

Knowledge Driven Health



Connected Health Framework Architecture and Design Blueprint

A Stable Foundation for Agile Health and Social Care

Part 2 – Business Framework

From Vision to Specification

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The Vision

Health and Social Care Is a Complex Business

Why is Health and Social Care so difficult in the systems sense? Designing and implementing Health and Social Care systems involves much more than just creating the necessary infrastructure, important though that is. The main problem is that Health and Social Care is a *Complex Adaptive System*¹ like many systems with a strong social focus.

“Complex adaptive systems” is a term applied to system environments in which the processes followed are highly variable and constantly changing and the outcomes are hard to predict. A frequently used analogy is to compare the flight of a bird with the flight of a stone thrown through the air. The flight of the bird is quite unpredictable, being influenced by winds, weather, feeding needs, predatory threats, and the presence of other birds, among many other factors. The destination is also unpredictable, although eventually some locations can be forecast. On the other hand, the flight and destination of the stone is completely predictable and can be calculated from a known set of parameters. Bird flight and other phenomena such as the weather and many social and biological systems are complex adaptive systems, as is Health and Social Care and perhaps sporting contests too.

It is very difficult, if not impossible, to specify a complex adaptive system in anything like its entirety. Not only is the functionality difficult to describe in the first place, but the requirements are constantly changing as new features are thought up. Thus any Health and Social Care system specified as a set of user-oriented requirements is going to be expensive in development cost (as functionality is understood) and slow to implement (as requirements change). A commonly observed phenomenon is the failure to achieve user “buy in”. The care professional sometimes finds it difficult to envisage the application of the software to his or her immediate set of problems and hesitates at the effort required to implement, particularly in terms of data capture. The “not invented here” syndrome is common.

Furthermore, care professionals usually insist on a system that is “user-friendly”, by which they mean that it can be used naturally and unobtrusively in a personal consultation and does not involve extensive “back office” operations. This usually means that the workflow to be followed must be intuitive and adaptable to their own individual way of working and that the user interface is clean and clear with all relevant data (and no more) shown or just a click away.

In approaching the “design” of a complex adaptive system, we suggest that there are two key principles to be observed (there are many more, but two will do for now).

The first principle is to understand the stable and agile aspects of the system. The “Stable” aspects include the fundamental data created and used, such as patient data, and the core business functions performed using the data, such as patient registration. The “Agile” aspects include the variable, adaptive features of the system, such as business processes or workflows and user interfaces and device-dependent procedures. This division into stable and agile provides a starting point for complex adaptive system design. Complexity is addressed by establishing the fundamental building blocks from which

An Architect’s Viewpoint

Architects are used to dealing with complexity. This usually takes the form of dealing with “multiplicity” – multiple users, multiple requirements, multiple formats, multiple interfaces, multiple platforms, multiple applications, multiple standards, and so on.

The way through this jungle is to establish the constant or stable parts of the systems environment – such as basic functions and fundamental data - and build on them using this foundation to support the variability and volatility of the domain.

¹ For a brief description of Complex Adaptive Systems see <http://www.trojanmice.com/articles/complexadaptivesystems.htm>

solutions can be assembled, while adaptive behavior is achieved by enabling multiple, dynamic linking of these building blocks.

The second principle is to define the building blocks such that they are as self-contained and independent of each other as possible, yet remain “plug compatible”. This allows a mix-and-match approach to the assembly of overall solutions and also the flexibility to reuse and replace building blocks as the need arises.

We believe that the stable building blocks are best realized by using a component-based approach while agility, including the plug and play capability, is best achieved using a service-oriented, message-based approach, which enables a highly flexible “orchestration” of stable functions and data to meet individual, but changeable, requirements and preferences.

In this part of the CHF Architecture Blueprint, we address these issues and describe our approach to Health and Social Care system design and implementation, concentrating for the moment on the business aspects, such as the “what” rather than the “how”.

First, we describe our view of some of the key Health and Social Care application concepts of a citizen-centric e-Health and e-Care system focused on the building, maintenance, and presentation of electronic health records (eHR).

Second, we describe some of the key architectural concepts of a citizen-centric, lifelong e-Health and e-Care system. We discuss the essential features of an enterprise-level service-oriented architecture as an approach to achieving seamless, “joined-up” systems.

We cover the following:

- The definitions of a Service, a Service-Oriented Architecture (SOA), and Web Services, showing their complementary roles
- The structure of a service-oriented application describing the various types of components used
- A process for defining business services, showing a typical Business Component Specification and the means of exposing services for consumption by agile business processes
- An example of Application Dynamic Behavior in which we trace the execution of a business process using components and services

Third, we offer a “Business Pattern for Health and Social Care” indicating a possible structure based on service orientation and use of the “Connected Health Services Hub”.

Finally, we discuss the issue of “Liberating Legacy” and the use of application packages.

Connected Health and Social Care – The Vision

The Microsoft vision for Health and Social Care is to enable the transformation of Health and Social Care delivery through innovative technology and partnerships that advance public health programs by enabling connected citizen care, improving quality of care and safety, and reducing the Health and Social Care cost burden.

“Seamless” or Just “Joined Up”?

“Seamless” is becoming a heavily used word. It is being used in many situations to indicate that transitions in a process from one state to another are, or might be, imperceptible to the user.

A current example is the hybrid powered car, which uses both a conventional internal combustion (IC) engine and an electric motor.² In situations where more power is required, the drive is provided by a petrol or diesel engine, but in coasting situations power is provided by one or more electric motors. The batteries for the electric motor are charged when the engine is running. From the driver’s point of view the change from IC engine to electric propulsion and back again is imperceptible. However the underlying technology is formidable, requiring a complex control system.

We use this example to explain the difference between “seamless” integration and “joined-up” interoperability. The driver’s experience is seamless—he or she is unaware that any change has taken place and does nothing to effect the change other than to accelerate or brake, which are standard operations. On the other hand the IC engine and the electric motor are interoperable—they are “joined up” under the direction of complex control logic. In order to have a seamless experience, the component parts must be interoperable and have a controller.

In a Health and Social Care context, we want the user, a care professional, to have a seamless user experience in which he or she interacts with a variety of relevant applications without any need to switch applications manually or even know that there has been a switch of application. This means that several important things have to happen:

1. There must be logic to control the execution of the business process, bearing in mind that the process spans a number of applications.
2. There must be a reliable mechanism for switching from one application to another and back again. This means that when a switch of application occurs, the application context (for example, current patient, disease, and professional information) must be passed to the second application and transaction status preserved in the first application.
3. There should be no major change of look and feel in the user display and function of the primary controls. Screens may change in terms of the detail they contain, but the general layout should be maintained with key information displayed consistently and any action requests behaving fully as expected.

We will explore how this is done later.

An illustration of **Seamless Healthcare** is provided in [Figure 1](#). This shows part of a major healthcare facility and depicts a vision of a hospital with its departments and facilities all operating smoothly and autonomously, each equipped with IT facilities. These are being used in both administrative and front-line clinical situations.

² For a fuller description of hybrid technology see http://www.lexus.com/models/hybrid/how_they_work.html



Figure 1. Seamless Healthcare

In [Figure 2](#), the upper “plane” depicts this vision of an automated hospital providing seamless healthcare. The lower “plane” depicts the platform needed to enable the seamless operation – a range of interlocking, “joined-up”, capabilities such as applications, business services, security, data, and systems management. The middle “plane” is the enabling integration layer providing capabilities such as business process management, messaging, integration services, identity management, privacy controls, collaboration services, record location, and metadata directories.

The Microsoft Connected Health Framework (CHF) is designed to enable the creation of Health and Social Care systems that are seamless and joined up. It provides the seamless experience through flexible user interfaces, driving dynamic, orchestrated business processes. It provides the “joined-up” environment by linking applications using open standards for communication, data representation, and process control.

Our hybrid car analogy still has some more mileage to run. Since it has two or more motors—the IC engine and electric motors—if both provide propulsion at the same time, the performance of the car is increased. So we might expect the overall performance of a “joined-up” IT system to be better than that of a set of disparate applications, for example by carrying out tasks in parallel rather than serially.

Further, the IC engine and the electric motors in the hybrid car are probably existing and proven conventional units. However, to incorporate them into the hybrid car, some modifications are required. For example, the IC engine needs to be able to start and shut down quickly as drive is transferred to and from the electric motors. This operation is initiated by the control unit rather than the driver. In other words, the interfaces between the components and the overall control mechanism need to be rethought. The control unit is the heart of the system, of course, and we need to consider carefully each and every operational scenario, and its associated processes, to ensure that efficient, effective, and safe control mechanisms are devised.

In the hybrid car, all the components usually come from one manufacturer and the mechanisms for integration and operational control are proprietary. This is not often the case in Health and Social Care where, typically, many manufacturers are involved in any integration scenario that involves more than a single department. Thus universally agreed standards are needed to define interfaces, transmit and understand commands, and transport meaningful data between system components. Fortunately

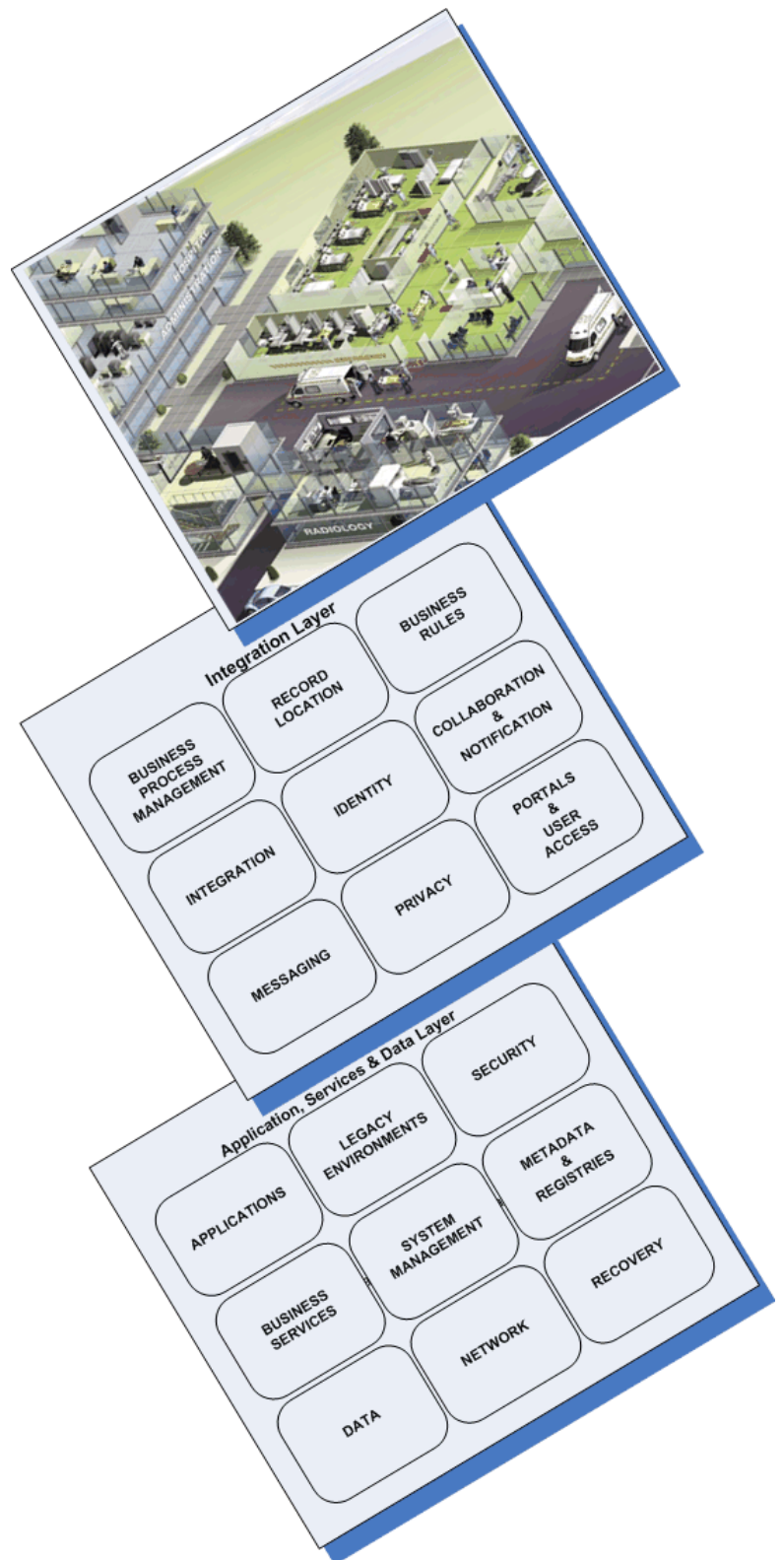


Figure 2. Seamless Integration

such standards exist in the form of XML, Web Services, HL7, and the various Internet standards. The Connected Health Services Hub is based on the use of these standards.

There is now a danger of stretching the analogy too far, but we think there are still some points of similarity between our hybrid car and our seamless Health and Social Care system.

Both are complex systems in that they adapt their functions to usage. However, Health and Social Care systems have variable and ever-changing processes and often have unpredictable outcomes, whereas the hybrid car has consistent, repeatable processes with predictable outcomes given competent driving. A key requirement of Health and Social Care system design, therefore, is to build in adaptability and flexibility and provide the ability to reconfigure components as needs change.

The major components of the hybrid car are usually existing units—for example the engines and the motors—modified for hybrid use. Other components such as the braking system or the interior furnishings are common with non-hybrid vehicles.

In the Health and Social Care domain, there is an imperative to reuse existing systems and software, and most if not all applications need some modification to function within the seamless environment. Modifications may be “invasive” – they actually change the way an existing application operates by re-engineering some of its capabilities. Alternatively, modifications may be “non-invasive” – the operation of an application being changed by adding additional features that provide other capabilities or by adjusting the way the application behaves or is invoked.

Some characteristics may not be compromised—reliability and safety, for example. They may of course be enhanced by design. The vehicle manufacturer will claim greater reliability because there are two propulsion methods. However, safety may be reduced because the vehicle is heavier and may not handle as well. Both are somewhat tenuous arguments.

The cost/benefit equations for the hybrid car are interesting. The vehicle is more expensive to buy but cheaper to run. There is the intangible benefit of being more environmentally friendly offset by a feeling that the vehicle might be more difficult to maintain because it is more complex.

These sorts of argument also apply to “seamless”, “joined-up” Health and Social Care systems.

Besides these points of similarity, there are important points of difference between our hybrid car and seamless Health and Social Care.

The first of these is that the scope of a patient-centric Health and Social Care system is much deeper than that of a hybrid car and the system boundaries are much wider. Both have significant hardware and software content, but the car is essentially a physical entity that behaves in a predictable way whereas our Health and Social Care system is essentially “soft” with a usage pattern that can be unpredictable and even self-modifying.

The second difference is that Health and Social Care presents unique requirements in terms of security, privacy, and confidentiality. All processes and use of data is subject to strict control and may only be accessed by those specifically authorized to do so.

At the beginning of this discussion, we mentioned three important things needed to realize seamless, joined-up operations. To recap, these are as follows:

Logic to control the execution of the business process

The “control unit” for Seamless Healthcare is vital. In the CHF we call it the “Connected Health Services Hub”. It acts as the “intelligent glue” between the care professional’s seamless interface and the joined-up systems under the covers. Its broad function is to enable the seamless experience by providing the underlying application integration. More specifically, this involves providing the capabilities to understand user requests, establish communication with the appropriate system components, pass instructions and

data to the actuators of each system component, monitor the initiation and execution of requested actions, manage the flow of data to and from the user and each system component, communicate status and operational parameters back to the user, and last but by no means least, manage the end-to-end process without user intervention.

A reliable mechanism for switching from one application to another and back again

This is a two-level mechanism depending on whether the user (the driver) wants to make the switch or whether the business process (the car) requires it. (Bear in mind that the hybrid car may not give the driver a choice.)

This is a function of the Connected Health Services Hub and is achieved by using business-focused service orientation coupled with orchestration of the business process. Essentially the user invokes the switch by his or her actions, either explicit or implicit.

The mechanism would involve “remembering” the status of application A and transferring key parameters to application B, which allow it to respond quickly and accurately, presenting its capabilities in the context of the transaction in progress, for example by presenting data for the specific patient, the relevant clinical condition, and the specific user. Having performed its function, application B returns the appropriate parameters and data to application A.

This all happens “under the covers” and is achieved by means of request/response mechanisms employing business-oriented services. A set of such services has been defined in the CHF Business Framework.

No change in the look and feel of the user display and function of the primary controls

This is a function of the user interface and the user process. The user interface is all that the user really sees; everything else is under the covers. It is here that the seamless experience manifests itself most in that the process the user follows flows efficiently without the need for user intervention or “steering”. The “look and feel” of the screens is consistent and the controls are familiar and “user-friendly” and operate in a standard way. For example, data is presented in a consistent format and on-screen buttons and controls behave in the same way irrespective of the application that is being used.

This is achieved by careful design with attention to ergonomic factors in the creation of the human-computer interface.

Users may use a variety of devices—desktop computers, laptops, tablet PCs, PDAs, or Smartphones. In each case user dialogues are created that optimize the use of the device and make the user experience as efficient and effective as it can be.

A set of guidelines and tools for user interface design, the Microsoft Health Common User Interface (CUI)³, enable the seamless user experience.

In a typical Health and Social Care IT organization, many manufacturers are involved in an integration scenario that involves more than a single department. Thus, universally accepted standards are needed to define interfaces, transmit and understand commands, and transfer meaningful data between system components. Fortunately, such standards exist in the form of XML, Web Services, Health and Social Care industry standards, and the various Internet standards. The Connected Health and Social Care Services Hub is based on the use of these standards.

³ Available from <http://www.microsoft.com/industry/healthcare/technology/solutions.aspx#UserInterface><http://mscui.net> and <http://mscui.net>

In addition, Health and Social Care systems have variable and ever-changing processes and often have unpredictable outcomes. Therefore, a key requirement of Health and Social Care system design is to build in adaptability and flexibility and provide the ability to reconfigure components as needs change.

Seamless and Interoperable

In *Part 1 – Introduction and Overview* of the CHF Architecture Blueprint we outlined the characteristics of the Microsoft Connected Health Framework and highlighted the need to achieve integration on two major levels: Application Integration in which systems and applications can talk to each other in mutually understandable terms, and Technical Interoperability, where systems can be securely and reliably interconnected.

In this section, we describe Application Integration achieved by means of a Service Oriented Architecture, focused on the unique and complex needs of Health and Social Care. First, we describe the characteristics of enterprise-level service orientation; second, we suggest a way of defining business services working from business requirements; third, we look at some Health and Social Care business components and services required for a patient-centric health records system; and finally, we consider how to service-enable existing applications.

Application Integration or “Joined-Up” Systems

It has been noticeable over a number of years that attempts at Health and Social Care system integration very often result in a tangle of specially crafted interfaces and connectors. There are issues with the definition of data and more subtle problems with mismatches in semantic meaning. Further, there can be problems with the timing of operations and the synchronization of records across a large and complex estate. All this has made the provision of IT application support for the rapidly evolving business processes of Health and Social Care both difficult and expensive.

A Service-Oriented Architecture (SOA) offers a clean and elegant solution to these issues. Based on standards such as XML, SOAP, and the Web Services stack, an SOA provides a means of achieving the necessary agility and flexibility to support rapidly evolving business processes and changing business objectives and goals.

The design and development of an SOA requires the application of a number of techniques—stemming from disciplines such as Enterprise Architecture, Business Process Modeling, Component-Based Development, and Object-Oriented Methods—to produce modular, reusable, and replaceable software applications. Further, most of the building blocks in the SOA will be in existence in the form of legacy applications. However, these will usually need reengineering to provide access to their functionality and data from a wider population of consumers.

The implementation of an SOA requires the building of a platform-independent networked environment spanning both in-house and Internet operations with the associated security, privacy, and performance issues. There is the need to establish a reliable, transparent middleware tier in the application environment that connects internal and external applications and services effectively and efficiently. These are non-trivial activities and there are also subtle problems of governance and operational control to be solved. We consider these in the next section of this guideline.

The earliest attempts in the early 1970s at Structured Programming and later at Structured Analysis and Design identified the benefits of loose coupling and tight cohesion. The recommendation was that a module of code should only address topics that are closely and intimately related to each other (tight cohesion), whereas different modules, even though they might work together, should not address the same topics or depend on each other for their internal functioning (loose coupling). Attempts at application integration have not always done this and have resulted in integration schemes that are too inflexible, costly, and non-responsive because they rely on complex interactions between the member applications.

The current trend in application integration is to move away from tightly coupled monolithic systems and towards systems of loosely coupled, dynamically bound components. Such a strategy is offered by SOA and might be termed “service integration” rather than “application integration”. The key drivers will be flexibility and lower cost, although there will still be challenges with performance.

Service integration is becoming the norm for Web-based applications, and we believe that it offers advantages for in-house integration too, because most internal system integration uses tight coupling around transaction-based systems and large complex databases. With these, a simple system change can ripple through the integration scheme causing, at a minimum, disproportionate maintenance activity and, at worst, operational disruption.

The Microsoft Value Proposition for Health and Social Care

Our vision of seamless Health and Social Care based on joined-up systems is implicit in the Microsoft Value Proposition for Health and Social Care. The key features of the proposition, realized using the Connected Health Framework, are as follows:

- **Connected – Interoperable by design**
 - Open architectures built on industry standards that facilitate the flow of patient information and clinical knowledge seamlessly through the care continuum and across agencies
 - Leverage legacy application and infrastructure investment
- **Productive – Familiar tools to automate the way you work**
 - Let clinicians be clinicians: improve adoption
 - Enable delivery of public health services in a standardized, replicable manner
- **Best Economics – Driving down the cost of Health and Social Care technology**
 - Create ROI faster than traditional investments
 - An integrated platform that lowers TCO overall
 - Local delivery model
 - Scalable from single providers to county-wide programs
- **Dependable – Proven and robust**
 - Applications that support 24/7/365 Health and Social Care operations
 - Financially stable
- **Extensive partner ecosystem gives decision-makers a choice**

The Business Environment

In this chapter, we describe the Health and Social Care domain in general architectural terms. We list ten key issues that we address in the CHF ADB, describe some important business concepts in simple terms, and outline a Business Architecture model that can be used as the basis for defining systems, processes, and organizational structures to meet the business goals and objectives of the enterprise and address the ten key issues.

Our experience of defining and developing citizen-centric Health and Social Care systems suggests the following ten key issues. These arise repeatedly from country to country and situation to situation.

Ten Key Issues in Health and Social Care Systems

1. How to define and create a citizen's Health and Social Care record
2. How to build a lifelong history for a citizen from information held in multiple, diverse systems
3. How to identify citizens or Health and Social Care professionals uniquely and reliably
4. How to manage citizen consents and professional authorities to ensure privacy and confidentiality
5. How to create a "seamless" user experience
6. How to "join up" diverse systems on diverse platforms with diverse data and make them interoperate
7. How to manage business processes that span multiple systems and multiple domains
8. How to enable legacy systems to participate in new, wider, integrated scenarios
9. How to achieve flexibility and agility to cope with rapid change
10. How to achieve performance and scalability as user populations, transaction numbers, and data volumes grow

These factors are usually highlighted in specifications of user requirements. Some are of a business nature, some are more technical, and a significant number have both business and technical dimensions. We will consider the business aspects of these in the following sections, and the technical aspects in *Part 3*.

Key Issue

When we address one of these ten key issues in the following guidance, we will highlight the particular issue and our recommendation in a text box like this.

Health and Social Care Domain Concepts

The concepts we present are couched in non-technical terms and are technology neutral. They might seem a little simplistic at first sight, but they are important. We are trying to address some of the key e-Health design issues and present them at a conceptual level before becoming embroiled in the complexities of implementation.

What Is a Care Record?

A Care Record contains a lifelong history of a person's health and well-being, including all relevant identification information, all permanent medical and social information, and all medical and social care events that have taken place in the patient's lifetime.

A Care Record (EHR or ECR) may be regarded as having four main parts: identification, standing medical and social care information, consents information, and the care record itself.

The *identification* portion would contain the primary identifier—patient or client number—and include demographic items such as name, address, and date of birth.

The *standing medical information* portion would contain details such as blood type and allergies and other information as might be useful in an emergency situation. Furthermore, it might contain, or point to, information on current medication and indications of relevant prevailing medical conditions such as diabetes or asthma.

The *standing social care information* portion would contain details such as a specific disability or difficulty such as blindness or deafness, status of those in care, and special needs information. Of course, some of this information is particularly sensitive and confidential and would be subject to stringent access controls as now described.

The *consents* portion would contain details of the areas of the Care Record to which the patient or client wishes to restrict access. A number of criteria could be envisaged such as permitting access only by nominated care professionals, restricting access to particular health subjects, limiting viewable data to certain care events, and applying time limits and date range restrictions to the lifelong record. It should be noted that with some conditions such as certain mental health problems, the patient should not have access to the Care Record that is under the guardianship of nominated care professionals.

The *care record* itself contains details of each and every contact and treatment the person has received in his or her lifetime or a significant portion thereof. The EHR may be recorded to varying levels of granularity. The finest grained entry is usually at the level of an "encounter", which is a consultation, examination, or treatment provided by a care professional typically at a single session or appointment. The EHR may be held at a higher level of summarization. For example, a number of encounters may be summarized into an "episode of care" which covers a specific condition and has a clear start and finish. In turn, a series of episodes of care may be summarized into an "event", which covers the complete treatment for a particular condition or illness. An event might last for many months or years or, in the case of a chronic condition, the event might be lifelong. Finally, at the highest level of summarization, we may have "spells of care" which may be of long duration and have many events during their currency. The Care Record is a virtual concept. Although it may be held as one large, physical, centralized record, it is more likely to be a collection of references or pointers to records held in a number of locations in a distributed system.

Addresses Key Issue #1

Contents of a Health and Social Care Record

Addresses Key Issue #2

Formation of a Lifelong Health and Social Care Record

Another concept that might be of use is that of a patient or client “problem”. This is at an even higher level of abstraction and describes some permanent or “chronic condition” (diabetes, hypertension, or deafness might be examples) that is a key factor in managing the patient’s health and well-being.

What Are Health and Care Subjects?

We define a Health and Care Subject as a high-level, general classification of a medical or social condition. Health Subjects are more coarse-grained than clinical codes such as SNOMED-CT or ICD. Examples might be cancer, heart disease, maternity, mental health, and so on. The notion is useful in organizing large numbers of medical events, and their constituent lower levels, into orderable and analyzable groups.

Care Subjects are similar in granularity to Health Subjects and might include topics such as elderly residential care, physical disabilities, sensory impairment, learning disabilities, mental health needs, children’s residential care, and fostering.

This allows patient and client Care Records to be constructed from the many diverse encounters and episodes in the care program and to contain many parallel streams of care. A further use is to allow the citizen to grant or deny access to portions of his or her Care Record. For example, a person may wish to deny access to his mental health record or a woman may wish to deny access to her maternity record to all other than her gynecologist. Within the Health or Care Subject, there would be many more detailed codes that define particular medical or social conditions and procedures.

An Architect’s Viewpoint

Health and Care subjects are course grained notions. We want to have an overarching categorization scheme that is usable by patients and clients and administrative people to group their data. The more fine grained clinical codes are vital too, but their use is focused on the care professional. In a sense we are separating “management” from “engineering”.

What are Care Pathways?

A Care Pathway is a generic program of care designed to treat a specified medical condition or recognized social situation. The care pathway embodies best Health and Social Care practice and specifies the treatments and activities required. Care Pathways can be long, perhaps lasting for years, and are typically divided into sections, or phases, which are separated by planned review points at which progress is assessed.

To illustrate, we show a portion of a generic Care Pathway (somewhat simplified) for Colorectal Cancer in [Figure 3](#). The diagram for the full Care Pathway is large and is included as an appendix in *Part 5 – References of the CHF Architecture and Design Blueprint*. We have also included there subsidiary diagrams showing the individual phases of the Care Pathway.

This Care Pathway has been constructed to illustrate the care process for colorectal cancer and is based on professional advice. We have structured the Care Pathway into a longitudinal, step-by-step process and grouped these steps into meaningful “blocks”. We have analyzed the process into four **phases** (in pink): Examination, Treatment, Post-Operative Treatment, and Follow-Up. Each of these phases comprises a number of **activities** (in green), each activity involves the carrying out of a “clinical process”, and each **clinical process** (in white) comprises a number of Actions. Each activity within the Care Pathway equates to a Patient Episode and each Phase equates to a Patient Event.

An Architect’s Viewpoint

We continue the management/engineering separation with Care Pathways and Clinical and Caring Processes. The Care Pathway is a generic workflow analogous to the “routing” found in the manufacturing industry. Routings form the basis for activities such as capacity planning and scheduling. The Clinical or Care Process is analogous to the “operational instructions” that describe each stage of the manufacturing process. These can vary in detail depending on the preference of the operative and the equipment to be used.

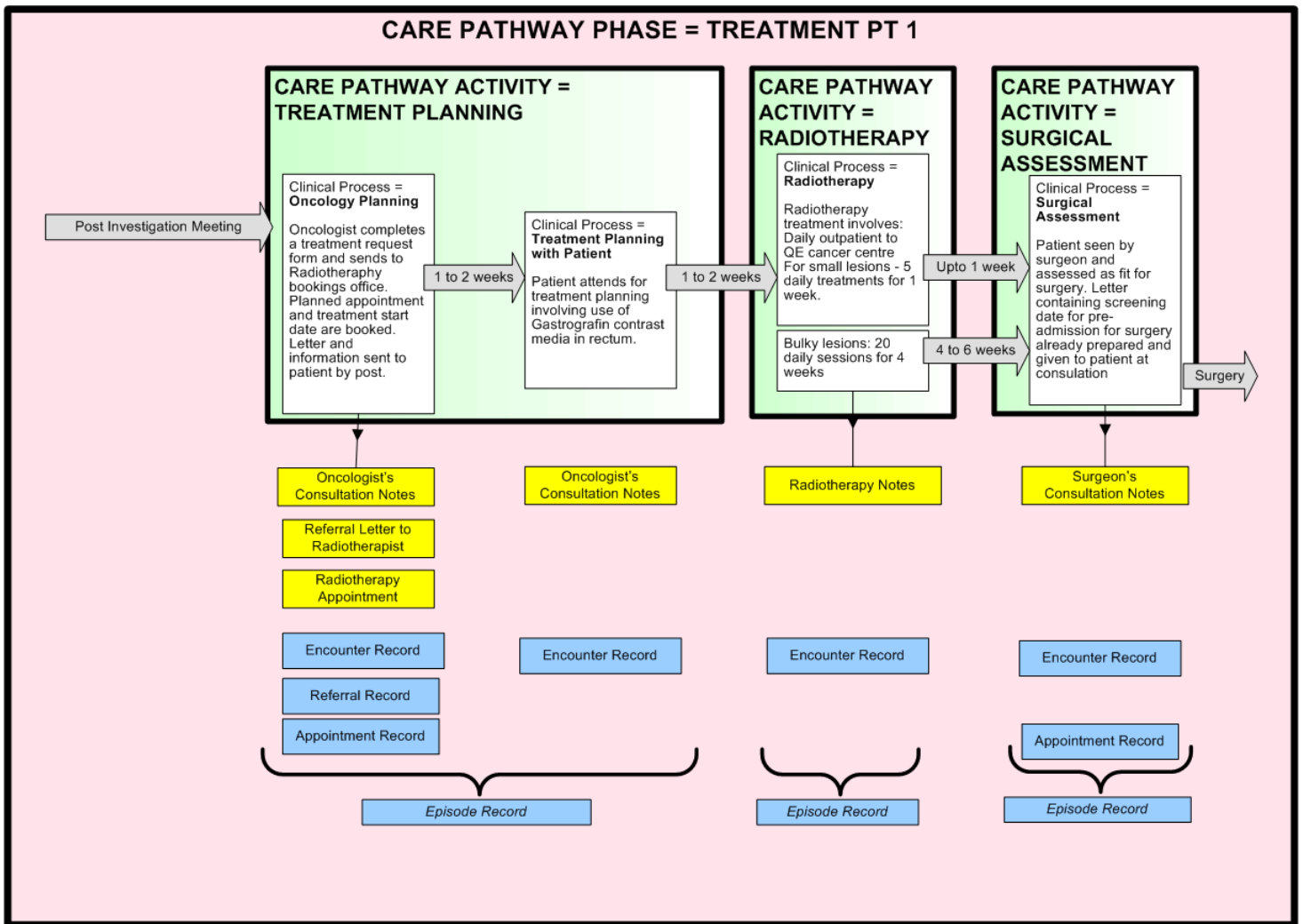


Figure 3. Care Pathway Phase - Treatment Part 1

What is a Clinical or Caring Process?

A Clinical or Caring Process and its subsidiary actions are typically carried out by a care professional or a team and generate data, also defined to a standard. A Clinical Process, for example Oncology Planning, might be carried out in different ways by different professionals but has the same entry and exit conditions. Similarly, a Caring Process might be a procedure such as carrying out a capability assessment on a client. In terms of the EHR or ECR, a Clinical Process equates to a potential Patient Encounter and a Caring Process equates to a Care Encounter for inclusion on the Care Record.

What Is a Patient or Client Journey?

The Care Pathway is generic in that it is designed as a standard process. Each and every patient or client will experience variations from the pathway depending on his or her individual needs and situation. These variations are pre-planned either before commencement of treatment or at each review point between phases. The patient-specific pathway is called the Patient Journey in Health or the Client Journey in Social Care. The Journey can be viewed as the forward-looking portion of the Care Record and is used to plan future care.

An Architect's Viewpoint

The Patient Journey is the specialization of a care pathway for a specific patient. It is analogous to a "Customer Order" in manufacturing.

Sometimes a patient or client can be traveling more than one Journey at a time, such as for chronic heart disease and diabetes. In such a case the Journeys may be merged in order to minimize the number of required consultations and tests and optimize the use of scarce resources. However it would not be common to merge a Health Journey and a Caring Journey because these usually involve different professionals and resources.

What Are Consents and Permissions?

A potential issue with joined-up Health and Social Care is the question of the confidentiality of person-specific information. Information that is held by a Health and Social Care provider is subject to the stewardship of that provider and is usually contained within the provider's security and confidentiality "envelope". Any plan to share that data on a wider interdepartmental basis will require the formation of a larger confidentiality "envelope", an action which may well require the patient or client's specific knowledge and consent.

Addresses Key Issue #4

Taking and managing Citizen Consents and assigning Professional Permissions

The key driver here is Data Protection legislation that broadly lays down that information gathered for one purpose may not be used for another without the subject's knowledge and consent. Thus we believe that the patient or client will require assurance that his or her information will not be misused or revealed to parties beyond those with whom authority rests or to whom specific permission has been granted.

With regard to Care Professionals, they will of course have continuing permission to access information within their sphere of authority. There is one very clear overriding constraint: a care professional is only allowed to access the records of his or her own patients or clients, and then only within his or her role.

However, we assume that specific authority, or permission, could be granted to professionals to access information held outside their role and patient relationships and, furthermore, that this permission is required on an individual patient basis.

Consents and permissions are not blanket authority to join up information from different sources. Usually the patient or client will want to apply differential criteria to the integration, specifying which data may be joined to which other data. The granularity of information to be joined will vary from full patient or client records to a much finer level. Sometimes this will be at “encounter level”. Very often it will be at the level of Health or Care Subject.

We would expect that the consent-taking process would form part of the enrollment process for joined-up Health or Social Care and it must be straightforward, yet comprehensive. We also expect that the consent-taking process would be different for Health as distinct to Social Care because different organizations and professionals are involved. Furthermore, consent taking in Social Care can present particular difficulties in situations where the client is not a voluntary participant in the care process.

At a minimum the process must be able to attach consent to a patient or client event, or more likely the converse, namely to block access to a patient or client event. Further, the blocking may only apply to a particular category of care professional; for example, “I don’t want a ward nurse in orthopedics to see my sexual health record.”

Facilities are needed to control access to the electronic Patient Record and apply the defined level of confidentiality to the patient’s records. The principle is straightforward: the patient owns his or her records (with certain defined exceptions) and grants access “consent” to those professionals with a “need to know”. We expect that most patients will impose no special restrictions and a set of default values, set in line with current good practice, will be appropriate. However, procedures to apply the wishes of the minority of patients who want to set specific confidentiality restrictions are required and must be completely reliable and rapid in their application.

In a situation where a professional has a valid, legal reason to see joined-up data for a patient or client, for example in an emergency situation, and the patient has withheld consent, the professional can override access restrictions; however, such overrides would trigger an “override reporting process”.

An issue also arises with “cross-domain” record access, such as a health professional requiring access to a Social Care Record or vice versa, or perhaps to records in another domain such as law and order. This can arise in complex situations such as child protection and access should be rapid and comprehensive. This can usually be authorized on an explicit basis at a senior professional level and would be subject to a reporting process. A problem can arise in knowing that such records actually exist in another domain and that they contain valid, pertinent information. (We want to avoid browsing and trawling for interesting information.) For example, a recent high-profile case of child abuse in the United Kingdom has led to suggestions that Accident and Emergency staff should routinely check whether any child entering their care is listed on the child protection register—a situation that crosses domain boundaries and has privacy and confidentiality implications. Additionally, an effective system for matching identities would be needed.

Joined-Up Data

Although there are many complex, interconnected processes and procedures in Health and Social Care, these are essentially data-intensive systems. Understanding of the data involved is essential if a stable foundation is to be laid upon which agile, relevant procedures can operate. [Table 1](#) shows the main data concepts underpinning the Connected Health Framework. It should be noted that this does not contain the rigor of a data model and that the data concepts shown are not necessarily single data entities. Later we will describe the data model for Health and Social Care in the form of an entity-relationship diagram. Nevertheless the table shows the main data groups and their interrelationships. The “→” and “↘” symbols indicate “one-to-many” relationships in the direction of the arrow. We have used the terminology of Social Care in this table.

An Architect’s Viewpoint

We think that architects and designers must have a complete grasp of the data structures that underpin the systems they are defining. To do this we need formal data models (to be described later), but these need to be discussed and verified by the system users and those familiar with the domain. We have found the simple Data Concepts diagram to be very useful in starting a user: analyst dialogue.

Continuing our manufacturing analogy we are in fact developing the “Bill of Material”.

Table 1. Data Concepts – Social Care

Data Concepts – Social Care									
	Care Pathways <i>(Generic Form)</i>	Personal Care Journeys <i>(Planned Activity)</i>	Personal Care Records <i>(Actual Activity)</i>	Person/Professional Contacts <i>(Planned/Actual Activity)</i>	Personal Demographics	Care Providers/Professionals <i>(Planned/Actual Activity)</i>	Assessments & Results <i>(Planned/Actual Activity)</i>	Care Processes & Protocols <i>(Generic Form)</i>	Care Subject <i>(Generic Form)</i>
← Granularity			Personal Care Problem						
	Generic Care Pathway	→ Personal Care Journey	↘ Personal Spell of Care						← Care Subject
	↘ GCP Phase	↘ Journey Segment	↘ Personal Event			→ Care Provider			←
	↘ GCP Activity	↘ Planned Action	↘ Personal Care Episode		Person Under Care	↘ Team and Facility			←
			↘ Personal Care Encounter	→ Appointment or Referral		↘ Care Professional	→ Assessments	← Care Process/Protocol	→ Analysis Type
			↘ Attendance/Admission/Discharge			↘ Results	↘ Care Process Action	→ Analysis Dataset	

A Business Architecture for Health and Social Care⁴

[Figure 4](#) shows a typical, industry-agnostic model used to represent a Business Architecture focused on Information Systems and Technology (IS/IT). The Business Architecture plays an important role in linking the important dimensions of development and change programs in areas such as organization, process, infrastructure, and technology. We can use this model to underpin activities such as Business Service Definition, Project Portfolio Planning, IT Technical Strategy, IT Application Development, and Business Process Reengineering. We stress that the Business Architecture is a “live” artifact and that these activities are not “one-shot” efforts but rather continuous programs of definition and refinement that track, and in many cases predicate, the development of the business domain in its evolving environment.

In a Business Architecture focused towards the development and use of IS/IT, we might define the structures as shown in [Table 2](#) on p.24. What is a structure? View it as a collection of information pertaining to a particular topic of interest, for example the enterprise’s “Organizational Structure”. Think of a structure as a set of filing cabinets containing all the information on a particular facet of the business, filed and organized for easy access. Various filing schemes could be used, but a major advantage would be to avoid redundancy. We only want to file a particular fact in one place, not many. This makes it easy to find and easy to update. Also it would be advantageous to organize the information in a tree structure, or hierarchy, provided that it fits. Thus we can keep the detail at the bottom of the stack and have summary layers above, making it easier to deal with large volumes of information. The information need not be textual; it could include diagrams, documents (or their references), or multimedia items.

Structures are related to other structures. An organizational unit could be said to have degrees of responsibility for, and involvement in, a business function. Therefore we could say that an organizational unit is “responsible for” or “involved in” or “interested in” a particular function. Since the relationships are two-way, the reverse relationship may be expressed as well—a business function is the “responsibility of”, “involves”, or “is an interest of” a particular organizational unit. We can record these relationships using a spreadsheet.

We might add other structures and relationships in specific circumstances. These structures and relationships need a little further explanation. In particular it should be stressed that these definitions may vary from enterprise to enterprise and domain to domain. What is important is that the concepts are recognized and incorporated into the overall architectural design.

In our diagrams, the structures are represented by spheres and we have shown all possible inter-structure relationships. The structures need not be restricted to this set or indeed contain any of these topics. Clearly however, in working with IS/IT projects, some of these topics are essential; the usefulness of others depends on the situation. In our example, there are 10 structures and a possible 45 sets of two-way relationships; this extends to 55 if we include “recursive” relationships between facts in the same structure. Some of these relationships are vital in binding the enterprise together—for example the relationships between Business Function and the Data it uses. Other relationships are quite obscure and are of no interest whatsoever.

⁴ The methods described here, and used to develop the Business Pattern for Health and Social Care, are adapted, with permission, from “Enterprise Architecture – Understanding the Bigger Picture” by Bob Jarvis (ISBN 0-85012-884-6), “Enterprise Architecture – What you can do with it once you’ve got it!” by Bob Jarvis and Martin White (ISBN 0-85012-904-4), and “Service-oriented Architecture for the Enterprise” by Bob Jarvis, all published by the National Computing Centre, Manchester, England 2003-2006.

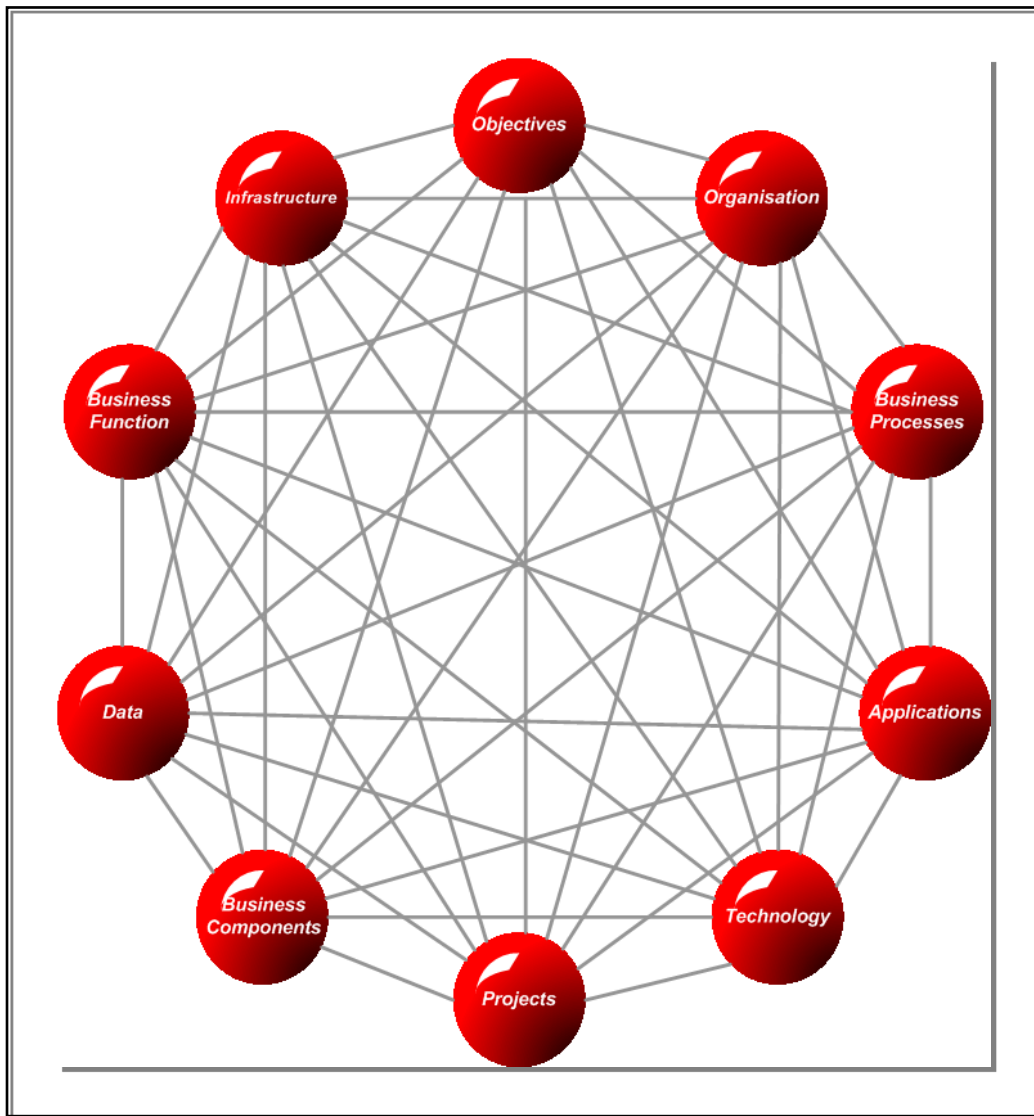


Figure 4. Typical Structures in a Business Architecture

“Stable” structures, like Infrastructure, Business Function, Data, and Business Components, do not change suddenly; they evolve. They are not static but their rate of change is low—unless there is major change in the scope or nature of the business. However, structures like Organization, Business Processes, Applications, and Technology are much more volatile and subject to regular change, and indeed much of the rationale for building and maintaining a Business Architecture lies in the benefit of being able to react quickly to changes in the business environment and respond to the relentless pressure to stay ahead of the game. This is usually called business “agility”. The Objectives and Goals of the enterprise become “dynamic”, varying frequently as conditions change and new business strategies emerge. The resulting projects that are implementing business change also become dynamic with frequent adjustment of their scope and boundaries. This is shown in [Figure 5](#).

We encourage the building of the Business Architecture from the minimum information. However, a caution is necessary. Although it is far from necessary to populate all the structures before useful results emerge, it is necessary to achieve a critical mass of related, stable data before significant decisions can be made.

We suggest the following definitions of these structures:

Table 2. Typical Structures for Information Systems and Technology

Objectives and Goals are the strategic and tactical aims of the business in fulfilling its mission. They may be high-level, such as “improve patient or client service,” or quite focused, such as “reduce call center waiting time to less than 30 seconds.” Objectives and goals include definitions of business drivers and constraints and indications of relative importance and priority. Objectives and goals impact business processes and are assigned to organizational units for their achievement.

Organization is concerned with the organizational structure of the organization—groups, departments, teams—and the interrelationship of these organizational units.

Infrastructure is concerned with the “fixed assets” of the care providers and other organizational units—locations, buildings, equipment (including IT equipment), networks, transportation—and their interrelationships.

Business Processes are defined here as the procedures and activities carried out by the business. A business may have hundreds of business processes, each of which carries out operations needed to achieve the efficient and effective conduct of Health and Social Care. Business processes are usually expressed as a sequence of work activities carried out by various organizational units working in a coordinated way. Examples might be “process customer orders,” “recruit staff,” or “prepare shipping documentation.” At a low level, processes consist of a series of indivisible operations that once started must be completed (or aborted with a return to the initial state), such as “calculate invoice total.” These are known as elementary processes. A specific elementary process may be carried out as part of a number of higher-level business processes.

Business Functions are “the things a Health and Social Care organization does,” like patient and client care, facilities provision, capacity management, work planning and scheduling, test and investigation conduct, prescribing, financial management, and personnel management. Functions can typically be represented in a non-redundant hierarchy. At the lowest level, functions take the form of “primitive functions”—indivisible units of work. These are the self-same objects as “elementary processes,” the difference being how they are incorporated into the hierarchy. The business function hierarchy is non-redundant and takes the form of a “functional decomposition.” Thus the primitive function appears only once in the hierarchy. The next level up groups a number of primitive functions, usually on the basis that they carry out similar operations on similar data. A functional decomposition is constructed on the principles of loose coupling and tight cohesion, principles of good modularization that will be familiar to software engineers.

Data are the fundamental pieces of information created and used by the business. Typically they are expressed at the level of a data entity such as “patient” or “procedure” or “care professional.” Each entity has lower-level attributes and may be included in higher-level groupings such as data subjects or databases.

Business Components are encapsulations of business function and data. A business function creates, reads, updates, and deletes data. Grouping together all the functions that create and update the same data entities, using a technique such as commutative clustering or affinity analysis, defines non-redundant “building blocks”—or business components—that may be used to construct systems or applications or offer services. In turn, these support particular business processes. The structure, business components, is an example of a “derived structure”—one which is deduced from the relationships between two other structures. This is a powerful tool that exploits hidden value in the Business Architecture. Components are also important artifacts in modern systems development. By encapsulating functionality and data, software reuse and replaceability become practical. Further, components offer “services” that may be used in conjunction with the services offered by other components to create a computer application. We are particularly interested in **Business Services**, which are coarse-grained services that provide specific business functionality and data for consumption by business processes. Applications are built from assemblies of components and thus can offer ranges of managed business services. Services exposed using Internet technologies are called “Web Services”.

Applications are the business’s inventory of computer and other systems. These would include all operational systems (the “as-is”), those under development, and those planned for the future (the “to-be”). They may be component-based and service-oriented or may have been built using older methods of construction. **Technology** describes the hardware, software, and communications environments and facilities used to construct and operate applications.

Projects are the controlled pieces of work needed to realize an application or set of applications. Projects are prioritized in alignment with objectives and goals. Projects are often part of larger “programs”.

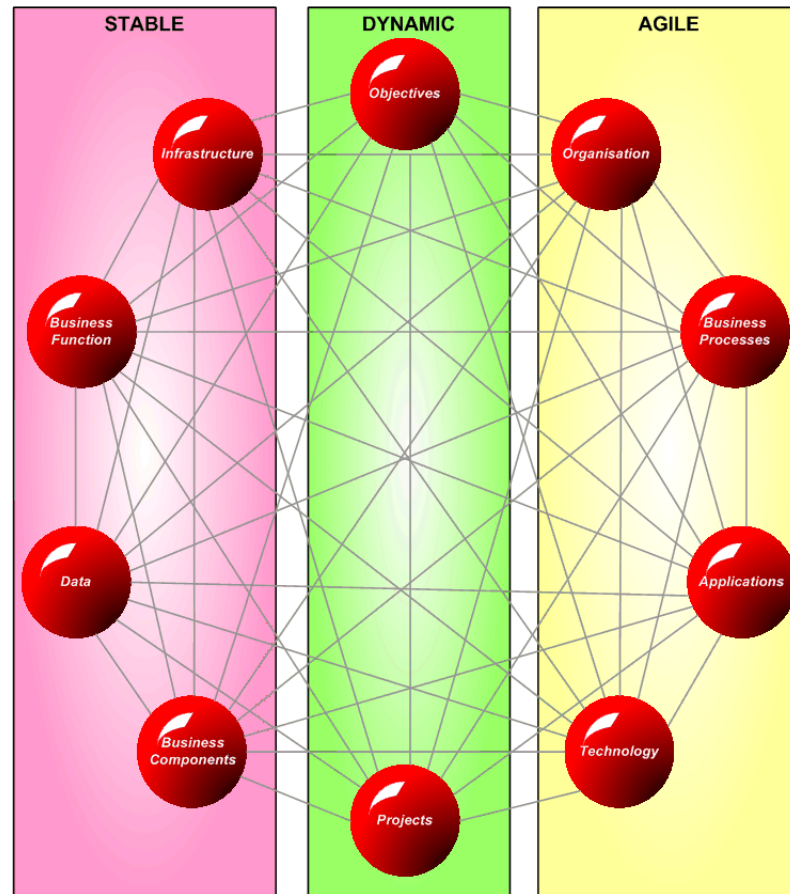


Figure 5. Stable, Agile, and Dynamic Structures

Our proposition, therefore, is that the first activity in building a Business Architecture is to capture and construct the stable structures above, populating these only to the level of detail needed for the initial purpose. We would only build an “as-is” structure at this stage, forming the baseline from which further development can flow. We would observe that the stable structures usually only need an “as-is” dimension, the “to-be” dimension only arising when a major business event, such as a merger or acquisition or the launch of major new range of services, is anticipated.

If the initial purpose is to address IT systems, as it often is, then we only need the Business Function and Data structures with their interconnecting relationships, which are usually the well-known CRUD (Create, Read, Update, Delete) operations. We then have a choice of second activities. Having done this, we would probably want to baseline the full inventory of IT systems, linking these to the current business activities. This involves building the Application and Business Process structures (both of which are agile structures) and connecting them together and with the Business Function and Data structures.

An Architect’s Viewpoint

An Architect will appreciate this division of the domain into its stable and agile dimensions. It is like separating specification from implementation. This allows us to define what systems do and then have many different implementations of the specification—on diverse platforms, for different organizations, using different applications, and supporting differing business processes. True agility!

Service-orientation, in a business context as distinct to a technical one, is a means of providing business functionality and data to business processes. Process design paradigms using techniques such as “process orchestration or choreography” have become popular and are supported by major IT software vendors. If our interest is in building service-oriented applications, as it is here, we need to establish which business services can be exposed from the domain’s functional and data resources and which business processes they might support. Our aim is to specify these business services and have these definitions available for subsequent business process reengineering and application development projects.

This procedure is described in detail under the heading “[*Defining Business Services*](#)” (p.60) in chapter [*Service Oriented Architecture for Business*](#). In the meantime, we explore some other important facets of the Health and Social Care domain concentrating on the “front-end” of the systems environment (the users or “consumers”); how information should be presented; the channels of presentation; and how new, larger-scale applications can be constructed from the existing inventory.

The Consumers of Health and Social Care Systems

We describe the various players in the Health and Social Care domain and how they interact. We will describe the various “views” of data and the various “centricities” of views. Whereas the CHFv1 concentrated on the provider’s view of care, the CHFv2 expands this to look at the domain from different angles: the patient’s view, the professional’s view, the administrator’s view, the payer’s view, and so on.

Who Are the Players?

As we pointed out in *Part 1* of the CHF Architecture Blueprint, there are effectively six main types of “customers” or “consumers” of e-Health and e-Care solutions. For convenience, we repeat these here.

Persons are national citizens; resident aliens; short-term visitors; and tourists in need of or receiving medical attention, social care, or allied treatments. When health care is involved they are called “Patients,” if social care then “Clients,” and in commercial situations “Customers.”

Care Professionals, in a medical context, include doctors, nurses, and allied care professionals. Doctors would include general practitioners, physicians and surgeons, and mental health specialists. Nurses would include hospital, community, and specialized nurses, such as cancer care nurses. Allied care professionals, who usually need formal training and accreditation before they are employed, would include medical assistants, dental hygienists, physio- and occupational therapists, laboratory technicians, medical equipment technicians, radiographers, medical secretaries, medical coders, care assistants, caterers, porters, and drivers.

In a social care context, care professionals would include social workers, counselors, community care workers, and many accredited volunteers and private sector carers. In certain, clearly defined circumstances, they might include special needs teachers, home care assistants, personal financial and legal assessors and councilors, police and probation officers, and addiction treatment and prevention specialists.

Care Providers include hospitals, clinics, care and residential homes, medical practices, laboratories, and other organizations that accommodate and treat patients or clients. They provide physical premises and facilities and operate medical and other equipment. They operate administrative and clinical systems and employ care professionals.

Policy Makers and Legislators are government departments, quasi-government organizations, and professional bodies responsible for the organization and regulation of care services on a national or regional basis. This would include the enactment of legislation, the provision and control of funding, and the setting and governance of professional standards of care and process.

Funding Organizations are those bodies—public or private—that provide the funding for e-Health and e-Care. They include national and local government departments like Ministries of Health or Social Work departments, official agencies like National Health Services, insurance companies, and charities and philanthropic organizations.

Researchers and Analysts are scientific, medical, statistical, and other professionals, institutes, and bodies interested in the analysis of trends, treatments, procedures, medications, facilities, screening programs, care initiatives, and many other aspects of Health and Social Care. Typically their interest lies in the experiences of groups of patients or clients rather than individuals, and patient information should be anonymized before use.

Other participants, not shown explicitly in the model for simplicity, include the following: Third parties administering services or managed care solutions (PHR, health portal, employer health portals, etc.); Bio-surveillance, hazard control, population health and intelligence agencies. Some of these may be grouped together with the main types identified above.

Relationships and Interactions

We illustrate the typical relationships and services in Health and Social Care in [Figure 6](#). We introduced this diagram in *Part 1* and repeat it here for convenience.

We have placed the citizen at the center of the diagram showing some important interactions that take place between the individual citizen, care professionals, care providers, funding organizations, and policy makers and legislators. We have used the following key values to provide a shortcut to the discussion of interrelationships:

- C** = Citizen, Client, or Patient
- D** = Care Professional (Doctor, Nurse, or Social Worker)
- P** = Care Provider (Hospital, Clinic, Practice, Social Work Department, or Care Home)
- F** = Funding Organization (Executive Agency, Insurer, Health Plan, Charity, or Local Government)
- G** = Policy Makers and Legislators (National, Regional, and Local Government; Professional Bodies; Regulators; or Official Bodies, etc.)
- R** = Researchers and Analysts (Medical and Social Care Researchers, Statisticians, Clinical Trialists, or Methods and Procedures Analysts)

While we often describe Health and Social Care as “citizen- or patient-centric”, the views of data can be centered on each of the above players. These “viewpoints” require the accessing, retrieval, analysis, and presentation of data starting from the appropriate entity—the citizen or the care professional or the provider and so on—and navigating the natural relationships between entities.

Each user can access “viewpoints” depending on his or her organizational role held within the Health and Social Care domain with the actual data they see being governed by the necessary consents and permissions. Each viewpoint looks at the data with the user’s professional requirements in mind, and in the most appropriate form for the user’s purposes.

The main possible relationships between the players (for example P2D or H2D), are described below.

This list of interactions is by no means exhaustive. A characteristic of complex systems is that new types of interaction arise continually as the system adapts to new and changing conditions. It is important, therefore, that e-Health and e-Care systems are built to allow a high degree of interoperability between their constituent parts, and that all channels of communication can be accessed and used.

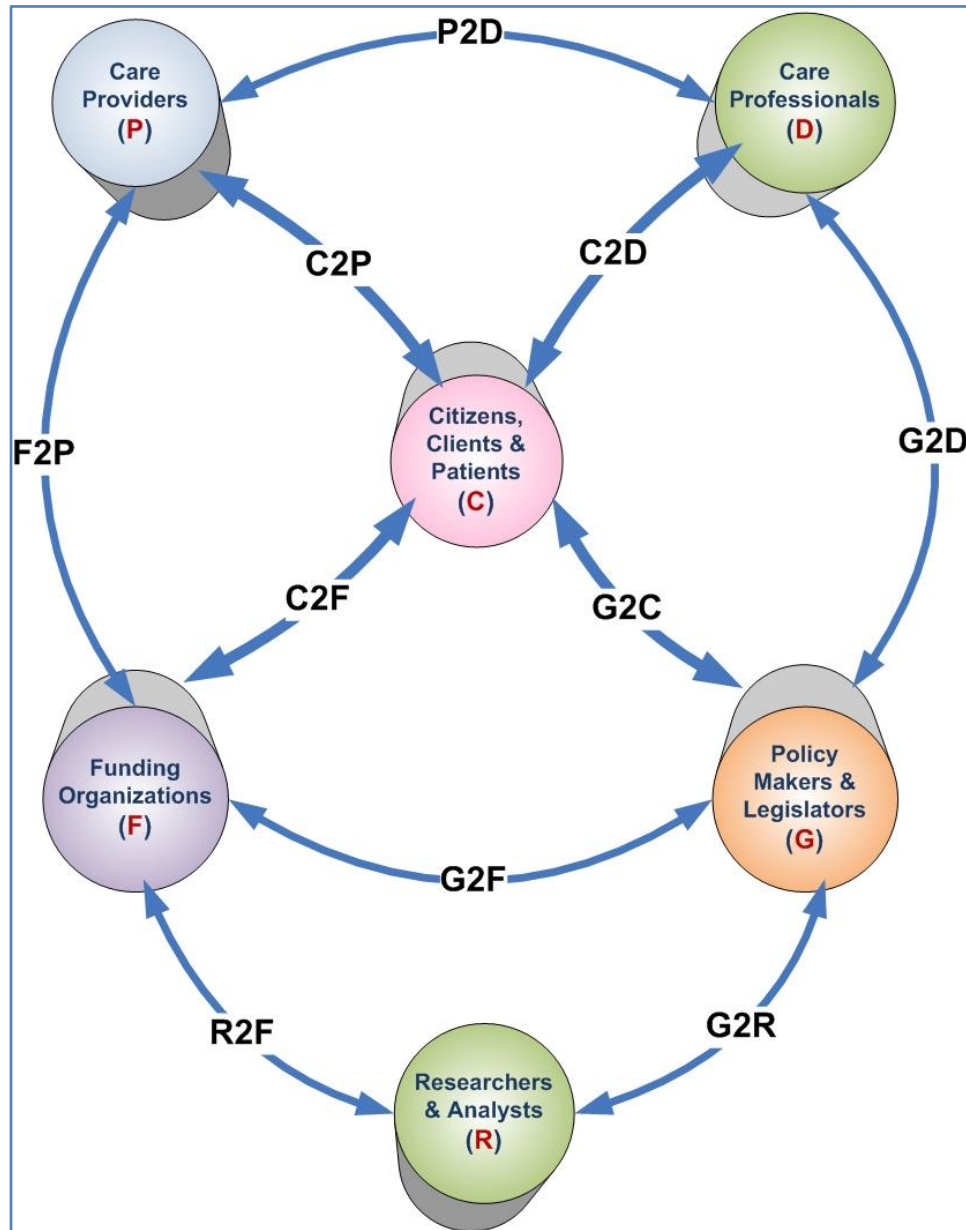


Figure 6. Players and Relationships

More detailed relationships between these main groups are shown in [Figure 7](#) and can be categorized as follows. We have used the classic x2y acronyms for brevity, but these are generalizations and may not fully reflect the potential scope of the interactions. Furthermore, although each relationship is two-way, for the sake of brevity, we describe it in only one direction, usually from the likely initiator of the main interactions.

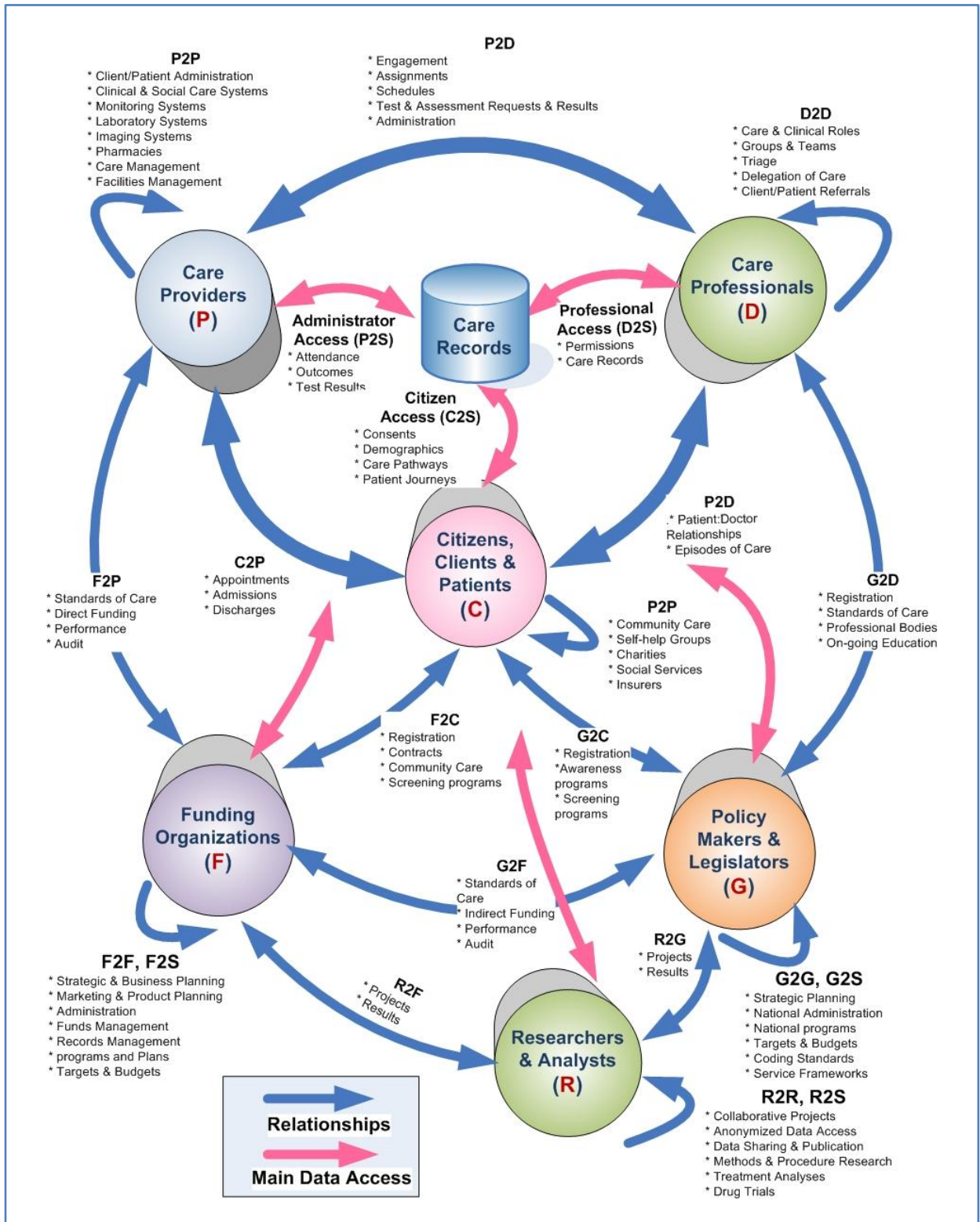


Figure 7. Care Relationships and Data Access

Person-centric Interactions

- C2P** – Person to Care Professional Interactions—typically concerned with episodes of patient care or treatment. These interactions are subject to stringent confidentiality requirements, including the observance of specific professional and ethical relationships.
- C2C** – Person to Person Interactions—typically concerned with self-help groups and community-based activities, including social services. In this group we would include charitable groups and activities such as hospices, elderly care, and other tertiary-care initiatives. We would include insurers in this set of interactions in so far as they trade with citizens and may represent patients in the arrangement of suitable care and treatment.

Care Professional-Centric Interactions

- P2P** – Care Professional to Care Professional Interactions—typically concerned with the referral of patients for further examination and treatment; case reviews and triage; peer knowledge and information sharing; and the delegation of care as well as the organization and management of clinical groups and specialist teams.

Care Provider-Centric Interactions

- B2C** – Care Provider to Person Interactions—typically concerned with administrative transactions such as the making of appointments, attendance at outpatient clinics, and hospital admissions and discharges.
- B2P** – Care Provider to Care Professional Interactions—typically falling into two types: administrative activities around engagement and assignment to particular roles and responsibilities, and clinical activities associated with patient care and treatment, such as requests for tests and imaging and the use of specialized facilities and equipment.
- B2B** – Care Provider to Care Provider Interactions—these are many and varied, covering patient administration and clinical care; the management of facilities; and the provision of specialist services such as laboratories, imaging systems, and specialist diagnostic equipment. Independent services such as dentists, opticians, and pharmacies may also be included in this grouping.

Policy Maker and Legislator-Centric Interactions

- G2C** – Policy Maker and Legislator to Person Interactions—typically concerned with registration for national and regional services and initiatives such as screening programs and community-based care activities. Citizens often will pay for their health service either as part of general taxation or through a specific, homologated charge.
- G2P** – Policy Maker and Legislator to Care Professional Interactions—under the term “Policy Makers and Legislators” we include not only national governments and state and regional authorities but also professional bodies concerned with registration of care professionals and the setting and observance of professional standards of care.
- G2B** – Policy Maker and Legislator to Care Provider Interactions—typically concerned with the setting and monitoring of standards of care and audit and performance measurement activities. Depending on the

An Architect’s Viewpoint

Figure 7 is a complicated diagram but it does illustrate the large number of interactions between the players. We could place any one of the players at the center of the diagram.

The interactions are the basis for discovering workflows and thus business processes.

An Architect’s Viewpoint

These relationships and interactions provide an inventory of scenarios from which we can deduce use cases or flow diagrams, which in turn can be developed into business process definitions (perhaps described in “swim lane” diagrams).

Analysis of these provides business function definitions, an essential artifact in defining business components and thus business services.

national business model in use, these interactions may take place either directly or via the appropriate funding organization.

G2F – Policy Maker and Legislator to Funding Organization Interactions—typically concerned with the setting and monitoring of budgets, levels of expenditure, and the audit and appraisal of performance.

G2G – Policy Maker and Legislator to Policy Maker and Legislator Interactions—typically include the overall definition, planning, and execution of national policy; the administration of the national service including the setting and monitoring of national targets and budgets; the definition and management of national programs; and the definition and monitoring of disease-specific service frameworks and guidelines.

Funding Organization-Centric Interactions

F2C – Funding Organization to Person Interactions—typically include the transactions involved in the registration and enrollment of persons for various services; the calculation and collection of premiums, contributions, and payments for care services and programs; and the operation of health assurance activities such as screening and risk assessment sessions.

F2B – Funding Organization to Care Provider Interactions— typically concerned with funding and audit, measuring and improving performance, and monitoring of standards of care.

F2F – Funding Organization to Funding Organization Interactions—typically include a full range of business management activities such as strategic and business planning activities, marketing and health and care product planning, financial planning and management, business improvement programs, and the setting and monitoring of financial and organizational targets.

Researcher and Analyst-Centric Interactions

R2F – Researcher and Analyst to Funding Organization Interactions—typically concerned with requests for, formulation of, and financing of research studies, statistical analyses, surveys, opinion polls, and so on, as well as the reporting of results.

R2G – Researcher and Analyst to Policy Maker and Legislator Interactions—as R2F

R2R – Researcher and Analyst to Researcher and Analyst Interactions—typically concerned with the organization and conduct of research and evaluation projects including collaborative projects, data collection and sharing, trials and evaluation of drugs and treatment procedures, and so on.

Information Flows

There are also interactions between each of the primary players and the “system”. These usually can be expressed as “information flows”. These are shown in summary in [Figure 8](#).

C2S – Person to System Interactions—typically concerned with the setting and maintenance of patient-supplied data such as some demographic details, family information, and, importantly, the viewing and variation of consent data for patient data access.

P2S – Care Professional to System Interactions—typically concerned with the viewing and maintenance of permissions to access patient data and the creation, updating, and audit of the patient Care Record.

B2S – Care Provider to System Interactions—typically concerned with the recording of activities such as patient attendance; maintenance of waiting lists; the scheduling of teams and facilities; and the recording of examination and test results.

G2S – Policy Maker and Legislator to System Interactions—typically concerned with the setup and maintenance of national administrative facilities; standard procedures and coding systems; and the setting of targets and budgets.

F2S – Funding Organization to System Interactions—typically concerned with administrative processes, funds management, billing and cash flow management, records management, management and statutory accounting, and so on.

R2S – Researcher and Analyst to System Interactions—typically includes project planning and control, the management of test and trial data (usually anonymized), and trial results processing and publication.

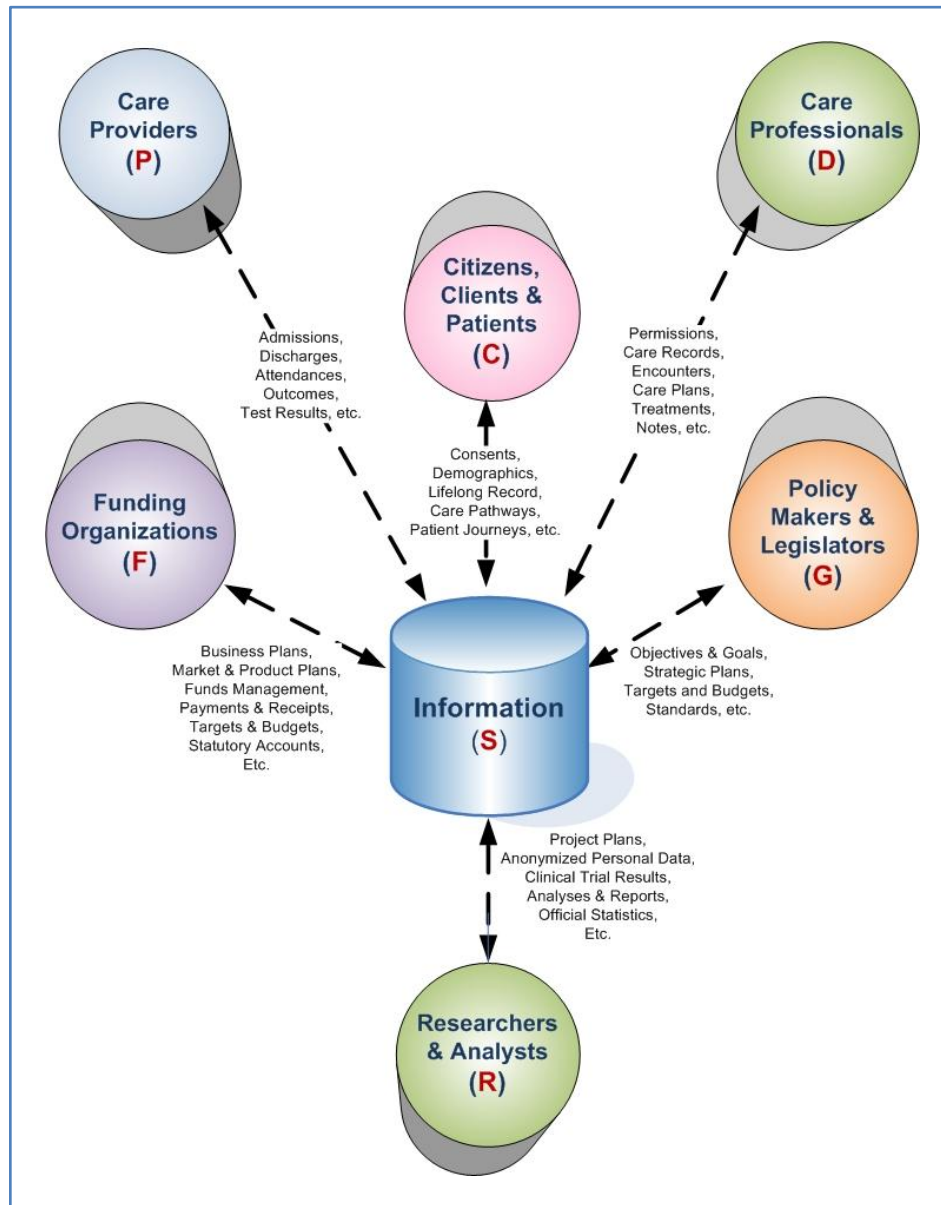


Figure 8. Information Flows

These interactions and information flows are important for developing business scenarios and, thus, the business processes and functions that drive the business of Health and Social Care. They are a major input to the definition of business services described later in *Part 2* of the CHF Architecture and Design Blueprint.

Achieving a Seamless User Experience

We have been disappointed to learn in recent times⁵ of the apparent resistance of care professionals to new e-Health and e-Care applications. It would seem that although great effort and expense has been incurred to create systems, people just do not seem to want to use them or at best might be reluctant users. Why should this be?

Although it is encouraging that new systems are indeed becoming available, the apparent difficulties in achieving implementation and acceptance give cause for concern.

We wonder whether this effort has in some way created the “wrong thing” and that users do not yet see the undoubted benefits of use because of the long development lead times causing skepticism, steep learning curves, unfamiliar user interfaces, non-intuitive dialogues, and an intrusion of strange technology into familiar, if inefficient, work practices. More likely we think that the current situation could be regarded as an inevitable step on the way to service maturity and the delivery of substantial benefits. Although user acclaim is muted, applications are indeed becoming joined up and data silos are being bridged. However we suspect that the user can still see the joins; can recognize old applications in new guises; and has to do too much searching, navigating, and rekeying to see any substantial gain in productivity and added value.

In *Part 1* of the CHF ADB we described a maturity model for e-Health and e-Care and in particular highlighted the “Trigger Point” at which e-Health and e-Care “take off” and become a central and critical foundation to effective and efficient Health and Social Care. We reproduce the maturity curve in [Figure 9](#). Our impression is that many current implementations are concerned with moving from the Baseline, Level 0, towards Integration, Level 1, rather than from an integrated platform through the Trigger Point to Transformation, Level 2, and eventual Revolution. In other words, Transaction might be happening, but Transformation and the Trigger Point most definitely are not.

The main thrust of the CHF Architecture and Design guidance is to help bridge the gap between Level 0 (the Baseline) and Level 2 (Health 2.0) by ensuring that Level 1 (Integration) is effectively and efficiently implemented. In this part of the CHF ADB we present a *Business Pattern* that can be regarded as a template for Levels 1 and 2. In this chapter we describe the key moves in creating the seamless user experience. We think there are three of these. The first is the user experience itself—what does the user see, how easy is it to use, does it deliver accurate information at the right time and in the right format? The second is concerned with information delivery—over which channels do we transport the information, how do we render it for the user’s devices, how do we ensure it is secure and delivered only to the appropriate, authorized person? The third is concerned with application integration—how do we bring a disparate set of basic applications with their own in-built processes and data bases into a coherent whole from which accurate, synchronized functions and data are made available?

These moves have to happen together in a coordinated development roadmap; the new user experience is not very useful without means of information delivery to the point of need and the underpinning applications that do the processing and data storage.

⁵ <http://www.ehealthurope.net/news/newsletters.cfm?ID=657>

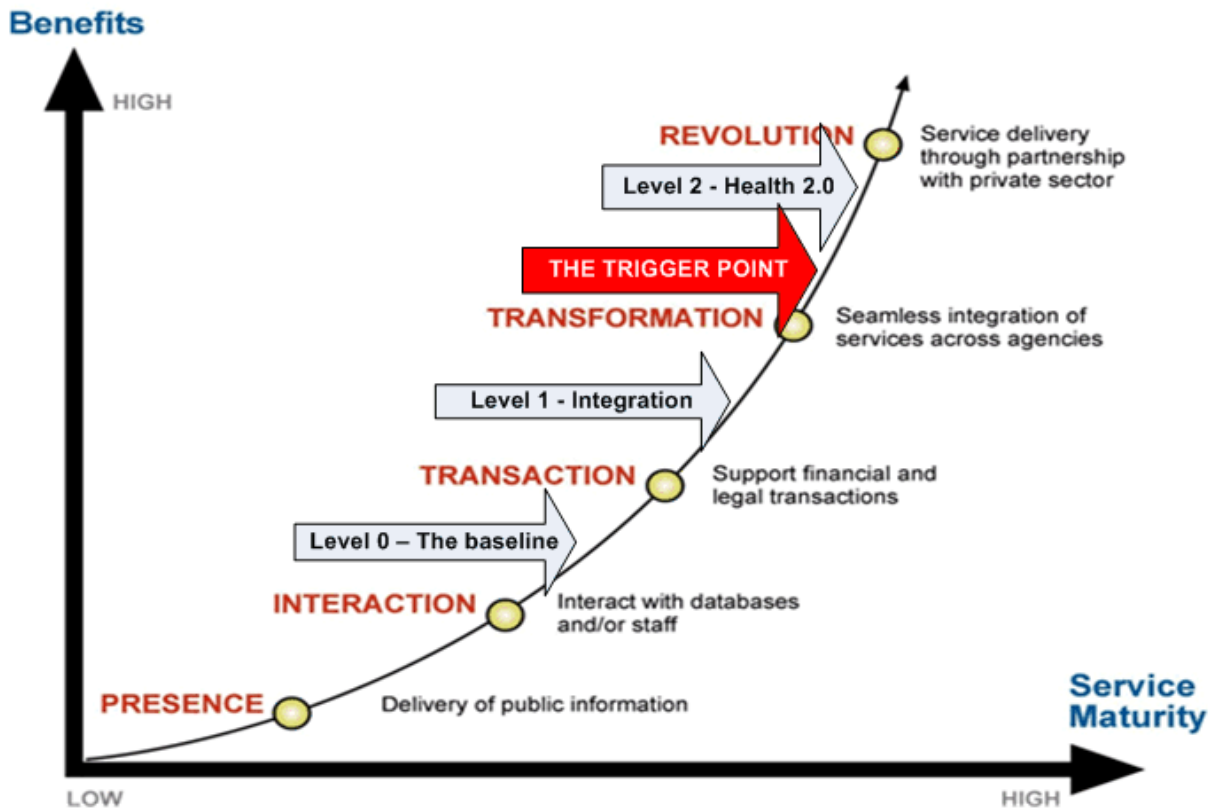


Figure 9. Phases of Maturity and Types of Solution

The User Experience

We want our systems to be “User Seductive”. A frequent complaint is that many Health and Social Care systems are far from user-friendly, indeed we have even heard the phrase “User Hostile”. How do we transform “hostility” into “seduction”?

It is important that users like their computer systems and that the system provides by far the easiest way of doing their job. We believe that this can be achieved by assembling all the data a user needs for a major task on the screen, or available just a click away. The dialogue he or she follows must be neat, intuitive, and guide the user through the task in the way that he or she wants to do it. Data entry must be in a logical sequence, following the workflow, with in-flight validation. When the user needs to change the information source, such as from patient or client demographics to the Care Record, the personal context should carry over automatically with no need to rekey the patient or client ID. Further, as we get deeper into the dialogue, other key context identifiers such as the encounter and condition parameters should also carry over into the new information source.

We think this kind of navigation is best done in a role-specific portal.

Using Portals

The portal is a vital piece of technology. It enables the assembly of relevant data from multiple sources, which can be presented to the user in a coordinated, task-oriented manner. It provides comprehensive content management and search capabilities, enables participation in shared business processes, and facilitates enterprise-wide information sharing across organizational boundaries.

It offers a single integrated platform for all intranet, extranet, and Web applications across an enterprise.

It needs to be attractive, slick, and professional and present highly relevant data to the user in a clear, unambiguous way. Technically, it needs to support Web Services and interoperability standards such as XML and SOAP. We would intend that the portal interfaces operate closely with the underlying integration engine, which will be the primary means of data exchange. Further, the portal should offer rich, open APIs and event handlers for lists and documents so as to integrate directly with existing systems. The portal must integrate with authentication and authorization providers and directory integration will be needed.

A “Web Part” framework is needed to integrate with other “line of business” applications and enable the user to access such applications from within the portal. WSRP (Web Services for Remote Portlets) technology can enable connection to other portal solutions.

The portal should offer each user a private and a public persona. In private mode, users can work within their own secure environment on their own tasks. In public mode, users can publish information about themselves such as professional information and data (not patient-related) via a “collaboration” component within the portal.

The collaboration component of the portal can make Contact and Availability data accessible by selected colleagues, and group and team meetings can be conducted online with shared viewing of exhibits such as patient test results and images. Note that patient data is normally anonymized for such purposes.

Further common uses of a portal are for document management (the portal may be the repository for patient-provided history and clinical notes prior to incorporation into the patient record) and for access to information sources (medical dictionaries, medication information and specialist professional data, real-time notice boards and news feeds, etc.).

The portal has a number of prerequisites. These include an underpinning Integration Engine, authentication and authorization systems, and enabled feeder applications.

The use of portal technology would enable comprehensive citizen, care professional, and management portals; effective application integration; collaboration mechanisms such as presence and meeting management; pre-commitment document management; information services; and so on.

The Citizen’s Portal

The citizen’s portal offers a snapshot of a person’s lifelong well-being. It is a secure, comprehensive window on a person’s health status and his or her social care situation, a means of enabling some self-care, and a way of keeping data up-to-date on relevant general health or care matters. It provides a gateway to personal care management, a source of controlled advice, and personalized tools to encourage and measure lifelong well-being. [Figure 10](#) shows a simple schematic of a possible citizen portal covering lifelong well-being, focusing on both the Health and Social Care domains. Each of the “buttons” leads to an appropriate capability where the citizen can review his or her situation, make controlled inputs, and follow linkages to further information.

The citizen portal is viewed as an interactive facility in which the citizen is “in control” of his or her situation and makes requests and receives responses as far as possible online. A key capability is that of providing monitoring

(such as “tele-monitoring”) both of long-term conditions and also, on a voluntary basis, of personal lifestyle factors such as weight, smoking, alcohol, and diet. A system of “traffic lights” could be implemented to track trends.

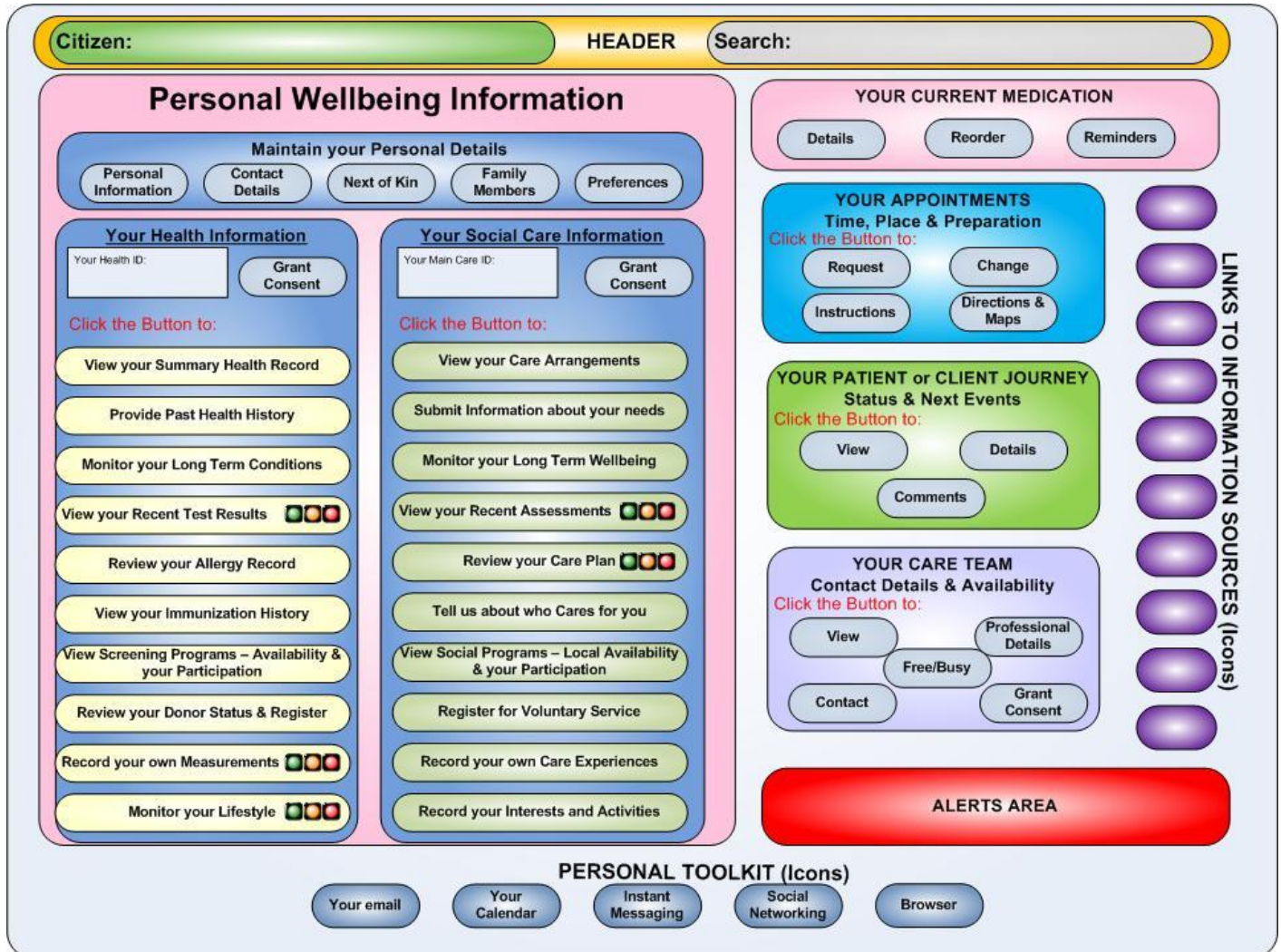


Figure 10. The Citizen Portal – A Generalized Structure

Using the portal, the citizen may **VIEW**:

- Own Health or main Social Care Identification Number
- Own demographic information: recorded name and address, date of birth, gender, etc.
- Own Summary Care Record
- Own diagnosed long-term conditions
- Own Test Results: new, history, and trends (traffic lights), with a help link to explanatory information
- Current medication: item, dosage, frequency, etc.
- Allergies
- Immunization history and status
- Screening and community social programs and participation

- Assigned clinicians and social workers with mini-CV of each
- Own Client or Patient Journey: next events, what will happen, and preparation required

The citizen may **MAINTAIN** (via standard data entry forms, which provide a controlled, recordable dialogue):

- Own address/phone numbers/e-mail addresses, and changes/updates
- Own consents: setting, reviewing, and modifying personal wishes (and those for dependents)
- Own religion/treatment preferences
- Next of kin
- Family: parents, children, close (blood) relatives—and their relevant histories
- Own medical history (e.g. from outside the present location or private care)
- Donor registration and status and registration for voluntary service
- Self measurements:
 - Height and weight (with BMI calculation with trends/traffic lights)
 - Self monitoring (BP, blood sugar, etc.) with trends/traffic lights
 - Telemedicine readings and logging (alerts/notifications/instructions)
- Lifestyle recording
 - Alcohol intake (via mini-diary with actual drink choice—calculates weekly units with trends/traffic lights)
 - Smoking habits: monitoring of quitting plans (self-help groups?)
 - Actual diet: record food preferences and actual consumption—suggested variations to reduce fat intake, etc. (Link to suppliers?)

The citizen may **REQUEST**:

- A repeat of a medication order or prescription
- An appointment with a care professional or clinic/department or to change an existing appointment
- An automated reminder (e.g. by SMS) to take medication or attend an appointment
- Directions/maps
- Preparatory Instructions and information for examinations and consultations
- Contact and biographical information about assigned care professionals, including availability information if appropriate
- Information about what will happen during investigations

The prerequisites to the satisfactory operation of the portal are a robust portal mechanism; comprehensive client and patient identification; an integration engine; a record locator service; means of validating, storing, and disseminating citizen-entered data; and access to the relevant databases.

Provision of a citizen portal such as this enables meaningful citizen participation and involvement in their own well-being and maintenance. As an example of a patient portal, see NHS England's "HealthSpace" facility.⁶

⁶ <https://www.healthspace.nhs.uk/visitor/default.aspx>

The Care Professional's Portal

The care professional's portal should present current, linked data from the standard systems in a user's professional domain and do so in an attractive, concise form that provides care professionals with a personalized "one-stop" entry point and a consolidated view of the wide range of systems they currently use.

Any duly authenticated and authorized care professional may access the clinical portal, but the information presented should be filtered by their professional role and the nature and extent of their permissions and patient or client consents. The portal should be "role-based", presenting information immediately relevant and tailored to the professional's current "log on" situation—for example consultant surgeon, general practitioner, community nurse, or social care worker—within the appropriate organizational context, such as hospital, practice, or locality. They should only see information about their own patients or clients.

A key feature of the care professional's portal is that it centers around the main professional applications used by the professional, for example, a patient management system, a radiology system, a clinical application, or a social care management system. This ensures that there is a solid anchor to the base processes and information sources used by the professional and that he or she continues to interact fully with their "home" systems environment. Application switching to other applications used by the professional is enabled by a click on the appropriate application icon, with automatic passing of the current context—for example, client identity, the health or care subject, and the timeframe. We show a generalized structure of the care professional's portal in [Figure 11](#).

We foresee a number of "quick-access" facilities to items such as calendar and schedule, patient/client information, and team and facility resources. These offer "collaboration" capabilities—for example, to check on the presence and availability of colleagues and commonly used facilities. Quick links are provided to general and professional information, such as medical and pharmaceutical directories, knowledge sources, and social care guidelines. A personal "toolkit" is provided with a full range of office and productivity tools, including the capability to schedule and conduct live online meetings and consultations.

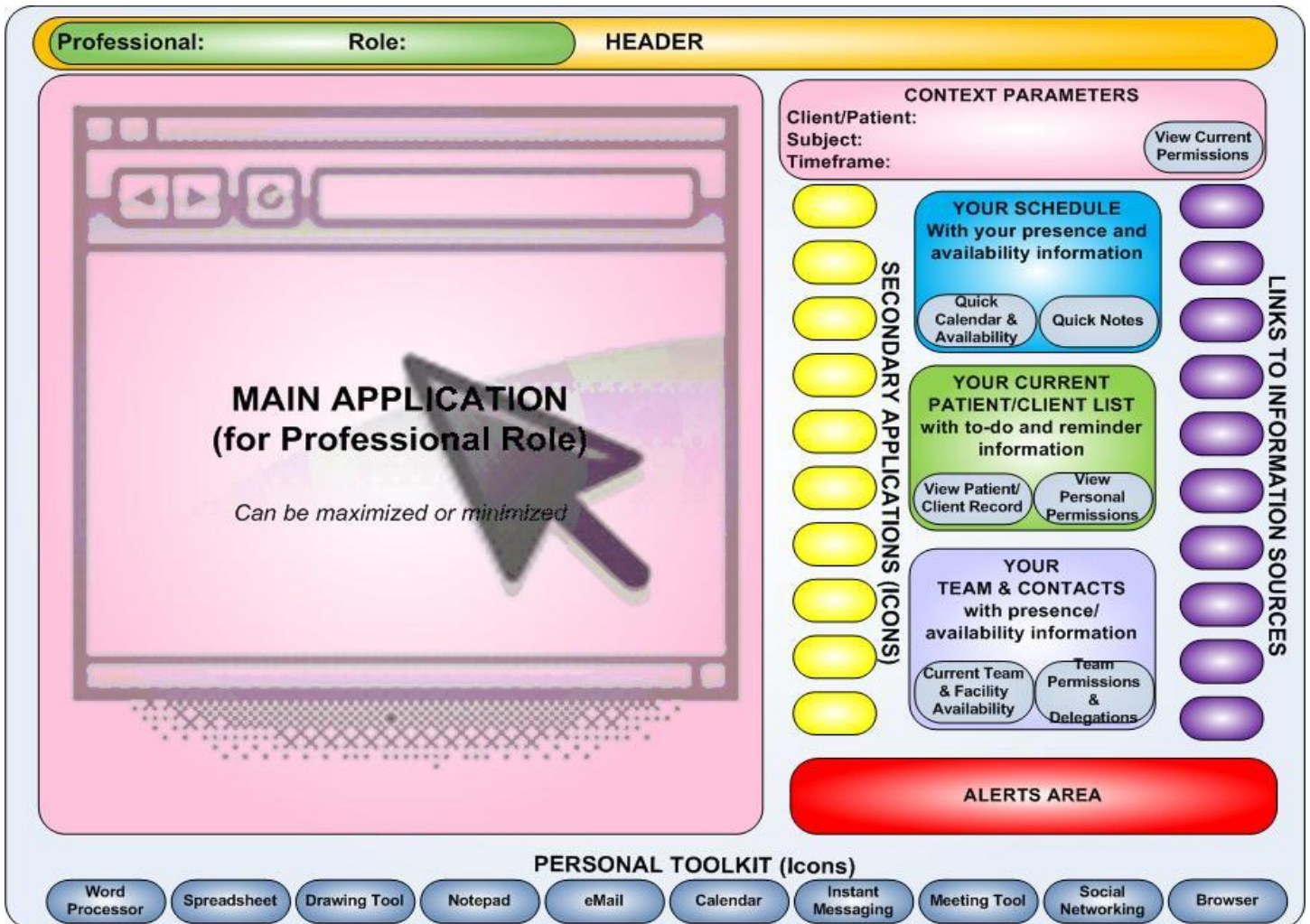


Figure 11. Role Specific Professional Portal – Generalized Structure

In summary, the care professional may **VIEW**:

- Own professional details
 - Staff number(s)
 - Name
 - Location(s)
 - Professional qualifications
 - Post(s) held and history—grades, etc.
 - Roles played
 - Organizational structure (up, down, and sideways)
 - Team and group membership

- Own permissions for each current role/health or care subject
- Own patient or client list—by role and location (legitimate relationships)
- For current (or registered) patients or clients (subject to consents and permissions)
 - Personal ID for the domain
 - Name
 - Current demographics (address, phone numbers, e-mail, etc.)
 - Patient Care Record (for consented and authorized health or care subjects)
 - Patient or client timeline
 - Care Pathways and Patient or Client Journeys
 - Test results: new, history, and trends (charts and tables)
 - Lifestyle measurements (H/W, BMI, cholesterol, blood sugar, etc.)
 - Consultation comparisons
 - Current medication and prescribing history
 - Allergies and immunization history
 - Upcoming appointments (own plus referrals)
- For his or her organizational unit/team/professional group
 - Presence/availability of colleagues
 - Practice or departmental notice board
 - News feeds
 - Knowledge support

The care professional may MAINTAIN:

- Own biographical details including current professional interests
- Own up-coming schedule with free/busy/unavailability control
- Own presence information
 - Contact Details including current location
 - Own availability with calendar sharing within teams and groups
- Own Clinical and Case Notes and other professionals notes given that they have been shared

The care professional may REQUEST/INVOKE/PROCESS:

- Repeat prescriptions
- Short-range appointment changes
- E-mail and instant messages
- Live Meetings including multidisciplinary team meetings

The following link⁷ gives a good example of what can be done to supply current patient data (and the right administrative tools) to a clinician—note that it uses the Microsoft Common User Interface guidelines, which are freely available⁸.

The care professional portal requires a fully functional staff identity management system, including permissions management, a robust portal mechanism, an effective and efficient integration engine, and appropriate data feeds to support functionality.

The portal would enable full care professional engagement and information supply/exchange and full patient management.

The Manager's Portal

Sometimes a further class of portal is developed for administrators or managers. We think that this would follow a very similar structure to the care professional's portal above, with the main and secondary applications being those used by the manager or administrator. Thus we view the manager's portal as being a role-based instance of the care professional's portal.

An important factor in the viability and success of a portal system, and indeed any user interface, is that the information presented is accurate and unambiguous—a vital aspect of patient and client safety. The Microsoft Common User Interface guidelines mentioned above provide extensive, detailed guidance on the design of health-oriented user interfaces and a large number of toolkit controls. For example, they provide detailed recommendations on the way potentially misinterpretable information, such as medication details and instructions, are presented, and further it addresses seemingly simple yet complex issues such as date formats.

Establishing Identity

In the citizen portal, means of establishing reliable, secure citizen identification, authentication, and authorization are essential. These should be simple but stringent. The need is to connect a fully authenticated user to the correct care records via a record locator service. Since different care domains can use different identification schemes, a matching service may be required that links a person in one care domain with his or her records in another care domain. Upon a verified identification, the appropriate authorization to read, and in some cases update, personal data is granted.

Possible mechanisms might be chosen from a banking style logon (username, password, characters from a strong password, secret item, etc.), a government gateway-generated username and password, a Windows "Live" or "Passport"-style authentication service, or the use of a smartcard. These options are described in *Part 3* of the CHF ADB.

In the care professional's portal, we need to be able to identify a care professional precisely and quickly and be able to establish the organizational units in which he or she works (could be more than one) and the roles played in each organizational unit (could be more than one). At logon, we need to authenticate the professional (establish that he or she is who they say they are); and then authorize the professional to access the systems and data of his or her "home" organizational unit. This usually means checking that the individual is a registered user of a particular application. At a simple level, this requires the verification of username and password.

⁷ <http://www.mscai.net/PatientJourneyDemonstrator>

⁸ <http://www.mscai.net>

However, healthcare professionals usually require access to a number of applications, not just at their home location but more generally in the whole Health and Social Care professional subject domains. To avoid a plethora of ill-remembered usernames and passwords, there is a need for a “single sign on” facility and “federated trust” arrangements between organizational units. This is a complex area—a detailed discussion is provided in *Part 3* of the CHF ADB. The basic need is for a healthcare professional to sign on once and automatically gain access to all his or her authorized systems no matter where they are housed. Such a facility also needs means of establishing authorized access for the professional to the records of his or her assigned patients and no others.

The staff identity facility also needs to know the current organizational structure, for example the composition of teams and workgroups, so that delegations of work (and the associated permissions) can be handled automatically, such as when a doctor is unavailable. This would be done in conjunction with the directories, calendars, and the integration engine.

Ensuring Privacy and Confidentiality

An issue with “joined-up” Health and Social Care systems is the question of the confidentiality of patient or client-specific information. Information that is contained within a general practice or department is subject to the stewardship of that practice or department and currently is contained within the organization’s security and confidentiality “envelope”. Any plan to share that data on a wider basis will require the formation of a larger confidentiality “envelope”, an action that may well require the patient’s specific knowledge and consent.

The Consent and Permissions rules control access to all electronic care records and apply a further defined layer of confidentiality to the citizen’s detailed records. The principle is straightforward: the citizen owns his or her records and grants access “consent” to those professionals with a “need to know”. We expect that most citizens will impose no special restrictions, and a set of default values, set in line with current good practice, will be appropriate. However, procedures to apply the wishes of the minority of citizens who want to set specific confidentiality restrictions are required and must be completely reliable and rapid in their application.

The key driver here is data protection legislation that broadly lays down that information gathered for one purpose may not be used for another without the subject’s knowledge and consent. Thus we believe that the patient or client will require assurance that his or her information will not be misused or revealed to parties beyond those with whom authority rests or to whom specific permission has been granted.

With regard to care professionals, they will of course have continuing permission to access information within their sphere of authority. However we assume, for now at least, that specific authority, or permission, is required by care professionals to access information held outside their sphere of authority and, furthermore, that this permission is required on an individual patient or client basis.

The granting of consents and permissions are not blanket authority to join up information from different sources. Usually the patient or client will want to apply differential criteria to the integration specifying which data may be joined to which other data. The granularity of information to be joined will vary from full practice or departmental information, or may be at a much finer-grained level, say for a particular spell of care, specified time period, or subcategory of data. Sometimes this will be at “record level”, where by “record” we mean an aggregation of data for a particular condition or “event”.

We would expect that the consent-taking process would form part of the enrollment process for joined-up services, perhaps through a patient or client portal, and must be straightforward, yet comprehensive. The process must be able to attach consent to a condition or event, or more likely the converse, namely to block access to a condition or an event. Further, the blocking may only apply to a particular category of care professional; for example, “*I don’t want a junior doctor dealing with my broken leg to see my data regarding my fertility treatment*”.

In a situation where a care professional has a valid, legal reason to see joined-up data for a patient—for example in an emergency situation—and the patient has withheld consent, the professional can override access restrictions; however such overrides would trigger an “override reporting process”.

In the general case of access to citizen information, we need to verify the “need to know”. We can conceive of a process where, starting from a default position, the citizen grants or withdraws access consent to specific classes of data. Similarly the professional is granted permission to access these specific classes of data. Clearly, to access specific data about a citizen, there needs to be a “tick in each box” for patient consent and professional access.

An important aspect is that the confidentiality model should be applied quickly and consistently. Thus we think it should be run on each citizen “logon” or professional access to healthcare data. The algorithms used must therefore be rapid in their application and not require access to practice and departmental systems to establish consent or permission.

Using Mobile Devices

The capabilities we have described are the context of a full-featured citizen or care professional Web-based portal that would require a capable client computer, broadband access, and operation within a comprehensive computing environment with substantial functionality and data handling capabilities. Given such an environment, the portal features or a subset of them could, of course, be made available on other devices within their capacity and capability.

Such devices might include PDAs and mobile phones as well as tablet PCs, rich client devices, and other portable terminals. While clearly the user interfaces would be different and the processes the user could carry will be limited to some extent, the information presented would come from the common source, be subject to the same levels of authentication and authorization, and apply the same levels of privacy and confidentiality.

Two recent reports in the London Guardian⁹ suggest that the common mobile phone may offer new ways of linking citizens with their carers, particularly in the developing world. The first of these reports survey results from the International Telecommunications Union, an agency of the UN, indicating that at least 50 percent of the global population now pays to use a mobile phone. Much of this growth is in Africa. Further, the ITU estimates that nearly a quarter of the world’s population now has access to the Internet. The second report describes how the mobile phone is transforming life in the Democratic Republic of Congo. People who do not have an address now have a mobile phone number. This can of course act not only as a means of communication but also as a personal identifier. This opens up a channel for the delivery of Health and Social Care advice and also a monitoring and care mechanism.

Figure 1.2 illustrates that developing-world citizens have plentiful access to mobile phones, even while other technologies and health infrastructure are scarce. This explosion of mobile phone usage has the potential to improve health service delivery on a massive scale. For example, mobile technology can support increasingly inclusive health systems by enabling health workers to provide real-time health information and diagnoses in rural and marginalized areas where health services are often scarce or absent altogether.

⁹ <http://www.guardian.co.uk/technology/2009/mar/03/mobile-phones1> and <http://www.guardian.co.uk/technology/2009/mar/03/mobile-phones2>

This area is sometimes called “mHealth”. A report from the United Nations Foundation and the Vodafone Foundation entitled “mHealth for Development – the Opportunity of Mobile Technology for Healthcare in the Developing World”¹⁰ describes 51 projects tackling issues such as:

- Increasing access to healthcare and health-related information, particularly for hard-to-reach populations.
- Improving the ability to diagnose and track diseases.
- Providing timelier, more actionable public health information.
- Expanding access to ongoing medical education and training for health workers.

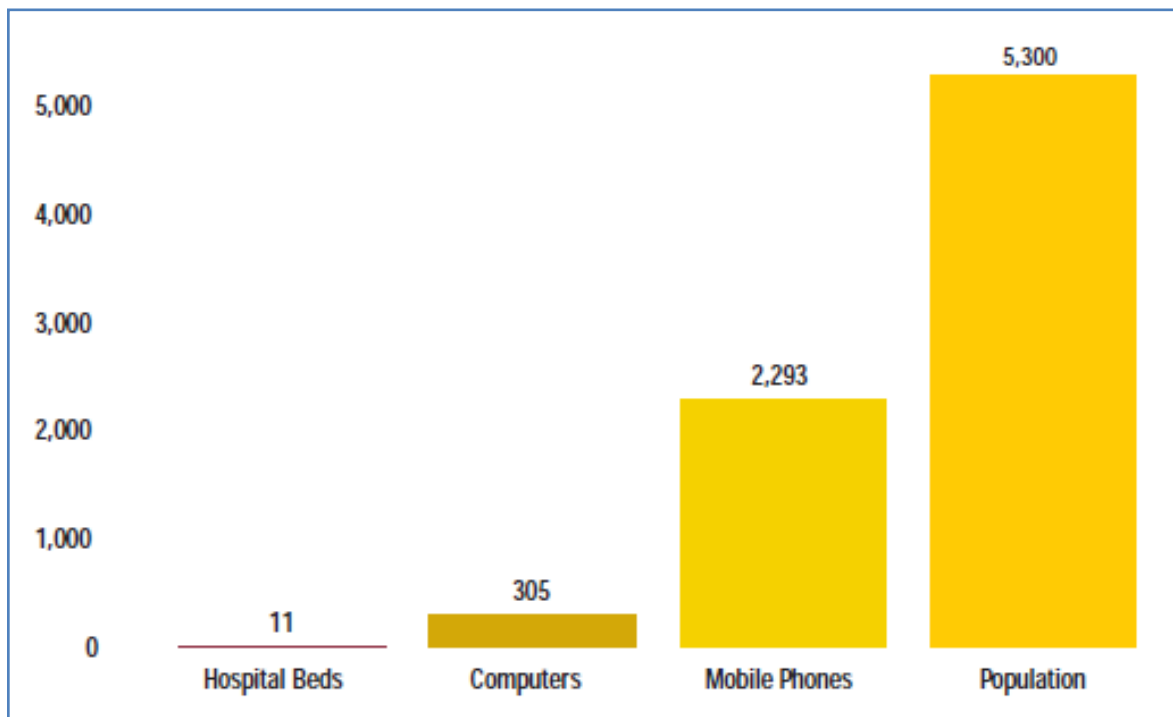


Figure 12. Technology and Health-Related Statistics for Developing Countries (millions)¹¹

The report states that the long-term goal for such programs is to make healthcare more effective and have a demonstrable and significant positive impact on clinical outcomes such as reduced infant mortality, longer life spans, and decreased contraction of disease. Experts across the field, and interviewed as part of this report, assert that there is an unprecedented opportunity at hand to fulfill mHealth’s promise. To accelerate this momentum and fully unleash the potential of mHealth applications, dynamic multisector collaboration between groups as diverse as governments, multilateral organizations, and the private sector is needed. Joint action should be directed toward the creation of a global mHealth infrastructure that lays out common standards and guidelines, and serves as a repository for shared resources and best practices. This is the best approach for scaling mHealth solutions and maximizing the field’s capacity to serve a vital development imperative.

¹⁰Vital Wave Consulting. mHealth for Development: The Opportunity of Mobile Technology for Healthcare in the Developing World. Washington, D.C. and Berkshire, UK: UN Foundation-Vodafone Foundation Partnership, 2009 at http://www.ehealthurope.net/img/document_library0282/mHealth_for_Development_full.pdf

¹¹ Vital Wave Consulting, Business Monitor International (BMI), International Telecommunications Union, World Bank’s World Development Indicators, and the United Nations.

mHealth and e-Health are inextricably linked—both are used to improve health outcomes and their technologies work in conjunction. For example, many e-Health initiatives involve creating an electronic “backbone” that ideally will standardize access to patient data within a national system. mHealth programs can serve as the access point for entering patient data into national health information systems, and as remote information tools that provide information to healthcare clinics, home providers, and health workers in the field. While there are many stand-alone mHealth programs, it is important to note the opportunity mHealth presents for strengthening broader e-Health initiatives.

The Connected Health Framework and the architectural guidance offered are completely compatible with these aims. The ideas we now put forward for information delivery, including “cloud computing” and for application integration by building “composite applications” are particularly relevant to the support of mHealth.

Information Delivery – Towards Health 2.0

“Cloud computing” is the fashionable new buzzword. Cloud computing¹² is Internet (“cloud”)-based development and use of computer technology (“computing”). It is a style of computing in which dynamically scalable and often virtualized resources are provided as a service over the Internet. Users need not have knowledge of, expertise in, or control over the technology infrastructure “in the cloud” that supports them.

The concept incorporates Infrastructure as a Service (*IaaS*), Platform as a Service (*PaaS*), and Software as a Service (*SaaS*) as well as Web 2.0 and other recent technology trends that have the common theme of reliance on the Internet for satisfying the computing needs of the users. SaaS vendors provide common business applications online that are accessed from a Web browser, while the software and data are stored on servers “in the cloud”.

Cloud computing offers some significant capabilities to Health and Social Care systems. These center around citizen interaction and data storage, as well as information delivery to remote care professionals.

In terms of citizen interaction and data storage, the required functionality and data repository facilities can be provided by a Web-based system such as Microsoft HealthVault¹³, which enables citizens to store and maintain their own health and fitness information. As such it complements and supports the citizen portal already described. Importantly, it forms a connector between the citizen and “official” electronic health and care records. It can also act as a buffer, allowing the assembly of citizen-provided information that can be screened and validated prior to incorporation in the “official” record. In situations where the “official” record is fragmented across many providers, the citizen is able to assemble his or her own lifetime record and present it to a new provider as and when necessary. In terms of remote care professionals, Web-based functionality and storage can provide essential information to professionals in the field and capture input data from remote client encounters.

The use of Web-based applications and data storage enables one of the main ideas of Health 2.0 as described in *Part 1*, namely, shifting the focus of care systems from the provider to the consumer, a term that covers both citizens and care providers. There is also a shift in mindset—currently, we think of the Web as connecting people to documents and applications. The fundamental transformation is beginning to think of the Internet and Web becoming the platform.

Clearly there are some issues to solve: identity, security, and integrity, for example. We discuss these, and possible use of Cloud Computing as part of e-Health solutions, in *Part 3 – Technical Framework* of the Connected Health Framework Architecture and Design Blueprint.

¹² http://en.wikipedia.org/wiki/Cloud_Computing

¹³ <http://www.healthvault.com/Personal/index.html>

Application Integration – Building Composite Applications

“Cloud” applications are unlikely to be entirely self-contained and self-sufficient and will need to draw upon enterprise-based applications for functionality and data.

A key issue is how such applications are constructed and how they operate. Essentially we need to be able to handle long-running workflows where the functionality and data are provided by a number of applications, on a number of platforms, in a number of locations, in a number of formats. In practice most information delivery mechanisms will be hybrids utilizing both Web-based and enterprise applications and services. A key question is how to meld differing channels and services into a consistent, reliable, and trustworthy system.

Addresses Key Issue #6

How to “join up” diverse systems on diverse platforms with diverse data and make them interoperate.

Some elements of a solution will be realized in the user interface on whichever device the consumer is using, some elements will reside in a hub or integration engine (workflows, for example), and some elements (functionality and data) will be provided by “business services” connected to the hub that orchestrates their use. A new term for this kind of assembly is “mashup”: a technique for building applications that combine data from multiple sources to create an integrated experience. Many mashups available today are hosted as sites on the Internet, providing visual representations of publically available data. A more elegant term is “composite application” – a business user’s equivalent of a mashup.

The Emerging Application Paradigm¹⁴

Composite application frameworks have the potential to change the way that applications are constructed, delivered, and experienced by end users. At some levels, however, this complicates the life of application developers, because now more thought needs to be given to which parts of the experience should be surfaced through which vehicles. It also puts pressure on vendors to think harder about developing true service-oriented applications, carefully considering service boundaries for capabilities in composite environments. As composition frameworks become easier to use, and operational and support models evolve to the point that composite applications are as easy to run, then the power of drawing on many vendors will be a strong incentive to accelerate change.

A successful framework needs to significantly reduce the friction across every level of composite boundaries. Collaborative scenarios are not a prerequisite for a composite application but are a natural place for a lighter-weight solution that is relatively simple yet high in value. The ability to compose elements of an application will move upstream to technical business users as these platforms increasingly move toward model, workflow, and rules-driven approaches, and bring to the surface more configurable attributes from business logic.

To realize this, we need to achieve interoperability at both the syntactic and semantic levels with line-of-business applications. Solutions to a number of difficult problems need to become accessible to everyday developers to achieve a full-blown composition infrastructure. Each of these areas warrants an article on its own, and several have already been explored in depth by others. These include:

- **Identity**—In particular, to have mechanisms to universally recognize a common user identity, either through single store or through federation. As cloud-based services mature, identity will be an important service that emerges. To realize a model of Software as a Service (SaaS), cloud-based identity stores will need to federate with local identity stores. The identity and authorization credentials must seamlessly pass between

¹⁴Adapted from “Composite Applications – the New Paradigm” by Chris Keyser, the Architecture Journal 10 - <http://msdn.microsoft.com/en-us/library/bb266335.aspx>

composite clients, composite services, and back-end service logic. Even on the desktop, experiences that cross applications need to be seamless to be useful in the long run. This will require broad adoption of mechanisms for federating and propagating identity.

- **Context**—For the parts of a composite application to work together to deliver a rich experience for sophisticated applications, they must have a shared notion of context. Mechanisms for passing context between cooperating composite applications and within a composite application need to be addressed.
- **Process Integration Between Composition Engines**—Projecting a view of the process interface defined within a particular service facilitates wiring complementary logic. As an example, you could design a document workflow that exposes a user interface and manages a Microsoft Excel document for sales-pipeline management and integrates into a multistep, roll-up approval process for the forecasts running in a sales force automation (SFA) business application. By projecting that roll-up process interface into a design environment, you could more easily build the cooperative workflow that triggers events or actions in a back-end system. Additionally, you could use the projected process interface to understand and interpret the current state of the corresponding process in another system.
- **Entity Definition**—For composition to cross boundaries of applications, and for entities to be used in many formats, we need a central notion that separates the conceptual entity from the physical representation. Once the notion of entity is defined, it can be reused through different physical representations. A centrally managed definition of entity, and the relationships between entities, will extend across a composite experience. Nontrivial problems remain to be solved: How will entities be managed across organizational boundaries? How will platforms make it easier to transform entities from one form to another? Clearly standardization approaches in the past have had mixed results at best.
- **Data/Information Management**—This relates to the entity problem, but is slightly different. As mentioned in the previous section, today's services and applications often don't have strong notions of data boundaries, or the mechanisms to make data boundaries enforceable while still delivering high performance. Notions of resource data, reference data, activity data (related to context), and message data need to be strongly identified and supported by design patterns, tooling, and infrastructure. Dealing with complexities like data ownership, data versioning, reference data syndication, and multiple valid versions is typically not considered when building applications today, nor does infrastructure make solving these issues easy.
- **Eventing Infrastructure**—In reality today, most Web services are request/response in nature. More sophisticated approaches supported by the WS-* protocol stack are needed for richer interaction patterns required by sophisticated applications.
- **Repository/Discovery Mechanisms**—UDDI gives one level of discoverability but has limitations. WS-Policy and WSMetadataExchange add additional layers to discover information for services and capabilities. This area needs to continue to mature.
- **Modeling and Metadata Frameworks**—Developers need to increasingly be aware of, and surface, developed functionality through models and metadata to pass more control through configuration to technical business users—and, ultimately, end users—to control the way applications behave and are assembled. The model components will be assembled using workflow and rules-based systems. Many of the concepts within software factories reflect this shift to both build better domain-specific solutions for developers, and to also pass control up the organization away from developers where warranted. This will require careful analysis by application architects and developers to determine whether to give up some level of behavior control and where to constrain configurability to ensure that correctness and consistency are not violated.

We address these issues in developing our Business Pattern for Health and Social Care in the following pages, but first we describe, in very simple terms, what a Composite Application looks like.¹⁵

Figure 13 is a representation of a composite application.

At the top are information workers, who access business information and documents through portals that are role-specific views into the enterprise. They create specific documents during the course of business activities, and these activities are part of larger business processes. These processes coordinate the activities of people and systems. The activities of systems are controlled through process-specific business rules that invoke back-end Line Of Business (LOB) applications and resources through service interfaces. The activities of people plug into the process through events that are raised when documents that are specific to the process are created or modified. Then business rules are applied to the content of those documents, to extract information, transform it, and transfer it to the next stage of the process.

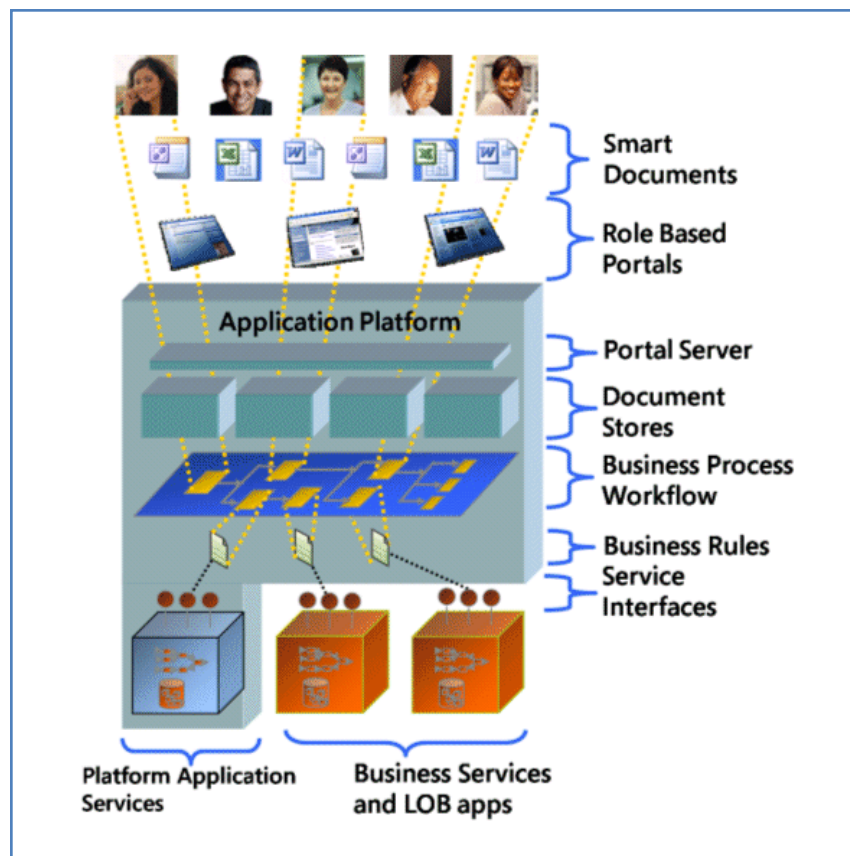


Figure 13. Structure of a Composite Application

An important factor in supporting information delivery and application integration is the ability to federate transaction processing capability and data sources into new application “experiences”. As an example, the Microsoft Amalga product offers a federated data capability in which data from multiple source applications is extracted, transformed, synchronized, and presented to a consumer in a new consolidated form.

¹⁵ Adapted from “What are Composite Applications” by Anatu Banarjee, December 2006

<http://msdn.microsoft.com/en-us/library/bb220803.aspx>

Since its first publication, the *Connected Health Framework Architecture and Design Blueprint* has advocated and described a composite application approach based on a service-oriented foundation. We describe a process for “composing” business services that offer integrated functionality and data from diverse application sources including legacy applications. We describe this approach and define a business pattern for Health and Social Care in the remainder of this *Part 2* of the CHF ADB.

Service Oriented Architecture for Business

In this chapter we describe how we go about building the stable foundation for agile Health and Social Care systems. We think the best way to do this is to use a Service-Oriented Architecture (SOA), so we define services, Web Services, service orientation, and SOA. We go on to define the structure of a service-oriented application and the component types it requires. We discuss the Enterprise Service Bus (with warnings) describing its essential role in pulling disparate applications and services together in support of business processes. Then we describe a method for defining business services and show an example of a business process being executed in a service-oriented environment. Lastly we discuss how to rejuvenate legacy applications to participate in the new environment.

Services, Web Services, Service-Orientation, and SOA

We have used these terms somewhat loosely so far and now they need definition and clarification. There are many definitions—all overlapping to some extent. We offer the following:

First, “**Service**”:

A “vehicle” by which a consumer’s need or want is satisfied according to a negotiated contract (implied or explicit) which includes a “service agreement”, the functions offered, and so on.

How about “**Web Service**”?

A software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a format that machines can process (specifically WSDL). Other systems interact with the Web Service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with XML serialization in conjunction with other Web-related standards (W3C).

XML Web services are the fundamental building blocks in the move to distributed computing on the Internet. Open standards and the focus on communication and collaboration among people and applications have created an environment where XML Web services are becoming the platform for application integration. Applications are constructed using multiple XML Web services from various sources that work together regardless of where they reside or how they were implemented.

There are probably as many definitions of XML Web Services as there are companies building them, but almost all definitions have these things in common:

- XML Web Services expose useful functionality to Web users through a standard Web protocol. In most cases, the protocol used is SOAP.
- XML Web services provide a way to describe their interfaces in enough detail to allow a user to build a client application to talk to them. This description is usually provided in an XML document called a Web Services Description Language (WSDL) document.
- XML Web services are registered so that potential users can find them easily. This is done with Universal Discovery Description and Integration (UDDI).

One of the primary advantages of the XML Web services architecture is that it allows programs written in different languages on different platforms to communicate with each other in a standards-based way.

Service orientation is an approach to organizing distributed IT resources into an integrated solution that breaks down information silos and maximizes business agility. Service orientation modularizes IT resources, creating loosely coupled business processes that integrate information across business systems. These capabilities are available through interfaces; complexity arises when service providers differ in their operating system or communication protocols, resulting in inoperability.

Service orientation is a means for integrating across diverse systems. Service orientation uses standard protocols and conventional interfaces—usually Web services—to facilitate access to business logic and information among diverse services.

Now for “**Service-Oriented Architecture**”:

Our definition is:

Service Oriented Architecture (SOA) provides the principles and guidance to transform an organization’s array of heterogeneous, distributed, complex, and inflexible systems into integrated, simplified, and highly flexible resources that can be changed and composed to more directly support business goals. SOA ultimately enables the delivery of a new generation of dynamic applications (sometimes called composite applications). These applications provide end users with more accurate and comprehensive information and insight into processes, as well as the flexibility to access it in the most suitable form and presentation factor, whether through the Web or through a rich client or mobile device. Service orientation uses standard protocols and conventional interfaces—usually Web services—to facilitate access to business logic and information among diverse services..

From a more technical standpoint, the Microsoft approach can be summarized as a three-step approach: *expose*, *compose*, and *consume*.

1. In the *expose* phase, existing IT resources (such as legacy systems and line of business applications) are made available as services that can be communicated with through standardized messaging formats. The most common suite of implementation technologies is the standards-based Web services. For existing technology assets that cannot natively speak Web service protocols, interoperability is attained through the use of adapters. As the developer moves forward in deliberations about which services to expose, such decisions must be driven by clearly defined and prioritized business needs.
2. Once individual services are exposed, they must be pulled together or *composed* into larger business processes or workflows. The goal of the compose phase is to enable greater business flexibility and agility by allowing processes to be added or changed without being constrained by the underlying IT systems and applications.
3. In the final step of constructing an SOA solution, the dynamic (or composite) applications that *consume* the underlying services and processes are developed. These applications—based on Web technologies (such as portals or AJAX), rich clients, Office business applications, or mobile devices—are what drive the productivity of the end-user.

It is important to recognize that all three steps are essential parts of every incremental SOA project. Without all three elements—including the delivery of the dynamic application—the business will not realize any return on the investment.

These definitions reveal a number of important aspects: SOA is about application interoperability, distributed systems, service provision and consumption—supporting business processes that provide better response and performance to their users, represent data and functionality at an appropriate level of granularity, and, of course, use carefully constructed interfaces that are independent of implementation. There is also mention of policies, contracts, frameworks, and so on. An important point to be made is that services are “fractal”—big services are

made up of smaller ones, which are made up of even smaller ones, and so on. Our concentration in these guidelines is towards the coarse-grained business service rather than the fine-grained technical service.

In these definitions there is also reference to “components”. This term is being used in a general sense in the definitions. However, in an SOA, there are quite specific functions that are carried out by quite specific component types. In particular, services are offered by software components that are constructed to provide defined functionality and assemble and present business data. We will discuss this later when we consider the structure of a service-oriented application and methods of defining services.

There is often a degree of confusion about SOA and Web Services – many developers think that by using Web Services in their application they are building a service-oriented architecture. In fact, one can use Web Services without constructing an SOA and an SOA need not use Web Services.

We can deduce, therefore, that SOA has two separate but vital functions. From a business viewpoint, it is a way of making enhanced business capability and information available to consumers both inside and outside the enterprise in a controlled manner, particularly by supporting improved business processes. This is achieved by joining-up systems at the application level and resolving issues of data consistency and business interoperability.

From a technical viewpoint, it is a design paradigm aimed at creating, or enabling, applications to interoperate across diverse technical and operational platforms. This is achieved at a technology level by observing detailed international standards and protocols, in particular those of Web services.

The Structure of a Service-Oriented Application

The concept of layered architecture will be familiar to many. The division of an application into three tiers—presentation, business logic, and data management—has been a useful strategy for many years since the advent of the client/server application architecture.

The move to service-orientation requires the expansion of this structure to accommodate the offering and consumption of “services”. Further, the notion of an “application” becomes less meaningful in the sense that we are now interested in working with a collection of services offered by a number of applications rather than working within the confines of a single application.

Figure 14 shows the various component types involved in a service-oriented application.

The offering and consumption of business services is a function of the business tier. Business logic is required to perform the business tasks handled by the application; apply consistent business rules; request, validate, and update the appropriate data; control the execution of consistent, approved business processes; and, when the application is service-oriented, make business functionality and data available to the consumer.

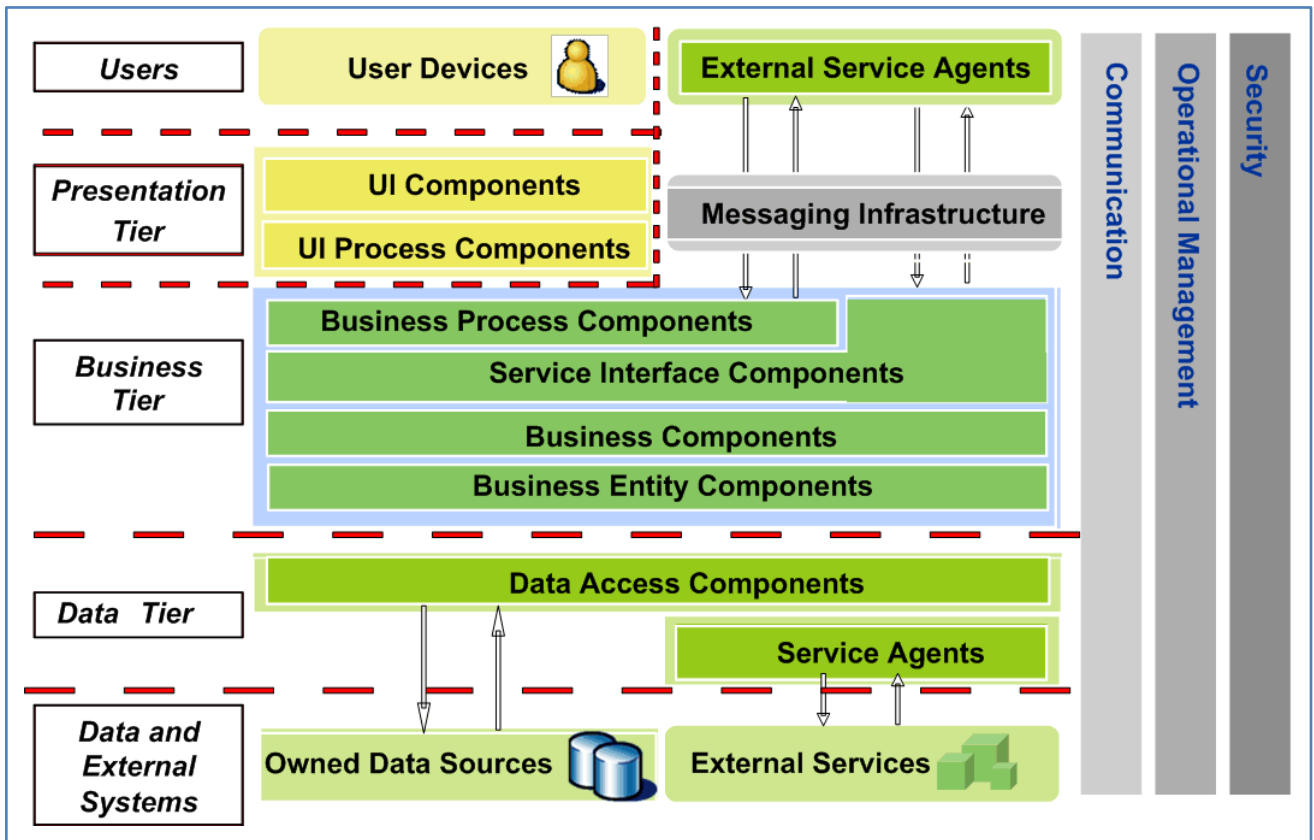


Figure 14. A Layered, Service-Oriented Architecture

The types of components deployed in the **business tier** are as follows:

Business Components, which perform business tasks, apply business rules, manage business data, and expose services for consumption by business process components.

Business Process Components, which are sometimes called Business Workflow Components. They have the job of controlling multistep business processes, invoking the appropriate business functionality at the right time and obtaining and submitting data at the appropriate stage of processing by communicating with the business components providing the required functional and data processing capabilities. Importantly, the Business Process Component has the responsibility of ensuring that the process steps are executed in the correct sequence. Since many business processes are “long running”, the component has to be aware of state and be able to suspend, restart, and roll-back processes as their execution proceeds or perhaps is abandoned. Furthermore, it may well need to invoke secondary sub-processes depending on the status and condition of the workflow. This process management activity is called “Orchestration”.

Business Entity Components, which manage the movement of data between components. These operate a logical level and maintain the data model “owned” by the business component.

... and, most importantly,

Service Interface Components, which expose the functionality of the business component (business logic) and the owned data of the business component (business entity) as a set of related services. This involves supporting the

service contract that describes the functionality and data available and the semantics for calling, as well as the information about message formats, access and security restrictions, protocols used, and so on.

The types of components deployed in the **presentation tier** are as follows:

User Interface Components, which provide a means of interaction between the user and the application. User Interface Components handle the rendering of data for particular end user devices such as PDAs and mobile phones, as well as more familiar computing devices such as browsers and rich client devices like PCs and terminal devices. User Interfaces are implemented by using interactive forms and Web pages and besides rendering and formatting data, provide data input and validation.

User Process Components, which control the interaction of the user with the application and ensure that a flexible, yet predictable, process is followed. For example, this involves making sure that all required input data is gathered and subject to first level validation. The User Process Component manages the state of the user transaction, handling issues such as cancellation and roll-back in the event of the abandonment of a transaction. Where dialogues are in progress with user devices that can lose connectivity, for example mobile phones, the component should be able to freeze the session and rehydrate when communication is restored. The User Process Component communicates with the Business Process Component to ensure that the business transaction is completed. This communication may use service-oriented mechanisms, as may the other inter-component interactions, although where the components co-reside on the same hardware device a tight coupled interface may be appropriate.

The main type of component deployed in the **data tier** is the **Data Access Component**, which manages the reading and writing of data to the persistent data stores that underpin the application. The business tier should, by and large, be unaware of how and where data is stored physically. Therefore the Data Access Component provides a translation between the logical and physical views of data. This mechanism also enables data sharing between applications.

The data tier also contains “**Service Agents**” to handle the semantics of communicating with each external service called by the application. Service agents may be thought of as data access logic components for services rather than as data stores.

So far we have discussed the structure of a single service-oriented application. From an enterprise perspective, we are interested in applying the service-oriented idea across the application portfolio. This involves multiple users running multiple user processes, performing multiple business processes, accessing multiple services, offered by multiple applications, based on multiple shared databases. This is a complex operation.

This is the structure of a single application with a single user. Of course, in reality many users will be running many processes accessing many applications at the same time.

This multidimensional picture is shown in [Figure 15](#). The tangle of services will be noticed. (The example is much simpler than real life.) This leads to the concept of the Enterprise Service Bus (ESB) and the Connected Health Services Hub that we describe in the next section.

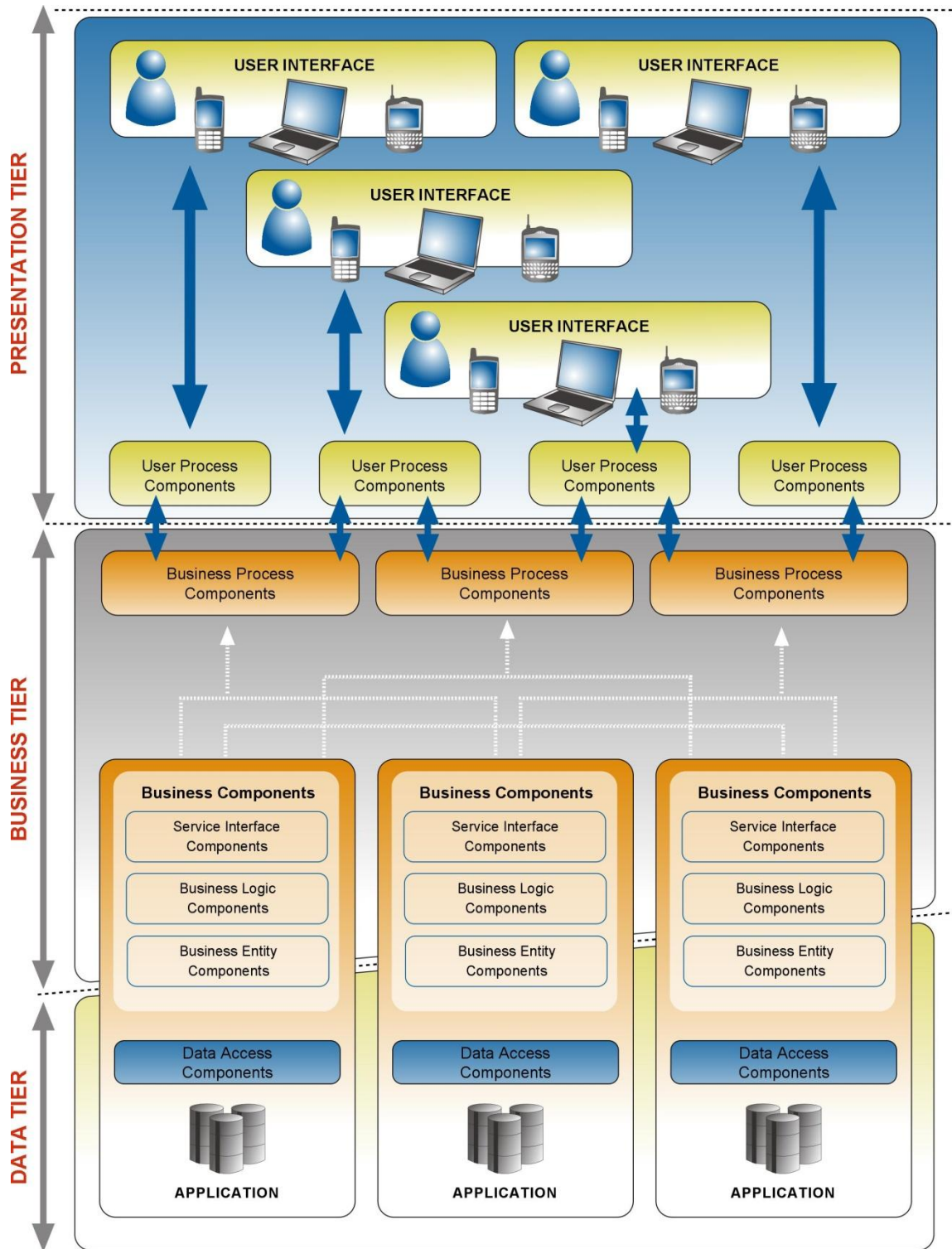


Figure 15. Multi-applications in the Enterprise

The Enterprise Service Bus

There is no precise definition of the Enterprise Service Bus (ESB) that is agreed upon by the industry. The recent buzz around ESBs is rivaled only by the ambiguity with which the term is defined.

Nor is there agreement on the content or scope of an ESB. For example, speaking to vendors, some might see orchestration as part of the ESB architecture, while others do not. ESB is often used to refer to the message bus architectural integration pattern as shown in [Figure 16](#). Some might package MOM (Message Oriented Middleware) and EAI (Enterprise Application Integration) in their ESB products, and some don't.

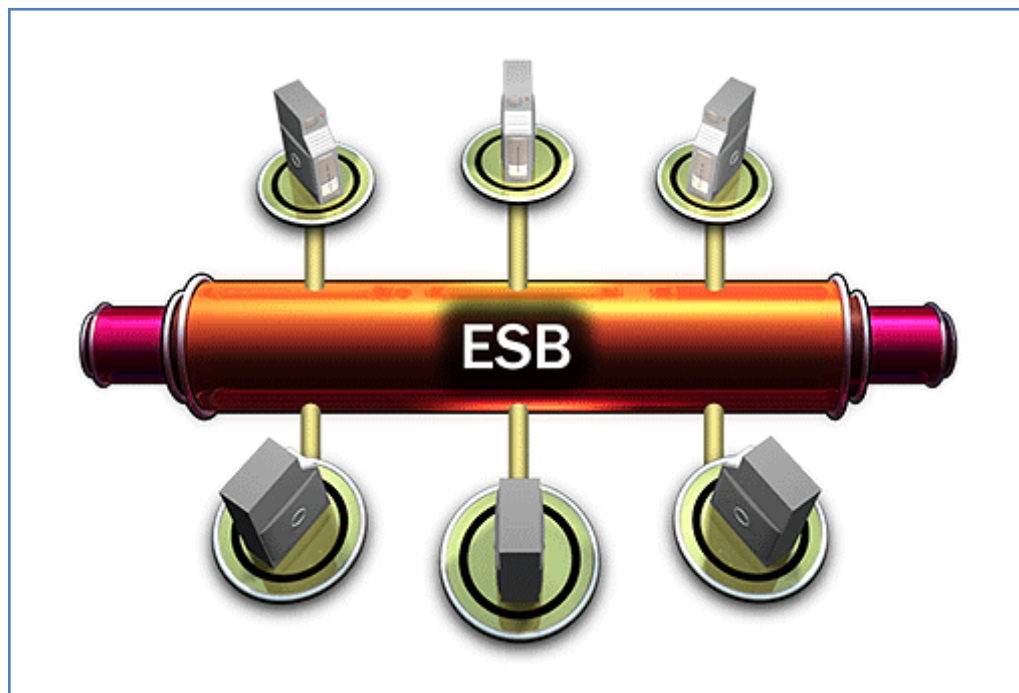


Figure 16. ESB as Message Bus Architectural Integration Pattern

Despite these varying definitions and usage, the ESB is a useful artifact that provides loose coupling between service provider and service consumer. Gartner¹⁶ suggests that an ESB should be used for larger applications of more than 20 services. Thus, we like CBDi's definition of the ESB: "The Enterprise Service Bus is a uniform service integration architecture of infrastructure services that provides consistent support to business services across a defined ecosystem. The ESB is implemented as a service-oriented architecture using Web Service interfaces".¹⁷

A word of caution: SOA is not about tools; it is about acquiring and utilizing an understanding of the enterprise, its processes, and data. Simply acquiring a tool will not deliver an SOA. However, having done one's homework, a good tool makes realization a lot easier. We should also caution about designing for one platform; it is more than likely that an SOA will need to link more than one technical domain, especially if external services are used.

¹⁶ "Integration Scenario: Leveraging the Enterprise Service Bus" by Roy Schulte, Gartner, presenting at the Application and Web Services Summit 2005.

¹⁷ "Time to board the Enterprise Service Bus" by Lawrence Wilkes – CDBi Journal July/August 2004. Available at <http://www.cbdiforum.com/inter2004.php>

A further downside to the ESB hype is that some vendors have promoted their aging tools to be ESBs without upgrading them to include the full range of features required. These include full messaging capabilities, process orchestration, dynamic routing, message transformation, full enterprise application integration (EAI) support, and complete support for the Web Services stack (WS-*).

Accordingly we will not use the term “Enterprise Service Bus” in the rest of this document, preferring to use “Connected Health Services Hub”. The Connected Health Services Hub provides all the capabilities listed above and is described in *Part 3* of this document.

During some recent projects, we have detected a degree of general confusion or uncertainty about what an “engine” or “bus” such as the Connected Health Services Hub should do, why it is useful, and what evaluation criteria we should use in designing and testing such a tool.

We are interested in a rich capability in which a user can request and receive data from the widest possible range of accredited sources (of which he or she need not be aware) and seamlessly incorporate it into their own workflows. Put another way, we are interested in business-level integration rather than application-level integration.

We want to run national-level and regional-level business processes that involve access to many applications and databases located locally throughout the e-Health and e-Care domain and maybe beyond. This involves much more than merely passing data from one application to another and requires much more functionality than is typically available from enterprise application integration and messaging platforms.

The Connected Health Service Hub needs to be able to manage long-running, “multi-hop” business processes, interact with a record locator and metadata services, interact with rules engines, carry out dynamic message transformation and routing, guarantee one-time-only message delivery, and do all this completely transparently to the user. Needless to say it must be completely secure and reliable, and perform to exacting design levels. Where existing integration engines are in use, we do not seek to replace them but will provide an overarching capability that integrates them into the overall scheme of things.

Addresses Key Issue #7

Managing business processes that span multiple systems and multiple domains

The hub is not the only capability in an e-Health and e-Care architecture; we also need enhanced patient and clinical portal capabilities using role-specific designs and common user interfaces in terms of information presentation and consistent user controls, as described earlier in the section [Achieving a Seamless User Experience](#) (p.34).

It is important to note that the hub is intended as a general, shared facility and is independent of any individual application. In the future, applications can be created that work with the engine as a matter of course and do not have to worry about data sources, transmission protocols, managing dialogues, and so on. These matters are all handled by the engine—“*Tell me what you need and I will get it for you*”.

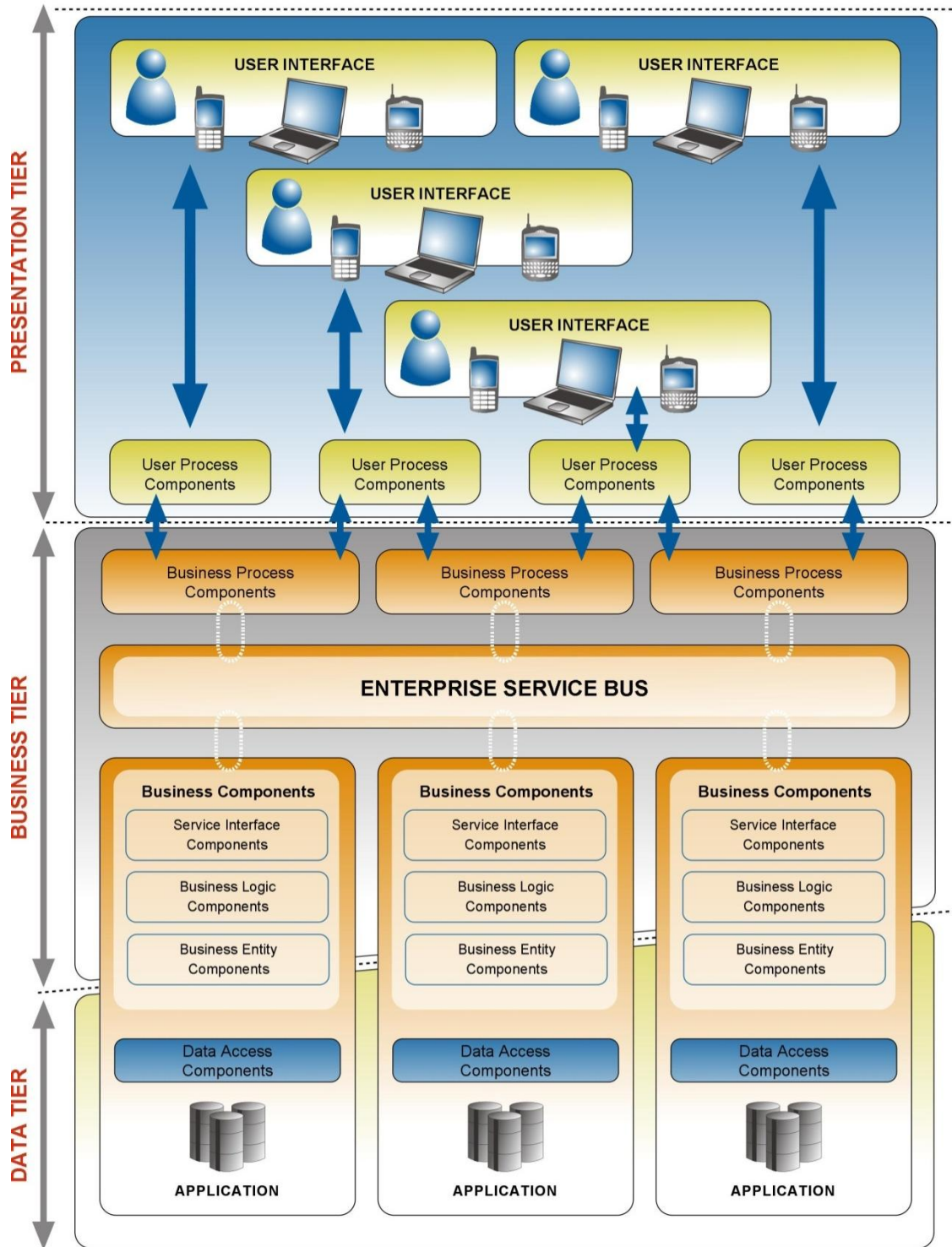


Figure 17. The Enterprise Service Bus

Defining Business Services

The Role of Component-Based Development

In these guidelines, we have made extensive reference to “components”. It is therefore appropriate to describe in a little more detail what we mean by “component”, describe its characteristics, and show how component-based development plays a major role in SOA.

A component is defined as an independently deliverable package of software operations that can be used to build applications or larger components. Technically, a component is an encapsulated software module accessible only through its interfaces. Components may be defined at a number of levels ranging from “widgets” used in graphical user interfaces to major pieces of business functionality. Components may be embedded within one another. A component has a single specification, a number of implementations, and a number of deployments of particular implementations to specific technical platforms. Component Based Development (CBD) is a paradigm for software development that focuses on the definition, development, cataloguing, and reuse of software components and the assembly of multiple applications from these components. In its widest sense, CBD can be viewed as a systems development approach that addresses the business functionality of the enterprise by providing an interlocking set of applications based on the assembly of predefined building blocks.

Business Components provide defined business functionality and the maintenance of persistent data. They can be quite large pieces of software, for example, an airfare calculator or an insurance “rules engine” and are usually applicable to a specific business domain.

Components are self-contained. If the component architecture is observed, business components do not overlap or have gaps between them. This means that a business component does not know of the existence of any other business component and can be replaced by another with equivalent or greater functionality, provided that its published interfaces are maintained.

Why is this relevant to SOA? Well, for “interface” read “service”. The interfaces to business components might simply be an API or a simple call, but they might just as easily follow the principles and standards for a Web service—for example, be message-oriented, protocol-based, autonomous, and transparent.

If business components offer services, a powerful facility opens up in which business processes may be orchestrated to use the appropriate service from the appropriate business component at the appropriate time. This gives great flexibility and the ability to rapidly respond to changing business requirements. Since the business component is a self-contained, replaceable unit, it can be upgraded or swapped as required, provided that the published service is maintained, or at least the content and format of the old service is offered as a subset of the new. Therefore, services can be obtained from the most current source—for example, by initially exposing the service from a legacy application and subsequently replacing it with a new or alternative component.

The service-oriented development method we propose uses a component-based approach.

The Role of Object-Orientation

Object-orientation plays a substantial role in SOA, but this is at a more detailed and technical level rather than at the “macro-level” of defining business components and services. Although both offer services, there is an important difference between components and objects. Put simply, perhaps too simply, components are big objects—coarse-grained, multifunctional, and managing multi-entity data structures. Fundamentally, the object-oriented application environment is usually focused on the reuse of application behavior as defined in classes and relationships, whereas CBD is focused on reuse of components at the implementation level.

Components are, of course, built from objects, but objects in themselves are usually insufficient in scope to fulfill the demands of a fully fledged business component. Although an object is encapsulated and offers services, and thus is like a component, it is normally too small to provide a meaningful business-related service. The business object concept is a good basis for component architecture, but not every class is automatically a component.

The Role of Business Process Engineering

SOA helps Business Process Reengineering (BPR) and conversely BPR helps SOA. As we showed above in our discussion of the structure of a service-oriented application, Business Process Components can “orchestrate” the execution of a business process, calling in the appropriate services for each step of the business process. Thus BPR or a business process definition exercise is very useful as a definition of the business services that might be required. We see the analysis of a well-defined set of business processes as an excellent starting point for the service definition method we describe later in this section. Equally, and perhaps less obviously, the existence of a well-defined set of business services makes the reengineering of business processes much easier since the process may be optimized around the availability of specific, valuable services.

We have briefly mentioned *Orchestration*. This is a technique for describing and enabling the execution of a business process in terms of the tasks to be carried out, their sequence, and the data to be accessed. At each step in a process orchestration, an action is carried out and, based on the results of that action, the next step is initiated. In an SOA, these actions can be achieved by calling a service by sending a message to the service provider and receiving a return message in response. The business process may be a long-running transaction, in which case the Business Process Component running the transaction needs to be able to maintain state and handle delays in response, correlate responses with specific instances of specific processes, and conduct retries and roll-backs as necessary.

What Services Do I Need?

One of the first questions asked by management is “what services do I need?” The second often is “how do I make sure I have all the services I need?” In this section we present an approach to determining the business services required by an enterprise and use enterprise architecture techniques to establish the completeness and integrity of the service inventory.

There are two ways of defining services: guess, or follow a reliable process. We recommend the latter and suggest a process that we have used successfully. This is not to say that an intelligent guess is not a good thing; it often is a very good starting point, but it is rarely enough by itself.

The process pictured below in [Figure 18](#) sets out a definition process aimed at specifying the required components and services for a business domain of known scope and boundaries. This method has been used with success in major, large-scale SOA projects including Health and Social Care. It is described in detail in *Part 4*. An example of a Business Component Specification (for Care Provider) with an indicative set of business services is given in [Table 3](#).

An important point about the method is that it defines business components that are fully independent and self-contained. The functions and data managed by the component are not managed or maintained by any other component. A component does not know the specification, or even of the existence, of any other component. A component may consume external services, but it does not know the provider. It only knows the service specification. The effect of this is that the business components are reusable and replaceable. A component may be replaced by a better one and, provided that the services offered by the new component include those of the old (perhaps as a subset), then the overall system continues to operate undisturbed.

In carrying out several Health and Social Care projects, a significant number of Business Components have now been defined. Their specifications are provided in *Part 4*. We have collected these into a “Business Pattern” for Health and Social Care which we describe in sections [A Business Pattern for Health and Social Care](#) (p.77) and [Health and Social Care Business Components and Indicative Business Services](#) (p.110).

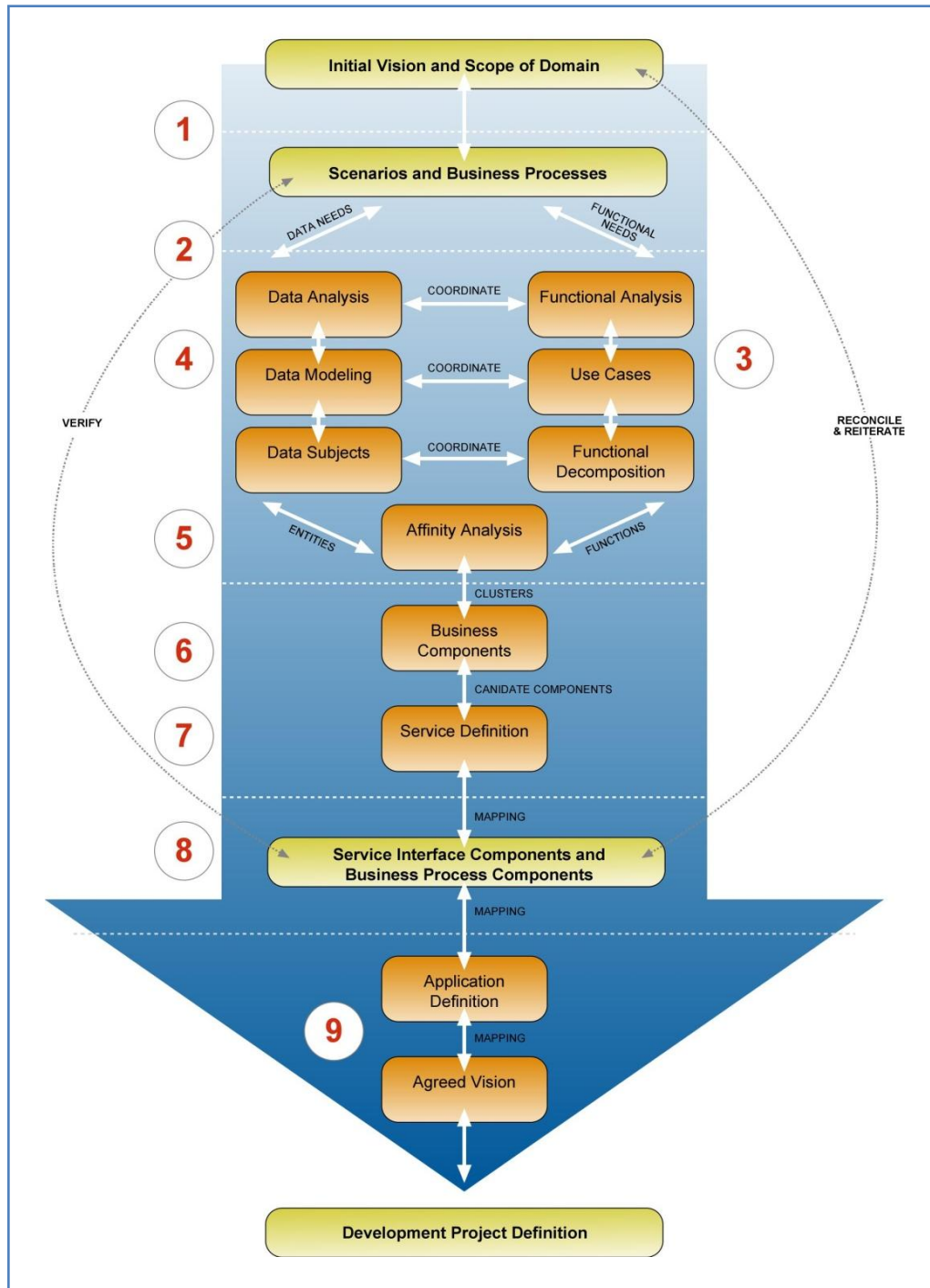


Figure 18. SOA – Service and Application Definition Method

A Method for Service and Application Definition

The general steps are as follows (see [Figure 18](#) above):

Step 1: Initial Vision and Scope of Domain

In the vision phase we ask a lot of questions. What are we trying to achieve? What are the objectives and goals of the enterprise? What business issues are we addressing? What statements of requirements are available? What are the scope and boundaries of the business domain in terms of business process and organizational structure? What is in scope and what is out of scope? Do the inclusions make a complete coherent set or are there gaps? Are the exclusions truly independent or are they linked to our chosen domain in some, perhaps subtle, way?

Step 2: Scenarios and Business Processes

Can we express our initial vision in a number of scenarios and relate these to current and future business processes? Document these scenarios. Commence work on business process definition leading to an understanding of the workflows involved and thus the functionality and data needed. If we have not already done so, we can start by gathering information about players in the domain, their interactions, and the information flows they create, and analyzing that to flesh out a set of scenarios that represents, as best we can, the dynamics of the organization.

Step 3: Functional Analysis, Use Cases, and Functional Decomposition

Analyze the required functionality by means of use cases. These will quickly prove to be highly redundant in that the same activities and tasks will recur in many use cases. Carry out a process of “disaggregating” to reduce the activities and tasks to a non-redundant set of functions (sometimes called “capabilities”) of roughly similar size. Organize these into a hierarchy, or functional decomposition, by grouping and summarizing in recognition of similarity of operation and business area addressed.

In the meantime the required business processes will have been progressively defined. Now reconcile against the functional decomposition. Each activity in the business process should be present as a single occurrence in the functional decomposition. Check the granularity. Is each activity in the business process of approximately similar size and complexity? Does each activity appear on the same level, or close by, in the functional decomposition? Resolve any anomalies.

Step 4: Data Analysis, Data Modeling, and Data Subjects

This step proceeds in parallel with functional analysis and there is frequent cross checking. The objective is to develop a data model of reasonable accuracy and depth that covers the full range of required functionality. In particular, make sure that all use cases have the correct data availability and that all data entities are appropriately created and updated. The data model is expressed at a logical level with all entities defined, primary keys identified, and all many-to-many relationships resolved. Attribute definition need not be complete, but the principal attributes will be identified. Normalization is implicit. Group strongly related entities into “data blocks”. These blocks are sometimes called “data subjects” and form embryo Business Entity Components.

Step 5: Affinity Analysis

In this step, carry out an analysis of the relationships between functionality and data to arrive at a number of self-contained groupings of business capability and owned data. These are the business components that form the building blocks from which applications are built and business processes are serviced. These components are course-grained objects that exhibit the object-oriented characteristic of encapsulation but not those of inheritance

or polymorphism. This is because these are the largest units in an object hierarchy. As development proceeds it is usual that these components are realized as assemblies of finer-grained objects that do exhibit the O/O characteristics.

The techniques used for defining the course-grained component are those of clustering and affinity analysis. These techniques are described in more detail in Reference¹⁸. In summary, form a matrix (usually in a spreadsheet) of function vs. data entity and map the relationships between these axes using the well-known CRUD (Create, Read, Update, and Delete) operations. Clustering on C and U defines the candidate groups or business components. The effect of this is that within each group, the functions only create and update the data in the group and no other, and the data is only created and updated by the functions in the group and no other – meaning that encapsulation has been achieved.

Step 6: Business Component Definition

We now have a list of candidate business components from the first pass. These are defined to the extent of provisional business functions performed and data owned and an indicative list of services offered. In this step we confirm the business component specifications, making such adjustments as are indicated by our more formal analysis. The candidate business components may be provisionally subdivided into business logic components and data entity components. We also incorporate the more detailed and precise functional and data definitions that have emerged in our functional and data analyses.

Step 7: Service Definition

In this step we more formally define the services offered and consumed by each component specifying the request and response schemas. We cross-check back to the scenarios and business processes examined in step 2. Are all scenarios and business processes supported by the defined services in terms of both function and data?

Step 8: Service Interface Components and Business Process Components

This step is vital and is concerned with ensuring that the required business processes are fully supported by the defined services and that the chosen application components do indeed supply the required capabilities. This includes verifying that all messages are correctly created and responded to.

Step 9: Application Definition and Agreed Vision

In this step, formulate the final application definition in terms of what the application should do and verify that it meets requirements. We are then able to move forward into the application development process.

In [Table 3](#) we show a suggested documentation format for a business component. The example is fictitious but hopefully not unrealistic. We try to map the content of the business component. After a description, we list the services offered (Service Interfaces), detail the functions supported (Business Logic Component) and the data managed (Business Entity Component). We list the databases accessed (Data Access Components) and any external services used (Service Agents).

Note that the business component specification describes only the stable aspects of the system.

The agile aspects—User Interface and Processes and Business Process (Workflows)—are described in *Part 3*.

¹⁸ “Enterprise Architecture – Understanding the bigger picture – A Best Practice Guide for decision makers in IT” by Bob Jarvis. The National Computing Centre – May 2003. Available from <http://www.ncc.co.uk/shop/default.php?cPath=2>

Table 3. Business Component Specification

Business Component Specification														
Care Provider Component														
<i>Description</i>		<i>Domain</i>												
<p>This component is concerned with the provision of <u>Organizational Information</u> about Care Providers in response to a request from any approved consuming process. Organizational Information includes data about organizational units, their structure (both hierarchical and matrix), and the professional groups and teams contained within organizational units including virtual teams that span organizational units.</p> <p>Care Providers include hospitals, medical practices, clinics, laboratories, residential homes, social care departments, and community care centers.</p> <p>Care providers may be publically or privately owned and operated, or be charitable bodies or voluntary organizations. They will employ or be run by care professionals.</p> <p>The information contains basic details of facilities operated or used by an organization unit (for example hospitals or clinics). The information includes the structure of teams in terms of the roles played by team members. Note that the data does not include identification of the individual playing the role (this is included in the Care Professionals business component).</p> <p>The data obtained is regarded as transient and is only held available for the duration of the requesting transaction.</p>		<p>Health Social Care</p>												
<i>Services offered (Service Interfaces)</i>														
<p><u>Indicative List</u></p> <ul style="list-style-type: none"> • Search for Care Provider by Care Provider ID or Name • Request Organizational Structure Information (Parent/Child Care Provider) • Search for Facilities by Facility Type/ID • Search for Facilities meeting defined criteria • Search for Teams by Team Attributes (independent of Care Provider) • Request Virtual Team Structure Information (Parent/Child Teams) • Search for Role Information (independent of Care Provider or Team) • Request Role in Team Information 		<p><u>Consuming Business Processes</u></p> <p>All relevant business processes with a “need to know”</p>												
<i>Functions performed (Business Logic)</i>		<i>Data owned (Business Entities)</i>												
<ul style="list-style-type: none"> • Care Provider Search • Care Provider and Facility Registration • Care Provider and Facility Maintenance • Care Provider Structure Search • Team/Role Maintenance • Team/Role/ Care Provider Assignment 	Care Provider													
	<table border="1"> <tr> <td>Care Provider ID</td> <td>PK</td> </tr> <tr> <td>Care Provider Name</td> <td>AK</td> </tr> <tr> <td>Care Provider Attributes</td> <td>String</td> </tr> </table>	Care Provider ID	PK	Care Provider Name	AK	Care Provider Attributes	String							
Care Provider ID	PK													
Care Provider Name	AK													
Care Provider Attributes	String													
	Care Provider Structure													
	<table border="1"> <tr> <td>Care Provider ID (1)</td> <td>PK, FK1</td> </tr> <tr> <td>Care Provider ID (2)</td> <td>PK, FK2</td> </tr> <tr> <td>Parent CPs(1 to 2) or Child CPs (2 to 1)</td> <td>Att</td> </tr> <tr> <td>Effective Start Date</td> <td>Att</td> </tr> <tr> <td>Effective End Date</td> <td>Att</td> </tr> <tr> <td>Limitations</td> <td>String</td> </tr> </table>	Care Provider ID (1)	PK, FK1	Care Provider ID (2)	PK, FK2	Parent CPs(1 to 2) or Child CPs (2 to 1)	Att	Effective Start Date	Att	Effective End Date	Att	Limitations	String	
Care Provider ID (1)	PK, FK1													
Care Provider ID (2)	PK, FK2													
Parent CPs(1 to 2) or Child CPs (2 to 1)	Att													
Effective Start Date	Att													
Effective End Date	Att													
Limitations	String													

<p><i>Note that the business component specification describes only the <u>stable</u> aspects of the system. The <u>agile</u> aspects – User Interface and Processes and Business Process (Workflows) are described in Part 3</i></p>	Facility		
		Care Provider ID Facility Type Facility ID Facility Description Facility Attributes	PK, FK1 PK PK Att String
	Team		
		Care Provider ID Team ID Professional ID (Leader) Team Name Team Attributes	PK, FK1 PK FK2 Att String
	Team Structure		
		Care Provider ID (1) Team ID (1) Healthcare Organization ID (2) Team ID (2) Effective Start Date Effective End Date Limitations	PK, FK1 PK, FK1 PK, FK2 PK, FK2 Att Att String
	Role		
		Role ID Role Description Role Attributes	PK Att String
	Role in Team		
		Care Provider ID Team ID Role ID Role in Team Description (variants) Number off	PK, FK1 PK, FK1 PK, FK2 Att Att
<i>Databases used (Data Access Logic)</i>		<i>Other Services consumed (Service Agents)</i>	
<ul style="list-style-type: none"> Organization and Facilities Roles and Teams 	<u>Action</u> CRUD CRUD	<u>Service</u> None	<u>Source Component</u>

We refer to our general description of the Business Architecture in Chapter 2. In the above general method, we could use and develop the Business Architecture to define business services.

To do so, we construct the Business Component Structure by analyzing the Business Function and Data Structures and their CRUD relationship. We then relate the resulting Business Services to the agile Business Processes again at an “as is” status. The subset of the Business Architecture that we use for Business Service Definition is shown in [Figure 19](#).

The structures and relationships used are as shown in [Table 4](#).

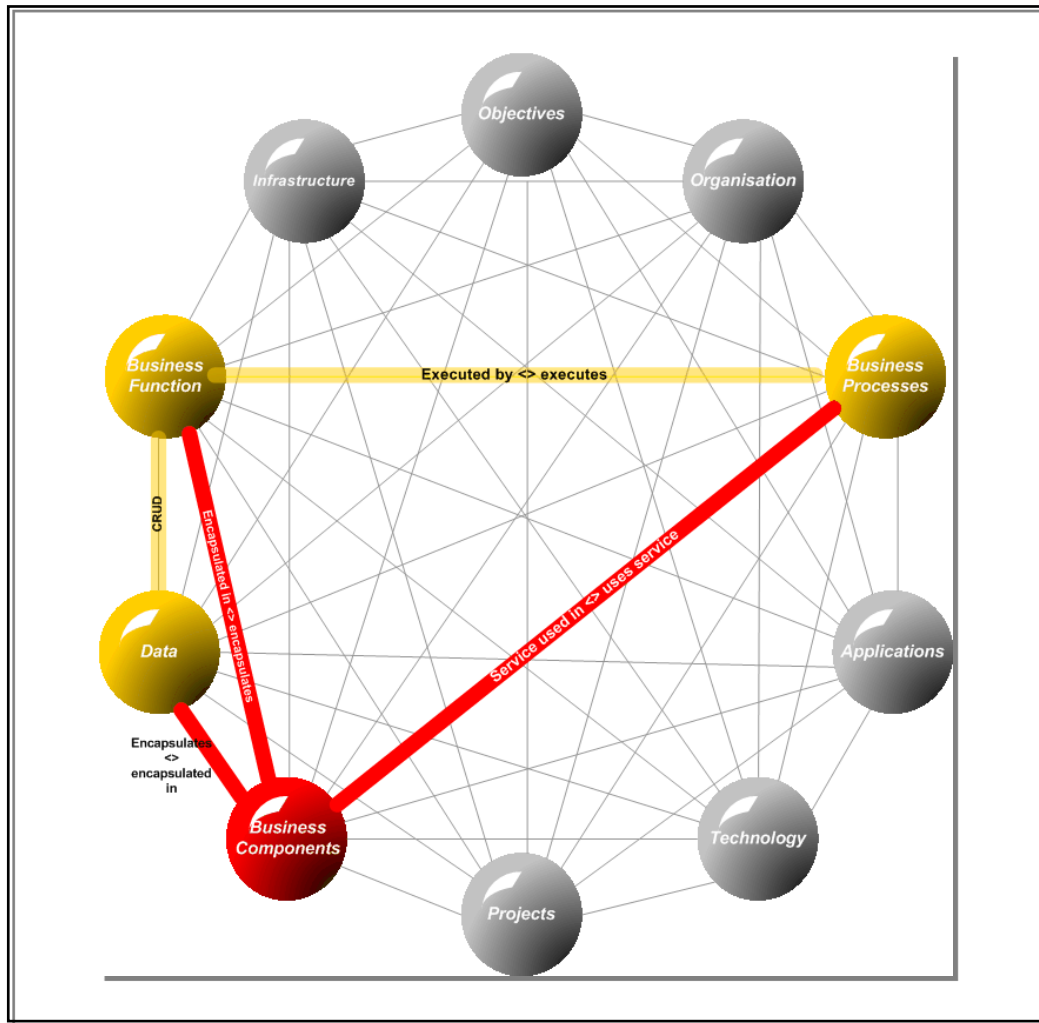


Figure 19. Business Service Definition

An Architect's Viewpoint
 This is the Minimum Essential Model for Business Service Definition.

Scenario: Business Service Definition					
Inputs:					
	<i>Structure</i>	<i>Dimension</i>		<i>Source</i>	
Structures used:	Business Processes	As-is and To-be		Baseline	
	Business Functions	As-is		Baseline	
	Data	As-is		Baseline	
	<i>Structure A</i>	<i>Relationship A:B →</i>	<i>Relationship ←B:A</i>	<i>Structure B</i>	<i>Source</i>
Relationships used:	Business Processes	Executes	Executed by	Business Function	Baseline
	Business Functions	Creates, reads, updates, deletes	Created by, read by, updated by, deleted by	Data	Baseline
Outputs:					
	<i>Structure</i>	<i>Dimension</i>		<i>Potential Uses</i>	
Structures created:	Business Components	As-is		Business Process Reengineering Project Portfolio Planning Application Development	
	Projects	To-be		Project Portfolio Planning	
	<i>Structure A</i>	<i>Relationship A:B →</i>	<i>Relationship ←B:A</i>	<i>Structure B</i>	<i>Potential Uses</i>
Relationships created:	Business Functions	encapsulated in	encapsulates	Business Components	Application Development
	Data	encapsulated in	encapsulates	Business Components	Application Development
	Business Components	developed by	develops	Projects	Project Portfolio Planning

Table 4. Structures and Relationships for Business Service Definition

In terms of using the Business Architecture for Service Definition, the method we would use is as follows. This provides detail to steps 2 through 7 in the general method above.

1. Decide if you want to define the full range of business services for the enterprise or a restricted subset. If a full definition is required, and your baseline architecture contains fully populated enterprise-wide Business Function and Data Structures, go to step 4. Otherwise:
2. Set the scope and boundaries for the business domain to be analyzed. We would suggest that this takes the form of a coherent set of complete end-to-end Business Processes, all of which are within the scope of the baseline architecture. Alternatively, the scope and boundaries can be delineated in terms of organization (such as division) or infrastructure (such as locations) or applications (major blocks of legacy applications),

but these can give less satisfactory results. If one of these alternatives is chosen as the scope delimiter, we still need to define the set of Business Processes involved.

3. Follow the baseline relationship from each Business Process to Business Function. This gives the tasks executed by the chosen Business Processes. Go up a level in the Business Function structure to get the set of Business Functions covered by the chosen business domain.
4. Map these Business Functions to the Data Structure using the relationships—create, read, update, delete. These relationships should link Business Functions (at an appropriate level of decomposition—probably the level above the base tasks) to data entities.
5. Perform commutative clustering on the Business Function versus Data matrix using the “create” and “update” relationships as the cluster-forming values. The resulting clusters are the candidate Business Components and each cluster will contain a group of functions and a group of data entities.
6. Form the Business Component structure and record the “encapsulates” relationships between the Business Components and the Business Functions and Data structures.
7. The functions and data “owned” by a component will not appear in any other component. This is what is meant by encapsulation. However, the functionality and data has to be made available for use by external agents—usually other business components or business processes or some other consumer such as a Web page. The “Read” relationship in the Business Function to Data matrix indicates which other Business Components will use the functionality and data.
8. Functionality and data are made available from the Business Component as “Business Services”. A Business Service is made available as a well-defined interface to the component and may be of two types: functionality-offering services or data-providing services.
9. We can now define the services that can be offered by each component. For each Business Function encapsulated in the component, decompose the function to tasks and each task provides a fine-grained functionality-offering service. Similarly each data entity encapsulated in the component can be offered as a fine-grained data-providing service.
10. Fine-grained business services can be aggregated to provide coarse-grained business services still within the encapsulation of the component, and this would be a normal action to define services of sufficient content and utility to support request/response-type operations as are common in Business Process orchestrations.
11. Record the coarse-grained business services in the Business Component structure as the next down layer from the providing Business Component. Record the fine-grained services as the next down layer from the aggregating coarse-grained service.
12. Finally, as a supplementary activity, the business service interface should be defined indicating the parameters and data needed in the request mechanism and content of the response to be provided.

What are the results of this process? What have we done? We have analyzed the functional and data resources for a defined business domain and defined a set of independent, reusable, replaceable components from which we might build applications. We have also defined a set of business services that can make the functionality and data available for use in business processes.

What can we do with it? We are now in a position to adopt service-orientation as a preferred design and development paradigm. This makes business process design and reengineering easier. This also lets us design and implement applications in a more modular and resilient way. This all contributes to achieving business agility.

Application Dynamic Behavior – An Example

In this section, we seek to show how a service-oriented architecture would handle a typical clinical process.

As our example, we choose part of a Care Pathway for colorectal cancer (see [Figure 3](#)). The portion we have chosen is concerned with patient treatment planning in an oncology situation (the first activity of the Treatment phase). Following professional sign on, the establishment of role-based access, and the confirmation of a legitimate relationship between patient and professional, the **steps** are as follows:

- Oncologist calls up Patient Record and reviews
- Oncologist completes treatment request, sends to Radiotherapy appointments office
- Planning appointment and treatment start date booked
- Patient informed (by post or e-mail or SMS)
- Oncologist completes notes (Consultation Notes)

The sequence diagram, [Figure 20](#), illustrates the operation of a service-oriented application. Thus we show the role of the User Interface and User Process in controlling the flow of work. The “hinge” of the operation is the service interface, which invokes and responds to the calls to the services offered by the business components.

The **business components** this scenario uses are as follows:

- [Professional Groups and Teams](#), for professional sign on and staff organization information for role-based access control
- [Patient Consents](#), to verify consent and role-based access controls
- [Patient Identity](#), to obtain the patient demographics
- [Permissions](#), to establish a legitimate patient:professional relationship
- [Examination Requests](#), to make a radiology appointment
- [Appointments](#), to make appointments for the treatment required and inform the patient
- [Patient Contacts](#), to record encounters
- [Clinical Data Management](#), to create and store clinical notes

See chapter [Health and Social Care Business Components and Indicative Business Services](#) (p.110) for a detailed description of these components.

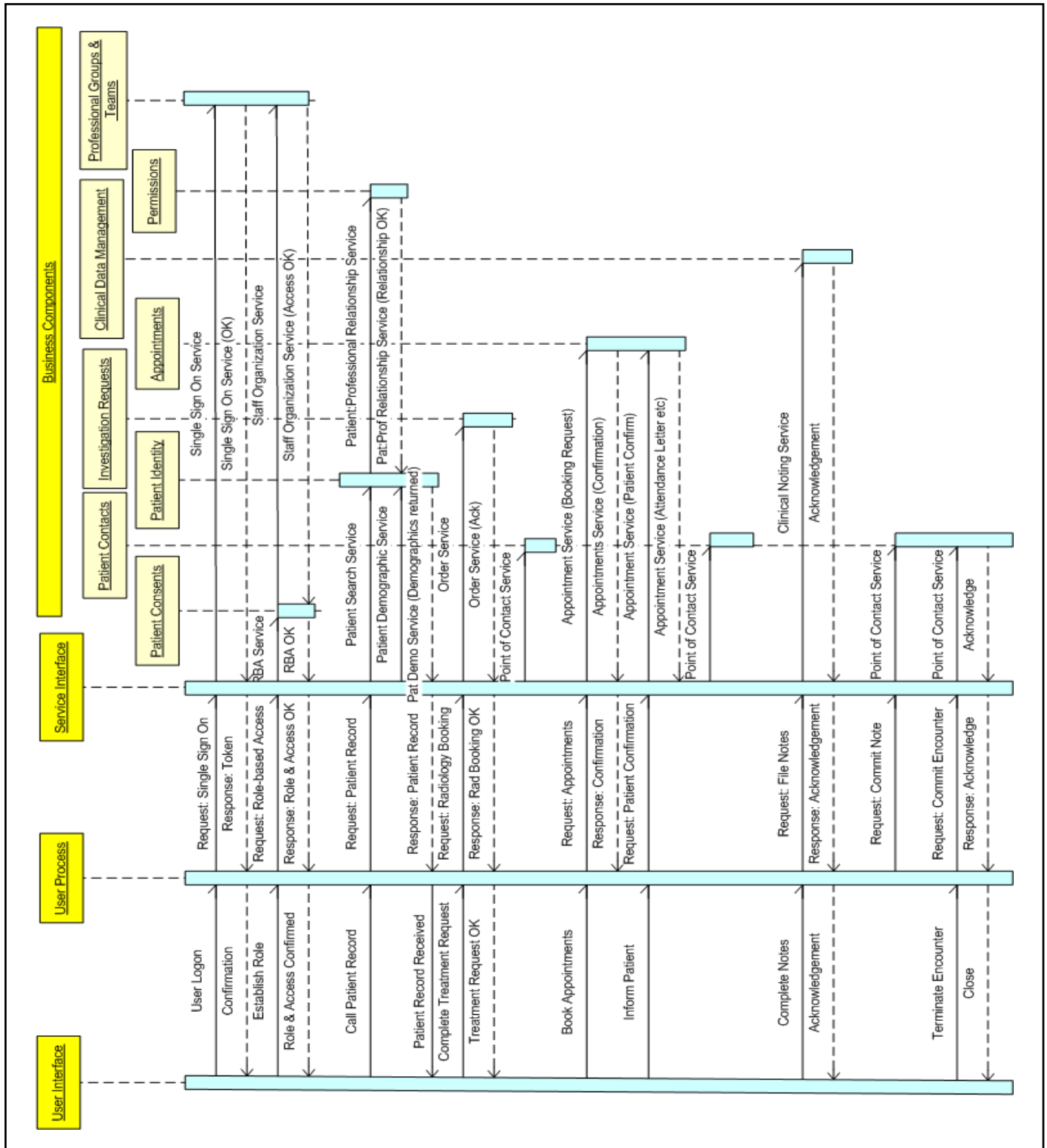


Figure 20. Sample Scenario Sequence Diagram

Liberating Legacy Applications

Up to now we have been talking largely in the context of building new service-oriented applications. However most enterprises need to work with the large number of existing applications developed long before SOA was around. Indeed the vast majority of service-oriented application development today involves service-enabling existing applications.

What is a “legacy application”? Our simple answer is any application currently in production. Before enabling a legacy application for a service-oriented mode of operation, it is necessary to establish several facts:

- Does the application offer the capabilities and functionality we want?
- Does the application own and manage the required data?
- What potential services are available from the application?
- Are these services we want?
- Does the application operate on a technical platform capable of offering services? (Note that this does not mean the same platform as other applications in the integration scheme.)

Addresses Key Issue #8

Enabling Legacy Systems to participate in new, wider, integrated scenarios

If the answers to all of these questions are positive, the legacy application is a candidate for service-enablement.

However, before doing this we should consider how to “refurbish” legacy applications to interoperate in a wider portfolio of applications both offering its functionality and sharing its data.

There are a number of refurbishment methods shown as a progressive “ladder” in [Figure 21](#), the sequence depending upon whether the application source code is available for amendment. They broadly fall into two groups: invasive and non-invasive methods.

Four levels of legacy refurbishment can be defined, the first two being non-invasive with no access to source code and the last two being invasive with access to the source code being required. These are as follows:

Non-Invasive Methods

Level 1 Improved Access. The objective is to extend and broaden the number and geographic range of users of an application. This will usually be achieved by Web-enabling the application, or enabling the application on simpler, cheaper terminal devices, and/or emulation of the application on more generally available equipment.

Level 2 Federated Transactions and Data. The objective is to create a new front-end “mini-application” that improves access to the transactions or data managed by existing applications—either one or several. In principle, this includes improving access to applications as addressed by Level 1. However, because a new application workflow control is needed, a new user interface may be provided.

Invasive Methods

Level 3 Redeployable Services. This method is concerned with the creation of Business Components from existing applications. This is achieved by creating a business logic “layer” that encapsulates business rules coded in existing systems and offering these new components for reuse or replacement purposes.

Level 4 Reusable Components. This method is concerned with the building of new applications from modules, or components, harvested from a number of applications and other diverse software sources.

The four levels of legacy “liberation” correspond to the Levels of Maturity of e-Health described in *Part 1*, namely, “Presence”, “Interaction”, “Transaction” and “Transformation”.

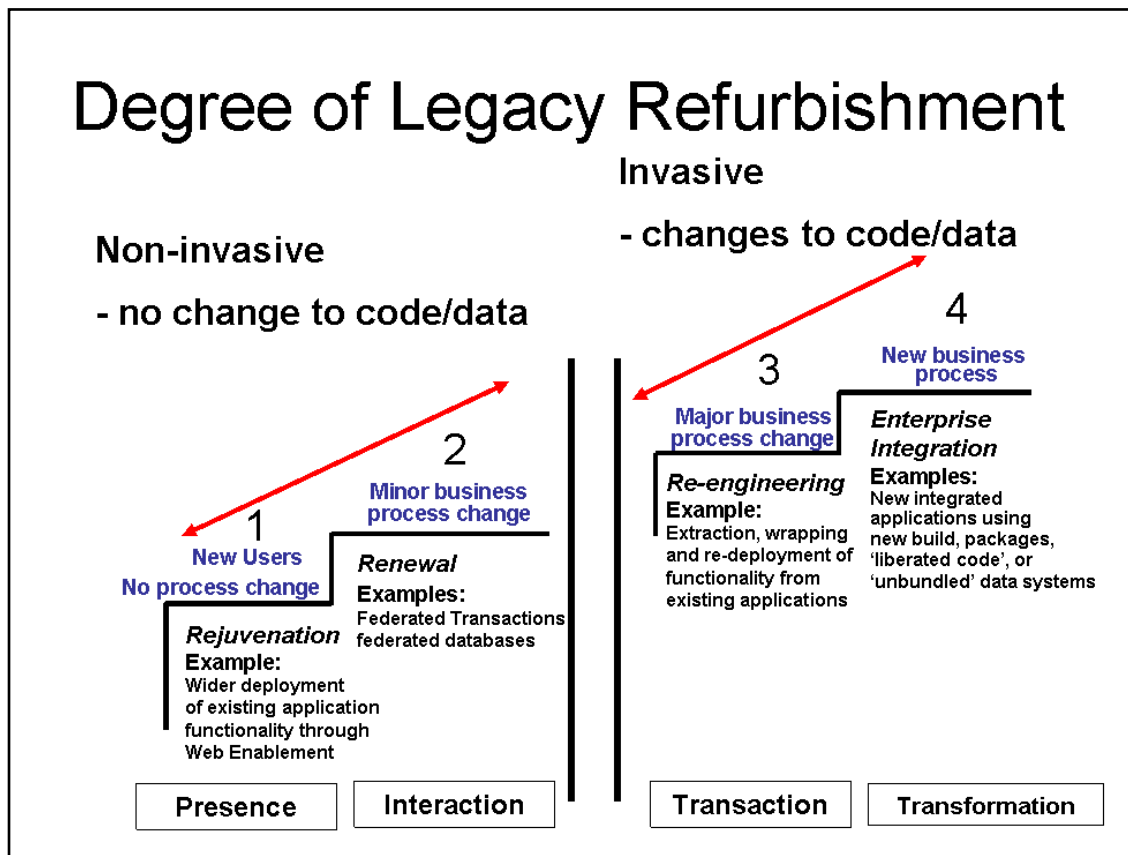


Figure 21. Degrees of Legacy Refurbishment

In situations where reengineering is not possible, the non-invasive methods have to be used. These range from simple Web enablement, through the use of “screen scraping” techniques, to methods involving the federation of transactions and federating of data.

The first two levels are “non-invasive”, meaning they do not require any alteration to the existing application code or data structure. However levels 3 and 4 do, and the extent to which reengineering can take place (and is worth doing) depends on the amenability of the code to being realigned into a layered architecture. A three-tier layering (presentation, business, and data) is usually possible with modern applications and would enable a level 3 (transaction) refurbishment. A level 4 refurbishment (transformation) ideally would require reconstruction to an application architecture structure similar to the one described in section [A Business Pattern for Health and Social Care](#) (p.77).

The ideal solution is to reengineer the application into a layered structure such as we have described earlier, preferably with the business tier being structured into business workflow, business logic, and business entity components. This would enable the building of a service interface and therefore would allow the legacy application to participate fully in a service-oriented architecture.

However this strategy is dependent upon the code being amenable to componentization, which might be quite straightforward with modern, structured applications but less so with many of the aging but vital applications still widely used in the Health and Social Care domains. It would also be desirable that legacy applications be able to offer defined services through a business façade (or wrapper). This would allow the application to participate in new business processes and feed new user processes and interfaces.

To assist with reengineering, there are code analyzer and restructuring tools available on the market to help with this task. However, full restructuring might be expensive and difficult to justify for older “spaghetti” applications; but at least the application should be restructured into a three-tier architecture with the services being exposed by “wrapping” the business logic tier. This is sometimes called a “business façade”. If this is not possible, all is not necessarily lost, because old-fashioned, non-invasive “screen scraping” methods may be sufficient to extract the necessary service content from the application and present it to the façade.

The federation of transactions exploits the availability of an API into the application to initiate the application’s transactions, such as maintaining a database involving two-phase commit methods. A “wrapper” is built that receives requests, perhaps as a Web Service, and reformats these into the appropriate commands to invoke the applications transactions, returning the appropriate completion codes. These transactions can be orchestrated into a new business process using existing transactions from a number of applications.

The federation of data involves the accessing of data held in a number of application databases extracting the data of interest, and joining it together to provide a particular consolidated data view. Clearly there are data format and semantic meaning difficulties with this approach that need to be addressed. Products are available, such as Microsoft Amalga, that offer data acquisition, parsing, transformation, consolidation, storage, and presentation capabilities.

In Health and Social Care, a high degree of legacy liberation is needed because of the fragmented nature of the normal application portfolio and the diverse standards and technical platforms used. At a minimum, a legacy application needs the capability to create messages describing the clinical event or administrative action it handles. Such a message would normally, for Health and Social Care, be a SOAP message carrying an administrative or clinical payload, the latter, say, in HL7. The payload would be encoded to the appropriate standards.

With the drive towards Knowledge Driven Health and “Health 2.0”, we can foresee the development of a “New Environment”— Step 5 on our Legacy Refurbishment ladder—characterized by the need for “Seamless Integration”. This is shown in [Figure 22](#). While the environment itself is essentially non-invasive, to participate in this world legacy applications will need to be service-enabled. This can of course easily be the case with reengineered applications from steps 3 and 4, but non-invasive revised applications from level 2 can pose limitations.

With Step 2 – Federated Transaction applications, the front end mini-application can be service-enabled and thus expose its available functionality and data for consumption by new “composite” applications at Step 5. Participation could be two-way—not only would the legacy application offer its capabilities but it could carry out its functions, such as processing a transaction, in response to a correctly formatted request.

An Architect’s Viewpoint

Particular problems are often presented by what are sometimes known as “Queen Bee” applications. These are mission-critical systems that lie at the heart of many businesses and enterprises but are old, complex and monolithic. The original developers have long gone and nobody knows how to maintain or enhance them. They work, maybe even quite well, but nobody knows how and, like the Queen Bee, nobody wants to touch them.

In recent times an interesting solution to re-engineering legacy applications has emerged in which a simulated version of the old application is built by analyzing its inputs and resulting outputs. Logic is then created in the simulator to reproduce the precise computational effect. The process continues in an iterative manner until a complete functioning clone of the legacy application is available. This can be deployed or used as the basis for the development of a replacement system which may be structured in a layered architecture so as it can participate in the new systems environment.

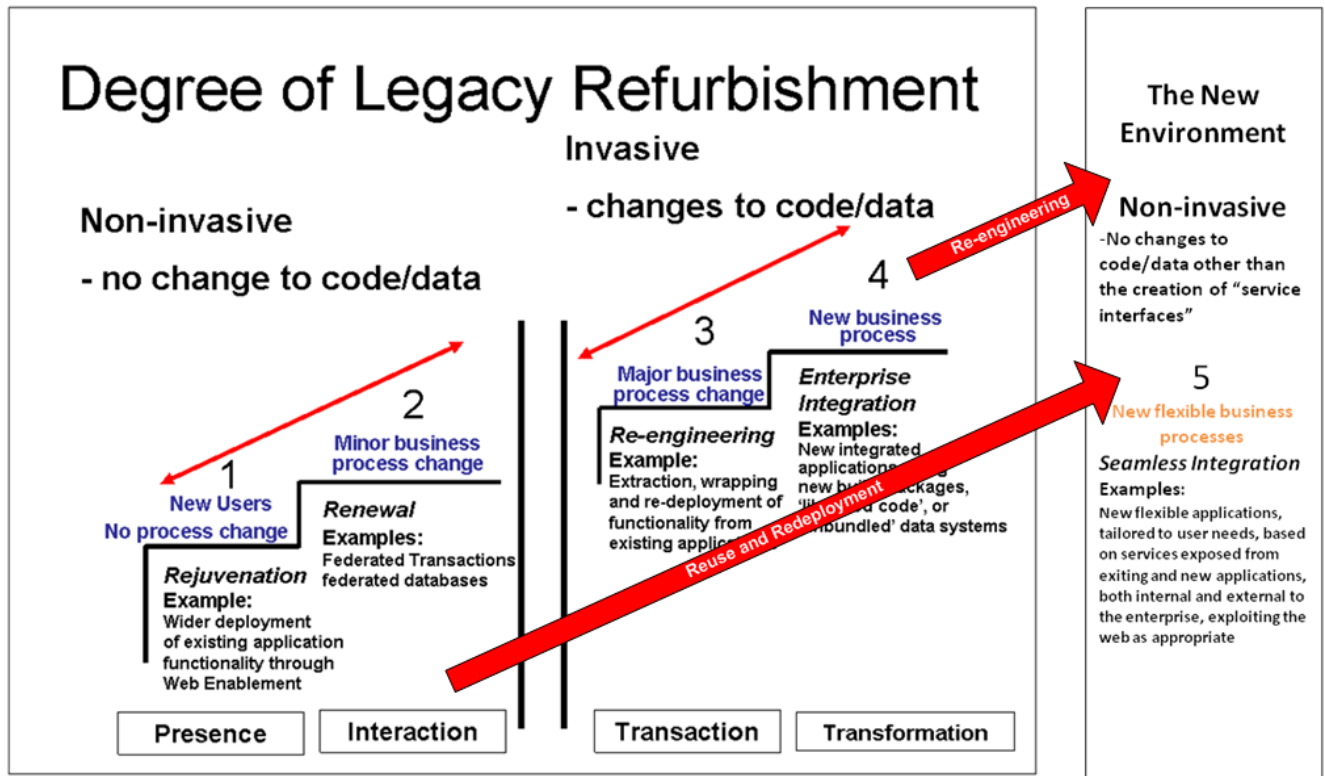


Figure 22. The New Environment

With Step 2 – Federated Data applications (such as those enabled by Amalga), the participation would be one-way. The application could offer its data, perhaps with reformatting and semantic translation, but this would be in read-only mode. Updating would need to be auctioned via the native application.

Implications for Application Providers

Given that the Connected Health Framework is in place, what does this mean for an Application Provider or Independent Software Vendor (ISV)? We define application provider generally to include all systems suppliers to the Health and Social Care industry and internal development groups. To a large extent, the Connected Health Framework also addresses the integration of existing systems (the legacy) into an overall service-based integrated environment. In short, the application provider is supplied with all he or she needs to make the application operate within the Health and Social Care environment.

There is a clear statement of functional scope and boundaries and clear interfacing definitions. This takes the form of specified process, business, and data access components with the required services being explicitly defined. The infrastructural and communications environments will be defined. The operating system and required system software will be defined.

In other words, all the application provider has to do is to construct his or her application to meet the given requirements and operate within the specified environment. Testing and acceptance criteria are easy to specify and measure.

If the application provider's solution is an existing package offering, we suggest he or she views it as legacy (in the sense of being an existing application) and either provide a non-invasive wrapper or adapter that furnishes the required services, as in [Figure 23](#), or else reconstruct the application into process, business, and data access components that provide the required services, thereby creating a much more flexible application. Many application providers build their applications this way as a matter of course.

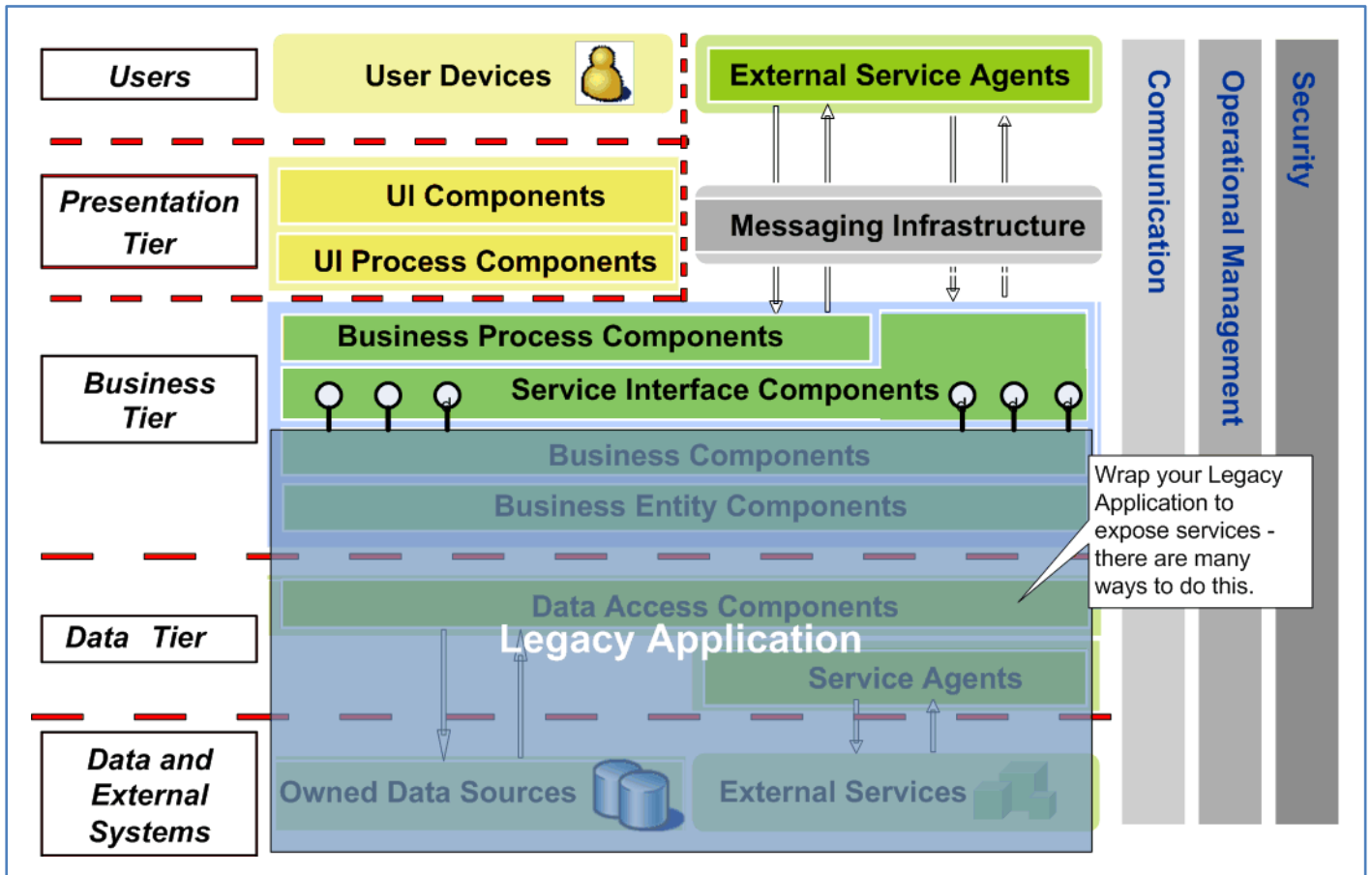


Figure 23. Service Enablement of a Legacy Application

A Business Pattern for Health and Social Care

What is a Pattern?

Patterns are useful things. A pattern describes a generic solution to a recurring problem, within a defined context. The basic premise of patterns is that if something has been done successfully before, don't reinvent the wheel. Developing and implementing a Service-Oriented Architecture (SOA) is amenable to a pattern-based approach. Patterns are available to address the business, integration, and technical aspects of SOA.

Focusing further the above definition, a Business Pattern describes a reusable approach to the solution of a particular business problem, usually scoped by a business process. It offers a solution based on previous success in defining solutions to the same, or similar, business problems. A business pattern may be described as an "architectural template for a business solution".

There are two possible, but complementary, ways to look at this. The first is to say that other enterprises, operating in a similar business domain, probably have an inventory of business components and services similar to yours. The implementations will be different because the infrastructural environment will be different, but in terms of conceptual function and data, they will be similar. This is the approach taken in the papers "*Business Patterns for Software Engineering Use*" published in the Microsoft Architects' Journal¹⁹ in which a model, similar to that described below, is developed and then populated with the functions and data pertinent to a Health and Social Care example. This results in the definition of a number of business components and services relevant to the Health and Social Care industry.

It should be strongly noted that a business pattern is NOT a design, nor is it a solution to a specific problem. It is a generalization that aids the first steps in formulating a specific solution. It is also a moving object in that it is being constantly updated as experience accrues. The Business Pattern documented here is a snapshot of current knowledge; it is not complete or definitive and there are many gaps and omissions and known areas for improvement. Comments and feedback are welcome.

A Business Pattern for Health and Social Care

In deriving our Business Pattern for Health and Social Care, we have followed the method for Service and Application Definition described earlier in the chapter *Service Oriented Architecture for Business* (p.51). What follows here is the specialization of the general method to Health and Social Care, in 7 steps:

- Step 1 – *Initial Vision and Scope of Domain*
- Step 2 – *Scenarios and Business Processes*
- Step 3 – *Functional Analysis*
-
- Step 4 – *Data Analysis*
- Step 5 – *Affinity Analysis*
- Step 6 – *Business Components*
- Step 7 – *Service Definition*

¹⁹"*Business Patterns for Software Engineering Use*" by Philip Teale and Bob Jarvis in the Microsoft Architects' Journal 2 & 3 – April and June 2004, Available at <http://msdn.microsoft.com/architecture/journal/default.aspx>

We tackled each of the steps as follows:

Step 1 – Initial Vision and Scope of Domain

Our vision is to create a “seamless” Health and Social Care environment focused on patient and client care. The business pattern describes how such a vision may be realized purely from a systems architecture point of view.

The scope of our domain for the business pattern covers the Health and Social Care relationships and services required by citizens and patients, care providers, and care professionals within primary and secondary care.

Figure 1 in *Part 1* of the *CHF Architecture and Design Blueprint* illustrates the overall scope of the domains. We are concentrating on Person, Care Professional, and Care Provider interactions as shown in [Figure 7](#) of this *Part 2* of the guide. In summary these are:

Person-Centric Interactions

- C2P** – Person to Care Professional Interactions—typically concerned with episodes of patient care or treatment. These interactions are subject to stringent confidentiality requirements, including the observance of specific professional and ethical relationships.
- C2C** – Person to Person Interactions—typically concerned with self-help groups and community-based activities including social services. In this group we would include charitable groups and activities such as hospices, elderly care, and other tertiary-care initiatives. We would include insurers in this set of interactions in so far as they trade with citizens and may represent patients in the arrangement of suitable care and treatment.

Care Professional-Centric Interactions

- P2P** – Care Professional to Care Professional Interactions—typically concerned with the referral of patients for further examination and treatment; case reviews and triage; peer knowledge and information sharing; and the delegation of care, as well as the organization and management of clinical groups and specialist teams.

Care Provider-Centric Interactions

- B2C** – Care Provider to Person Interactions—typically concerned with administrative transactions such as the making of appointments, attendance at outpatient clinics, and hospital admissions and discharges.
- B2P** – Care Provider to Care Professional Interactions—typically falling into two types: administrative activities around engagement and assignment to particular roles and responsibilities, and clinical activities associated with patient care and treatment, such as requests for tests and imaging and the use of specialized facilities and equipment.
- B2B** – Care Provider to Care Provider Interactions—these are many and varied, covering patient administration and clinical care; the management of facilities; and the provision of specialist services such as laboratories, imaging systems, and specialist diagnostic equipment. Independent services such as dentists, opticians, and pharmacies may also be included in this grouping.

We are also concerned with **Person, Care Professional, and Care Provider interactions with the “system”** and these include:

- C2S** – Person to System Interactions—typically concerned with the setting and maintenance of patient-supplied data such as some demographic details, family information, and, importantly, the viewing and variation of consent data for patient data access.
- P2S** – Care Professional to System Interactions—typically concerned with the viewing and maintenance of permissions to access patient data and the creation, updating, and audit of the patient Care Record.
- B2S** – Care Provider to System Interactions—typically concerned with the recording of activities such as patient attendance; maintenance of waiting lists; the scheduling of teams and facilities; and the recording of examination and test results.

Step 2 – Scenarios and Business Processes

In seeking to understand these interactions, we have studied a large number of statements of requirements; several proof of concept projects; and, most importantly, real-life, large-scale, patient-centric applications in a number of countries. We have examined a number of commercially available Health and Social Care application systems in detail. We have also spent time with care professionals to learn how they operate and appreciate the workflows and data requirements involved in day-to-day Health and Social Care.

From these we have extracted, coordinated, and catalogued the required functionality and foundation data for a patient-centric Health and Social Care system. This resides in a number of detailed conceptual-level models. These models are implementation-independent and concentrate on the business requirements and data unconstrained by physical and technological factors. The analysis of this metadata forms the essence of our business pattern.

Step 3 – Functional Analysis

In functional analysis, we seek to “disaggregate” multiple, highly redundant business processes into a non-redundant set of business functions of roughly similar size. We organized more than 200 functions into a hierarchy, or functional decomposition, by grouping and summarizing in recognition of similarity of operation and business area addressed. We have recognized five main functional groups: Patient-related functions; Health and Social Care Activity functions; Care Providers functions; Care Professionals functions; and Standards, Methods, and Data Management related functions. The result of this process is shown in [Figure 24](#).

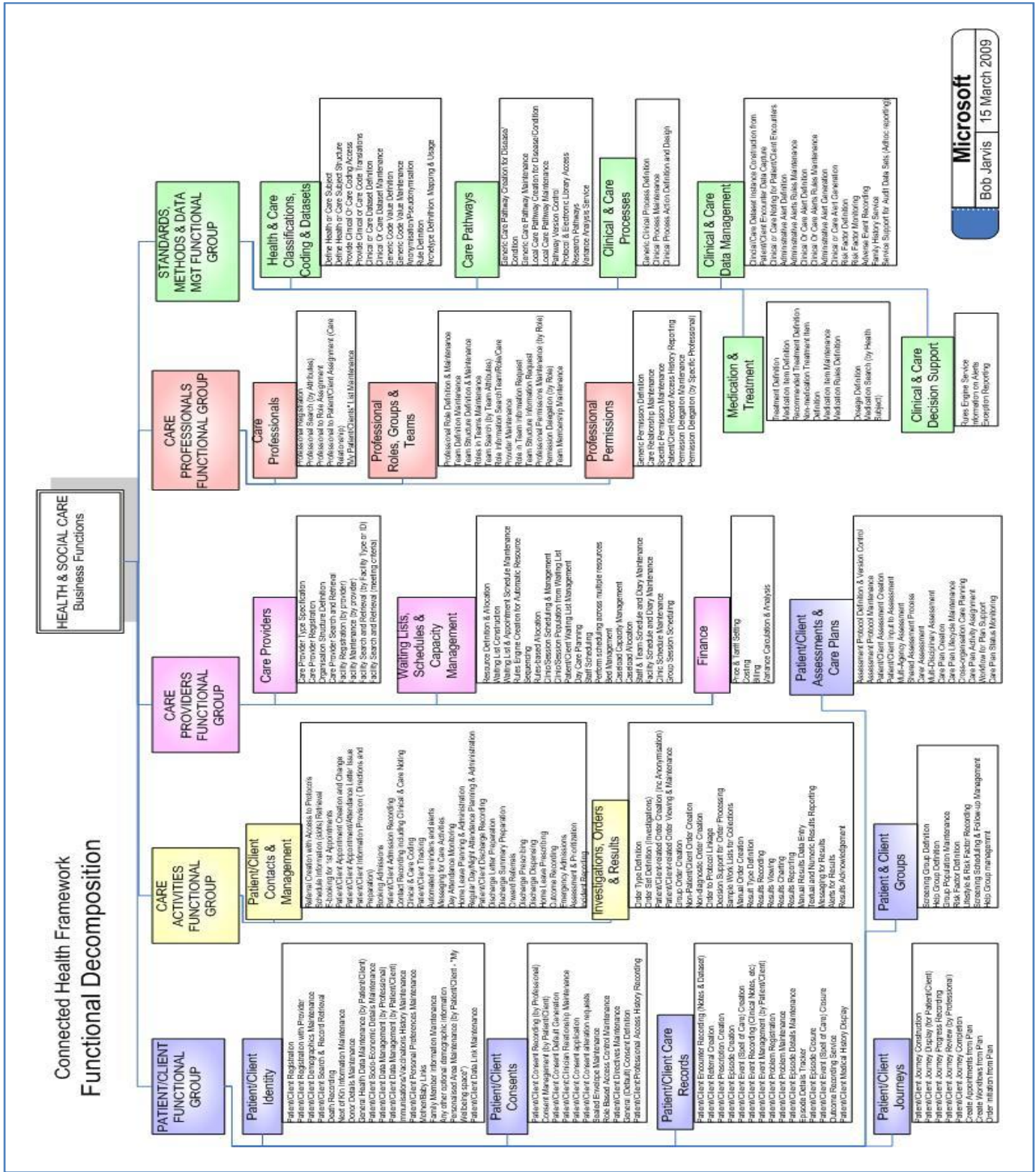


Figure 24. Functional Decomposition

Step 4 – Data Analysis

This step proceeds in parallel with functional analysis and there is frequent cross checking. The objective is to develop a data model of reasonable accuracy and depth that supports the full range of required functionality—in particular, making sure that all functions have the correct data availability and that all data entities are appropriately created and updated. The data model is expressed at a conceptual level with all entities defined, primary keys identified, and all many-to-many relationships resolved. Attribute definition is not complete, but the principal indicative attributes are identified. Normalization is implicit. We identified more than 60 data entities and grouped strongly related entities into “data blocks” or “data subjects”. We also grouped the data subjects into larger blocks aligned with the functional groups identified in the functional analysis. This checked scope coverage and boundary conditions. The conceptual data model is shown in summary form in [Figure 25](#).

Entity-Relationship diagrams are provided for each data group and provisional data entity definitions have also been provided in [Figure 25](#). Conceptual Data Model

Table 5 to aid understanding of the model. Each data group model shows the main group of entities and their relationships within a bounded, colored block. The main “interfacing” entities in other groups are reproduced around the perimeter of the block.

Connected Health Framework
Summary Conceptual Data Model

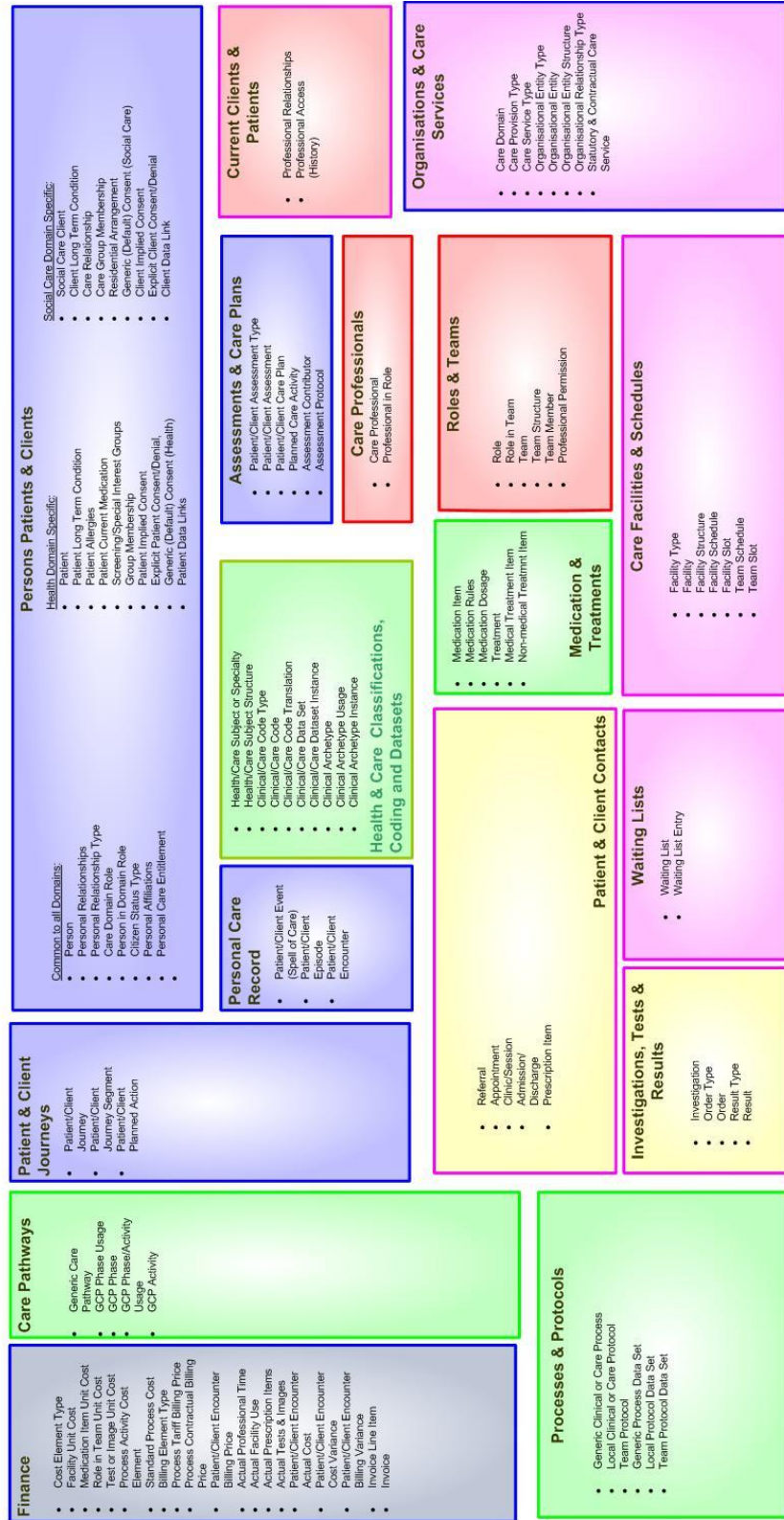


Figure 25. Conceptual Data Model

Table 5. Data Group Models & Entity Definitions (alphabetical sequence)

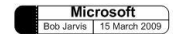
Data Group	Data Entity	Definition
<p>Assessments & Care Plans</p>	<p>Assessment Contributor</p> <p>Role ID Professional ID Assessment ID Patient ID Social Care Client ID Care Domain Name Care Domain Role</p> <p>Opinion Care Service Type Name Organisational Entity Type Name Organisational Entity Name O/E Effective Start Date O/E Effective End Date Care Provision Type Name Team ID</p> <p>Assessment Protocol</p> <p>Patent/Client Assessment Type D Assessment Protocol ID Description</p> <p>Patient/Client Assessment</p> <p>Assessment ID Patient ID Social Care Client ID Care Domain Name Care Domain Role</p> <p>Health/Care Subject ID Patient/Client Assessment Type D Patient/Client Assessment Type D Assessment Protocol ID</p> <p>Patient/Client Assessment Type</p> <p>Patent/Client Assessment Type D Description</p> <p>Patient/Client Care Plan</p> <p>Patient ID Social Care Client ID Care Domain Name Care Domain Role Plan date</p> <p>Professional ID Assessment ID Care Service Type Name Organisational Entity Type Name Organisational Entity Name O/E Effective Start Date O/E Effective End Date Care Provision Type Name Team ID</p> <p>Planned Care Activity</p> <p>Plan date Patient ID Social Care Client ID Care Domain Name Care Domain Role</p> <p>Professional Relationships</p> <p>Patient ID Social Care Client ID Organisational Entity Type Name Organisational Entity Name O/E Effective Start Date O/E Effective End Date Care Domain Name Care Service Type Name Care Provision Type Name Care Domain Role Role ID Team ID Professional ID Effective Start Date Effective End Date</p> <p>Patient</p> <p>Patient ID Person Identifier Care Domain Name Care Domain Role</p> <p>Social Care Client</p> <p>Care Domain Name Care Domain Role Social Care Client ID Person Identifier</p> <p>Health/Care Subject/Specialty</p> <p>Health/Care Subject ID Health/Care Subject Specialty Name Health/Care Subject ID 2 Health/Care Subject ID 1 Professional ID Role ID Care Service Type Name Organisational Entity Type Name Organisational Entity Name O/E Effective Start Date O/E Effective End Date Care Domain Name Care Provision Type Name Team ID</p>	<p>A care or other professional who is responsible for a contribution to an assessment in respect of a patient. There may be multiple contributors per assessment.</p> <p>Describes the process to be followed for the type of assessment being carried out.</p> <p>An evaluation of patient or client condition in a defined context (for example, health subject) using an agreed common protocol.</p> <p>Indicates the nature of assessment to be carried out (for example, a single assessment for an older person). An assessment may be inter-disciplinary and multi-agency.</p> <p>A program of care activities constructed in response to a patient or client assessment.</p> <p>An intended action incorporated into a care plan. Responsibility for the action will be assigned to a Care Professional and will have a defined time and place for its execution.</p>
<p>Assessment Contributor</p>	<p>Assessment Contributor</p> <p>Role ID Professional ID Assessment ID Patient ID Social Care Client ID Care Domain Name Care Domain Role</p> <p>Opinion Care Service Type Name Organisational Entity Type Name Organisational Entity Name O/E Effective Start Date O/E Effective End Date Care Provision Type Name Team ID</p>	<p>A care or other professional who is responsible for a contribution to an assessment in respect of a patient. There may be multiple contributors per assessment.</p>
<p>Assessment Protocol</p>	<p>Assessment Protocol</p> <p>Patent/Client Assessment Type D Assessment Protocol ID Description</p>	<p>Describes the process to be followed for the type of assessment being carried out.</p>
<p>Patient/Client Assessment</p>	<p>Patient/Client Assessment</p> <p>Assessment ID Patient ID Social Care Client ID Care Domain Name Care Domain Role</p> <p>Health/Care Subject ID Patient/Client Assessment Type D Patient/Client Assessment Type D Assessment Protocol ID</p>	<p>An evaluation of patient or client condition in a defined context (for example, health subject) using an agreed common protocol.</p>
<p>Patient/Client Assessment Type</p>	<p>Patient/Client Assessment Type</p> <p>Patent/Client Assessment Type D Description</p>	<p>Indicates the nature of assessment to be carried out (for example, a single assessment for an older person). An assessment may be inter-disciplinary and multi-agency.</p>
<p>Patient/Client Care Plan</p>	<p>Patient/Client Care Plan</p> <p>Patient ID Social Care Client ID Care Domain Name Care Domain Role Plan date</p> <p>Professional ID Assessment ID Care Service Type Name Organisational Entity Type Name Organisational Entity Name O/E Effective Start Date O/E Effective End Date Care Provision Type Name Team ID</p>	<p>A program of care activities constructed in response to a patient or client assessment.</p>
<p>Planned Care Activity</p>	<p>Planned Care Activity</p> <p>Plan date Patient ID Social Care Client ID Care Domain Name Care Domain Role</p>	<p>An intended action incorporated into a care plan. Responsibility for the action will be assigned to a Care Professional and will have a defined time and place for its execution.</p>

Data Group	Data Entity	Definition
<p>Care Facilities & Schedules</p>	<p>The diagram shows the following entities and their attributes:</p> <ul style="list-style-type: none"> Order: Order Type, Order ID, Order Received DateTime, Processing Required, Sample ID, Care & Service Provider ID (Processing), Team ID (Processing), Care Professional ID (Processing), Required Date, Urgency Flag, Requested Date, Requested Report, Encounter Type, Role ID, Patient/Client No, Episode Start Date, Event Start Date, Care Domain Name, Start Date, Care Domain Role, Patient ID, Social Care Client ID, Health Subject ID. Waiting List: List ID. Organisational Entity: Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, O/E Effective End Date. Facility Schedule: Facility Type, Facility ID, Date, Actual No of Orders, Max No of Orders. Facility Type: Facility Type, Facility Type Description. Facility: Facility Name, Facility Description, Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, O/E Effective End Date. Facility Slot: Facility Type, Date, Slot No. Facility Structure: Facility Type (parent), Facility ID (parent), Facility Type (child), Facility ID (child). Team Schedule: Team ID, Care Service Type Name, Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, O/E Effective End Date, Care Domain Name, Care Provision Type Name, Date, Actual No of Orders, Max No of Orders. Team: Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, O/E Effective End Date, Care Domain Name, Care Service Type Name, Care Provision Type Name, Team ID, Team Name. Team Slot: Team ID, Care Service Type Name, Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, O/E Effective End Date, Care Domain Name, Care Provision Type Name, Date, Slot No., Free/Taken, Order Type, Order ID, List ID, Line Item ID. <p>Relationships include: owned, operated by, describes, operates to, offers, may reserve, may be assigned to, comprises, part of, and consists of.</p>	<p>Examples: Hospital Care Home Ward/Room Bed Machine Item of Equipment Vehicle Etc.</p>
Facility Type		A classification of facilities such as hospital, care home, Ward or Room, bed, equipment, etc.
Facility		A generic term for a schedulable physical resource such as a bed, diagnostic device or treatment suite.
Facility Structure		A Facility may be made up of smaller facilities and in turn may be a member of one or more higher-level facilities. For example, the high level subject “hospital” may comprise wards, theaters, consultation rooms, laboratories, and so on. Each one of these may sub-divide further and also may be a member of other higher level groups. Facility Structure records the parent and child relationships between facilities.
Facility Schedule		The reservation of all necessary resources (people, places, equipment, examinations, interventions and events) associated with the diagnosis, treatment and care management of the patient.
Facility Slot		A time period, within which a facility may be used, typically covering a single instance of treatment.
Team Schedule		The reservation of all necessary human resources associated with the diagnosis, treatment and care management of the patient.
Team Slot		A time period, within which a team may be available, typically covering a single instance of treatment.



Data Group	Data Entity	Definition
<p>Care Pathways</p>		
<p>Generic Care Pathway</p>	<p>A program of care designed to treat a specified medical or social care condition. A care pathway may be long, perhaps lasting for months or even years, and comprise many sections, or phases, between planned reviews of the patient's or client's progress.</p>	
<p>Generic Care Pathway Activity</p>	<p>A generic treatment within a care pathway is made up of a number of discrete activities each with a defined objective and start and finish points at which results may be assessed or measured.</p>	
<p>Generic Care Pathway Phase</p>	<p>A section of a Care Pathway between two review points. A treatment will not normally be changed during its execution except in care of a change in the patient's condition.</p>	
<p>Generic Care Pathway Phase Usage</p>	<p>The deployment of a Care Pathway generic phase within a care pathway. A patient journey will be made up of a chosen set of treatments within the framework offered by the overall care pathway.</p>	
<p>Generic Care Pathway Phase/Activity Usage</p>	<p>The deployment of care pathway activities within a phase within a generic care pathway.</p>	

Data Group	Data Entity	Definition
<p>Care Professionals</p>	<p>The diagram illustrates the relationships between various data entities. A central purple box highlights the Care Professional entity, which includes attributes like Name, Base Location, Contact Details, Qualifications, Healthcare Provider ID, Healthcare Provider Type ID, Care Service Type Name, Organisational Entity Name, Organisational Entity Type Name, O/E Effective Start Date, O/E Effective End Date, Care Domain Name, and Care Provision Type Name. It is linked to Professional in Role (Role ID, Professional ID, Effective Start Date, Effective End Date) via a 'qualified as' relationship. Professional in Role is further linked to Role (Role ID, Role Description) via a 'fulfilled by' relationship. Professional in Role also has a 'has as patients/clients' relationship with Patient/Client:Professional Relationships (Role ID, Professional ID, Start Date, End Date, Restrictions, Team ID, Care Service Type Name, Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, O/E Effective End Date, Care Domain Name, Care Provision Type Name). Other entities include Prescription Item (Patient/Client No, Event Start Date, Episode Start Date, Encounter Type, Encounter Date, Medication Item ID, Dosage Level), Team Member (Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, O/E Effective End Date, Care Domain Name, Care Service Type Name, Care Provision Type Name, Team ID, Role ID, Professional ID), and Care & Service Provider (Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, O/E Effective End Date, Care Domain Name, Care Service Type Name, Care Provision Type Name, Effective Start Date, Effective End Date).</p>	<p>Care Professional</p> <p>A qualified individual, appointed, employed or contracted by a Care Provider. Anybody involved in the provision of health or Social Care.</p> <p>Professional in Role</p> <p>The Health and Social Care role carried out by a Care Professional.</p>



Data Group	Data Entity	Definition
<p>Current Clients & Patients</p>	<p>The diagram illustrates the following entities and their relationships:</p> <ul style="list-style-type: none"> Professional Relationships (highlighted in a purple box): <ul style="list-style-type: none"> Attributes: Patient ID, Social Care Client ID, Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, O/E Effective End Date, Care Domain Name, Care Service Type Name, Care Provision Type Name, Care Domain Role, Role ID, Team ID, Professional ID. Relationships: <ul style="list-style-type: none"> Is cared for by: Professional Relationships (0) to Patient (1) Is cared for by: Professional Relationships (0) to Social Care Client (1) Applies to: Professional Permissions (1) to Professional Relationships (0) makes: Professional Access (1) to Professional Relationships (0) Professional Permissions: <ul style="list-style-type: none"> Attributes: Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, O/E Effective End Date, Care Domain Name, Care Service Type Name, Care Provision Type Name, Role ID, Team ID, Professional ID. Professional Access: <ul style="list-style-type: none"> Attributes: Role ID, Professional ID, Date, Social Care Client ID, Care Domain Name, Care Domain Role, Patient ID, Care Service Type Name, Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, O/E Effective End Date, Care Provision Type Name, Team ID, Date & Time, Declared Purpose, Own Patient/Client (Y/N), Privacy Override (Y/N). Patient: <ul style="list-style-type: none"> Attributes: Patient ID, Person Identifier, Care Domain Name, Care Domain Role. Social Care Client: <ul style="list-style-type: none"> Attributes: Social Care Client ID, Care Domain Name, Care Domain Role, Social Care Client ID, Person Identifier. 	<p>Professional Relationship</p> <p>A formal assignment of a patient or client to a Care Professional, operating in a defined role, for care in relation to a general health or social care subject.</p> <p>Professional Access (History)</p> <p>A record of each and every access to Patient or Client data by each Care Professional.</p>
		<p style="text-align: right;"> Bob Jarvis 15 March 2009 </p>

Data Group	Data Entity	Definition
Cost	Care Provider Standard Unit Cost	
	Cost Element Type	The classes of cost involved in a process or activity. Typically specified as labor, material and overhead.
	Facility Unit Cost	The costs of operation of a facility in terms of labor, material and overhead.
	Invoice Line Item	An item on an invoice typically defined by the quotation of a unit price for an item of service or material, extended by the quantity provided.
	Invoice	The formal billing of a payer for services performed
	Medication Item Unit Cost	The unit cost of a medication or treatment service or product
	Patient/Client Encounter Actual Cost	The billed and actual costs incurred in a patient or client encounter and the difference (variance) between them indicating a nominal profit or loss.
	Patient/Client Encounter Billing Margin	
	Patient/Client Encounter Cost Variance	
	Test or Image Unit Cost	The standard costs of test and images by type of order.

Data Group	Data Entity	Definition
<p>Health Classifications Coding and Data Sets</p>		<p>Health/Care Classifications, Coding and Datasets</p> <p>Health Domain Specific</p>
	<p>Clinical/Care Code</p>	<p>Many coding schemes exist to classify and identify medical conditions and procedures. Examples would be Snomed CT, OPCS, Read2, and ICD10. These individual schemes are not necessarily complete or all embracing perhaps focusing on a particular clinical aspect. Similar schemes are used for classifying social care data</p>
	<p>Clinical/Care Code Type</p>	<p>A classification of clinical coding schemes</p>
	<p>Clinical Code Translation</p>	<p>Clinical Code Translation relates an instance of another health code to the encompassing higher-level Clinical Code.</p>
	<p>Clinical Dataset</p>	<p>A definition of the items of data that should be recorded for a particular medical condition or procedure.</p>
	<p>Clinical Dataset Instance</p>	<p>A valid occurrence of a set of values meeting the requirements of a national data set.</p>
	<p>Health Subject</p>	<p>A high level classification of medical conditions formed for the purpose of recording Patient Consent and classifying Patient Events. Examples might be "Cancer, Cardiac Care, Maternity, Mental Health, and so on".</p>
	<p>Health Subject Structure</p>	<p>A Health Subject may be made up of smaller health subjects and in turn may be a member of one or more higher-level</p>

Data Group	Data Entity	Definition
		Health Subjects. For example, the high level subject "Cancer" may comprise Lung Cancer, Breast Cancer, Colon Cancer and so on. Each one of these may sub-divide further and also may be a member of other higher level groups. Health Subject Structure records the parent and child relationships between Health Subjects.
	Clinical Archetype	A method of representing values in a clinical dataset using structured statements based on a reference (information) model. Used in the OpenEHR methodology examples of Clinical Archetypes include concepts such as "blood pressure", "physical examination (headings)", "biochemistry results" and so on.
	Clinical Archetype Usage	A collection of clinical archetypes into larger structures that might correspond to a screen form, document, report or message. Their use is to express the data collection requirements for specific clinical situations - many will be situation specific and some will express the requirements of individual users. Sometimes called a "template"
	Clinical Archetype Instance	A valid occurrence of an archetype representing actual measurements in an actual situation.
	Anonymization Rule	A definition of the circumstances when patient data should be anonymized and the algorithm to be used.

Data Group	Data Entity	Definition
<p>Investigations, Tests & Results</p>		<p>Investigations, Tests & Results</p>
<p>Investigation</p>		<p>A coordinated set of orders (laboratory tests, imaging, physical tests, social interviews, etc) required to examine a patient or client's condition.</p>
<p>Order</p>		<p>A request to have a defined process or procedure carried out. Normally patient related, orders are raised for diagnostic testing and activities involving utilization of team or facility resources.</p>
<p>Order Type</p>		<p>A classification of orders defining activities of a common or similar nature, such as pathology test, radiography test.</p>
<p>Result</p>		<p>The values resulting from a test or examination instigated by an order. Values may be numeric or textual and may involve physical exhibits, like images.</p>
<p>Result Type</p>		<p>A classification of the results of orders of a common or similar nature, like pathology test results, radiography test results.</p>

Data Group	Data Entity	Definition
<p>Medications & Treatments</p>	<p>The diagram shows the following entities and relationships:</p> <ul style="list-style-type: none"> Patient Current Medication (Attributes: Medication Item ID, Dosage Level) is associated with Medication Item (Attribute: Medication Item ID). Prescription Item (Attributes: Patient/Care Client No, Event Start Date, Episode Start Date, Encounter Type, Encounter Date, Medication Item ID, Dosage Level) is associated with Medication Item (Attribute: Medication Item ID) via a relationship labeled "taken by". Medication Item (Attribute: Medication Item ID) is associated with Medication Rules (Attributes: Medication Item ID 1, Medication Item ID 2) via relationships "must be given with" and "must NOT be given with". Medication Item (Attribute: Medication Item ID) is associated with Medication Dosage (Attributes: Medication Item ID, Dosage Level) via a relationship "is available in". Medication Dosage (Attributes: Medication Item ID, Dosage Level) is associated with Medication Treatment Item (Attributes: Medication Item ID, Treatment ID, Dosage Level) via a relationship "Applies to". Medication Treatment Item (Attributes: Medication Item ID, Treatment ID, Dosage Level) is associated with Treatment (Attributes: Treatment ID, Treatment Description) via a relationship "has". Treatment (Attributes: Treatment ID, Treatment Description) is associated with Non-medication Treatment Item (Attributes: Treatment ID, Activity Description, Team ID, Care Service Type Name, Organisational Entity Type Name, O/E Effective Start Date, Care Domain Name, Care Provision Type Name, Team ID) via a relationship "has". Non-medication Treatment Item (Attributes: Treatment ID, Activity Description, Team ID, Care Service Type Name, Organisational Entity Type Name, O/E Effective Start Date, Care Domain Name, Care Provision Type Name, Team ID) is associated with Team (Attributes: Organisational Entity Type Name, Organisational Entity Name, O/E Effective Start Date, Care Domain Name, Care Service Type Name, Team ID) via a relationship "gives". 	<p>Medication Dosage</p> <p>Available strengths or dispensing quantities of a specific medication item.</p> <p>Medication Item</p> <p>A prescribable item such as a drug, medicine or health-oriented artifact</p> <p>Medication Rules</p> <p>Indication of which medication items should be or should not be prescribed together for a single patient</p> <p>Treatment</p> <p>Indication of appropriate medication items prescribable for particular medical conditions.</p> <p>Medication Treatment Item</p> <p>A medication item used in a particular treatment</p> <p>Non-medication Treatment Item</p> <p>An item, not a medication, used in a particular treatment for example an item of apparatus.</p>

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Data Group	Data Entity	Definition
<p>Organizations & Care Services</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 20%;"> <p>Personal Affiliations</p> <p>Person Identifier Citizen Status Type Organisational Entity Type Name Organisational Entity Name O/E Effective Start Date O/E Effective End Date Affiliation Start Date Affiliation End Date</p> </div> <div style="width: 20%;"> <p>Facility</p> <p>Facility Type Facility ID Facility Name Facility Description Organisational Entity Type Name Organisational Entity Name O/E Effective Start Date O/E Effective End Date</p> </div> <div style="width: 20%;"> <p>Invoice</p> <p>Invoice No Invoice Total Organisational Entity Type Name Organisational Entity Name O/E Effective Start Date O/E Effective End Date</p> </div> </div>		<p>Care Domain</p> <p>A broad categorization of the areas involved in lifelong wellbeing – primary health care, acute, health care</p> <p>Care Provision Type</p> <p>Indicates the kind of care offered a Care Provider & Service Provider – complete healthcare, surgical treatment, residential care, home help.</p> <p>Care Service Type</p> <p>Indicates the kind of overall service categories on a national, regional, local or private basis: national health service, insurance services, care plan services, dental service, etc.</p> <p>Care & Service Provider</p> <p>A generic term for hospitals, clinics, medical practices, laboratories and other organizations that accommodate and treat patients. They will provide physical premises and facilities and operate medical and other equipment. They will operate administrative and clinical systems. They may also provide services such as Health and Social Care insurance, paramedical transport and so on. They will employ Care Professionals.</p> <p>Organizational Entity</p> <p>An official or private body, company, trust, authority or functional group. An organizational entity can be described</p>
<p>Care Domain</p>		<p>A broad categorization of the areas involved in lifelong wellbeing – primary health care, acute, health care</p>
<p>Care Provision Type</p>		<p>Indicates the kind of care offered a Care Provider & Service Provider – complete healthcare, surgical treatment, residential care, home help.</p>
<p>Care Service Type</p>		<p>Indicates the kind of overall service categories on a national, regional, local or private basis: national health service, insurance services, care plan services, dental service, etc.</p>
<p>Care & Service Provider</p>		<p>A generic term for hospitals, clinics, medical practices, laboratories and other organizations that accommodate and treat patients. They will provide physical premises and facilities and operate medical and other equipment. They will operate administrative and clinical systems. They may also provide services such as Health and Social Care insurance, paramedical transport and so on. They will employ Care Professionals.</p>
<p>Organizational Entity</p>		<p>An official or private body, company, trust, authority or functional group. An organizational entity can be described</p>

Data Group	Data Entity	Definition
		<p>at any level of granularity from the largest (government), to the smallest (a two-person department).</p> <p>Organizational Entity Structure A means of recoding the relationships between organizational units. Often these structures are hierarchical but increasingly matrix organizations and virtual teams are used. This entity, based on a bill-of-material pattern, handles such structures.</p> <p>Organizational Entity Type A classification of organizations from the largest (nations, states, regions), through private companies, insurers, charities, voluntary organizations, to local authorities and groups.</p> <p>Organizational Relationship Type Indicates the nature of an association between two organizational units: governs, owns, customer of, supplier to, etc.</p>
<p>Patient & Client Contacts</p>		<p>Admission & Discharge The entry or exit of a patient or client from a residential episode of care administered by a team within a facility. Admission is normally in response to a referral and takes place following allocation to an available slot in a team or facility schedule. The discharge is normally accompanied by a discharge note explaining the treatment given; follow up requirement and specifying any medication required.</p> <p>Appointment An arranged time and place for the conduct of activities connected with the treatment of a medical or social</p>

Data Group	Data Entity	Definition
		condition. An appointment, or series of appointments, is arranged to satisfy the requirements of a due Patient or Client Encounter and results in the creation of entries in the personal care record.
	Clinic/Session	The holding of an investigatory or treatment session by a team at a location at a time and date. The session may involve the carrying out of a defined clinical process, social procedure or set of related processes. Patient or client attendance at the clinic is normally by appointment.
	Referral	The process by which a care professional refers a patient, client or service user to another. This will usually include the transfer of clinical and social care information about the patient or client, and may be undertaken before or after an appointment is made.
	Prescription Item	A medication item in a specific dosage prescribed by a care professional for a patient.

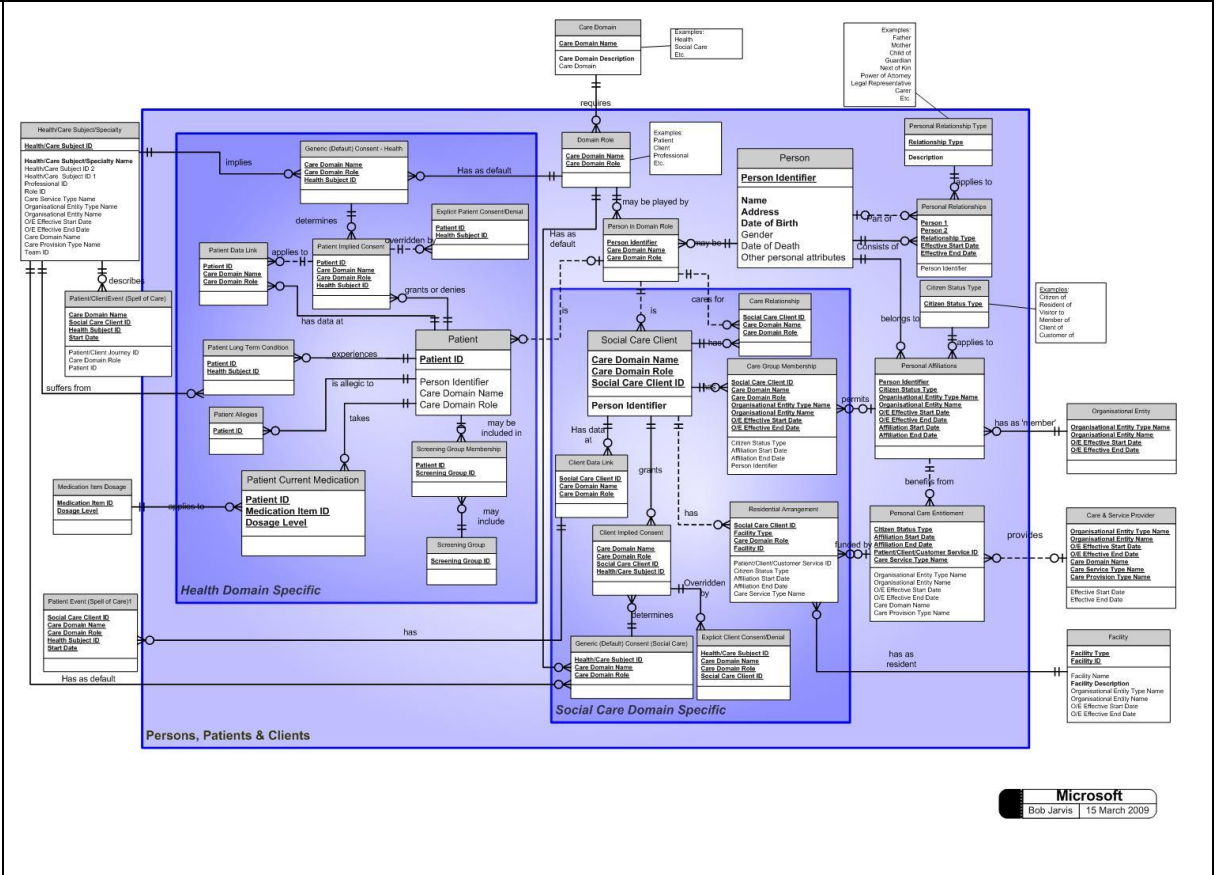
Data Group	Data Entity	Definition
<p>Patient & Client Journeys</p>		<p>Patient/Client Journey</p> <p>A summary of the events - past, present and future – expressed in the form of a “care pathway” dedicated to the treatment of a particular medical or social condition for a specific patient or client. The Patient/Client Journey is unique to the patient or client and is constructed from a number of “segments” each containing planned events.</p> <p>Patient/Client Journey Planned Action</p> <p>A defined activity to be carried out as part of a Patient/Client Journey.</p> <p>Patient/Client Journey Segment</p> <p>A set of Planned Actions to be carried out, usually in sequence, as part of a Patient/Client Journey.</p>
	<p>Patient/Client Journey</p>	<p>A summary of the events - past, present and future – expressed in the form of a “care pathway” dedicated to the treatment of a particular medical or social condition for a specific patient or client. The Patient/Client Journey is unique to the patient or client and is constructed from a number of “segments” each containing planned events.</p>
	<p>Patient/Client Journey Planned Action</p>	<p>A defined activity to be carried out as part of a Patient/Client Journey.</p>
	<p>Patient/Client Journey Segment</p>	<p>A set of Planned Actions to be carried out, usually in sequence, as part of a Patient/Client Journey.</p>

Data Group	Data Entity	Definition
<p>Personal Care Records</p>	<p>Personal Care Records</p>	<p>Health/Care Subject/Specialty</p> <p>Health/Care Subject ID</p> <p>Health/Care Subject Specialty Name Health/Care Subject ID 2 Health/Care Subject ID 1 Professional ID Role ID Care Service Type Name Organisational Entry Type Name Organisational Entry Name O/E Effective Start Date O/E Effective End Date Care Domain Name Care Provision Type Name Team ID</p> <p>Clinical/Care Code</p> <p>Clinical Code Type Clinical Code</p> <p>Meaning Health/Care Subject ID</p> <p>is described by</p> <p>Clinical/Care Data Set</p> <p>Encounter Type Clinical Dataset Item</p> <p>Dataset Attributes Role ID Patient/Client No Encounter Date Event Start Date Episode Start Date Patient No Start Date Social Care Client ID Health Subject ID Care Domain Name</p> <p>has gathered</p> <p>Clinical/Care Dataset Instance</p> <p>Encounter Type Clinical Dataset Item Instance/Record No</p> <p>Patient (Pseudonymized) Data Values Role ID Patient/Client No Encounter Date Event Start Date Episode Start Date Patient No Start Date Social Care Client ID Health Subject ID Care Domain Name</p> <p>Care Professional</p> <p>Professional ID</p> <p>Name Base Location Contact Details Qualifications Healthcare Provider ID Healthcare Provider Type ID Care Service Type Name Organisational Entry Type Name Organisational Entry Name O/E Effective Start Date O/E Effective End Date Care Domain Name Care Provision Type Name</p> <p>Microsoft Bob Jarvis 15 March 2009</p>
	<p>Patient/Client Encounter</p>	<p>A direct interaction between an individual patient or client and a Care Professional or team of professionals. The interaction may be a visit, or use a communication medium like the telephone.</p>
	<p>Patient/Client Episode</p>	<p>A discrete event or set of activities, usually in the form of a number of consecutive encounters, that has a start and finish, usually relating to the treatment of a single disease or social condition. The care given during the episode is usually provided by a single Care Provider.</p>
	<p>Patient/Client Event (Spell of Care)</p>	<p>A summary of care received for a specific medical or social condition at a particular time. The summary comprises a high level categorization of the condition and a brief</p>

Data Group	Data Entity	Definition
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indication of the outcome.

Persons, Patients & Clients



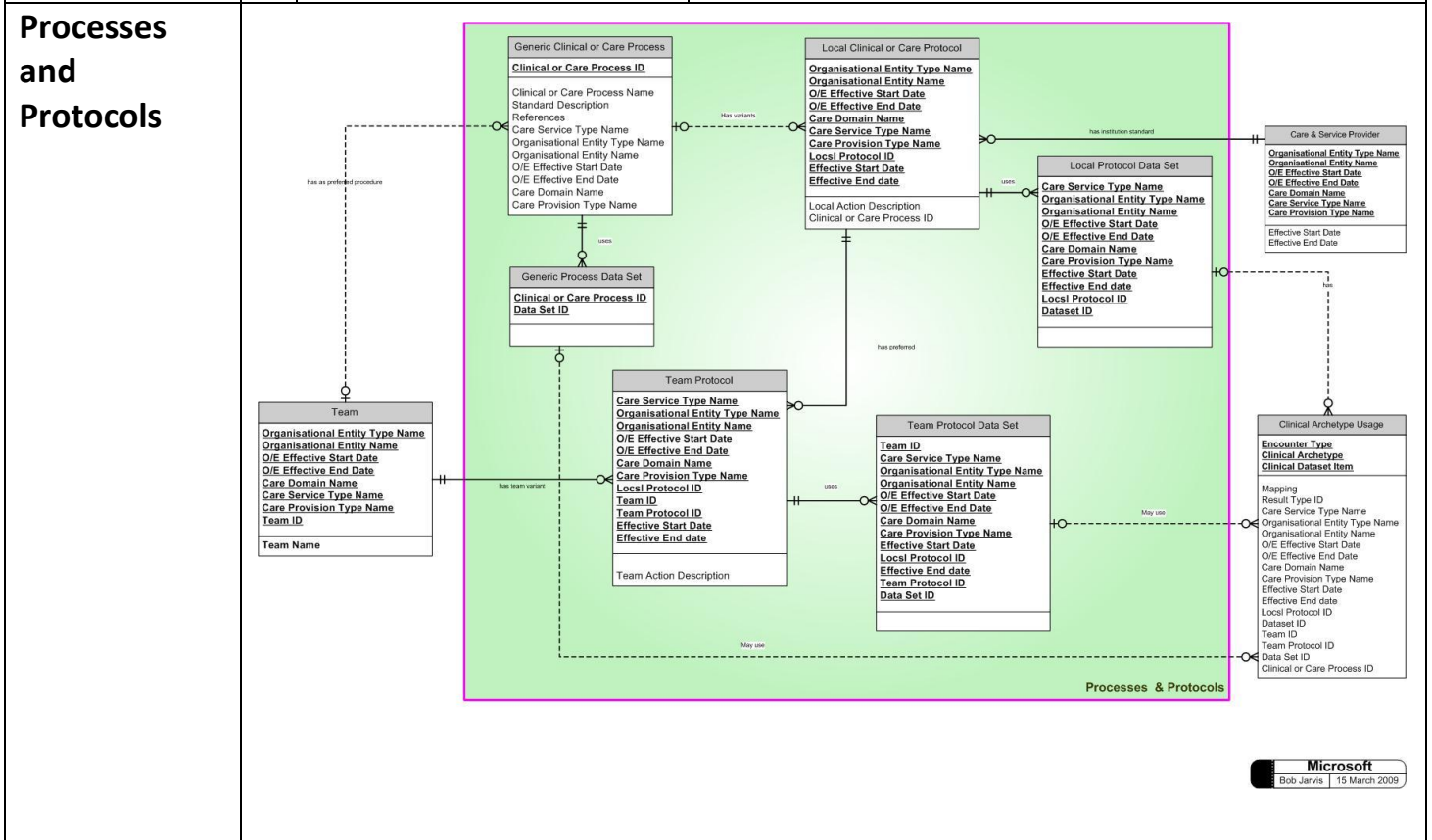
Domain Independent	Citizen Status Type	Indicates whether a person is a citizen, a foreign national, a visitor, a member of the armed forces or diplomatic service, or anyone in transit through a country.
	Domain Role	Indicates the care domain within which a person needs are being addressed.
	Person	A member of the public.
	Person in Domain Role	A person working in or being cared for within a domain: patient, social care client, care professional, etc.
	Personal Affiliations	Indicates the organizations with which a person “does business” – national health service, insurance company, voluntary organization, etc.
	Personal Care Entitlement	Indicates the care that a person is entitled to by reason of their affiliations and indicates who is the care and service provider.
	Personal Relationships	Indicates pertinent relationships between persons.
	Personal Relationship Type	Classifies pertinent relationships: father, mother, children, family structure, legal status, next of kin, etc.

Data Group	Data Entity	Definition
	General (Default) Consent (Health)	Permission for a health care professional to access the records of patients assigned to him or her in accordance with their professional role and authorities. Consent restrictions may be imposed by the patient and in certain circumstances by an approved clinician. This general consent may be denied by the patient.
	Patient	A person, a member of the public, who may be a citizen or visitor, who may receive medical care within a GP practice or local hospital or institution.
	Explicit Patient Consent/Denial	A patient may vary the general default consent for specific conditions, treatments and health categories by explicitly granting or denying consent. This may include agreeing to or denying care by specific care professionals.
	Patient Health Summary	A list of a patient’s current health status including key indicators, allergies and adverse reactions such as would be useful for emergency treatment purposes.
	Patient Implied Consent	The assumption that by agreeing to treatment, the patient has granted of consent for the viewing of patient-related information relevant to the treatment. Some jurisdictions do not regard this as adequate and will require explicit consent.
	Patient Current Medication	A list of medications and their dosages currently prescribed for a patient.
	Patient Data Link	A pointer – either a URL or system address – that locates detailed patient records held in other computer systems.
	Patient Long Term Condition	A current, or chronic, medical condition being experienced by a patient.
	Screening Group	A collection of patients formed on defined criteria that will be examined/tested/questioned in support of preventative medicine, or clinical surveillance purposes.
	Screening Group Membership	A specific instance of a patient being included in a screening group
	Care Group	A collection of social care clients brought together in defined circumstances for reasons of treatment or support or general care.
	Care Relationship	Indicates the relationships between persons in terms of the giving and receiving or care, i.e. who are the carers.
	Care Group Membership	Indicates participation in care or self help groups.
	Client Data Link	A pointer – either a URL or system address – that locates detailed care records held in other computer systems. Note that specific arrangements for data sharing may need to be in place before such data may be accessed.
	Client Implied Consent	The assumption that by agreeing to care or treatment, the patient has granted of consent for the viewing of client-related information relevant to the care or treatment.

Health Domain Specific

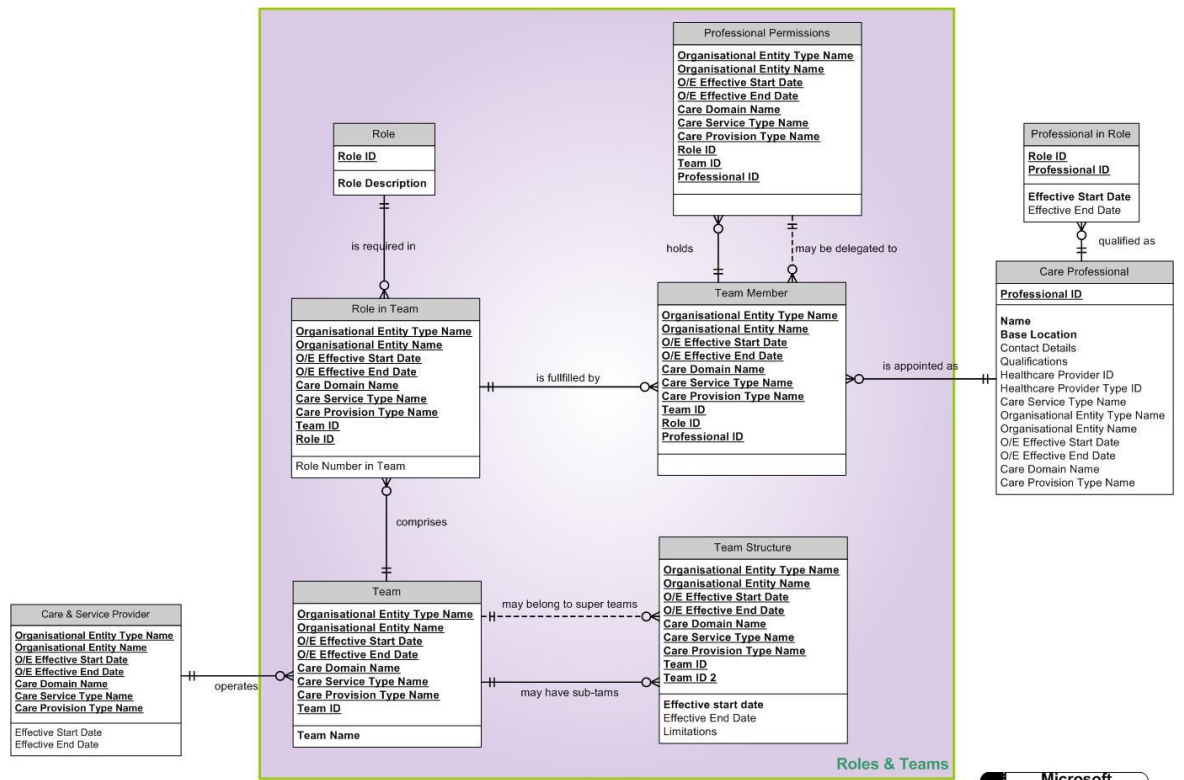
Social Care Domain Specific

Data Group	Data Entity	Definition
		Usually social care organizations do not regard this as adequate and will require explicit consent.
	Generic (Default) Consent (Social Care)	Permission for a social care professional to access the records of clients assigned to him or her in accordance with their professional role and authorities. This general consent may be denied by the patient. Note that the nature of general consent may differ from that of health.
	Explicit Client Consent/Denial	A client may vary the general default consent for specific conditions, treatments and social care categories by explicitly granting or denying consent. This may include agreeing to or denying care by specific care professionals. Explicit consent is a normal practice in social care although the treatment of some conditions is mandatory under certain legal conditions. Information sharing between care domains may be mandatory in certain situations, such as child protection.
	Residential Arrangement	Indicates the residential arrangements of a social care client undergoing long term care or specific short term clinic stays.
	Social Care Client	A person, a member of the public, who may be a citizen or visitor, who may receive social care from a social worker either at home or within a local facility or institution.



Data Group	Data Entity	Definition
	Generic Clinical or Care Process	A procedure, or set of procedures, carried out by a Health and Social Care group or team in the treatment of medical condition, typically within a component activity of a Care Pathway.
	Generic Process Data Set	Defines the data that is collected from each instance of a generic clinical or care process. Clinical archetypes may be used as a data definition mechanism.
	Local Clinical or Care Protocol	A more detailed version of a Clinical or Care Process describing how the process is carried out step by step and how the steps vary locally – for example, in a particular hospital or social work department. Typically the protocols are expressed as a sequence of “actions” which once started must be completed or abandoned or restarted.
	Local Protocol Data Set	Defines the data that is collected from each instance of a local clinical or care protocol. Clinical archetypes may be used as a data definition mechanism.
	Team Protocol	An even more detailed version of a Clinical or Care Process in which each action is described in terms of how specific teams carry out the actions.
	Team Protocol Data Set	Defines the data that is collected from each instance of a team protocol. Clinical archetypes may be used as a data definition mechanism.

Roles & Teams



Data Group	Data Entity	Definition
	Role	A categorization of professional activities carried out in Health and Social Care indicating the level of activity (Consultant, Registrar, Nurse), and the medical or clinical area (for example, Health Subject).
	Role in Team	<p>Teams are usually multi-disciplinary in their composition. "Role in Team" represents the make-up of teams in terms of the roles included in the team and the planned numbers of professionals performing specific roles.</p> <p>"Role in Team" also records the specific professional(s) playing a designated role within the team at a particular point in time. Note that an individual can play many roles in many teams at a point in time.</p>
	Team	Care professional activity is focused and channeled through groups of Care Professionals organized to deliver defined services in specific clinical and support areas.
	Team Member	A specific care professional assigned to a team.
	Team Structure	Care teams operate in a coordinated fashion where high-level groups encompass lower-level teams who in turn may have yet lower-level teams focused on one aspect of care. Team Structure records the inter-relationships of groups and is not restricted to a simple hierarchical view but represents the de-facto matrix organizational structure.
	Professional Permission	The assigned authority of care professional to access the records of specific patients or clients placed under his or her care and in accordance with his or her professional role.

Data Group	Data Entity	Definition
<p>Waiting Lists</p>		<p>Waiting List</p> <p>List ID</p> <p>Waiting List Entry</p> <p>List ID Line Item ID</p> <p>Date entered Date Fulfilled Maximum Waiting Time Actual Waiting Time to Date Actual Waiting Time to Fulfillment Team ID Care Service Type Name Organisational Entity Type Name Organisational Entity Name O/E Effective Start Date O/E Effective End Date Care Provision Type Name Referral Date Encounter Type Role ID Patient/Client No Encounter Date Event Start Date Episode Start Date Location ID Date & Time Clinical Process ID Patient No Start Date Social Care Client ID Health Subject ID Care Domain Name</p> <p>Team Slot</p> <p>Team ID Care Service Type Name Organisational Entity Type Name Organisational Entity Name O/E Effective Start Date O/E Effective End Date Care Domain Name Care Provision Type Name Date Slot No</p> <p>Free/Taken Order Type Order ID List ID Line Item ID</p> <p>Facility Slot</p> <p>Facility Type Facility ID Date Slot No</p> <p>List ID Order ID Order Type Line Item ID Free/Taken</p> <p>Microsoft Bob Jarvis 15 March 2009</p>
	<p>Waiting List</p>	<p>A list or queue, sequenced in order of arrival, of patients requiring treatment, consultations or equipment use provided by a team or facility.</p>
	<p>Waiting List Entry</p>	<p>Details of each entry in the queue.</p>

Given the functional decomposition and conceptual data model, we now continue with the development of our business pattern.

Step 5 – Affinity Analysis

In this step we carried out an analysis of the relationships between the business functions and the data entities we identified in the previous steps. The techniques used for defining the course-grained component are those of clustering and affinity analysis. These techniques are described in more detail in Reference²⁰.

In summary, we formed a matrix in a spreadsheet with business function and data entity entered in the x- and y-axes respectively. In the cells we mapped the relationships between these axes using the well-known CRUD (Create, Read, Update, and Delete) operations. We mapped more than 1,000 relationships in this way.

Clustering on C and U defines candidate groupings of function and data. The effect of this is that within each resulting cluster, the functions only create and update the data in the group and no other, and the data is only created and updated by the functions in the group and no other, such as when encapsulation has been achieved. These groupings are the candidate business components

These components are course-grained objects that exhibit the object-oriented characteristic of encapsulation but not those of inheritance or polymorphism. This is because these are the largest units in an object hierarchy.

We show an extract from the matrix in [Figure 26](#).

²⁰ “Enterprise Architecture – Understanding the bigger picture – A Best Practice Guide for decision makers in IT” by Bob Jarvis. The National Computing Centre – May 2003. Available from <http://www.ncc.co.uk/shop/default.php?cPath=2>

Step 6 – Business Components

The candidate business components, described in more detail in the next chapter *Health and Social Care Business Components and Indicative Business Services* (p.110) are:

1. *Persons and Identities Component*
2. *Patient and Client Groups Component*
3. *Personal Health and Care Status Component*
4. *Personal Affiliations and Entitlements Component*
5. *Personal Consents Component*
6. *Patient and Client Journey Component*
7. *Personal Care Records Component*
8. *Patient and Client Management Component*
9. *Assessments and Care Plans Component*
10. *Health and Care Classifications Component*
11. *Medications and Treatments Component*
12. *Investigations, Orders, Tests and Results Component*
13. *Care Pathways Component*
14. *Processes and Protocols Component*
15. *Organizations, Care Providers and Services Component*
16. *Care Facilities and Schedules Component*
17. *Waiting Lists Component*
18. *Care Professionals' Component*
19. *Professional Roles and Teams Component*
20. *Current Clients, Patients and Care Relationships Component*
21. *Costs and Prices Component*
22. *Clinical and Care Data Management Component*
23. *Rules Engine Component*
24. *Clinical Coding and Datasets Component*
25. *Social Care Coding and Datasets Component*

In this step we develop and confirm the business component specifications, checking that all business functions and data entities are incorporated into a component and that the grouping makes sense. We check that all data entities have their data creating and updating functions encapsulated within the assigned component.

In summary, these components are platform- and technology-independent, and each is also functionally independent and uniquely “owns” its data. In other words, the components are fully encapsulated. Indicative contents (function and data) have been defined and are listed below. It should be noted that our initial arbitrary groups or families of business functions and data entities are now no longer needed. The encapsulated business components provide new, more stable groupings. As such, it will be seen that individual business functions and data entities have “moved” from their initial family groups into components with greater affinity and internal strength.

This list forms a basic inventory of components for a patient-centric care record system. It is not exhaustive, of course. Individual real-world projects will require their own unique set of components, although the list above will form a substantial majority in most implementations. Two components that are often asked for are:

- Clinical Decision Support
- Health and Social Care Knowledge Management

The need for these two components is usually a function of the chosen implementation and the actual application software to be used. Since the components defined in the Connected Health Framework Business Pattern are fully encapsulated, the functionality and data (or “rules”) associated with decision support and knowledge management are included within the component. Sometimes, however, the logic involved is part of the overall business process and is dependent upon interactions between components—for example, in following a particular patient journey based on patient condition and treatment availability. This is sometimes called a “rules engine”. In this case the logic is contained within the business process as distinct to the actual business functions, and the rules engine function is carried out by the Connected Health Framework Hub.

Step 7 – Service Definition

The functionality and data of each business component is made available via defined services. The main business services have been identified, although the identification is not exhaustive. It should be noted that business services are “coarse-grained” and may in themselves may be made up of many smaller services. Many other business services may well be needed, and each component is able to provide many more. The range is only limited by the defined functionality and owned data.

The component-based approach provides a highly modular Integration Framework and, besides providing a development specification, provides means of evaluating the content, coverage, and fit of third-party and legacy-derived components.

Given an inventory of components and services such as this, we can foresee a potential service-oriented architecture for Health and Social Care as having the following general pattern (shown in [Figure 27](#)).

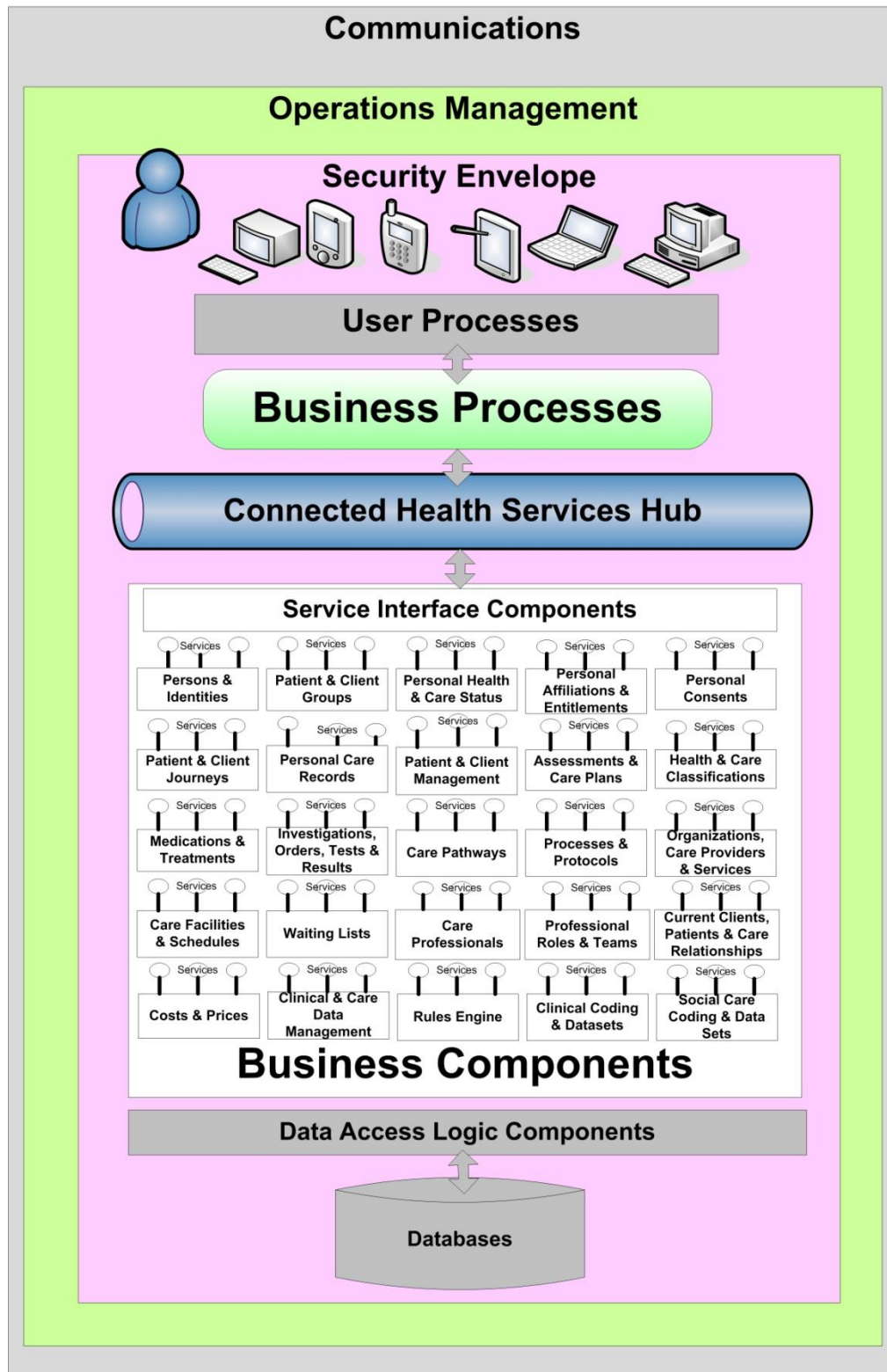


Figure 27. A Business Pattern for Health and Social Care

Health and Social Care Business Components and Indicative Business Services

This section contains specifications of the business components identified in the section [A Business Pattern for Health and Social Care](#) (p.77).

Business Component Specification
Persons and Identities Component
<i>Description</i>
<p>The Persons and Identities Component stores, maintains and enables access to data regarding a Person, their Health enrollment (as Patient) and their Social Care enrollment (as Social Care Client).</p> <p>Capabilities are provided to input, validate, maintain, store and output personal demographic data such as name and address, personal details, family relationships and care arrangements and limited medical and social care-related data.</p> <p>A linkage is provided via the personal identifier to the different identifiers used in the health and care domains, of which there could be many.</p> <p>Details of patient and client care and treatments are often stored in local doctors, care professionals, hospital and social work department systems in local ePRs (electronic patient records) or eCRs (electronic care records). Linkages are provided to these systems in the form of pointers, or URLs to the appropriate ePR or eCR records.</p>
<i>Services (Service Interfaces):</i>
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Record new person and their demographics • Registers Patient • Records Person Death • Records Birth of Child (and create Person and Health/Care Record) • Records Person Emigration (deregister) • Searches for Person (or Patient or Client) by Personal/Patient/Client Number or Name/Address/DoB etc. • Provides Personal Demographic Data • Provides Family Links (Father, Mother, Children, etc) • Provides Next of Kin Information • Updates Personal Details and Preferences (by the Person) • Updates Donor/Volunteer Information • Updates Family Information (incl. Next of Kin) (by the Person) • Provide Care Residence information • Provide Carer information • Maintain demographic classifications

Functions performed (Business Logic):	Data owned (Business Entities):		
Person Identification Personal Demographics Maintenance Personal Relationships Mapping Family Member Information Maintenance Family History Service Any other optional demographic information Next of Kin Information Maintenance Patient/Client Socio-Economic Details Maintenance Death Recording Patient/Client Registration Mother/Baby Links Patient/Client Search and Record Retrieval Donor Details Maintenance Patient/Client Personal Preferences Maintenance Patient/Client Data Link Maintenance Social Care Client Registration Family/Carer Links Client Search and Record Retrieval Volunteer Details Maintenance Client Personal Preferences Maintenance Client Residential Information Maintenance Client Data Link Maintenance	Person		
	A member of the public.		
	Primary Key <i>Indicative Attributes</i>	Person Identifier Name Address Date of Birth Gender Date of Death Patient Demographics: Religion Occupation Sex Ethnic Origin Special Needs Marital Status Next of Kin	
	Domain Role		
	Indicates the care domain within which a person needs are being addressed.		
	Primary Key <i>Indicative Attributes</i>	Care Domain Name Care Domain Role Definition Date Definition Constraints	
	Person in Domain Role		
	A person working in or being cared for within a domain, e.g. patient, social care client, care professional, etc.		
	Primary Key <i>Indicative Attributes</i>	Person Identifier + Care Domain Name + Care Domain Role Date of Classification Classifying Org Unit	
	Personal Relationship Type		
	Classifies pertinent relationships e.g. father, mother, children, family structure, legal status, next of kin, etc.		
	Primary Key <i>Indicative Attributes</i>	Relationship Type Description	
	Personal Relationship		
	Indicates pertinent relationships between persons.		
Primary Key <i>Indicative Attributes</i>	Person Identifier 1 + Person Identifier 2 + Relationship Type + Effective Start Date + Effective End Date Notes Observations		

Citizen Status Type	
Indicates whether a person is a citizen, a foreign national, a visitor, a member of the armed forces or diplomatic service, or anyone in transit through a country.	
Primary Key <i>Indicative</i> <i>Attributes</i>	Citizen Status Type Description
Patient	
A person, a member of the public, who may be a citizen or visitor, who may receive medical care within a GP practice or local hospital or institution.	
Primary Key <i>Indicative</i> <i>Attributes</i>	Patient ID Person Identifier Care Domain Name Care Domain Role Enrollment Dates
Patient Data Links	
A pointer – either a URL or system address – that locates detailed patient records held in other computer systems.	
Primary Key <i>Indicative</i> <i>Attributes</i>	Patient ID + Care Domain Name + Care Domain Role + Link ID Pointer or URL Access Limitations
Social Care Client	
A person, a member of the public, who may be a citizen or visitor, who may receive social care from a social worker either at home or within a local facility or institution.	
Primary Key <i>Indicative</i> <i>Attributes</i>	Social Care Client ID + Care Domain Name + Care Domain Role Person Identifier Enrollment Dates
Client Data Link	
A pointer – either a URL or system address – that locates detailed care records held in other computer systems. Note that specific arrangements for data sharing may need to be in place before such data may be accessed.	
Primary Key <i>Indicative</i>	Social Care Client ID + Care Domain Name + Care Domain Role + Link ID

	<i>Attributes</i>	Pointer or URL Access Limitations
	Care Relationship	
	Indicates the relationships between persons in terms of the giving and receiving or care, i.e. who are the carers.	
	<i>Primary Key</i>	Social Care Client ID + Care Domain Name + Care Domain Role + Person Identifier (Carer) + Care Domain Name (of Carer) + Care Domain Role (of Carer) +
	<i>Indicative Attributes</i>	Effective Dates Responsibilities
	Residential Arrangement	
Indicates the residential arrangements of a social care client undergoing long term care or specific short term clinic stays.		
<i>Primary Key</i>	"PK of Social Care Client" + "PK of Facility"	
<i>Indicative Attributes</i>	Start and End Dates Contractual References	

Business Component Specification					
Patient and Client Groups Component					
<i>Description</i>					
<p>The Patient and Client Groups component provides facilities for the definition, formation, operation, analysis and reporting of patient/client groups and the population of such groups with relevant patients or clients.</p> <p>Screening Groups are formed to perform preventative medicine and clinical surveillance of defined groups of patients.</p> <p>Care Groups are formed to provide help and assistance to persons with similar care needs and might include self help and voluntary care sector activities as well as “official” provisions.</p>					
<i>Services offered (Service Interfaces):</i>					
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Provides Screening Group Definition capability • Provides Risk Factor Definition and Evaluation capability • Provides Group Membership Qualifying Criteria • Provides Patient or Client Search against Qualifying Criteria • Provides Candidate Membership List • Produces Membership Invitations • Enrolls Patient in Screening Group • Enrolls Social Care Client in Care Group • Schedules Screening Test • Performs Screening Test • Records Screening Test Results • Records Care Group Progress and Outcomes • Performs Individual Screening Test Results Analyses • Evaluates Results • Provides for Communication of Results to Patient or Client • Performs Group Analyses • Reports Conclusions and Trends 					
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>				
Screening Group Definition Screening Group Population Maintenance Care Group Definition Care Group Membership Maintenance Risk Factor Definition Lifestyle and Risk Factor Recording	<p>Screening Group</p> <p>A collection of patients formed on defined criteria that will be examined/tested/questioned in support of preventative medicine, or clinical surveillance purposes.</p>				
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Screening Group ID</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Purpose of Group Items measured</td> </tr> </table>	<i>Primary Key</i>	Screening Group ID	<i>Indicative Attributes</i>	Purpose of Group Items measured
	<i>Primary Key</i>	Screening Group ID			
<i>Indicative Attributes</i>	Purpose of Group Items measured				

	Control Values Membership Qualifications Date formed Date disbanded "Care Provider" (operates) "Care Professional" (manages) "Health Subject" (is about)
Screening Group Membership	
A specific instance of a patient being included in a screening group	
<i>Primary Key</i>	Screening Group ID + Patient No
<i>Indicative Attributes</i>	Date joined Date left Last call Risk Factor measured Item Results Measurement Date Outcome
Care Group	
A collection of social care clients brought together in defined circumstances for reasons of treatment or support or general care.	
<i>Primary Key</i>	Care Group ID
<i>Indicative Attributes</i>	Purpose of Group Membership Qualifications Date formed Date disbanded "Care Provider" (operates)
Care Group Membership	
Indicates participation in care or self help groups.	
<i>Primary Key</i>	Care Group ID + Social Care Client ID
<i>Indicative Attributes</i>	Date joined Date left Outcome

Business Component Specification							
Personal Health and Care Status Component							
<i>Description</i>							
<p>The Personal Health and Care Status Component offers data regarding a person’s current wellbeing such as would be useful in providing a summary to a new health or social carer.</p> <p>This includes current medication and medical problems and allergies that would be of assistance in emergencies and for treatment when away from home. In effect the component constitutes a summary health record.</p>							
<i>Services (Service Interfaces):</i>							
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Provides Patient Summary Health Record • Updates patient medical attributes (blood group, etc.) (by Care Professional) • Updates immunization/vaccination information (by Care Professional) • Provides Health Status (Current Problems, Allergies, Immunizations, Weight, BP, etc.) 							
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>						
<p>General Health Data Maintenance (by Patient/Client) Patient /Client Problem Registration Patient/Client Problem Maintenance Patient/Client Data Management (by Professional) Patient/Client Data Management (by Patient/Client) Personalized Area Maintenance (by Patient/Client – e.g. "My Healthspace") Immunizations/Vaccinations History Maintenance</p>	<p>Patient Health Summary</p> <p>A list of a patient’s current health status including key indicators, allergies and adverse reactions such as would be useful for emergency treatment purposes.</p>						
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Patient No</td> </tr> <tr> <td><i>Indicative</i></td> <td></td> </tr> <tr> <td><i>Attributes</i></td> <td> Patient Medical Summary : Height Weight Blood Group Allergies Immunization History Vaccination History Weight History Blood Pressure History “Care Professional” (GP) Family Links (to other Patient Nos) </td> </tr> </table>	<i>Primary Key</i>	Patient No	<i>Indicative</i>		<i>Attributes</i>	Patient Medical Summary : Height Weight Blood Group Allergies Immunization History Vaccination History Weight History Blood Pressure History “Care Professional” (GP) Family Links (to other Patient Nos)
	<i>Primary Key</i>	Patient No					
	<i>Indicative</i>						
	<i>Attributes</i>	Patient Medical Summary : Height Weight Blood Group Allergies Immunization History Vaccination History Weight History Blood Pressure History “Care Professional” (GP) Family Links (to other Patient Nos)					
<p>Patient Long Term Condition</p> <p>A current, or chronic, medical condition being experienced by a patient.</p>							
<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Patient No +</td> </tr> <tr> <td><i>Indicative</i></td> <td>Health Subject ID</td> </tr> <tr> <td><i>Attributes</i></td> <td>Problem Description</td> </tr> </table>	<i>Primary Key</i>	Patient No +	<i>Indicative</i>	Health Subject ID	<i>Attributes</i>	Problem Description	
<i>Primary Key</i>	Patient No +						
<i>Indicative</i>	Health Subject ID						
<i>Attributes</i>	Problem Description						

	Patient Current Medication	
	A list of medications and their dosages currently prescribed for a patient.	
	<i>Primary Key</i>	Patient No + Medication Item ID + Dosage
	<i>Indicative</i>	Date prescribed
	<i>Attributes</i>	Date Ending

Business Component Specification					
Personal Affiliations and Entitlements Component					
<i>Description</i>					
<p>The Personal Affiliations and Entitlements Component indicate from whom a person receives health and social care and the nature and extent of the care services provided</p> <p>The affiliation will be with a national health service or an insurance scheme or care plan organization. The entitlement will describe the extent of cover and the applicable terms and conditions</p>					
<i>Services offered (Service Interfaces):</i>					
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Provide details of the care providing organizations relative to a specific person • Provide details care entitlement and applicable terms and conditions 					
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>				
Patient/Client Registration with Provider Patient/Client-Provider Contract Specification	<p>Personal Care Entitlement</p> <p>Indicates the care that a person is entitled to by reason of their affiliations and indicates who is the care and service provider.</p>				
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>"PK of Personal Affiliation" + Affiliation Service ID</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Entitlement Details</td> </tr> </table>	<i>Primary Key</i>	"PK of Personal Affiliation" + Affiliation Service ID	<i>Indicative Attributes</i>	Entitlement Details
	<i>Primary Key</i>	"PK of Personal Affiliation" + Affiliation Service ID			
	<i>Indicative Attributes</i>	Entitlement Details			
<p>Personal Affiliations</p> <p>Indicates the organizations with which a person "does business" e.g. national health service, insurance company, voluntary organization, etc.</p>					
<table border="1"> <tr> <td><i>Primary Key</i></td> <td>"PK of Person" + "PK of Organizational Entity" (Care Provider) + Affiliation Start and End Dates</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Affiliation Service ID (e.g. Policy No) Terms and Conditions</td> </tr> </table>	<i>Primary Key</i>	"PK of Person" + "PK of Organizational Entity" (Care Provider) + Affiliation Start and End Dates	<i>Indicative Attributes</i>	Affiliation Service ID (e.g. Policy No) Terms and Conditions	
<i>Primary Key</i>	"PK of Person" + "PK of Organizational Entity" (Care Provider) + Affiliation Start and End Dates				
<i>Indicative Attributes</i>	Affiliation Service ID (e.g. Policy No) Terms and Conditions				

Business Component Specification					
Personal Consents Component					
<i>Description</i>					
<p>The Personal Consents component manages the default values for granting access to patient or Social care client data pairing Health/Care Subjects with professional roles. It also supports the recording of specific consents which note the wishes of a patient or client in granting or denying access to his or her record. It also handles the reversal of default consents by patients and clients and the granting of specific access rights to nominated Care Professionals in respect of individual patients, clients and health/care subjects. The component can also compose “Sealed Envelopes” – a virtual, protected set of patient information and data links (for example, pertaining to a particular health subject) which may be opened by authorized care professionals in defined situations like emergencies.</p>					
<i>Services offered (Service Interfaces):</i>					
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Setting of general consents (default values) – confidentiality guardian function • Viewing of general consents (default values) • Provides consent information for a patient • Provides access denial information for a patient or social care client • Reversal of specific consents – patient/client function • Grants individual access consents to specified Care Professionals – patient/client function • Provides “sealed envelopes” containing confidential patient information and data links • Receives and record patient/client directives such as religious wishes and visitor restrictions. 					
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>				
Patient/Client Consent Recording (by Professional) Consent Management (by Patient/Client) Patient/Client Consent Default Generation Patient/Client Consent application Patient/Client Consent alteration requests Sealed Envelope Maintenance Patient/Client Directives Maintenance General (Default) Consent Definition	<p>General (Default) Consent (Health)</p> <p>Permission for a health care professional to access the records of patients assigned to him or her in accordance with their professional role and authorities. Consent restrictions may be imposed by the patient and in certain circumstances by an approved clinician. This general consent may be denied by the patient.</p>				
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Care Domain Name + Care Domain Role + Health Subject ID</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Default Consent (Y/N)</td> </tr> </table>	<i>Primary Key</i>	Care Domain Name + Care Domain Role + Health Subject ID	<i>Indicative Attributes</i>	Default Consent (Y/N)
	<i>Primary Key</i>	Care Domain Name + Care Domain Role + Health Subject ID			
	<i>Indicative Attributes</i>	Default Consent (Y/N)			
<p>Patient Implied Consent</p> <p>The assumption that by agreeing to treatment, the patient has granted of consent for the viewing of patient-related information relevant to the treatment. Some jurisdictions do not regard this as adequate and will require explicit consent.</p>					
<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Patient ID + Care Domain Name + Care Domain Role + Health Subject ID</td> </tr> </table>	<i>Primary Key</i>	Patient ID + Care Domain Name + Care Domain Role + Health Subject ID			
<i>Primary Key</i>	Patient ID + Care Domain Name + Care Domain Role + Health Subject ID				

	<i>Indicative Attributes</i>	Consent Y/N Date Granted Date Revoked Consent Reversal Date
Explicit Patient Consent/Denial		
A patient may vary the general default consent for specific conditions, treatments and health categories by explicitly granting or denying consent. This may include agreeing to or denying care by specific care professionals.		
	<i>Primary Key</i>	Patient ID + Health Subject ID
	<i>Indicative Attributes</i>	Consent Y/N Date Granted Date Revoked Consent Reversal Date Patient Directives
General (Default) Consent (Social Care)		
Permission for a social care professional to access the records of clients assigned to him or her in accordance with their professional role and authorities. This general consent may be denied by the patient. Note that the nature of general consent may differ from that of health.		
	<i>Primary Key</i>	Health/Care Subject ID + Care Domain Name + Care Domain Role
	<i>Indicative Attributes</i>	Default Consent (Y/N)
Client Implied Consent		
The assumption that by agreeing to care or treatment, the patient has granted of consent for the viewing of client-related information relevant to the care or treatment. Usually social care organizations do not regard this as adequate and will require explicit consent.		
	<i>Primary Key</i>	Social Care Client ID + Care Domain Name + Care Domain Role + Health/Care Subject ID
	<i>Indicative Attributes</i>	Consent Y/N Date Granted Date Revoked Consent Reversal Date
Explicit Client Consent/Denial		
A client may vary the general default consent for specific conditions, treatments and social care categories by explicitly granting or denying consent. This may include agreeing to or		

	<p>denying care by specific care professionals. Explicit consent is a normal practice in social care although the treatment of some conditions is mandatory under certain legal conditions. Information sharing between care domains may be mandatory in certain situations, e.g. child protection.</p>	
	<p><i>Primary Key</i></p>	<p>Social Care Client ID + Care Domain Name + Care Domain Role + Health/Care Subject ID</p>
	<p><i>Indicative Attributes</i></p>	<p>Consent Y/N Date Granted Date Revoked Consent Reversal Date Client Directives</p>

Business Component Specification

Patient and Client Journey Component

Description

Patient and Client Journey Component summaries of care received or to be received in future by a patient or client for a specific medical or social condition at a particular time or over a defined timeframe.

Planned care is described by the Patient Journey. This may be based on a generic care pathway for a particular disease or condition. However, the care pathway is usually customized for the patient particular situation and needs. The Patient Journey is also records “future” events which are used as triggers for appointment making.

Care Records are usually held in local systems but may be accessed remotely via Patient Data Links held in the Patient Identity and Health Status Component.

Services offered (Service Interfaces):

Indicative Business Services

- Conducts Construction of Patient Journeys
- Reports Patient Journey Status
- Provides Patient Journey “next step”
- Receives Patient Journey Updates
- Generates Planned Patient Events, Episodes and Encounters from the Patient Journey
- Triggers Appointments and Orders for the Next Step

Functions performed (Business logic):

Patient/Client Journey Construction
 Patient/Client Journey Display (for Patient/Client)
 Patient/Client Journey Progress Recording
 Patient/Client Journey Review (by Professional)
 Patient/Client Journey Completion

Data owned (Business Entities):

Patient/Client Journey

A summary of the events - past, present and future – expressed in the form of a “care pathway” dedicated to the treatment of a particular medical or social condition for a specific patient or client. The Patient/Client Journey is unique to the patient or client and is constructed from a number of “segments” each containing planned events.

Primary Key

Patient/Client Journey ID

Indicative Attributes

Care Pathway ID
 Patient ID or Social Client ID
 Care Domain Name
 Care Domain Role

Generic or Custom
 Actual Start Date
 Planned Completion Date
 Actual Completion Date
 Summary Description
 Status/Outcome
 “Care Pathway” (based on)

	Patient/Client Journey Segment	
	A set of Planned Actions to be carried out, usually in sequence, as part of a Patient/Client Journey.	
	<i>Primary Key</i>	Patient/Client Journey ID + PJ Segment ID
	<i>Indicative Attributes</i>	Generic or Custom Planned Start Date Actual Start Date Planned Completion Date Actual Completion Date Summary Description Status/Outcome "Care Pathway Phase"(based on)
Patient Journey Planned Action		
A defined activity to be carried out as part of a Patient/Client Journey.		
<i>Primary Key</i>	Patient/Client Journey ID + PJ Segment ID + PJ Planned Action ID	
<i>Indicative Attributes</i>	Generic or Custom Planned Start Date Actual Start Date Planned Completion Date Actual Completion Date Summary Description Status/Outcome "Care Pathway Activity" (based on)	

Business Component Specification

Personal Care Records Component

Description

This component manages Patient and Client Care Records – the summaries of care received by a patient or social care client for a specific medical or social condition at a particular time or over a defined timeframe.

The component provides functionality and data to support the actual provision of patient care. Planned care is described by the Patient Journey.

The actual care received is recorded in a structured manner in the form of Patient Events (or spells of care), Patient Episodes (such as a hospital admission) and Patient Encounters (an interaction with a care professional) such as a consultation, examination or administration of a treatment or perhaps a merely a telephone conversation). Looked at another way, a Patient Encounter entails a single interaction between patient and professional, a Patient Episode is a related series of encounters, with a clear beginning and end such as a stay in hospital, addressing a particular patient condition or complaint. A Patient Event (sometimes called a “Spell of Care”) encompasses a number of episodes over a period of time, perhaps lifelong, addressing a particular condition or complaint.

Care Records are usually held in local systems but may be accessed remotely via Patient Data Links held in the Patient Identity and Health Status Component.

Services offered (Service Interfaces):

Indicative Business Services

- Records Patient Encounter
- Records Unplanned Encounters (e.g. Emergencies, A & E activity)
- Closes Encounter Appointment
- Records Clinical Notes and Dataset for Encounter
- Issues Referral
- Issues Prescription
- Updates Episodes from Encounters and Events from Episodes
- Records Patient Journey Action, Segment and Overall Completion
- Provides Integrated Patient Information from standing data, event data, patient journeys, etc.

Functions performed (Business logic):

Data owned (Business Entities):

Patient/Client Encounter Recording (Notes & Dataset) Clinical Noting for Patient/Client Encounters Contact Recording including Clinical Noting Patient/Client Episode Creation Patient/Client Event (Spell of Care) Creation Patient/Client Event Recording (Clinical Notes, etc) Patient/Client Event Management (by Patient/Client) Patient/Client Episode Details Maintenance Episode Details Tracker Patient/Client Episode Closure	<p>Patient/Client Spell of Care (Event)</p> A summary of care received for a specific medical or social condition at a particular time. The summary comprises a high level categorization of the condition and a brief indication of the outcome.		
	<table border="1" style="width: 100%;"> <tr> <td style="width: 30%;"><i>Primary Key</i></td> <td> Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role) + Health Subject ID + </td> </tr> </table>	<i>Primary Key</i>	Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role) + Health Subject ID +
<i>Primary Key</i>	Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role) + Health Subject ID +		

Business Component Specification

Patient and Client Management Component

Description

The Patient and Client Management Component handles all administrative actions with regard to a patient or Client relative to arranging, conducting, recording and reporting patient or client contacts and interactions in both primary and secondary care health settings and social care situations.

Activities include receiving and responding to referrals, making appointments, handling admissions, monitoring attendance and “patient processing”, handling discharges and clinic and session attendance.

Also included are the maintenance of indices of patients registered with a Care Provider and attending, or who have attended, a particular facility operated by a Care Provider.

Services offered (Service Interfaces)

Indicative Business Services

- Registers Patient with Provider
- Deregisters Patient with Provider
- Issues Patient Lists by Provider/Facility and Date Range (current, future and historic)
- Provides Attendee List for Planned Clinic or Session
- Retrieves Protocol for Referral
- Retrieves Potential Providers, Teams and Professionals for Referral
- Creates Referral
- Assigns Referral to Provider, Team and Professional
- Allocates Appointment and Issue Letter and Instructions
- Rearranges Appointments
- Issues Reminders
- Receives and Admits Patient (Planned)
- Receives and Admits Patient (Unplanned)
- Creates Workflow for Patient Treatment
- Allocates Patient to Facility (Ward and Bed)
- Monitors Patient Attendance
- Creates Recurring Attendance/Admission Plans
- Records Patient Discharge
- Issues Discharge Letters and Summaries
- Creates Onward Referral
- Creates Follow-up Appointment
- Issues Patient Prescription

Functions performed (Business Logic):

Create Appointments from Plan
 E-booking for 1st Appointments
 Patient/Client Appointment Creation and Change
 Clinic Population from Waiting List
 Referral Creation with Access to Protocols

Data owned (Business Entities):

Referral
 The process by which a care professional refers a patient, client or service user to another. This will usually include the transfer of clinical and social care information about the patient or

Patient/Client Referral Creation Patient/Client Appointment/Attendance Letter Issue Patient/Client Information Provision (Directions and Preparation) Booking Admissions Patient/Client Admission Recording Day & Ward Attendance Monitoring Automated Reminders and Alerts Home Leave Planning and Administration Regular Day/Night Attendance Planning and Administration Patient/Client Discharge Recording Discharge Letter Preparation Discharge Summary Preparation Onward Referrals Screening Scheduling and Follow-up Management Create Workflows from Plan Emergency Admissions Day Care Planning Patient/Client Prescription Creation Discharge Prescribing Discharge Dispensing Home Leave Prescribing	client, and may be undertaken before or after an appointment is made.	
	<i>Primary Key</i>	“PK of Patient/Client Encounter” + “PK of Team” + Referral Date or ID
	<i>Indicative Attributes</i>	Problem Description Planned Protocol “Team” (referred to) “Patient Encounter” (referred from) “Protocol” (to be used)
	Appointment	
	An arranged time and place for the conduct of activities connected with the treatment of a medical or social condition. An appointment, or series of appointments, is arranged to satisfy the requirements of a due Patient or Client Encounter and results in the creation of entries in the personal care record.	
<i>Primary Key</i>	“PK of Referral” + Location ID + Date & Time Notes and requirements	
<i>Indicative Attributes</i>	“Clinical Process” (planned action)	
Admissions and Discharges		
The entry or exit of a patient or client from a residential episode of care administered by a team within a facility. Admission is normally in response to a referral and takes place following allocation to an available slot in a team or facility schedule. The discharge is normally accompanied by a discharge note explaining the treatment given; follow up requirement and specifying any medication required.		
<i>Primary Key</i>	“PK of Referral” + Care Provider Type ID + Care Provider ID + Facility Type + Facility ID + Admission/Discharge Date	
<i>Indicative Attributes</i>	Admission Notes Discharge Notes, Letters, Summaries etc. “Team” (referred to) “Referral” (resulted from)	

	Prescription Item	
	A medication item in a specific dosage prescribed by a care professional for a patient.	
	<i>Primary Key</i>	"PK of Patient/Client Encounter" + Medication Item ID Dosage Level + Professional ID Specific Instructions
	<i>Indicative Attributes</i>	"Encounter" (results from) "Care Professional" (prescribing) "Medication" (subject of)

Business Component Specification					
Assessments and Care Plans Component					
<i>Description</i>					
<p>Assessments are structured analyses of a patient’s or client’s condition or situation. They are made using an agreed, applicable common protocol by one, or usually more, care professionals and perhaps, professionals from other disciplines. The result of an assessment is a plan for the patient’s or client’s care and hopefully recovery.</p> <p>The Assessments and Care Plans component provides capabilities and services to aid the conduct of the assessment, the production of the care plan and its subsequent execution.</p>					
<i>Services offered (Service Interfaces)</i>					
<p>Indicative Business Services</p> <ul style="list-style-type: none"> • Provides Assessment Type Definition Capability • Records Assessment Protocol • Provides Revision and Updating facilities for Protocols including Version Control • Provides Assessment Protocol Templates and Guidance • Accepts Assessment Inputs from Patient and multiple Professionals • Provides Interim Assessment Output • Provides Care Plan Activity Definition capability • Provides Care Plan Assembly capability • Provides Care Plan Maintenance capability • Provides Care Plan Activity Assignment capability • Provides Care Plan Activity Prioritization capability • Provides Care Plan Programming capability • Publishes Care Plan • Provides Care Plan Alerts • Provides Care Plan Status Report 					
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>				
Patient/Client Assessment Creation Patient/Client Input to Assessment Multiagency Assessment Shared Assessment Process Carer Assessment Multidisciplinary Assessment Assessment Protocol Definition and Version Control Assessment Protocol Maintenance A & E Assessment and Prioritization Care Plan Creation Care Plan Lifecycle Maintenance Cross-organization Care Planning Care Plan Activity Assignment Clinical Messaging for Care Activities Care Plan Status Monitoring	<p>Patient/Client Assessment</p> <p>An evaluation of patient or client condition in a defined context (e.g. health subject) using an agreed common protocol.</p>				
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Assessment ID + Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role)</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Assessment Notes “Protocol” used</td> </tr> </table>	<i>Primary Key</i>	Assessment ID + Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role)	<i>Indicative Attributes</i>	Assessment Notes “Protocol” used
	<i>Primary Key</i>	Assessment ID + Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role)			
	<i>Indicative Attributes</i>	Assessment Notes “Protocol” used			
<p>Patient/Client Assessment Type</p> <p>Indicates the nature of assessment to be carried out e.g. a single assessment for an older person. An assessment may be inter-disciplinary and multi-agency.</p>					

	<i>Primary Key</i>	Patient/Client Assessment Type ID
	<i>Indicative Attribute</i>	Description
Patient/Client Care Plan		
A program of care activities constructed in response to a patient or client assessment.		
	<i>Primary Key</i>	Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role) Assessment ID + Plan Date
	<i>Indicative Attributes</i>	Plan Description "Care Professional" (monitored by)
Planned Care Activity		
An intended action incorporated into a care plan. Responsibility for the action will be assigned to a Care Professional and will have a defined time and place for its execution.		
	<i>Primary Key</i>	Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role) Assessment ID + Plan Date + Activity No
	<i>Indicative Attributes</i>	Activity Description "Care Professional" (assigned to) "Clinical Process Action" (planned as)
Assessment Contributor		
A care or other professional who is responsible for a contribution to an assessment in respect of a patient. There may be multiple contributors per assessment.		
	<i>Primary Key</i>	Role ID + Professional ID Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role) Assessment ID
	<i>Indicative Attributes</i>	Contribution (Notes, Opinion, etc)
Assessment Protocol		

	Describes the process to be followed for the type of assessment being carried out.	
	<i>Primary Key</i>	Assessment Protocol ID
	<i>Indicative Attributes</i>	Process Description Effective Date

Business Component Specification

Health and Care Classifications Component

Description

The Health and Care Classifications Component maintains and applies a categorization scheme for summarizing the disease, medical or social condition or procedures involved in patient or social care client care. A Health Subject may comprise smaller, more detailed Health Subjects and in turn may be a sub-division of a more general Health Subject.

A Health Classification may align with a medical “Specialty” – such as “geriatrics” or “cardiology” or “gastroenterology”, etc. or the Social care equivalents such as “care of the elderly” or “visual impairment”, etc.

A Health Subject qualifies Patient Events, Consents, Permissions and Roles of Care Professionals. Health Subjects provide a common denominator between schemes and the component provides a translation service between a code value in a particular scheme and the corresponding code in another.

Services offered (Service Interfaces):

Indicative Business Services

- Provides Health Subject definition and maintenance
- Provides Health Subject Structure definition and maintenance
- Searches for Health Subjects by Name or Synonym

Functions performed (Business Logic):

- Define Health or Care Subject
- Define Health or Care Subject Structure
- Provide Clinical or Care Coding Access
- Provide Clinical or Care Code Translations

Data owned (Business Entities):

Health Subject/Specialty	
A high level classification of medical conditions formed for the purpose of recording Patient Consent and classifying Patient Events. Examples might be “Cancer, Cardiac Care, Maternity, Mental Health, etc”.	
<i>Primary Key</i>	Health/Care Subject ID
<i>Indicative</i>	Health/Care Subject Name
<i>Attributes</i>	Synonyms
	Description
	None
Health Subject Structure	
A Health Subject may be made up of smaller health subjects and in turn may be a member of one or more higher-level Health Subjects. For example, the high level subject “Cancer” may comprise Lung Cancer, Breast Cancer, Colon Cancer and so on. Each one of these may sub-divide further and also may be a member of other higher level groups. Health Subject Structure records the parent and child relationships between Health Subjects.	
<i>Primary Key</i>	Senior Health/Care Subject ID + Junior Health/Care Subject ID

	<i>Indicative Attributes</i>	Date defined Date superseded
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Business Component Specification							
Medications and Treatments Component							
<i>Description</i>							
<p>The Medication Component offers basic information on medication items, their recommended usages and dosages and information about their use in conjunction with other medications. It provides only a quick reference and is not intended as a full prescribing system or pharmacopeia.</p>							
<i>Services offered (Service Interfaces):</i>							
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Provide a Medication Item Definition and Maintenance capability • Provide a Medication Rules Definition and Maintenance capability • Provide a Medication Item Dosage Definition and Maintenance capability • Provide a Recommended Treatment Definition and Maintenance capability • Search for Medication by Name or Health Subject 							
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>						
Treatment Definition Medication Item Definition Recommended Treatment Definition Non-medication Treatment Item Definition Medication Item Maintenance Medication Rules Definition Dosage Definition Medication Search (by Health Subject)	<p>Medication Item</p> <p>A prescribable item such as a drug, medicine or health-oriented artifact</p> <table border="1"> <tr> <td><i>Primary Key</i></td> <td>Medication Item ID</td> </tr> <tr> <td><i>Alternate Keys</i></td> <td>Medication Name Commercial Name</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Description</td> </tr> </table>	<i>Primary Key</i>	Medication Item ID	<i>Alternate Keys</i>	Medication Name Commercial Name	<i>Indicative Attributes</i>	Description
	<i>Primary Key</i>	Medication Item ID					
	<i>Alternate Keys</i>	Medication Name Commercial Name					
	<i>Indicative Attributes</i>	Description					
	<p>Medication Rule</p> <p>Indication of which medication items should be or should not be prescribed together for a single patient</p> <table border="1"> <tr> <td><i>Primary Key</i></td> <td>Medication Item ID 1 + Medication Item ID 2</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Use together (Y/N) Do NOT use together (Y/N)</td> </tr> </table>	<i>Primary Key</i>	Medication Item ID 1 + Medication Item ID 2	<i>Indicative Attributes</i>	Use together (Y/N) Do NOT use together (Y/N)		
	<i>Primary Key</i>	Medication Item ID 1 + Medication Item ID 2					
	<i>Indicative Attributes</i>	Use together (Y/N) Do NOT use together (Y/N)					
	<p>Medication Dosage</p> <p>Available strengths or dispensing quantities of a specific medication item.</p> <table border="1"> <tr> <td><i>Primary Key</i></td> <td>Medication ID + Dosage Level</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Dispensing Form (e.g. Tablet, Liquid, etc.)</td> </tr> </table>	<i>Primary Key</i>	Medication ID + Dosage Level	<i>Indicative Attributes</i>	Dispensing Form (e.g. Tablet, Liquid, etc.)		
	<i>Primary Key</i>	Medication ID + Dosage Level					
	<i>Indicative Attributes</i>	Dispensing Form (e.g. Tablet, Liquid, etc.)					
<p>Treatment</p> <p>Indication of appropriate medication items prescribable for particular medical conditions.</p>							

	<i>Primary Key</i>	Treatment ID
	<i>Indicative Attributes</i>	Health Subject ID Description
	Medication Treatment Item	
	A medication item used in a particular treatment	
	<i>Primary Key</i>	Treatment ID + Medication ID + Dosage Level
	<i>Indicative Attributes</i>	Instructions
	Non-medication Treatment Item	
An item, not a medication, used in a particular treatment for example an item of apparatus.		
<i>Primary Key</i>	Treatment ID + Item ID	
<i>Indicative Attributes</i>	Description Instructions	

Business Component Specification

Investigations, Orders, Tests and Results Component

Description

Orders are created in order to perform tests or to carry out various imaging or diagnostic examinations.

Orders are raised as a result of a Patient Encounter and are sent to the appropriate laboratory or facility. Coordinated sets of orders can be specified to carry out a detailed investigation. Tests involving samples are usually carried out anonymously as far as the patient is concerned; the test being identified by a sample number with is related back to the patient by the requestor. Tests and examinations carried out on the person are clearly not anonymous. Some orders are not patient-related and others are for non-clinical purposes (e.g. catering). Orders may be grouped in sets for one patient or be for a group of patients.

Tests and examinations are carried out using standard processes and may involve automated or manual activity.

The Investigations, Orders, Tests and Results component provides capabilities to manage and conduct order processing and results production.

Services offered (Service Interfaces)

Indicative Business Services

- Provides Order Type Definition capability
- Provides Order Set Definition (Investigation) capability
- Accepts Patient-related Order
- Provides Anonymization/Pseudonymisation capability
- Allocates Sample Numbers
- Accepts Group Order
- Accepts non-patient Order
- Accepts non-clinical or non-diagnostic order
- Provides Order Viewing and amendment capability
- Provides Test Process Definition capability
- Provides Result Type Definition capability
- Records Results
- Provides Manual Results Data Entry capability
- View Results
- Provides Results to Requestor
- Provides Messaging and Alerts for Results
- Accepts Results Acknowledgement

Functions performed (Business Logic):

Data owned (Business Entities):

Order Initiation from Plan
 Order Type Definition
 Order Set Definition (Investigation)
 Patient/Client-related Order Creation (inc Anonymisation)

Investigation

A coordinated set of orders (laboratory tests, imaging, physical tests, social interviews, etc) required to examine a patient or client’s condition.

Patient/Client-related Order Viewing and Maintenance Group Order Creation Non-Patient/Client Order Creation Non-diagnostic Order Creation Order to Protocol Linkage Decision Support for Order Processing Sample Work Lists for Collections Manual Order Creation Result Type Definition Results Recording Results Viewing Results Charting Results Reporting Manual Results Data Entry Textual and Numeric Results Reporting Clinical Messaging for Results Alerts for Results Results Acknowledgement	<i>Primary Key</i> <i>Indicative</i> <i>Attributes</i>	"PK of Patient/Client Episode"
	Order Type	
	A classification of orders defining activities of a common or similar nature, e.g. pathology test, radiography test.	
	<i>Primary Key</i> <i>Indicative</i> <i>Attributes</i>	Order Type ID Description Order Parameters Nature of Sample Process used "Clinical Process" (for available Protocols)
	Order	
	A request to have a defined process or procedure carried out. Normally patient related, orders are raised for diagnostic testing and activities involving utilization of team or facility resources.	
	<i>Primary Key</i> <i>Indicative</i> <i>Attributes</i>	Order Type + Order ID Requirements Narrative Explanations Sample No Sample Parameters Result parameters requested Date ordered Date required "Patient" (Anonymized or Pseudonymized) "Care Professional" (requesting)
	Result Type	
	A classification of the results of orders of a common or similar nature, e.g. pathology test results, radiography test results.	
	<i>Primary Key</i> <i>Indicative</i> <i>Attributes</i>	Result Type ID Description Result Parameters Process used "Clinical Process" (protocol used)
Result		
The values resulting from a test or examination instigated by an order. Values may be numeric or textual and may involve physical exhibits, e.g. images.		
<i>Primary Key</i>	Result Type ID + Order Type ID + Order ID	

	<p><i>Indicative Attributes</i></p>	<p>Requirements addressed Narrative Explanations Sample ID tested Sample Parameters measured Result parameters and values Date ordered Date required Date of Result</p> <p>“Patient” (Anonymized or Pseudonymized) “Care Professional” (requesting) “Care Professional” (performing)</p>
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Business Component Specification

Care Pathways Component

Description

The Care Pathways Component provides services in support of standard programs of treatment and care for defined diseases and medical and social conditions. Such programs are often applicable at a national level and include target timings for the provision of treatment. A Care Pathway is lengthy and may last for some months or even years. Although standard programs are specific, an individual care pathway for a particular patient or client can be constructed to suit individual circumstances and may be modified, in flight, to respond to changes in the patient’s or client’s condition. Thus the Care Pathway is build from “phases” which lie between major decision points on the pathway. Segments contain “activities” which specify actions to be taken in the course of treatment. In terms of granularity, these planned events correspond to Patient Events.

Services offered (Service Interfaces):

Indicative Business Services

- Provide Care Pathway Definition and Deployment capability
- Provide Care Pathway Phase Definition and Configuration capability
- Provide Care Pathway Activity Definition and Deployment capability
- Define Care Pathway Activity Outputs and generated Care Record Data
- Provide Custom Care Pathway from GCP Activities
- Provide Research Pathway from GCP Activities
- Provide Generic Protocol to GCP Activity applicability

Functions performed (Business Logic):

Generic Care Pathway Creation for Disease/Condition
 Generic Care Pathway Maintenance
 Local Care Pathway Creation for Disease/Condition
 Local Care Pathway Maintenance
 Research Pathways
 GCP Version Control
 Variance Analysis Service

Data owned (Business Entities):

Generic Care Pathway (GCP)

A program of care designed to treat a specified medical or social care condition. A care pathway may be long, perhaps lasting for months or even years, and comprise many sections, or phases, between planned reviews of the patient’s or client’s progress.

<i>Primary Key</i>	Care Pathway ID
<i>Indicative Attributes</i>	Care Pathway Name Care Pathway Description “Health Subject” (used for)

GCP Pathway/Phase Use

The deployment of a Care Pathway generic phase within a care pathway. A patient journey will be made up of a chosen set of treatments within the framework offered by the overall care pathway.

<i>Primary Key</i>	Care Pathway ID + Care Pathway Phase ID + Sequence in Pathway
<i>Indicative Attributes</i>	Mandatory/Optional

		Inter-phase time delay
GCP Phase		
The deployment of a Care Pathway generic phase within a care pathway. A patient journey will be made up of a chosen set of treatments within the framework offered by the overall care pathway.		
<i>Primary Key</i>		Care Pathway Phase ID
<i>Indicative Attributes</i>		Pathway Phase Description
GCP Phase/Activity Use		
The deployment of care pathway activities within a phase within a generic care pathway.		
<i>Primary Key</i>		Care Pathway Phase ID + Care Pathway Activity ID + Sequence in Segment + Mandatory/Optional Interactivity Time delay
<i>Indicative Attributes</i>		
GCP Activity		
A generic treatment within a care pathway is made up of a number of discrete activities each with a defined objective and start and finish points at which results may be assessed or measured.		
<i>Primary Key</i>		Care Pathway Activity ID
<i>Indicative Attributes</i>		Care Pathway Activity Description Activity Time Requirement Activity Outputs "Generic Protocol" (used as standard)

Business Component Specification					
Processes and Protocols Component					
<i>Description</i>					
<p>A Clinical or Care Process describes the activities undertaken by a specific Health and Social Care Team. Clinical or Care Process Actions are the individual actions taken. These are described at a level of granularity such that when commenced an action must be completed or restarted. Examples might be x-rays or blood tests. The component manages the definition of the clinical or care process and its actions.</p>					
<i>Services offered (Service Interfaces):</i>					
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Provide Clinical or Care Process Definition, recording, maintenance and dissemination capability • Provide Clinical or Care Process Action Definition and Design capability • Provide Local Protocol Definition and Maintenance capability • Provide Team Protocol Definition and Maintenance capability • Search for Clinical or Care Process by Name or Location or Team 					
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities)</i>				
Protocol and Electronic Library Creation and Access Generic Clinical or Care Process Definition Clinical or Care Process Maintenance Clinical Process Action Definition and Design	<p>Generic Clinical or Care Process</p> <p>A procedure, or set of procedures, carried out by a Health and Social Care group or team in the treatment of medical condition, typically within a component activity of a Care Pathway.</p>				
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Clinical or Care Process ID</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Clinical Process Name Clinical Process Description "GCP Activity" (implementation of)</td> </tr> </table>	<i>Primary Key</i>	Clinical or Care Process ID	<i>Indicative Attributes</i>	Clinical Process Name Clinical Process Description "GCP Activity" (implementation of)
	<i>Primary Key</i>	Clinical or Care Process ID			
	<i>Indicative Attributes</i>	Clinical Process Name Clinical Process Description "GCP Activity" (implementation of)			
	<p>Local Clinical or Care Protocol</p> <p>A more detailed version of a Clinical or Care Process describing how the process is carried out step by step and how the steps vary locally e.g. in a particular hospital or social work department. Typically the protocols are expressed as a sequence of "actions" which once started must be completed or abandoned or restarted.</p>				
<table border="1"> <tr> <td><i>Primary Key</i></td> <td>"PK of Care or Service Provider" + Local Protocol ID + Effective Dates</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Action Description Action Sequence within Clinical Process "Role" (carried out by) "Local Protocol" (used as standard)</td> </tr> </table>	<i>Primary Key</i>	"PK of Care or Service Provider" + Local Protocol ID + Effective Dates	<i>Indicative Attributes</i>	Action Description Action Sequence within Clinical Process "Role" (carried out by) "Local Protocol" (used as standard)	
<i>Primary Key</i>	"PK of Care or Service Provider" + Local Protocol ID + Effective Dates				
<i>Indicative Attributes</i>	Action Description Action Sequence within Clinical Process "Role" (carried out by) "Local Protocol" (used as standard)				
<p>Local Protocol Data Set</p>					

Defines the data that is collected from each instance of a local clinical or care protocol. Clinical archetypes may be used as a data definition mechanism.	
<i>Primary Key</i>	"PK of Local Clinical or Care Protocol" Data Set ID
<i>Indicative Attributes</i>	Data Elements Effective Dates
Generic Process Data Set	
Defines the data that is collected from each instance of a generic clinical or care process. Clinical archetypes may be used as a data definition mechanism.	
<i>Primary Key</i>	"PK of Generic Clinical or Care Process" Data Set ID
<i>Indicative Attributes</i>	Data Elements Effective Dates
Team Protocol	
An even more detailed version of a Clinical or Care Process in which each action is described in terms of how specific teams carry out the actions.	
<i>Primary Key</i>	"PK of Care or Service Provider" + Team ID + Effective Dates
<i>Indicative Attributes</i>	Action Description Action Sequence within Clinical Process "Role" (carried out by) "Local Protocol" (used as standard)
Team Protocol Data Set	
Defines the data that is collected from each instance of a team protocol. Clinical archetypes may be used as a data definition mechanism.	
<i>Primary Key</i>	"PK of Team Protocol" Data Set ID
<i>Indicative Attributes</i>	Data Elements Effective Dates

Business Component Specification					
Organizations, Care Providers and Services Component					
Description					
<p>This component is concerned with the provision of <u>Organizational information</u> about official bodies, private companies and any enterprise active in the broad health and social care domains. In response to a request from any approved consuming process. Organizational Information includes data about organizational units, their structure (both hierarchical and matrix), and their inter-relationships.</p> <p>An important sub-set is that of Care and Service Providers who provide diverse Health and Social Care related services of various types and functions. They include hospitals, general practices, groupings of providers (e.g. Health and Social Care trusts), ancillary disciplines such as dentists and opticians, tertiary facilities such as care homes, hospices, etc.</p>					
Services offered (Service Interfaces):					
<p>Indicative Business Services</p> <ul style="list-style-type: none"> • Provides Organizational information • Provides Organizational Structure Information (Parent/Child Care Provider) • Provides Care Provider Type definition capability • Provides Care Provider definition capability • Provides Care Provider Organizational Structure definition capability • Search for Care Provider by Care Provider ID or Name etc • Provides Care Provider Information 					
Functions performed (Business Logic):	Data owned (Business Entities):				
Care Domain Definition Care Provision Type Definition Care Service Type Definition Organizational Entity Definition Organizational Entity Type Specification Care and Service Provider Registration Organizational Structure Definition Organizational Relationship Type Definition Care and Service Provider Search and Retrieval	<p>Care Domain</p> <p>A broad categorization of the areas involved in lifelong wellbeing e.g. primary health care, acute, health care</p> <table border="1"> <tr> <td><i>Primary Key</i></td> <td>Care Domain Name</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Care Domain Description</td> </tr> </table>	<i>Primary Key</i>	Care Domain Name	<i>Indicative Attributes</i>	Care Domain Description
	<i>Primary Key</i>	Care Domain Name			
	<i>Indicative Attributes</i>	Care Domain Description			
	<p>Care Provision Type</p> <p>Indicates the kind of care offered a Care Provider and Service Provider e.g. complete healthcare, surgical treatment, residential care, home help, etc.</p> <table border="1"> <tr> <td><i>Primary Key</i></td> <td>Care Provision Type Name</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Nature of Provision</td> </tr> </table>	<i>Primary Key</i>	Care Provision Type Name	<i>Indicative Attributes</i>	Nature of Provision
	<i>Primary Key</i>	Care Provision Type Name			
	<i>Indicative Attributes</i>	Nature of Provision			
	<p>Care Service Type</p> <p>Indicates the kind of overall service categories on a national, regional, local or private basis e.g. national health service, insurance services, care plan services, dental service, etc.</p>				

	<p><i>Primary Key</i> Care Service Type Name</p> <p><i>Indicative Attributes</i> Nature of Service</p>
Care and Service Provider	
<p>A generic term for hospitals, clinics, medical practices, laboratories and other organizations that accommodate and treat patients. They will provide physical premises and facilities and operate medical and other equipment. They will operate administrative and clinical systems. They may also provide services such as Health and Social Care insurance, paramedical transport and so on. They will employ Care Professionals.</p>	
	<p><i>Primary Key</i> "PK of Organizational Entity" + Care Domain Name + Care Service Type Name + Care Provision Type Name</p> <p><i>Indicative Attributes</i> Care Provider Name Care Provider Attributes Effective Dates</p>
Organizational Entity Type	
<p>A classification of organizations from the largest, e.g. nations, states regions, etc., through private companies, insurers, charities, voluntary organizations, to local authorities and groups.</p>	
	<p><i>Primary Key</i> Organizational Entity Type Name</p> <p><i>Indicative Attributes</i> Description</p>
Organizational Entity	
<p>An official or private body, company, trust, authority or functional group. An organizational entity can be described at any level of granularity from the largest, e.g. government, to the smallest e.g. a two-person department.</p>	
	<p><i>Primary Key</i> Organizational Entity Type Name + Organizational Entity Name + Effective Dates + Organization Relationship Type Name + Org Rel Dates</p> <p><i>Indicative Attributes</i> Description</p>
Organization Entity Structure	
<p>A means of recoding the relationships between organizational units. Often these structures are hierarchical but increasingly matrix organizations and virtual teams are used. This entity, based on a bill-of-material pattern, handles such structures.</p>	

	<i>Primary Key</i>	“PK of Org Ent 1” + “PK of Org Ent 2” + Care Provider Type ID (1) + Organization Relationship Type Name + Org Rel Dates
	<i>Indicative Attributes</i>	[Nb.Parent (1 to 2) or Child (2 to 1)] Effective Start Date Effective End Date Limitations
	Organizational Relationship Type	
	Indicates the nature of an association between two organizational units e.g. governs, owns, customer of, supplier to, etc.	
<i>Primary Key</i>	Organizational Entity Type Name	
<i>Indicative Attributes</i>	Description	

Business Component Specification				
Care Facilities and Schedules Component				
<i>Description</i>				
<p>The Care Facilities and Schedules Component contains basic details of facilities operated or used by an organization unit (e.g. of hospitals, clinics, etc.) which includes accommodation to bed level, schedulable equipment such as scanners and major diagnostic devices and treatment facilities such as theatres.</p> <p>Facility and Team schedules are maintained.</p> <p>It also provides details of team schedules so that the joint availability of a physical facility and its operating and supporting personnel can be ensured.</p> <p>No capability for workload leveling or schedule optimization is provided at this stage.</p>				
<i>Services offered (Service Interfaces):</i>				
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Provides Resource Definition Capability (Team and Facility slots) • Provides Facility definition capability • Search for Facilities by Facility Type/ID • Search for Facilities meeting defined attributes • Provides Facility Information • Reports Capacity Utilization • Provides long range Capacity Demand Forecast • Reports Workload by Team and Facility • Provides Work Schedules and Diaries by Team and Team Member • Provides Facility and Team Schedules (e.g. for Theatres and Bed Occupancy) • Provides Clinic Attendance and Staffing Schedules • Provides Requirement Allocation capability • Provides Allocation Review and Revision Capability • Provides Multiple Resource Allocation capability 				
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>			
Facility Registration (by provider) Facility Maintenance (by provider) Facility Search and Retrieval (by Facility Type or ID) Facility Search and Retrieval (meeting criteria) Resource Definition and Allocation Rules-based Allocation Staff Scheduling Perform scheduling across multiple resources Workflow for Plan Support Bed Management	Facility			
	A generic term for a schedulable physical resource such as a bed, diagnostic device or treatment suite.			
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Facility Type + Facility ID</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Facility Description Effective Dates Facility Attributes</td> </tr> </table>	<i>Primary Key</i>	Facility Type + Facility ID	<i>Indicative Attributes</i>
<i>Primary Key</i>	Facility Type + Facility ID			
<i>Indicative Attributes</i>	Facility Description Effective Dates Facility Attributes			

Patient/Client Tracking Caseload Capacity Management Caseload Allocation Staff and Team Schedule and Diary Maintenance Facility Schedule and Diary Maintenance Schedule Information (slots) Retrieval Clinic Scheduling and Management Clinic Schedule Maintenance Group Session Scheduling	Facility Type	
	A classification of facilities such as hospital, care home, Ward or Room, bed, equipment, etc.	
	<i>Primary Key</i>	Facility Type ID
	<i>Indicative Attributes</i>	Description
	Facility Structure	
	A Facility may be made up of smaller facilities and in turn may be a member of one or more higher-level facilities. For example, the high level subject “hospital” may comprise wards, theaters, consultation rooms, laboratories, and so on. Each one of these may sub-divide further and also may be a member of other higher level groups. Facility Structure records the parent and child relationships between facilities.	
	<i>Primary Key</i>	Facility Type 1 + Facility ID 1 + Facility Type 2 + Facility ID 2
	<i>Indicative Attributes</i>	Effective Dates Relation attributes
	Facility Slot	
	A time period, within which a facility may be used, typically covering a single instance of treatment.	
<i>Primary Key</i>	Facility Type + Facility ID + Slot No	
<i>Indicative Attributes</i>	Free/Taken	
Facility Schedule		
The reservation of all necessary resources (people, places, equipment, examinations, interventions and events) associated with the diagnosis, treatment and care management of the patient.		
<i>Primary Key</i>	Facility Type + Facility ID	
<i>Indicative Attributes</i>	Actual no of Orders Max No of Orders	

Team Slot	
A time period, within which a team may be available, typically covering a single instance of treatment.	
<i>Primary Key</i>	"PK of Team" + Date + Slot No
<i>Indicative Attributes</i>	Free/Taken
Team Schedule	
The reservation of all necessary human resources associated with the diagnosis, treatment and care management of the patient.	
<i>Primary Key</i>	"PK of Team" + Date
<i>Indicative Attributes</i>	Actual no of Orders Max No of Orders
Clinic/Session	
The holding of an investigatory or treatment session by a team at a location at a time and date. The session may involve the carrying out of a defined clinical process, social procedure or set of related processes. Patient or client attendance at the clinic is normally by appointment.	
<i>Primary Key</i>	"PK of Team* + Clinical or Care Process ID + Location + Date/Time
<i>Indicative Attributes</i>	Capacity Instructions

Business Component Specification					
Waiting Lists Component					
<i>Description</i>					
<p>The Waiting Lists component provides capabilities to manage demand for patient/client: professional interaction and facility usage.</p> <p>The approach is simple – capacity of teams and team members and also for facilities is expressed in units or “slots” of defined duration – a consultation or a hospital bed for a day is regarded as a “slot”. Requirements (i.e. appointments or orders) are allocated to slots, the nature of the requirement determining how many slots will be required of any particular team discipline or facility. The “queue” of requirements is maintained in a number of lists sequenced by arrival and modified by urgency. Lists are serviced by multiple teams and facilities by allocating a requirement to a slot.</p>					
<i>Services offered (Service Interfaces)</i>					
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Provides Waiting List Definition Capability • Provides Waiting List Population Capability • Provides Waiting List Viewing and Maintenance Capability 					
<i>Functions performed (Business Logic):</i>					
<p>Outpatient/Client Waiting List Management Waiting List Construction Waiting List and Appointment Schedule Maintenance</p>	<i>Data owned (Business Entities):</i>				
	Waiting List				
	A list or queue, sequenced in order of arrival, of patients requiring treatment, consultations or equipment use provided by a team or facility.				
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>List ID</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>List Purpose List Parameters List Processing Criteria “Appointment” (entered in) “Referral” (entered in)</td> </tr> </table>	<i>Primary Key</i>	List ID	<i>Indicative Attributes</i>	List Purpose List Parameters List Processing Criteria “Appointment” (entered in) “Referral” (entered in)
	<i>Primary Key</i>	List ID			
<i>Indicative Attributes</i>	List Purpose List Parameters List Processing Criteria “Appointment” (entered in) “Referral” (entered in)				
Waiting List Entry					
Details of each entry in the queue.					
<table border="1"> <tr> <td><i>Primary Key</i></td> <td>List ID + List Item ID</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>“Referral details” “Team Slot” – when allocated “Facility Slot” - when allocated</td> </tr> </table>	<i>Primary Key</i>	List ID + List Item ID	<i>Indicative Attributes</i>	“Referral details” “Team Slot” – when allocated “Facility Slot” - when allocated	
<i>Primary Key</i>	List ID + List Item ID				
<i>Indicative Attributes</i>	“Referral details” “Team Slot” – when allocated “Facility Slot” - when allocated				

Business Component Specification					
Care Professionals' Component					
<i>Description</i>					
The Care Professionals' Component records details of individuals employed contracted or assigned to professional work within the Health and Social Care domain, their specific roles and effective dates.					
<i>Services offered (Service Interfaces):</i>					
<u>Indicative Business Services</u>					
<ul style="list-style-type: none"> • Provides Care Professional Registration capability • Provides Professional to Role Assignment Capability • View Care Professional's Location and Credentials • View Care Professional's Roles and specialties 					
<i>Functions performed (Business Logic):</i>					
Professional Registration Professional Search (by Attributes) Professional to Role Assignment	<i>Data owned (Business Entities):</i>				
	Care Professional				
	A qualified individual, appointed, employed or contracted by a Care Provider. Anybody involved in the provision of health or Social Care.				
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Care Professional ID</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td> Professional's Name Date of Birth Qualifications Professional Body Registration Details Work Address Home Address Phone Numbers "Care and Service Provider" (employed by) </td> </tr> </table>	<i>Primary Key</i>	Care Professional ID	<i>Indicative Attributes</i>	Professional's Name Date of Birth Qualifications Professional Body Registration Details Work Address Home Address Phone Numbers "Care and Service Provider" (employed by)
	<i>Primary Key</i>	Care Professional ID			
<i>Indicative Attributes</i>	Professional's Name Date of Birth Qualifications Professional Body Registration Details Work Address Home Address Phone Numbers "Care and Service Provider" (employed by)				
Care Professional in Role					
The Health and Social Care role carried out by a Care Professional.					
<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Care Professional ID + Professional Role ID + Health Subject (Prof Specialization)</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td> Start Date in Role End Date in Role </td> </tr> </table>	<i>Primary Key</i>	Care Professional ID + Professional Role ID + Health Subject (Prof Specialization)	<i>Indicative Attributes</i>	Start Date in Role End Date in Role	
<i>Primary Key</i>	Care Professional ID + Professional Role ID + Health Subject (Prof Specialization)				
<i>Indicative Attributes</i>	Start Date in Role End Date in Role				

Business Component Specification					
Professional Roles and Teams Component					
<i>Description</i>					
<p>Care Professionals perform defines roles and are organized in groups and teams dedicated to specific activities in clear areas of treatment and care. The Professional Groups and Teams component maintains the definitions of roles and the structure and membership of each group and team. These structures are used to determine the access permissions of individuals to patient records either on the basis of role or team membership.</p>					
<i>Services offered (Service Interfaces):</i>					
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Provides Role Definition and Maintenance capability • Provides Team Definition and Maintenance capability • Provides Role in Team Definition capability • Provides Team Structures and inter-relationships Definition and Maintenance capability • Search for Teams and Team Members by Role • Records Team Membership 					
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>				
Professional Role Definition and Maintenance Team Definition Maintenance Team Structure Definition and Maintenance Roles in Teams Maintenance Team Search (by Team Attributes) Role Information Search Team/Role/Healthcare Provider Maintenance Role in Team Information Request Team Structure Information Request Team Membership Maintenance Generic Permission Definition Permission Delegation Maintenance Permission Delegation (by Specific Professional) Professional Permissions Maintenance (by Role) Permission Delegation (by Role)	<p>Role</p> <p>A categorization of professional activities carried out in Health and Social Care indicating the level of activity, e.g. Consultant, Registrar, Nurse, etc., and the medical or clinical area, e.g. Health Subject.</p>				
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Role ID</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td> Role Description Role Classification (e.g. Clinical, Nursing, Paramedical, Ancillary, etc.) </td> </tr> </table>	<i>Primary Key</i>	Role ID	<i>Indicative Attributes</i>	Role Description Role Classification (e.g. Clinical, Nursing, Paramedical, Ancillary, etc.)
	<i>Primary Key</i>	Role ID			
	<i>Indicative Attributes</i>	Role Description Role Classification (e.g. Clinical, Nursing, Paramedical, Ancillary, etc.)			
	<p>Team</p> <p>Care professional activity is focused and channeled through groups of Care Professionals organized to deliver defined services in specific clinical and support areas.</p>				
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>"PK of Care & Service Provider" + Team ID</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td> Group/Team Name Team Charter Location/Address Date Team formed Date Team disbanded </td> </tr> </table>	<i>Primary Key</i>	"PK of Care & Service Provider" + Team ID	<i>Indicative Attributes</i>	Group/Team Name Team Charter Location/Address Date Team formed Date Team disbanded
<i>Primary Key</i>	"PK of Care & Service Provider" + Team ID				
<i>Indicative Attributes</i>	Group/Team Name Team Charter Location/Address Date Team formed Date Team disbanded				
<p>Role in Team</p> <p>Teams are usually multi-disciplinary in their composition. "Role in Team" represents the make-up</p>					

	<p>of teams in terms of the roles included in the team and the planned numbers of professionals performing specific roles.</p> <p>“Role in Team” also records the specific professional(s) playing a designated role within the team at a particular point in time. Note that an individual can play many roles in many teams at a point in time.</p>
<i>Primary Key</i>	“PK of Team” + Role ID
<i>Indicative Attributes</i>	Headcount (No in Team) Job Specification
Team Structure	
	<p>teams operate in a coordinated fashion where high-groups encompass lower-level teams who in turn may yet lower-level teams focused on one aspect of care. n Structure records the inter-relationships of groups s not restricted to a simple hierarchical view but presents the de-facto matrix organizational structure</p>
<i>Primary Key</i>	Senior “Team ID” + Junior “Team ID”
<i>Indicative Attributes</i>	Start Date End Date
Team Member	
	A specific care professional assigned to a team.
<i>Primary Key</i>	“PK of Role in Team”+ Care Professional ID
<i>Indicative Attributes</i>	Role ID (Prof) Health Subject Code (Prof) Membership Start Date Membership End Date None

Business Component Specification					
Current Clients, Patients and Care Relationships Component					
<i>Description</i>					
<p>Patients and Clients are formally assigned to Care Professionals.</p> <p>Each Professional has established “care relationships” in which they are charged with specific aspects of individual patient’s care. The Current Clients, Patients and Care Relationships Component maintains these care relationships.</p> <p>Care Professionals have a formal range of permissions to access “their” patient or client data derived from their roles, specialties and team memberships or by specific wish of the patient or client.</p> <p>This component maintains and communicates a record of accesses made to patient related data by each Care Professional. This includes information on the use of clinical overrides.</p>					
<i>Services offered (Service Interfaces):</i>					
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Provides Care Relationship Formation and Cessation capability • Provides History of Professional access to Patient Health Records and Information • Provides Information on use of clinical overrides by Care Professional • Provides Information on access to the records of specific patients and health subjects by named professionals both using and not using overrides • Searches for Professionals caring for a Specific Patient • Searches for Patients cared for by a Specific Professional • Provides a “My Patients” List 					
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>				
Professional to Patient/Client Assignment (Care Relationship) Patient/Client Record Access History Reporting Role Based Access Control Maintenance "My Patient/Clients" List Maintenance Specific Permission Maintenance Patient/Client:Professional Relationship Maintenance	<p>Professional Relationship</p> <p>A formal assignment of a patient or client to a Care Professional, operating in a defined role, for care in relation to a general health or social care subject.</p>				
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td> “PK of Care Professional” + Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role) </td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td> Start Date End Date </td> </tr> </table>	<i>Primary Key</i>	“PK of Care Professional” + Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role)	<i>Indicative Attributes</i>	Start Date End Date
	<i>Primary Key</i>	“PK of Care Professional” + Patient ID or (Social Care Client ID + Care Domain Name + Care Domain Role)			
<i>Indicative Attributes</i>	Start Date End Date				
Professional Access History					

	A record of each and every access to Patient or Client data by each Care Professional.	
	<i>Primary Key</i>	"PK of Professional Relationship" + Access Date
	<i>Indicative Attributes</i>	Override used (Y/N)

Business Component Specification					
Costs and Prices Component					
<i>Description</i>					
<p>The Costs and Prices Component provides means of recording the prices and costs of Health and Social care activities and billing the appropriate “payer”.</p> <p>Means are available to record standard unit costs for the elements of care activity e.g. Facility usage, Professional Time, Prescription Item, Test and Images, etc. and the billing tariff for defined care activities. Actual usage of the billable elements is recorded and thus margins and Price variances can be calculated.</p>					
<i>Services offered (Service Interfaces):</i>					
<u>Indicative Business Services</u>					
<ul style="list-style-type: none"> • Request and issue invoices for defined care activities • Request actual cost reports for defined care activities • Report Price variances • Report Price Margins • Maintain standard costs • Maintain Billing Prices 					
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>				
	Actual Usage				
Price and Tariff Setting Costing Billing Variance Calculation and Analysis	<p>The actual billable elements incurred during a patient encounter – elements include Facility, Professional Time, Prescription Item, Test and Images, etc.</p> <table border="1" style="width: 100%;"> <tr> <td style="width: 20%;"><i>Primary Key</i></td> <td>“PK of Patient/Client Encounter” + Cost Element Type Name + Facility or Order or Prof Time or Pres. Item ID</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Actual Usage</td> </tr> </table>	<i>Primary Key</i>	“PK of Patient/Client Encounter” + Cost Element Type Name + Facility or Order or Prof Time or Pres. Item ID	<i>Indicative Attributes</i>	Actual Usage
<i>Primary Key</i>	“PK of Patient/Client Encounter” + Cost Element Type Name + Facility or Order or Prof Time or Pres. Item ID				
<i>Indicative Attributes</i>	Actual Usage				
	Billing Element Type				
	The services, materials and equipment usage that are billed in respect of patient or client treatment				
	<table border="1" style="width: 100%;"> <tr> <td style="width: 20%;"><i>Primary Key</i></td> <td>Billing Element Type Name</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Description</td> </tr> </table>	<i>Primary Key</i>	Billing Element Type Name	<i>Indicative Attributes</i>	Description
<i>Primary Key</i>	Billing Element Type Name				
<i>Indicative Attributes</i>	Description				
	Care Provider Costs and Prices				
	The costs and prices of care provision per care provider per process activity				
	<table border="1" style="width: 100%;"> <tr> <td style="width: 20%;"><i>Primary Key</i></td> <td>“PK of Care & Service Provider” + Billing Element Type Name or Cost Element Type Name</td> </tr> </table>	<i>Primary Key</i>	“PK of Care & Service Provider” + Billing Element Type Name or Cost Element Type Name		
<i>Primary Key</i>	“PK of Care & Service Provider” + Billing Element Type Name or Cost Element Type Name				

	<i>Indicative Attributes</i>	Cost or Billing Price
Cost Element Type		
The classes of cost involved in a process or activity. Typically specified as labor, material and overhead.		
	<i>Primary Key</i>	Cost Element Type Name
	<i>Indicative Attributes</i>	Description
Facility Unit Cost		
The costs of operation of a facility in terms of labor, material and overhead.		
	<i>Primary Key</i>	"PK of Facility" + Cost Element Type Name
	<i>Indicative Attributes</i>	Facility Unit Cost
Invoice Line Item		
An item on an invoice typically defined by the quotation of a unit price for an item of service or material, extended by the quantity provided.		
	<i>Primary Key</i>	Invoice Number + Line Item Number
	<i>Indicative Attributes</i>	Item Description Billing Element Type Name Unit Price Quantity Billed Amount
Invoice		
The formal billing of a payer for services performed		
	<i>Primary Key</i>	Invoice Number
	<i>Indicative Attributes</i>	Description (Patient Encounter & Protocol) "Billed to" Invoice Total
Medication Item Unit Cost		
The unit cost of a medication or treatment service or product		
	<i>Primary Key</i>	Cost Element Type Name + Medication Item ID + Dosage Level
	<i>Indicative Attributes</i>	Med Unit Cost

	Patient/Client Encounter Prices and Costs	
	The billed and actual costs incurred in a patient or client encounter and the difference (variance) between them indicating a nominal profit or loss.	
<i>Primary Key</i>	"PK of Patient/Client Encounter" + Cost or Billing Element Type +	
<i>Indicative Attributes</i>	Actual Quantities Cost or Billing Price Actual Cost Cost Variance Billing Margin	
	Test or Image Unit Cost	
	The standard costs of test and images by type of order.	
<i>Primary Key</i>	Cost Element Type Name + Order Type	
<i>Indicative Attributes</i>	Unit Cost	

Business Component Specification							
Clinical and Care Data Management Component							
<i>Description</i>							
<p>A Patient Encounter might involve taking measurements, readings, and so on. For a particular medical condition of procedure there is a defined set of items that should be recorded.</p> <p>The Clinical Data Management Component provides facilities to define the items required for each encounter type.</p> <p>Optionally, data may be structured using archetypes as used in the OpenEHR methodology</p>							
<i>Services offered (Service Interfaces)</i>							
<p><u>Indicative Business Services</u></p> <ul style="list-style-type: none"> • Provide Dataset Definition • Provide Specialized Data Capture Mechanisms • Provide Archetype based data set Definition 							
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>						
Clinical or Care Dataset Definition Clinical or Care Dataset Maintenance Generic Code Value Definition Generic Code Value Maintenance Anonymization/Pseudonymisation Archetype Definition, Mapping and Usage Clinical or Care Noting for Patient/Client Encounters Service Support for Audit Data Sets (Ad-hoc reporting) Adverse Event Recording							
	Clinical/Care Code						
	Many coding schemes exist to classify and identify medical conditions and procedures. Examples would be Snomed CT, OPCS, Read2, ICD10, etc. These individual schemes are not necessarily complete or all embracing perhaps focusing on a particular clinical aspect. Similar schemes are used for classifying social care data						
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Clinical Code Type</td> </tr> <tr> <td><i>Indicative</i></td> <td>+ Clinical Code</td> </tr> <tr> <td><i>Attributes</i></td> <td>Meaning</td> </tr> </table>	<i>Primary Key</i>	Clinical Code Type	<i>Indicative</i>	+ Clinical Code	<i>Attributes</i>	Meaning
	<i>Primary Key</i>	Clinical Code Type					
	<i>Indicative</i>	+ Clinical Code					
	<i>Attributes</i>	Meaning					
	Clinical/Care Code Type						
A classification of clinical coding schemes.							
<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Clinical/Care Code Type</td> </tr> <tr> <td><i>Indicative</i></td> <td>Type Attributes</td> </tr> <tr> <td><i>Attributes</i></td> <td></td> </tr> </table>	<i>Primary Key</i>	Clinical/Care Code Type	<i>Indicative</i>	Type Attributes	<i>Attributes</i>		
<i>Primary Key</i>	Clinical/Care Code Type						
<i>Indicative</i>	Type Attributes						
<i>Attributes</i>							
Clinical Code Translation							
Clinical Code Translation relates an instance of another health code to the encompassing higher-level Clinical Code.							
<table border="1"> <tr> <td><i>Primary Key</i></td> <td>Clinical Code Type 1 +</td> </tr> </table>	<i>Primary Key</i>	Clinical Code Type 1 +					
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Business Component Specification									
Rules Engine Component									
<i>Description</i>									
<p>Two Business components that are often required are for Clinical Decision Support and Health and Social Care Knowledge Management. However, since business components are fully encapsulated, the functionality and data (or “rules”) associated with decision support and knowledge management are usually included within the specific component. Sometimes however, the logic involved is part of the overall business process and is dependent upon interactions between components, for example, in following a particular patient journey based on patient condition and treatment availability. This is sometimes called a “rules engine”. In this case the logic is contained within the business process as distinct to the actual business component.</p> <p>A Rules Engine Component would contain a Rules Database which for example might contain Prescribing rules, Clinical Process rules, Datasets rules (value ranges etc), Form Set rules, scheduling and capacity management rules and the rules used to raise clinical and administrative alerts. The Rules Database might also contain lists of valid codes e.g. departmental codes.</p>									
<i>Services offered (Service Interfaces)</i>									
<u>Indicative Business Services</u>									
<ul style="list-style-type: none"> • Provide Rule Definition and Maintenance Capability • Provide Code Table Definition and Maintenance Capability • Provide Alert Definition and Rule Applicability Capability • Search for Rule, Alert and Code by Name • Report on Rule, Alert and Code Use 									
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>								
Rules Engine Service Rule Definition Clinical Alerts Rules Maintenance Administrative Alerts Rules Maintenance Administrative Alert Definition Clinical or Care Alert Definition Administrative Alert Generation Clinical Alert Generation Risk Factor Definition Risk Factor Monitoring Rules Engine Creation for Automatic Resource Sequencing Information on Alerts Exception Reporting	Rule								
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;"><i>Primary Key</i></td> <td>Rule ID</td> </tr> <tr> <td><i>Alternate Keys</i></td> <td>Rule Name</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Rule Classification (e.g. Prescribing Rule) Rule Description</td> </tr> <tr> <td><i>Foreign Keys</i></td> <td>Rule Algorithm None</td> </tr> </table>	<i>Primary Key</i>	Rule ID	<i>Alternate Keys</i>	Rule Name	<i>Indicative Attributes</i>	Rule Classification (e.g. Prescribing Rule) Rule Description	<i>Foreign Keys</i>	Rule Algorithm None
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	<i>Alternate Keys</i>	Rule Name							
<i>Indicative Attributes</i>	Rule Classification (e.g. Prescribing Rule) Rule Description								
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Alert Definition									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;"><i>Primary Key</i></td> <td>Alert Type ID + Alert ID</td> </tr> <tr> <td><i>Alternate Keys</i></td> <td>Alert Name</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Trigger Condition Alert Mechanism</td> </tr> </table>	<i>Primary Key</i>	Alert Type ID + Alert ID	<i>Alternate Keys</i>	Alert Name	<i>Indicative Attributes</i>	Trigger Condition Alert Mechanism			
<i>Primary Key</i>	Alert Type ID + Alert ID								
<i>Alternate Keys</i>	Alert Name								
<i>Indicative Attributes</i>	Trigger Condition Alert Mechanism								

	<i>Foreign Keys</i>	Alert Format Rule (governs)
	Code Table	
	<i>Primary Key</i> <i>Alternate Keys</i> <i>Indicative Attributes</i> <i>Foreign Keys</i>	Code Table ID + Code Table Entry No Code Code Meaning Usage Guidance Date valid Date discontinued None

Business Component Specification		
Clinical Coding and Datasets Component		
<i>Description</i>		
<p>This component manages the data capture and maintenance of Clinical datasets, the items of information that should be recorded for a medical condition or procedure.</p> <p>Mechanisms are provided to anonymize such that the specific patient is not identifiable</p>		
<i>Services offered (Service Interfaces):</i>		
<u>Indicative Business Services</u>		
<ul style="list-style-type: none"> • Provide dataset population from encounters • Provide data capture of clinical data • Provide data anonymization and pseudonymisation of data • Provide ad hoc reports 		
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>	
Clinical Coding Anonymisation/Pseudonymisation Rule Definition Clinical Dataset Instance Construction from Patient Encounter Service Support for Audit Data Sets (Ad-hoc reporting)		
	Clinical Data Set Instance	
	A valid occurrence of a set of values meeting the requirements of a national data set.	
	<i>Primary Key</i>	"PK of Clinical/Care Dataset"+ Clinical Data Set Instance or Record No
	<i>Indicative Attributes</i>	Value Date taken "Patient" (Anonymized) "Anonymization Rule" (used) "Clinical Dataset Item" (applies to)
	Clinical Archetype Instance	
	A valid occurrence of an archetype representing actual measurements in an actual situation.	
	<i>Primary Key</i>	Encounter Type + Clinical Archetype + Clinical Code Type + Clinical Code + Clinical Dataset Item + Instance or Record No
<i>Indicative Attributes</i>	Values	
Anonymization Rule		
A definition of the circumstances when patient data should be anonymized and the algorithm to be used.		
<i>Primary Key</i>	Anonymization Rule ID	
<i>Indicative Attributes</i>	Rule Name	

		Rule Classification (e.g. Prescribing Rule) Rule Description Rule Algorithm
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Business Component Specification							
Social Care Coding and Datasets Component							
<i>Description</i>							
<p>This component manages the data capture and maintenance of Social Care datasets, the items of information that should be recorded for a social condition or procedure.</p> <p>Mechanisms are provided to anonymize such that the specific client is not identifiable</p>							
<i>Services offered (Service Interfaces):</i>							
<u>Indicative Business Services</u>							
<ul style="list-style-type: none"> • Provide dataset population from encounters • Provide data capture of social care data • Provide data anonymization and pseudonymisation of data • Provide ad hoc reports 							
<i>Functions performed (Business Logic):</i>	<i>Data owned (Business Entities):</i>						
Care Coding Anonymisation/Pseudonymisation Rule Definition Care Dataset Instance Construction from Client Encounter Service Support for Audit Data Sets (Ad-hoc reporting)							
	Care Data Set Instance						
	A valid occurrence of a set of values meeting the requirements of a national data set.						
	<table border="1"> <tr> <td><i>Primary Key</i></td> <td>"PK of Care Dataset"+ Care Data Set Instance or Record No</td> </tr> <tr> <td><i>Indicative Attributes</i></td> <td>Value Date taken "Patient" (Anonymized) "Anonymization Rule" (used)</td> </tr> <tr> <td><i>Foreign Keys</i></td> <td>"CareDataset Item" (applies to)</td> </tr> </table>	<i>Primary Key</i>	"PK of Care Dataset"+ Care Data Set Instance or Record No	<i>Indicative Attributes</i>	Value Date taken "Patient" (Anonymized) "Anonymization Rule" (used)	<i>Foreign Keys</i>	"CareDataset Item" (applies to)
	<i>Primary Key</i>	"PK of Care Dataset"+ Care Data Set Instance or Record No					
	<i>Indicative Attributes</i>	Value Date taken "Patient" (Anonymized) "Anonymization Rule" (used)					
<i>Foreign Keys</i>	"CareDataset Item" (applies to)						
Care Anonymization Rule							
A definition of the circumstances when patient data should be anonymized and the algorithm to be used.							
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