSI) for approval.

A Full Business Case will follow once the preferred vendor has been appointed and accurate cost and benefits models have been created. Again, this can follow the approval process for each stakeholder, including NHSI and NHSE if appropriate.

7.1.2.2 Procurement

This activity will follow an appropriate route from the options described in Section 4.1 (such as Innovation Partnership or Pre-Commercial Procurement), subject to vendor discussions and approval of the OBC.

7.1.2.3 Contract negotiation

At the end of the procurement process, a period is allocated for vendor negotiation, considering the large number of stakeholders and the potential for an innovation value proposition. It is envisaged that negotiations would be led by the Commercial Workstream Leader.

7.1.2.4 Monitoring

For the remainder of the programme duration, the Commercial Workstream will revert to contract monitoring, ensuring that the appointed vendor(s) deliver in line with their contract, and that the GNCR and its stakeholders meet their obligations to avoid any potential penalties.

7.1.3 Implementation workstream

Although this workstream is primarily technical, it is recommended that a multidisciplinary approach be taken, combining technical leadership with strong care professional and researcher engagement at all stages.

7.1.3.1 Design

The Design phase will involve establishing a Design Authority to establish standards, best practice, set up user engagement and advisory groups, and to map out the development process in more detail. Much of this work can commence prior to appointment of the vendor to avoid delays later in the programme.

7.1.3.2 Development

To maximise innovation, an agile development approach is recommended, using 'sprints' as a method to 'build-measure-learn' rapidly, involving clinicians, researchers and developers working intensely to solve well-defined use cases.

In parallel to this approach, the more conventional build process can get underway to customise / create local instances of the vendor's tools and platform.

Integrations / connections with key feeder systems can be run systematically based on an agreed Connection Strategy, with a consistent and rigorously applied sign-off process.

7.1.3.3 Roll-out

It is recommended that roll-out be planned on a locality-by-locality basis. Although the high-level roadmap suggests roll-out not to start before Year 2, in practice the development activity may deliver working instances ahead of this for the initial localities.

7.1.4 Communications and engagement workstream

The communications workstream will consist of the following activities:

7.1.4.1 Mobilisation

Mobilisation will include:

- Appointing PR and media partners/suppliers
- Developing and agreeing initial messages
- Designing an Engagement plan and press plan
- Using social media and stakeholder's existing networks to maximise reach to the general public.

7.1.4.2 Delivery

From Q3 2017/18 onwards, the workstream will move to delivery against the plan, engaging with the public, project stakeholders and the press as appropriate.

7.1.4.3 Monitoring

As part of the engagement plan, a monitoring plan will be needed to measure and monitor reach and gain feedback so that action can be taken where necessary to rebalance channels / messages as necessary.

7.2 Key milestones

In summary, the key milestones in the roadmap are as follows:

Table 7 : Summary of Key Project Milestones

Milestone	Due	Workstream
Programme team appointed and mobilised	June 2017	Governance
Joint ownership company established	Sept 2017	Governance
OBC approved	June 2017	Commercial
Preferred supplier appointed	Dec 2017	Commercial
High level solution design signed-off	Dec 2017	Implementation
First digital care record use case live	June 2018	Implementation
First analytics use case live	Sept 2018	Implementation
All localities live with digital care record	Mar 2019	Implementation
Initial communications issued	June 2017	Communications
Programme benefits announced	Sept 2018	Communications

7.3 Risks and risk management

The table below summarises the high-level risks in this project. These have been mitigated as far as possible in the design of the workstreams, and will need to be monitored and managed by the Programme Director and PMO.

Table 8 : Summary of Key Project Risks

Risk	Impact	Mitigation
Financial risks – mainly funding sources yet to be identified, solution unaffordable or	Delay	Explore supplier investment /

potential project cost overruns		financing
Commercial risks - value proposition with suppliers yet to be tested	Delay	Engage early in discussions
Governance risks – new structure yet to be setup and commissioned	Delay	Begin stakeholder exec engagement early
IG risks – mainly data controller acceptance, especially primary care	Delay	Effective communications and engagement
Technology risks around integration with closed platforms / existing suppliers not willing to open up their source systems	Delay, cost, project outcome	Begin supplier technical engagement early
User acceptance risks - Clinicians refusing to use the system for clinical decision making, researchers for research studies etc.	Delay, cost, project outcome	Strong user engagement in the implementation process.
Public acceptance risks - Concerns over privacy and data protection, system not easy to use etc.	Delay, cost, project outcome	Well planned communications and engagement plan
Data quality risks - Variable or poor data quality reduces system take-up	Delay, cost, project outcome	Undertake data quality audit for existing data as a matter of urgency
Service management risks - GNCR does not have appropriate levels of support in place to underpin clinical service delivery	Delay, cost, project outcome	Ensure appropriate service levels in place in the contract, including business continuity and disaster recovery planning

Appendix 1 Documentation Provided by CHC organisations

Individual Organisation	All CCGs	Newcastle and Gateshead CCG	CDDFT	TEWV FT	Hartlepool BC	Stockton BC	Gateshead Health	NTW FT	South Tyneside FT	NE Ambulance	Northumbria Healthcare	South Tyneside Council	City Hospital Sunderland	Sunderland CC	Northern Doctors	NECS
Shared Care Record																
Digital Strategy																
Clinical Systems List																
Workflow / pathway solutions																
System architecture																
Infrastructure																
BI / DW Tools																
Other Docs																
Information Governance																
DSAs																
PIAs																
FPNs																
3rd party processors																
IG Information Asset Register																
IG Toolkit																
ICO investigations / penalties																

LHC / STP Area	CHC Programme	Cumbria CCG	DDES, Darlington and ND CCG	Hartlepool and Stockton CCG	Newcasle and Gateshead CC	North Tyneside CCG	Northumberland CCG	South Tees CCG	South Tyneside CCG	Sunderland CCG
CHC Programme Level										
Stakeholder lists										
GNCR scoping / requirements										
GNCR Brief / PID										
Baseline mapping										
Project Governance										
Minutes of Project Meetings										
LDRs										
STP Plans										
Other system wide docs										
Health research projects										
System wide ISAs										
Cross-agency working										
Consent architecture										
Volumetric data										

Appendix 2 List of Project Interviewees

Name	Role	Organisation
Nick Booth	CIO	Connected Health Cities
Val Maddison	(Analytics)	NECS
Rick McLeod	(Analytics)	NECS
Chris Kewin	Deputy Head of IT	NECS
Brian Lonsdale	Head of IT	NECS
Lianne Cotteril	(IG)	NECS
Deborah Bowden	Transformation Delivery Manager	NECS
Jacqui Fawcett	Head of Programmes	NECS
Paul Calvert	Programme Manager	NECS
Maria Williams	Senior Project Manager	NECS
Darren Mckenna	Director of informatics	Northumberland, Tyne and Wear NHS FT
Farouq Din	Interim Associate Director of E-Health	Cumbria Partnership NHS Foundation Trust
John Fraser	(IT)	NUTH
Nick Black	Deputy Director of Informatics	Gateshead Health NHS FT
Darren Rigg	IG Manager	Gateshead Health NHS FT
Tracey Best	(IG)	Northumbria Healthcare
Mark Thomas	Director of Health Informatics	Northumbria Healthcare
Paul James	Technical Services Manager	Northumbria healthcare
Mark Holland	Tech PM	Northumbria Healthcare
Jon Gair	Head of Informatics - Infrastructure	Northumberland, Tyne and Wear NHS FT
Jon Potts	Infrastructure Manager	Gateshead Health NHS FT
David Thompson	Information and Development manager	Gateshead Health NHS FT
Alastair Beattie	Head of Information and Statistics	Northumbria Healthcare
Jonathan Harness	GP and CCIO	Newcastle & Gateshead CCG

Phil Stamp	(A&E consultant & CCIO	Northumbria Healthcare
Joe McDonald	Psychiatrist & CCIO	Northumberland, Tyne and Wear NHS FT
Gbenga Afolabi	Medical director	Northumbria Healthcare
Ben Kaner	Head of IT strategy	North Tyneside Council
Steph Downey	Director of Social Services	Gateshead Council
Janet Kelly	Matron	Northumbria Healthcare
Tony Naylor	AD ICT	North Tees and Hartlepool
Gillian Colquoran	AD for digital programmes	North Tees and Hartlepool
Andrew Izon	Director of Health Informatics	CDDFT
Gareth Forbes	GP partner, director of GP federation	Derwentside Healthcare
Graham Earl	Business Mgr and IT	Hartlepool and Stockton CCG
Neil Dobinson	IG Lead	North Tees and Hartlepool
Kai Sander	GP Clinical lead	Hartlepool and Stockton CCG
Stephanie El Malak	Delivery Suite Manager	North Tees and Hartlepool
Ian Saunderson	Informatics lead	Tees, Esk and Wear Valleys NHS FT
Richard Yaldren	Informatics Lead	Tees, Esk and Wear Valleys NHS FT
Paul Gibson	Interim Programme Manager	Sunderland CCG
Matthew Beattie	GP Clin Dir, LTC, NEAS – integrated urgent care hub NHS 111 service	South Tyneside CCG
Deanna Lagun	Head of safeguarding, designated nurse for child protection	Sunderland CCG
James Bell	GP, community integrated teams project in the west	Sunderland CCG
James Caroll	Chief of Information Security	South Tyneside FT
Scott Watson	Director of Contracting and Informatics	Sunderland CCG
Andy Hart	Director of Information management	City Hospitals Sunderland

Simon Joyce	Network Services Manager	City Hospitals Sunderland
Kathryn Walvin		City Hospitals Sunderland
Aaron Tucker		South Tyneside CCG
Sharon Lowes	Intelligence Lead	Sunderland City Council
Emma Anderson	Service Manager for Therapies	Sunderland City Council
Rachel Daurat	Adult Social Care Team Manager	Sunderland City Council
Kevin Joisce	ED Consultant, CCIO, Ass Med Dir	City Hospitals Sunderland
Chris Bartlett	Business Relations, ICT Unit	Sunderland City Council
Matt Thubron		Sunderland CCG
Mike Jarman	Head of Information Services	South Tyneside FT
Andrew Macin		Northern Doctors
John Mawson		Northern Doctors
Conn Crawford		Sunderland City Council
Andrea Adams	MCP Vanguard PMO	Sunderland CCG
Rachael Forbister	Technology Enabled Care services	Sunderland CCG
Florence ??	Palliative care clinical lead	Sunderland CCG
Chris Plummer	CCIO and consultant cardiologist	NUTH
Mark Lovell	CCIO and consultant psychiatrist (LD)	TEWV
Paul Nicholson	Director of IT	NEAS
Scott Wilkes	GP and Professor of General Practice	Sunderland University
Yvonne Salkeld	Head of IG	Cumbria Partnership
Mark Dornan	CCG Chair	NHS Newcastle Gateshead CCG
Mike Martin	Senior Research Advisor	Newcastle University
Ian Briggs		Connected Health Cities
Camila Caiado	Lecturer, Department of Mathematical Sciences	Durham University
Andrew Fisk	Information Security Project Advisor	Durham University
Rachel Oughton	Department of Mathematical Sciences	Durham University

Appendix 3 Requirements Workshop Attendees

Digital Care Record

Name	Organisation
David Oxenham	County Durham and Darlington NHS FT
Gareth Forbes	Derwentside Healthcare Ltd / NE Research Network
Ian Scholfield	NUTH NHS FT
Kevin Joisce	City Hospital Sunderland NHS FT
Kai Sander	NHS Hartlepool and South Tees CCG
Louise Wilson	Connected Health Cities Programme
Lynn Eddon	South Tyneside NHS FT
Lynne Thompson	NHS Sunderland CCG
Maria Williams	NECS
Matthew Alexander	Gateshead Health NHS FT
Paul Gibson	NHS Sunderland CCG
Phil Stamp	Northumbria Healthcare NHS FT
Richard Glennie	Northumberland CCG
Scott Watson	NHS Sunderland CCG
Steph Downey	Gateshead Council
Tim Goodship	Newcastle University
Trevor Smith	Hartlepool Borough Council
Mike Martin	Newcastle University
Ian Briggs	Connected Health Cities
Joe McDonald	Connected Health Cities
Kate Lambert	City Hospital Sunderland NHS FT
Mark Walsh	Connected Health Cities
Nick Booth	Connected Health Cities

System Architecture

Name	Organisation
Kathyrn Walvin	City Hospitals Sunderland NHS FT
Gillian Colquhoun	North Tees and Hartlepool NHS FT

Mike Jarman	South Tyneside NHS FT
Andrew Izon	County Durham and Darlington NHS FT
Lynne Thompson	NHS Sunderland CCG
Robert Graham	Gateshead Council
Conn Crawford	Sunderland City Council
Nick Black	Gateshead Health NHS FT
Paul Gibson	NHS Sunderland CCG
Paul Nicholson	NE Ambulance Service NHS FT
Carol Robinson	Gateshead Council
Trevor Smith	Hartlepool Borough Council
Laurence Thompson	NUTH NHS FT
Nick Booth	Connected Health Cities

Analytics and Research

Name	**Organisation**
Claire Toas	Newcastle City Council
Ian Briggs	Connected Health Cities
Nick Black	Gateshead Health NHS FT
Stephen Foreman	Newcastle City Council
Theodoros Bampouras	University of Cumbria
Tracey Best	Northumbria Healthcare NHS FT
Trevor Smith	Hartlepool Borough Council
Wendy Leanne Craig	Newcastle University
Nick Booth	Connected Health Cities
Dr. Stuart Wheater	Arjuna Technologies Limited
Jim Fraser	Durham University
Rachel Oughton	Durham University

Information Governance

Name	**Organisation**
Andy Brown	Redcar Cleveland City Council
Ian Saunderson	Tees, Esk & Wear Valleys NHS Foundation Trust

Keith Forster	Durham City Council
Lianne Cotterall	North of England Commissioning Support Unit
Neil Dobinson	North Tees and Hartlepool Hospitals NHS Foundation Trust
Tracey Best	Northumbria Healthcare NHS FT
Nick Booth	Connected Health Cities
Louise Eastham	Tees, Esk & Wear Valleys NHS Foundation Trust
Darren Rigg	Gateshead Health NHS Trust
Dr. Stuart Wheater	Arjuna Technologies Limited
Wendy Leanne Craig	Newcastle University

Appendix 4 List of Engaged Commercial Suppliers

Name	Role	Organisation
Dennis Kehoe	CEO	AIMES Grid Services CIC
Glenn Roberts	Sales	AIMES Grid Services CIC
David Farrell	Sales Director, Northern England	Orion Health
Gary Birks	General Manager – UK/Ireland	Orion Health
Andy Bratt	Director of Sales & strategy	Graphnet
Simon Cavell	CTO	Graphnet / System C
Brian Waters	CEO	Graphnet
Steve Caughey	CEO	Arjuna
John Neeson	Sales Manager	InterSystems
Ewan Davis	CEO	Operon System
Andrew	CEO	Stalis
Tomaz Gornik	CEO	Marand
Graham Berry	Head of Middleware/PaaS Public Sector	Redhat
Mark Boschier	Client Director Public Sector	Redhat
Lee Randall	Sales Public Sector	Redhat
Joel Ratnasothy	Vice President Product Strategy	Caradigm
Bernie McBride	Sales Manager	Caradigm
David Stables	Trustee, CEO	Endeavour Health
Mark Winstone	CEO	Synapps Solutions
Gary Britnell	Health Account Manager	Synapps Solutions
Adam Cooper	Sales Manager	Oracle
Greg Timotheou	Population Health Business Development Manager	Cerner
Steven Normyle	Service Sales Manager	NTT Data (UK reseller of MPHRX Minerva)
Paul Thomas	Digital Advisor	Microsoft
Mark Tovey	Business Development Executive	Quiksilva
Ian Thomas	Managing Director, UK and Ireland	Tiani Spirit

Appendix 5 List of Option Appraisal Workshop Attendees

Name	Organisation
Carol Robinson	Gateshead Council
Emma Anderson	Sunderland City Council
Graham King	Newcastle Hospitals NHS FT
Ian Briggs	Durham University
Ian Davison	NECS
Jonathan Harness	Newcastle Gateshead CCG
Kai Sander	Hartlepool and Stockton CCG
Lisa Nattrass	County Durham and Darlington NHS FT
Lynn Eddon	South Tyneside NHS FT
Nick Black	Gateshead Health NHS FT
Paul Gibson	Sunderland CCG
Rob Graham	Gateshead Council
Sharon Lowes	Sunderland City Council
Steve Foreman	Newcastle City Council
Tejal Shah	Newcastle University
Theo Bampouras	University of Cumbria
Tim Goodship	Newcastle University
Tony Naylor	North Tees and Hartlepool NHS FT
Tracey Best	Northumbria Healthcare
Trevor Smith	Hartlepool Borough Council
Nick Booth	Connected Health Cities
Joe McDonald	Connected Health Cities
Mark Walsh	Connected Health Cities