



Connected Health Framework Architecture and Design Blueprint

A Stable Foundation for Agile Health and Social Care

Part 4 – Using the Connected Health Framework

*Second Edition Published March 2009
Rev April 2011*

The information contained in this document (a) represents the current view of Microsoft Corporation on the issues discussed as of the date of publication and is subject to change at any time without notice to you, and (b) should not be interpreted as an offer or commitment on the part of Microsoft. The information presented here is “**AS IS**” and Microsoft does not guarantee the accuracy of any information presented and assumes no liability arising from your use of the information. **MICROSOFT MAKES NO WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, IN THIS DOCUMENT.**

It is the user's responsibility to comply with all applicable copyright laws. Without limiting the rights under copyright, no part of this document may be reproduced, stored in or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), or for any purpose, without the express written permission of Microsoft Corporation. Microsoft may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from Microsoft, the this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property. Unless otherwise noted, the example companies, organizations, products, domain names, e-mail addresses, logos, people, places, and events depicted herein are fictitious, and no association with any real company, organization, product, domain name, email address, logo, person, place, or event is intended or should be inferred. *The descriptions of other companies' products in this proposal, if any, are provided only as a convenience to you. Any such references should not be considered an endorsement or support by Microsoft. Microsoft cannot guarantee their accuracy, and the products may change over time. Also, the descriptions are intended as brief highlights to aid understanding, rather than as thorough coverage. For authoritative descriptions of these products, please consult their respective manufacturers.* Microsoft, Active Directory, BizTalk, Windows, Windows Server, and Windows Server System are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. All other trademarks are property of their respective owner.

© 2009 Microsoft Corporation. All rights reserved.

Contents

INTRODUCTION.....	5
ORGANIZING REQUIREMENTS.....	7
THE SCENARIO	7
THE APPROACH	8
<i>Step 1: Clarifying Needs</i>	<i>10</i>
<i>Step 2: Understanding Required Features and Potential Solutions</i>	<i>11</i>
<i>Step 3: Understanding Architectural Requirements</i>	<i>12</i>
<i>Step 4: Documenting Business and Technical Requirements</i>	<i>14</i>
OUTCOMES AND DELIVERABLES.....	15
DEFINING THE OPERATIONAL ENVIRONMENT	16
THE SCENARIO	16
THE APPROACH	16
<i>Step 1: Understanding the Environment.....</i>	<i>18</i>
<i>Step 2: Defining the Initial Technical Architecture</i>	<i>19</i>
<i>Step 3: Configuring the Technical Environment</i>	<i>20</i>
<i>Step 4: Defining the Technical Solution.....</i>	<i>21</i>
OUTCOMES AND DELIVERABLES.....	22
ALIGNING A HEALTH OR SOCIAL CARE APPLICATION WITH THE CONNECTED HEALTH FRAMEWORK	23
THE SCENARIO	23
THE APPROACH	23
<i>Step 1: Understanding Current and Target Capabilities</i>	<i>26</i>
<i>Step 2: Understanding Interoperability Capabilities.....</i>	<i>27</i>
<i>Step 3: Reengineering the Application.....</i>	<i>28</i>
<i>Step 4: Defining a Preferred Application Solution</i>	<i>31</i>
OUTCOMES AND DELIVERABLES.....	32
DEVELOPING SOLUTIONS	33
THE SCENARIO	33
THE APPROACH	33
<i>Step 1: Understanding Scope and Boundaries</i>	<i>35</i>
<i>Step 2: Understanding Key Architectural Features.....</i>	<i>36</i>
<i>Step 3: Defining Business and Technical Architectures.....</i>	<i>38</i>
<i>Step 4: Defining and Documenting the Solution</i>	<i>39</i>
OUTCOMES AND DELIVERABLES.....	40

Figures

Figure 1. Using the Connected Health Framework – Organizing Requirements	9
Figure 2. Using the Connected Health Framework – Defining the Operational Environment	17
Figure 3. Using the Connected Health Framework – Aligning an Application with the Connected Health Framework	25
Figure 4. Using the Connected Health Framework – Developing Solutions.....	34

Tables

Table 1. Organizing Requirements – Step 1 – Clarifying Needs	10
Table 2. Organizing Requirements – Step 2 – Understanding Required Features and Potential Solutions.....	12
Table 3. Organizing Requirements – Step 3 – Understanding Architectural Requirements	13
Table 4. Organizing Requirements – Step 4 – Documenting Business and Technical Requirements	15
Table 5. Defining the Operational Environment – Step 1 – Understanding the Environment	18
Table 6. Defining the Operational Environment – Step 2 – Defining the Initial Technical Architecture	19
Table 7. Defining the Operational Environment – Step 3 – Configuring the Technical Environment	20
Table 8. Defining the Operational Environment – Step 4 – Defining the Technical Solution.....	21
Table 9. Aligning an Application– Step 1 – Understanding Current and Target Capabilities	26
Table 10. Aligning an Application– Step 2 – Understanding Interoperability Capabilities	28
Table 11. Aligning an Application – Step 3 – Reengineering the Application	30
Table 12. Aligning an Application – Step 4 – Defining a Preferred Application Solution	31
Table 13. Developing Solutions – Step 1 – Understanding Scope and Boundaries	35
Table 14. Developing Solutions – Step 2 – Understanding Architectural Features	37
Table 15. Developing Solutions – Step 3 – Defining Business and Technical Architectures	39
Table 16. Developing Solutions – Step 4 – Defining and Documenting the Solution	40

Introduction

The *Connected Health Framework Architecture and Design Blueprint* is designed to assist the process of defining practical, effective solutions to Health and Social Care system requirements. It is based on the cumulative practical experience of Microsoft architects and engineers working on diverse Health and Social Care projects, both large and small, throughout the world.

The Connected Health Framework Architecture and Design Blueprint offers this body of knowledge in two main ways: first, by providing a Business Pattern for patient or client-centric Health and Social Care systems (specified in *Part 2* of this guide) and second, by describing a Reference Architecture that details technical guidelines for the building of highly distributed systems in a Health and Social Care environment (specified in *Part 3* of this guide).

However, given this volume of sometimes highly detailed and complex material, a frequently asked question is “How do I apply this in my organization to help me solve my problems?” In this Part 4 of the guide we attempt to answer this question.

To do so, we have revisited the many projects that have contributed in some way to the Connected Health Framework; examined their objectives and goals, their varying architectural approaches, and the outputs they produced; and assessed how the Connected Health Framework would help clarify requirements, simplify and accelerate the process of producing solutions, and provide focus to the resulting definition and presentation of solutions.

We have identified four main situations, or scenarios, in which the Connected Health Framework is directly applicable and has a central role to play in arriving at accurate, viable solutions.

Organizing Requirements, in which we suggest a process for formulating and presenting a structured set of requirements for a patient- or client-centric Health and Social Care system. Typically this is a difficult process involving many inputs, many changing and challenging opinions and requirements, and an evolving technical platform. We believe that the Business Pattern provided by the Connected Health Framework can help in clarifying and organizing concepts and needs by providing a context in which ideas may be compared and contrasted. In a similar way, technical factors may be checked against the Connected Health Framework Reference Architecture.

Defining the Operational Environment, in which large-scale hardware and software environments may be hypothesized and evaluated against the Connected Health Framework Reference Architecture. This is always done in the context of the expected business environment and the requirements and capability of available application software.

Aligning a Health or Social Care Application with the Connected Health Framework, in which an existing Health or Social Care application may be assessed for alignment with the Connected Health Framework Business Pattern and Reference Architecture. This suggests areas of the application that might be reengineered to enable interoperability of the application in an environment built in accordance with the Connected Health Framework guidance. This is achieved by aligning the application with the range of business and technical services described in the Connected Health Framework Business Pattern and Reference Architecture.

Developing Solutions, in which a Statement of Requirements (RFP) is analyzed to clarify and categorize requirements against the business and technical frameworks of the Connected Health Framework. This allows a comparison of requirements to be made against the Business Pattern and Reference Architecture and thus against available, aligned application software and preferred operational environments. This enables identification of gaps and overlaps and provides a vehicle for a structured response to the RFP.

In all of this work, we must stress that the Connected Health Framework is only a pattern—it is not a solution on its own. Therefore, we would caution that the business pattern and reference architecture are not definitive. They contain generalizations and approximations and are incomplete in terms of coverage of the business domain. They are NOT complete solutions and are offered only as a guideline.

In each of these scenarios there are two major **prerequisites**. These are the need to define business scope and boundaries and to decide upon key technical architecture parameters.

In defining **business scope and boundaries**, we suggest asking and getting answers to the following questions:

- What is the *thrust* of the requirements? Is it national, regional, or only local?
- What is the *focus* of the requirements? Are they:
 - Patient- or client-centric (eHR/eCR, Care Pathways, Patient or Client Journeys, etc.)?
 - Process-centric (referrals, admissions, discharges, etc.)?
 - Research-centric (clinical or care data gathering, clinical coding, etc.)?
 - Administration-centric (appointments, scheduling, performance, etc.)?
 - Some or all of these? What balance?
- What *granularity* is involved? Are we addressing personal demographics only, or patient or client high-level events only, or is each detailed patient or client encounter to be recorded?

In deciding the **key technical architecture parameters**, we suggest considering first the likely *topography* of the solution. Are we dealing with centralized, decentralized, or distributed data? Do we envisage a network of peers or a tiered network solution?

There are also a number of important technical issues about which we need to have some provisional ideas. These are discussed in detail in Section B of Part 3 of this guide. In summary, they are as follows:

- **Multiplicity** – how to achieve “joined-up” interoperability, handling multiple, diverse systems, platforms, technologies, access and delivery channels, applications, languages, credentials, and so on
- **Identity Management** – how to provide a single, consistent credential for many applications, including authentication and authorization of different kinds of users
- **Integration** – how to interact with a constantly growing range of service-specific back-end systems
- **Flexibility and Agility** – how to cope effectively with changes and adapt to accommodate new requirements
- **Security** – how to build multiple layers of security into the architecture from the start
- **Scalability, Performance, and Availability** – how to design for planned and unplanned growth in demand, maintaining service levels and ensuring high levels of “up-time”
- **Hub Architecture** – how to achieve the “common hub” enabling large-scale interoperability of diverse applications using diverse platforms

Organizing Requirements

The Scenario

Health or Social Care system requirements usually arise at a national or regional level. The span of effect usually covers many citizens, perhaps whole populations, and complete national-level Health and Social Care services.

All too often a “Statements of Requirement” lists needs, or “wants”, in a confusing, or at least confusingly structured, way. When individual requirements are described, they are often not self-contained – they depend on each other, or are part of an overriding concept, or are often overlapping in content, and they do not necessarily present a coordinated view of what is required. We believe that the Connected Health Framework (CHF) helps to clarify the often confused, or confusing, situation by providing a “structure” within which to organize, compare, and contrast a set of requirements. It can give a focus by providing a Business Pattern and Reference Architecture that can be used as a “template” to organize thoughts and consolidate requirements into a coherent presentation of needs.

Statements of requirements usually emanate from Government or major care providers and most often take the form of “Requests for Proposal (RFP)” or Tender documents. These are often couched in legal or quasi-legal language and this sometimes obscures the actual functionality being requested. Two further factors also confuse the issue: the need to implement a phased solution, perhaps over a number of years, and the need to achieve a seamless migration from the current, usually fragmented, system inventory to the ideal future integrated environment.

To this should be added the pressures of cost limitations and the inevitable political pressure for “quick wins”.

In this scenario, we suggest a process for formulating and presenting a structured set of requirements for a patient- or client-centric Health and Social Care system. Typically this involves many inputs, many changing and challenging opinions and requirements, and an evolving technical platform. We believe that the Business Pattern provided by the Connected Health Framework can help in clarifying and organizing concepts and needs by providing a context in which ideas may be compared and contrasted. In a similar way, technical factors may be checked against the Connected Health Framework Reference Architecture.

Our concentration in this scenario is on the business tier and the associated technical facilities. Requirements focused on the other application tiers are addressed as follows:

- It is expected that the requirements for User Interface, User Processes, Business Workflows, and Data Access Logic (logical to physical mapping) will be unique to the problem domain.
- It is expected that the requirements for Security, in the sense of transactional and data integrity, will be broadly similar across different problem domains. Security requirements in the sense of confidentiality and privacy may vary in line with national legislation and professional practice.
- Requirements for operational management may be met by applying best practice guidelines derived from deployments in similar technical environments.
- Communications-related requirements, including messaging mechanisms and transactional controls, are amenable to a “building block” approach using experience gained in similar large-scale environments, not necessarily in Health or Social Care.
- Requirements for cross-functional capabilities such as identity management, privacy and confidentiality, and patient data access logging are candidates for a “building block” approach using a mixture of standard

components and services and best practice guidelines, which provide advice on the configuration and implementation of suitable schemes and facilities.

- Requirements for non-functional capabilities such as scalability, performance, availability, reliability, security, and messaging will vary by environment but should also be governed by best practice guidelines.

In summary, we expect that requirements for business functionality and data, and business service provision, can be addressed using a business “patterns”-based approach. Requirements for user interactions, business process support, and access to physical data are likely to be unique to the problem domain but should be governed by best practice guidelines.

The Approach

Our approach is illustrated in [*Figure 1. Using the Connected Health Framework – Organizing Requirements*](#) and a suggested procedure follows.

The procedure has four steps, described in [*Table 1*](#) to [*Table 4*](#). The steps are:

1. [*Table 1. Organizing Requirements – Step 1 – Clarifying Needs*](#), in which we develop a list of known needs.
2. [*Table 2. Organizing Requirements – Step 2 – Understanding Required Features and Potential Solutions*](#), in which we assess the facilities required and develop an understanding of requirements in terms of features and possible solutions.
3. [*Table 3. Organizing Requirements – Step 3 – Understanding Architectural Requirements*](#), in which we compare and reconcile the required features and potential solutions with the Connected Health Framework Business Pattern and Reference Architecture and investigate any gaps, mismatches, and overlaps.
4. [*Table 4. Organizing Requirements – Step 4 – Documenting Business and Technical Requirements*](#) in the form of a first pass “to-be” statement of architectural requirements.

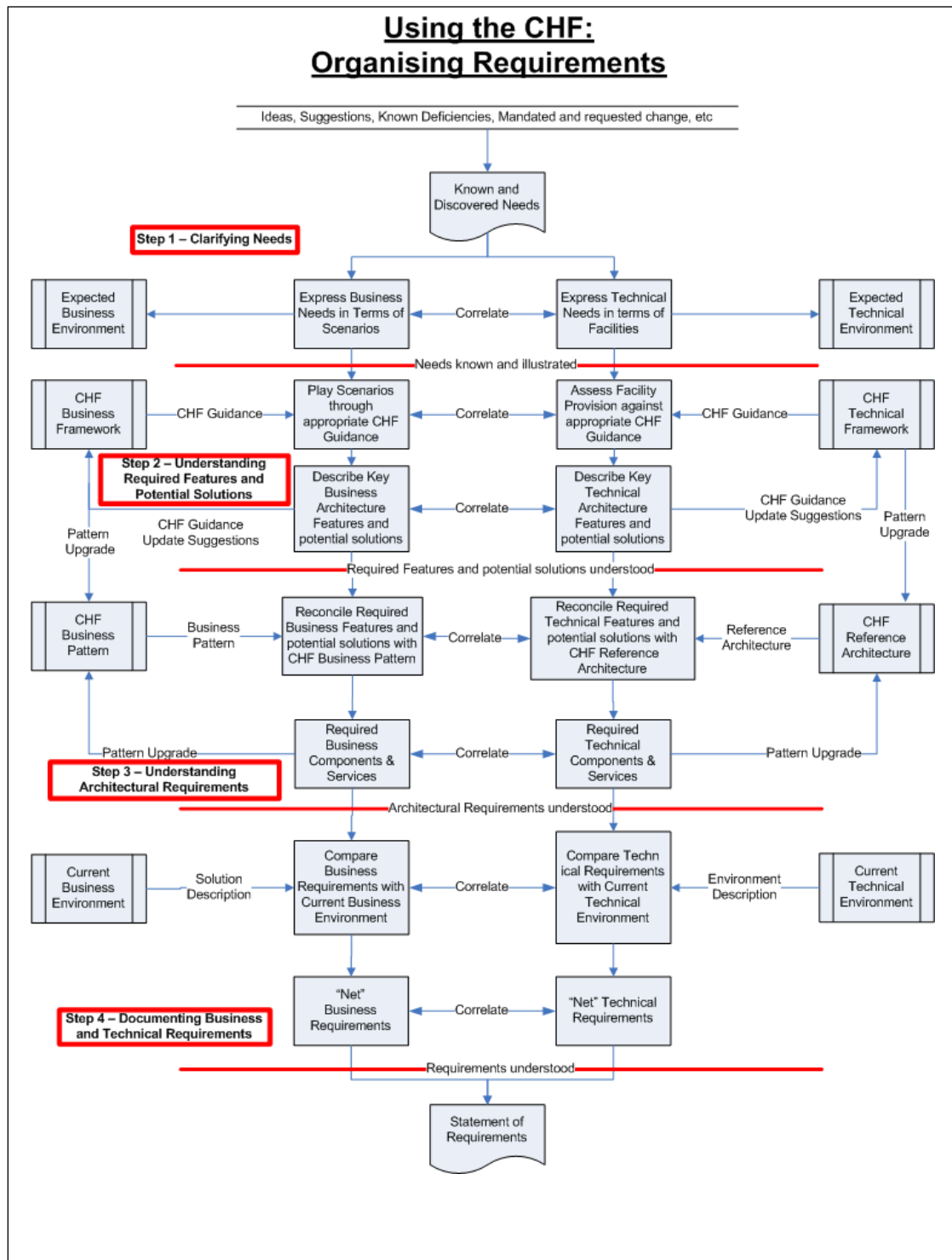


Figure 1. Using the Connected Health Framework – Organizing Requirements

We suggest the following steps:

Step 1: Clarifying Needs

ORGANIZING REQUIREMENTS – STEP 1 – CLARIFYING NEEDS	Objectives:
	<ul style="list-style-type: none"> ➤ Our overall aim is to describe needs in ordered, understandable terms. It should be borne in mind that the audience is non-technical – so complex application and architectural concepts should be avoided in describing needs. ➤ We want to illustrate needs using realistic scenarios and simple demonstrations.
	Inputs:
	<ul style="list-style-type: none"> ➤ Ideas, suggestions, known deficiencies, mandated and requested changes, etc., organized as “Known and Discovered Needs”
	Process:
	<ul style="list-style-type: none"> ➤ Express Business Needs in Terms of Scenarios <i>This is a convenient, easily understood way of describing business needs. Scenarios should describe the way we want a function to work; a suitable approach is to try and describe the business process—for example, how a patient consultation might take place, how a referral is made, how a test is ordered.</i> ➤ Express Technical Needs in Terms of Desired Facilities <i>Similarly, what are the main technical characteristics we are looking for? All that is needed at this stage is a list of the main things, such as single sign on, identity and authorization methods, cross-platform interoperability, standards to be used, and ideas on messaging and business process orchestration.</i> ➤ Correlate Business and Technical Needs <i>How do business and technical needs stack up against each other? Are there any business requirements that will need special technical facilities? Are there any technical constraints that will limit business capabilities?</i> ➤ Describe and Illustrate Known Needs <i>The description should now be given in the form of a number of business scenarios, each not only describing a business situation but illustrating the general technical environment that will be needed.</i>
	Outputs:
	<ul style="list-style-type: none"> ➤ List of Agreed Needs ➤ Expected Business Environment ➤ Expected Technical Environment

Table 1. Organizing Requirements – Step 1 – Clarifying Needs

Step 2: Understanding Required Features and Potential Solutions

ORGANIZING REQUIREMENTS STEP 2 – UNDERSTANDING REQUIRED FEATURES AND POTENTIAL SOLUTIONS	Objectives:
	<ul style="list-style-type: none"> ➤ Use the Connected Health Framework guidance from the Business and Technical Frameworks to shape potential solutions. ➤ Describe the solutions more precisely, using the structure of the Connected Health Framework as a template. ➤ Are these solutions in line with the guidance? If not, the guidance can be updated to reflect emerging needs and experience.
	Inputs:
	<ul style="list-style-type: none"> ➤ Known and Discovered Needs from Step 1 ➤ Guidance from the Connected Health Business Framework ➤ Guidance from the Connected Health Framework—Technical Framework
	Process:
	<ul style="list-style-type: none"> ➤ Play the Business Scenarios through appropriate Connected Health Framework Guidance <i>The Connected Health Framework Business Guidance gives an overview of the characteristics and features of a patient- or client-centric Health or Social Care application. Do the business scenarios “gel” with this guidance? Does the guidance on care records, health subjects, care pathways, clinical and care processes, patient and client journeys, and consents and permissions apply? If there are differences, what are they and are they varying shades of opinion or is there a conflict of approach?</i> ➤ Assess Facility Provision against appropriate Connected Health Framework Guidance <i>This is a similar activity to the previous one, but this time is focused on the technical or operational environment. Consider a situation regarding multiplicity, identity management, integration, messaging, flexibility and agility, security, scalability, performance, disaster recovery, interoperability, and so on. Form some initial ideas.</i> ➤ Correlate Business and Technical streams <i>How do business and technical ideas stack up against each other now? Are there any more business requirements that will need special technical facilities? Are there any further technical constraints that will limit business capabilities?</i> ➤ Describe Key Business Architecture Features and potential solutions <i>The description should now be recast to provide an overview of the main business architectural features needed, such as which business components offering which business services are in the frame. Formulate some provisional ideas about potential solutions.</i> ➤ Describe Key Technical Architecture Features and potential solutions <i>As with Business Architecture features, the required Technical Architecture should now be outlined also with preliminary ideas about solutions.</i> ➤ Correlate Business and Technical potential solutions <i>Now bring the ideas about business and technical solutions together. Prepare a briefing comparing requirements and solutions.</i> ➤ Consider and agree Features and Potential Solutions

	<i>Present ideas and obtain agreement to proceed.</i>
	<i>Outputs:</i>
	<ul style="list-style-type: none"> ➤ Agreed Features and Potential Solutions ➤ Suggested Connected Health Framework Guidance Updates

Table 2. Organizing Requirements – Step 2 – Understanding Required Features and Potential Solutions

Step 3: Understanding Architectural Requirements

ORGANIZING REQUIREMENTS – STEP 3 – UNDERSTANDING ARCHITECTURAL REQUIREMENTS	<i>Objectives:</i>
	<ul style="list-style-type: none"> ➤ Assess the required business features and potential solutions against the Business Pattern – what business components and services do we need? ➤ Assess technical features against the Reference Architecture – what technical components and services do we need? Are these compatible? ➤ Now firm up on the Architectural Requirements – expressed as required services and facilities (the “to-be”)
	<i>Inputs:</i>
	<ul style="list-style-type: none"> ➤ Agreed Features and Potential Solutions from Step 2 ➤ Connected Health Framework Business Pattern ➤ Connected Health Framework Reference Architecture
	<i>Process:</i>
	<ul style="list-style-type: none"> ➤ Reconcile required Business Features and Potential Solutions with the Connected Health Framework Business Pattern <p><i>Refer to the business components and services as described in the business pattern. Try to note which tasks in which scenario “hit” which business components and, if possible, which services they would use. This can be done quite informally, but if more rigor is required, consider drawing “swim lane” diagrams or UML Activity Diagrams for each scenario (or process). Note any gaps, mismatches, and overlaps in both requirements and the business pattern. Resolve them, including providing feedback on the business pattern.</i></p>

	<ul style="list-style-type: none"> ➤ Reconcile required Technical Features and Potential Solutions with the Connected Health Framework Reference Architecture <i>Perform a similar reconciliation between the technical features needed and the reference architecture. Try to note the correspondence between the desired feature and the more detailed architectural guidance offered. Start to specify what features are now needed, what they should do, and how they might be provided. Note any gaps, mismatches, and overlaps in both requirements and the reference architecture.</i> ➤ Correlate potential Business and Technical Solutions <i>How do business and technical solutions stack up against each other? Can all business features be supported by the potential technical platform? Is an operational environment emerging?</i> ➤ Identify required Business Components and Services <i>Now list the required business components and their services. Use the Connected Health Framework Business Component Specifications as a starting point, and extend and modify them as necessary to provide the desired functionality and data provision.</i> ➤ Identify required Technical Services <i>Similarly list the Technical Services needed, such as Identity Management, Privacy and Security</i> ➤ Describe potential Connected Health Framework Business Pattern and Reference Architecture corrections, updates and improvements <i>Feedback to Microsoft</i> ➤ Produce a provisional Statement of Architectural Requirements <i>Describes the first-pass “to-be” business and technical environment</i>
	Outputs:
	<ul style="list-style-type: none"> ➤ Provisional statement of Architectural Requirements

Table 3. Organizing Requirements – Step 3 – Understanding Architectural Requirements

Step 4: Documenting Business and Technical Requirements

ORGANIZING REQUIREMENTS STEP 4 – DOCUMENTING BUSINESS AND TECHNICAL REQUIREMENTS	Objectives:
	<ul style="list-style-type: none"> ➤ Compare the “to-be” architecture with the “as-is” situation ➤ Work out the “delta” (i.e. what is needed) ➤ Express as your “Statement of Requirements”
	Inputs:
	<ul style="list-style-type: none"> ➤ Provisional Statement of Architectural Requirements (from Step 3) ➤ Information on Current Business Environment ➤ Information on Current Technical Environment
	Process:
	<ul style="list-style-type: none"> ➤ Compare Business Requirements with the Current Business Environment <i>What is the current environment and system coverage? Are we talking about new business capabilities or merely improvement of the old? Is this new initiative totally replacing the old or is it necessary to carry forward a substantial number of legacy applications (likely)?</i> ➤ Determine “Net” Business Requirements <i>What are the new bits and what of the old must carry forward? Calculate the “delta”. What adjustments must we make to the “old” to operate in the new environment and participate in the new processes and “modus operandi”?</i> ➤ Compare Technical Requirements with the Current Technical Environment <i>Similarly, how does the existing technical environment need to change? Are we talking about a completely new operating framework with new provisions for security, privacy, disaster recovery, etc.? Are we faced with stringent performance criteria? Can we migrate or enhance existing capability or are we talking about a complete technical refresh?</i> ➤ Determine “Net” Technical Environment <i>What are the major changes as compared with the existing facilities? Is a migration route available or are we going to build a new environment?</i> ➤ Compare “Net” Business and Technical Requirements <i>Do the business and technical “deltas” link up? Can we formulate a migration plan that synchronizes business and technical change? What are the “tranches” of coordinated business functionality and technical capability that might form a series of “releases”? Can we sequence these to form a migration plan and roadmap? Are we aware of and have we accommodated all prerequisites and environmental preparations?</i> ➤ Produce Statement of Requirements <i>Now document all requirements in a coherent, logical way. Format is unimportant so long as it is consistent. The statement should include an overview of the current situation, a projection towards the future in the form of a description of the “end target” and the planned steps or “releases” towards its realization. The relevant business scenarios should be described and the features of the technical environment specified. Descriptions of the envisaged business components and services, and the business processes which they support, should be given. Similarly descriptions of the operation of technical facilities such as</i>

	<i>identity management, authorization and authentication, messaging systems, backup and disaster recovery mechanisms should be offered.</i>
	Outputs:
	➤ Statement of Requirements

Table 4. Organizing Requirements – Step 4 – Documenting Business and Technical Requirements

Outcomes and Deliverables

This scenario describes a suggested process for organizing a seemingly random collection of ideas, suggestions, known deficiencies, and mandated and requested changes into a coherent, structured statement of requirements. We use a progressive series of steps to collate, refine, and consolidate the requirements:

1. “Clarifying Needs”
2. “Understanding Required Features and Potential Solutions”
3. “Understanding Architectural Requirements”
4. “Documenting Business and Technical Requirements”

The progressive deliverables are as follows:

First, by filtering and coordinating all needs against a future business and technical vision, we arrive at:

- A list of agreed needs
- Descriptions of the expected business and technical environments

Second, based on this and using the Connected Health Framework as guidance, we develop a number of scenarios that illustrate future capabilities enabled by the expected environments. This is expressed as:

- A list of agreed features and potential solutions

Third, we compare these features against the more detailed Connected Health Framework Business Pattern and Reference Architecture to establish the viability of requirements and refine them into provisional component and service specifications. This is expressed as:

- A provisional statement of architectural requirements

And finally, we formulate the requirements in a structured, more formal way to provide documentation that may be included in a Request for Proposal. This takes the form of:

- The Statement of Requirements

We think that this process is a practical one, facilitated by the “template” of a patient- or client-centric Health or Social Care system offered by the Connected Health Framework. The process is not rigid and it lays down no mandated steps and procedures. We believe the process to be applicable to both large- and small-scale implementations.

Defining the Operational Environment

The Scenario

Our Scenario is that of a Care Provider or a Systems Integrator who needs to build an environment to interoperate a number of related Health and Social Care applications. This is a common need in larger implementations and the environment is often national or regional in scope, covering a number—perhaps a large number—of hospitals, practices, and care facilities.

For the purposes of the scenario, it is assumed that the applications are aligned with the Connected Health Framework. Scenario 3 that follows describes the process of aligning an application.

The operational environment will need to provide a range of common services and facilities across the estate. These include:

- A suitable *Infrastructure* to ensure a robust, manageable environment
- A practical and efficient scheme of *Identity Management* to ease the burden of access and authentication
- *Integration* of systems running on different platforms to create an information-sharing environment
- Means of capturing, transforming, and presenting *Information* to turn data into useful knowledge
- A degree of *Independence* in terms of processes and procedures to allow clinicians to work in their most effective way

These topics are all addressed by the Connected Health Framework *Part 3 – Technical Framework*. In this scenario, therefore, we recommend a process in which large-scale hardware and software environments may be hypothesized and evaluated against the Connected Health Framework Reference Architecture. This is always done in the context of the expected business environment and the requirements and capability of available application software.

The Approach

Our approach is illustrated in [*Figure 2. Using the Connected Health Framework – Defining the Operational Environment*](#) and a suggested procedure follows.

The procedure has four steps, described in [*Table 5*](#) to [*Table 8*](#). The steps are:

[*Table 5. Defining the Operational Environment – Step 1 – Understanding the Environment*](#), in which we develop a first-pass technical environment.

[*Table 6. Defining the Operational Environment – Step 2 – Defining the Initial Technical Architecture*](#), in which we define the scope and boundaries of the technical architecture.

[*Table 7. Defining the Operational Environment – Step 3 – Configuring the Technical Environment*](#), in which we develop our preferred technical architecture solution.

[*Table 8. Defining the Operational Environment – Step 4 – Defining the Technical Solution*](#) in which we define the preferred Operational Environment

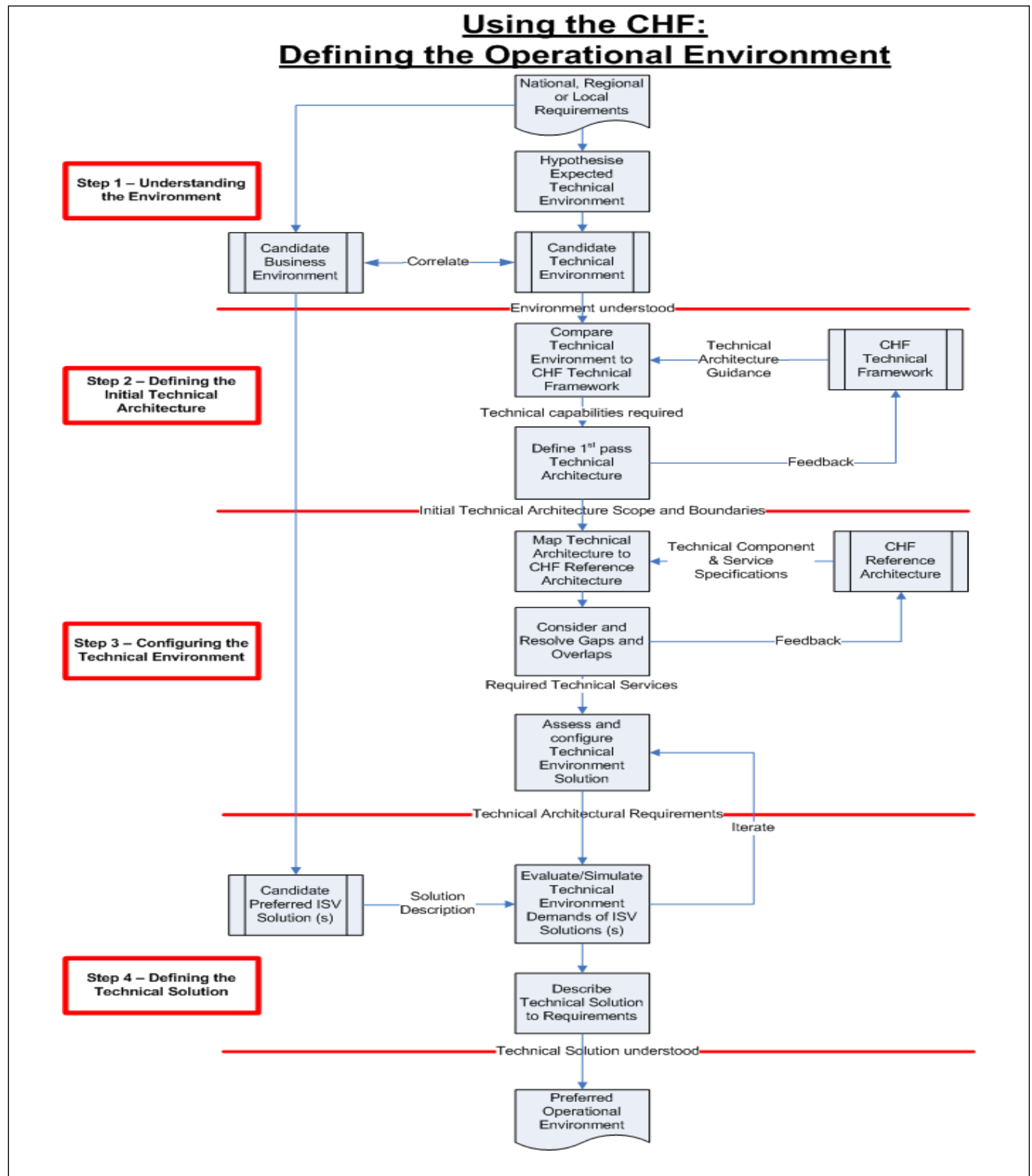


Figure 2. Using the Connected Health Framework – Defining the Operational Environment

Step 1: Understanding the Environment

DEFINING THE OPERATIONAL ENVIRONMENT STEP 1 – UNDERSTANDING THE ENVIRONMENT	Objectives:
	<ul style="list-style-type: none"> ➤ What is the first-pass technical environment? ➤ Does this support the expected business environment?
	Inputs:
	<ul style="list-style-type: none"> ➤ National, regional, or local requirements ➤ Candidate business environment
	Process:
	<ul style="list-style-type: none"> ➤ Hypothesize Expected Technical Environment(s) <i>What do we think the likely technical environment will look like? Do we have preliminary ideas about the general “shape” of the Infrastructure, how we might handle Identity Management, how we might achieve the Integration of the application portfolio, how we will bring diverse Information flows together, and how we will provide flexible, user-friendly interfaces and processes and recognize Independent ways of doing things? What are our initial ideas on single sign on, data standards, security, performance, capacity management, back up and disaster recovery, and so on?</i> ➤ Reconcile Candidate Business and Technical Environments <i>A major error in defining a technical environment is to ignore or be ignorant of the actual business-related work that has to be done. Is our expected technical environment capable of supporting the expected business environment? Do we see ways of handling the various business transactions? What constraints exist? Can we remove them?</i> ➤ Describe First Pass “To-Be” Technical Environment <i>Now describe the initial ideas for the technical environment. What are the main technical characteristics we are looking for? All that is needed at this stage is a list of the main things, such as single sign on, identity and authorization methods, cross-platform interoperability, standards to be used, and ideas on messaging and business process orchestration.</i>
	Outputs:
	<ul style="list-style-type: none"> ➤ First-Pass “To-Be” Technical Environment

Table 5. Defining the Operational Environment – Step 1 – Understanding the Environment

Step 2: Defining the Initial Technical Architecture

DEFINING THE OPERATIONAL ENVIRONMENT STEP 2 – DEFINING THE INITIAL TECHNICAL ARCHITECTURE	Objectives:
	<ul style="list-style-type: none"> ➤ How does the expected Technical Environment compare with the Connected Health Framework? ➤ Is there a general alignment? ➤ What areas need more guidance? ➤ What’s “in” and what’s “out”?
	Inputs:
	<ul style="list-style-type: none"> ➤ First Pass “To-Be” Technical Environment from Step 1 ➤ Connected Health Framework Technical Architecture Guidance
	Process:
	<ul style="list-style-type: none"> ➤ Compare “To-Be” Technical Environment with the Connected Health Framework—Technical Framework <i>Perform a reconciliation between the technical features needed and the Connected Health Framework—Technical Framework. Try to note the correspondence between the desired feature and the more detailed architectural guidance offered. Start to specify what features are now needed, what they should do, and how they might be provided. Note any gaps, mismatches, and overlaps in both requirements and the reference architecture.</i> ➤ Determine required technical capabilities <i>Now develop the first pass description into more detailed descriptions of the technical facilities needed. Try now to state <u>how</u> things will work rather than just <u>what</u> is required. Make sure that the facilities can work together and that an attractive solution in one area does not disable an equally attractive solution in another.</i> ➤ Define First Pass Technical Architecture <i>The description should now be recast to provide an overview of the main technical architectural features needed, such as which technical components offering which technical services are in the frame. Formulate some provisional ideas about potential solutions. Try to follow the general structure of the Connected Health Framework—Technical Framework; for example, express needs in terms of the layered architecture—Identity Management, Privacy and Security, Presentation and Point of Access Services, Service Publication and Location, and the operation of the Connected Health Services Hub.</i> ➤ Feedback to Connected Health Framework—Technical Framework <i>Communicate any gaps, overlaps, or omissions in the Connected Health Framework—Technical Framework back to Microsoft.</i> ➤ Describe Initial Technical Architecture Scope and Boundaries <i>Document the now emerging Technical Architecture in terms of what it will do, how it might do it, and also what it will <u>not</u> do. Present ideas and seek approval to proceed.</i>
	Outputs:
	<ul style="list-style-type: none"> ➤ Initial Technical Architecture (Scope and Boundaries)

Table 6. Defining the Operational Environment – Step 2 – Defining the Initial Technical Architecture

Step 3: Configuring the Technical Environment

DEFINING THE OPERATIONAL ENVIRONMENT STEP 3 – CONFIGURING THE TECHNICAL ENVIRONMENT	Objectives:
	<ul style="list-style-type: none"> ➤ What technical components are needed? ➤ Are they described in the Connected Health Framework Reference Architecture? ➤ What's missing? How do we resolve gaps? ➤ Configure architecture solution and publish requirements.
	Inputs:
	<ul style="list-style-type: none"> ➤ Initial Technical Architecture (Scope and Boundaries) ➤ Connected Health Framework Reference Architecture (Technical Components and Service Specifications)
	Process:
	<ul style="list-style-type: none"> ➤ Map Initial Technical Architecture to the Connected Health Framework Reference Architecture <i>Now is the time to get more detailed. The initial ideas on the Technical Architecture are now related to the more specific guidance offered in the Connected Health Framework Reference Architecture. Try to note the correspondence between the desired feature and the more detailed architectural guidance offered. Start to specify the features that are needed, what they should do, and how they might be provided. Note any gaps, mismatches, and overlaps in both requirements and the reference architecture.</i> ➤ Consider and Resolve Gaps and Overlaps <i>Are there and gaps or overlaps in our emerging architecture? Does the Connected Health Framework mention things we have not thought about? Are there things we are not doing that the Connected Health Framework thinks we should? Are there things we want to do that the Connected Health Framework doesn't mention (quite possible)? Resolve all these issues.</i> ➤ Define Required Technical Services <i>Now define the required Technical Services. Extend and firm up on the services needed. Either use the Connected Health Framework Reference Architecture as a checklist or take the building blocks described in the reference architecture (i.e., the service descriptions) and use them as templates, replacing the generic advice with your specifics.</i> ➤ Assess and configure Technical Environment Solution <i>Now document the resulting Technical Environment Solution. In doing so, ensure that the solution is complete and that the facilities are compatible and will interoperate. Most importantly does it support the Business Solution?</i>
	Outputs:
	<ul style="list-style-type: none"> ➤ Preferred Technical Architecture Solution

Table 7. Defining the Operational Environment – Step 3 – Configuring the Technical Environment

Step 4: Defining the Technical Solution

DEFINING THE OPERATIONAL ENVIRONMENT STEP 4 – DEFINING THE TECHNICAL SOLUTION	Objectives:
	<ul style="list-style-type: none"> ➤ Does the business solution fit into the technical environment? ➤ Test the solution – benchmarks, simulations, “scale up and out” tests, proofs of concept, etc. ➤ Satisfied? – Document and publish.
	Inputs:
	<ul style="list-style-type: none"> ➤ Preferred Technical Architecture Solution from Step 3 ➤ Candidate Preferred Applications (Solution descriptions)
	Process:
	<ul style="list-style-type: none"> ➤ Evaluate/simulate Technical Environment Demands of preferred applications <i>The Technical Environment now needs to be tested, preferably in the context of the expected business solution. It is of course not possible to build the full solution, so we will use a mixture of benchmarks, simulations, and “proof of concept” projects to make sure that our ideas are viable. Our usual process will be to create a small-scale test environment that as far as possible simulates the technical architecture. Within that, we can run candidate applications not only to assess their business capabilities but to evaluate how they might behave in the technical environment. This testing should include scale out and scale up testing to establish application capability and performance in the expected real-world implementation.</i> ➤ Reiterate to preferred Technical Architecture Solution until satisfied <i>This testing will reveal necessary changes and adjustments to the technical environment. These should be made and appropriate retesting should take place until satisfactory results are obtained.</i> ➤ When satisfied, describe Technical Solution to Requirements <i>Now document the Technical Solution in detail. Demonstrate that all requirements have been met.</i>
	Outputs:
	<ul style="list-style-type: none"> ➤ Preferred Operational Environment

Table 8. Defining the Operational Environment – Step 4 – Defining the Technical Solution

Outcomes and Deliverables

This scenario describes a suggested process for defining an Operational Environment for a medium- to large-scale Health or Social Care system implementation.

Our concentration is on the technical features required but always in the context of the business need.

We use a progressive series of steps to hypothesize, refine, and specify the environment:

1. “Understanding the Environment”
2. “Defining the Initial Technical Architecture”
3. “Configuring the Technical Environment”
4. “Defining the Technical Solution”

The progressive deliverables are:

First, by collecting, organizing, and considering national, regional, and local requirements, we arrive at a first pass idea of the technical environment.

Second, based on this and using the Connected Health Framework technical guidance, we develop a list of the required technical features expressed as an Initial Technical Architecture covering the scope and boundaries of the main technical areas, such as Identity Management and Privacy and Security provisions.

Third, we compare these features against the more detailed Connected Health Framework Reference Architecture to establish the viability of requirements and the provisional solutions and refine them into provisional technical service specifications. This is expressed as the Preferred Technical Architecture Solution, which describes the architecture in a structured, more formal way. This provides documentation that may be included in the application software selection process or in a more formal Request for Proposal.

Finally, we evaluate and simulate the capability of the emerging operational environment to host and support the preferred applications in the expected business solution. This is usually done by performing a series of tests within a small-scale operational environment designed to establish how the applications would behave in the environment and conversely how the environment would support the applications. The outcome of this step would be a definition of the Preferred Operational Environment.

As with our other scenarios, we think that this process is a practical one, facilitated by the “template” of a patient- or client-centric Health or Social Care system offered by the Connected Health Framework. The process is not rigid and it lays down no mandated steps and procedures. We believe the process to be applicable to both large- and small-scale implementations.

Aligning a Health or Social Care Application with the Connected Health Framework

The Scenario

In this scenario we consider the situation where we have to modify or restructure an existing application to align with the Connected Health Framework.

We would want to do this in circumstances where we are building a larger Health or Social Care systems environment, and where we want an existing application to participate in the wider environment by making its functionality and data available to business processes of wider scope that cross the boundaries of a number of applications.

A second situation arises where a vendor of an application wants to make his or her product more widely applicable such that it can participate in larger-scale, multiproduct Health or Social Care systems and interoperate with other products in such a scheme.

An existing application, whether implemented or not, is usually designed to operate on its own; it has its own unique user interface, in-built business processes, business logic, and a proprietary database. Typically, it has been implemented to perform a specific job in a specific way.

We now want it to operate in a larger environment, alongside other applications within a distributed processing environment. We envisage two degrees of integration: the first enabling the application to interoperate with other applications, and the second integrating the application functionally with others and to use shared data.

This may mean modifying the application to use a common user interface and exposing its functionality and data to participate in larger, more complex business processes.

In this scenario we compare the application with the Connected Health Framework Business Pattern and Reference Architecture. This suggests areas of the application that might be reengineered to enable interoperability of the application in an environment built in accordance with the Connected Health Framework guidance. This is achieved by aligning the application with the range of business and technical services described in the Connected Health Framework Business Pattern and Reference Architecture.

The Approach

Our approach is illustrated in [*Figure 3. Using the Connected Health Framework – Aligning an Application with the Connected Health Framework*](#), and a suggested procedure follows.

The procedure has four steps, described in [*Table 9*](#) to [*Table 12*](#):

1. [*Table 9. Aligning an Application– Step 1 – Understanding Current and Target Capabilities*](#), in which we form a view of current scope, boundaries, and capabilities of the application and its planned future development.
2. [*Table 10. Aligning an Application– Step 2 – Understanding Interoperability Capabilities*](#), in which we develop a statement of the interoperability capabilities of the application.

3. [Table 11. Aligning an Application – Step 3 – Reengineering the Application](#), in which we map the application to the Connected Health Framework and define the revised application architecture and reengineering work needed to align with the Connected Health Framework.
4. [Table 12. Aligning an Application – Step 4 – Defining a Preferred Application Solution](#), in which we define the resulting application architecture of the Connected Health Framework-aligned application.

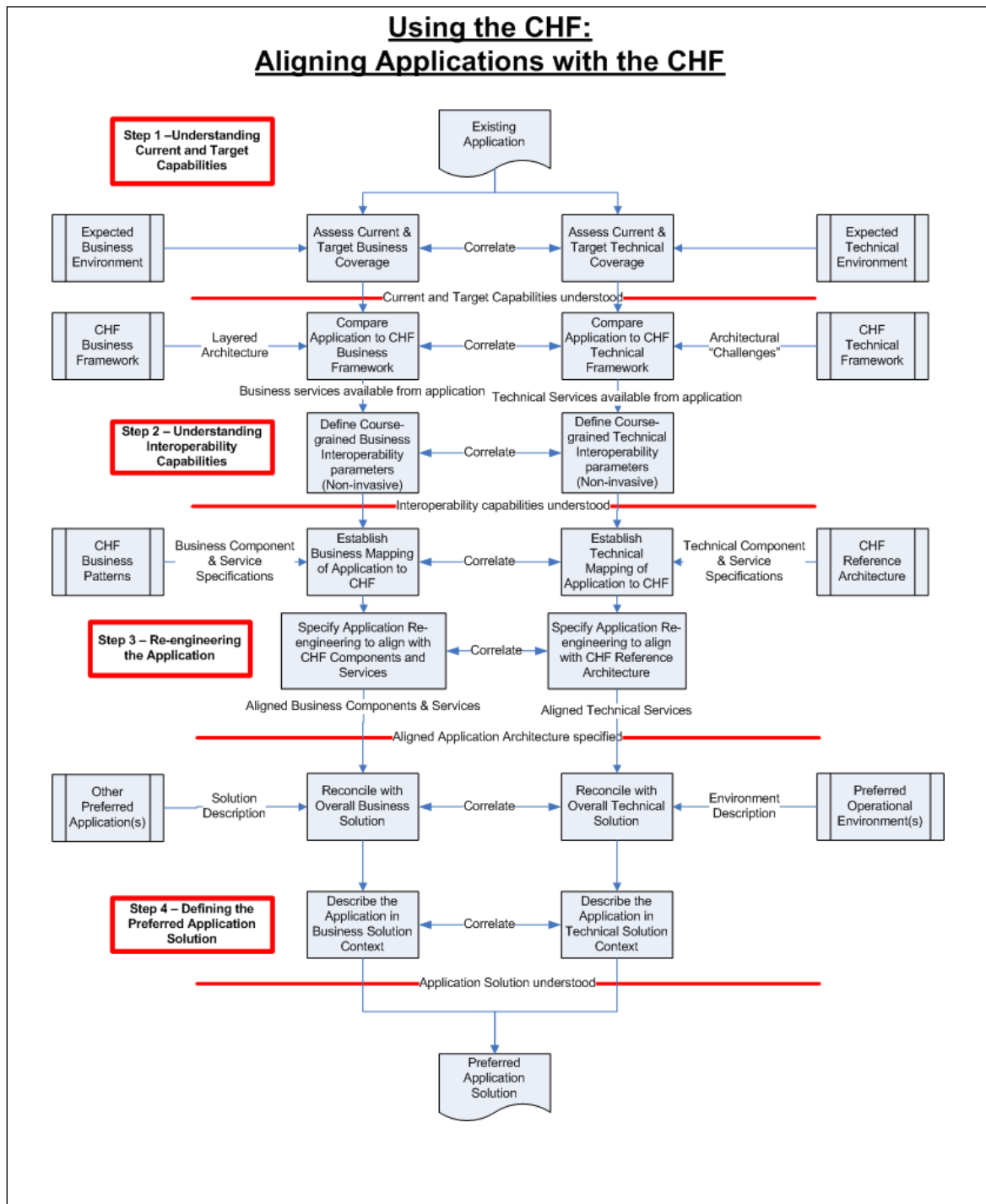


Figure 3. Using the Connected Health Framework – Aligning an Application with the Connected Health Framework

Step 1: Understanding Current and Target Capabilities

ALIGNING AN APPLICATION WITH THE Connected Health Framework STEP 1 – UNDERSTANDING CURRENT AND TARGET CAPABILITIES	Objectives:
	<ul style="list-style-type: none"> ➤ What does the existing application do? ➤ How does it do it? ➤ What is the future need? ➤ What is the current coverage and what is missing?
	Inputs:
	<ul style="list-style-type: none"> ➤ Existing Application(s) ➤ Expected Business Requirement ➤ Expected Technical Environment
	Process:
	<ul style="list-style-type: none"> ➤ Assess current and target Business Coverage <i>What does the application do? How does it do it? Review existing documentation, view a demonstration, and if possible talk to a selection of users. What do they like? What do they not like? Distinguish between business functionality and technical capability. What plans exist for the application? What will the “next release” do? Is there a plan to move to a service orientation? Does it seem to fit in with your future plans?</i> ➤ Assess current and target Technical Coverage <i>Similarly, establish the technical environment required by the application. Is the business functionality clearly separated from the technical implementation? Does the application need a specific technical environment or can it be implemented on multiple platforms? How does it handle cross-application tasks such as authentication and authorization, security and privacy, and non-functional factors such as performance and scalability? What are the future technical plans? What platforms will it be able to operate on? Are there facilities to connect to messaging engines? What are they? Does it seem to fit into your future environment?</i> ➤ Correlate current and target capabilities <i>Consolidate your assessment of current business and technical capabilities. What lies in the future? Are the development plans (if any) in line with your requirements? Is the application vendor open to aligning his plans with yours?</i> ➤ Understand target scope and boundaries <i>Prepare an assessment of the application. What can it do now? What will it do in the future? Has it a future? What has to be done to use the application in the future?</i>
	Outputs:
	<ul style="list-style-type: none"> ➤ Statement of Current and Target Capabilities

Table 9. Aligning an Application– Step 1 – Understanding Current and Target Capabilities

Step 2: Understanding Interoperability Capabilities

ALIGNING AN APPLICATION WITH THE Connected Health Framework STEP 2 – UNDERSTANDING INTEROPERABILITY CAPABILITIES	Objectives:
	<ul style="list-style-type: none"> ➤ How does the application stack up against the Connected Health Framework? ➤ Which services described by the Connected Health Framework can the application offer? ➤ How would we expose these services for external consumption? ➤ Define the façade (or service interface) to the application. ➤ This would achieve interoperability, for the available services, without change to the existing application code.
	Inputs:
	<ul style="list-style-type: none"> ➤ Statement of Target Scope and Boundaries (from Step 1) ➤ Connected Health Framework—Business Framework (Layered Architecture) ➤ Connected Health Framework—Technical Framework (Architectural “Challenges”)
	Process:
	<ul style="list-style-type: none"> ➤ Compare Application to Connected Health Framework—Business Framework <i>Given the statement of current scope and boundaries, we now compare the application with the Connected Health Framework—Business Framework. Does the application use a layered architecture approach? Is it a thick, thin, or smart client application? Does it separate presentation, business logic, and data tiers? Does it offer a choice of UI? How does it handle business processes—are these configurable or are they hard coded into the application? Does the application use an internal service bus? Does the application use messaging—is this purely internal, or a means of interfacing, or a means of interoperation with other applications? Is the application built from encapsulated business components? What is its data structure? Is the data tier independent or tightly bound into the business logic? How much use is made of stored database procedures?</i> ➤ Compare Application to Connected Health Framework—Technical Framework <i>Similarly compare the application with the Connected Health Framework—Technical Framework. Does this use a layered architecture approach too? Are technical facilities separated into presentation, application hosting, and data management facilities? Is use made of an e-services hub? If so, what is it, what does it do, and how does it do it?</i> ➤ Correlate Business and Technical Factors <i>How do business and technical factors stack up against each other? Is the “business stack” tightly or loosely bound to the “technical stack”? Are there any business requirements that use special technical facilities? Are there any technical constraints that limit business capabilities?</i> ➤ List Business Services available from Application <i>Discover reusable functionality and available data in existing legacy implementations.</i> ➤ List Technical Services available from Application <i>Discover reusable technical services in existing legacy implementations.</i> ➤ Define Coarse-grained Business Interoperability parameters <i>State which business capabilities and data could be made available to other applications in an integrated environment. These capabilities should be made available without restructuring the</i>

	<p><i>application—for example, they would be non-invasive.</i></p> <ul style="list-style-type: none"> ➤ Define Coarse-grained Technical Interoperability parameters <i>State which technical features could be used outside the application “envelope”—for example, is there an authentication mechanism that could be used by other applications? These capabilities should be made available without restructuring the application—for example, they would be non-invasive.</i> ➤ Correlate Business and Technical Interoperability parameters <i>Do the business and technical interoperability parameters, taken together, offer a coarse-grained service to other applications? What would be the interfaces?</i> ➤ Document Interoperability Capabilities <i>Produce an “application assessment” stating the capability of the application to play a role in a wider application environment.</i>
	Outputs:
	<ul style="list-style-type: none"> ➤ Interoperability Capability Statement

Table 10. Aligning an Application– Step 2 – Understanding Interoperability Capabilities

Step 3: Reengineering the Application

<p>ALIGNING AN APPLICATION WITH THE Connected Health Framework</p> <p>STEP 3 – REENGINEERING THE APPLICATION</p>	Objectives
	<ul style="list-style-type: none"> ➤ Map the application modules and data structures to the components (functions and data) of the Connected Health Framework Business Pattern. ➤ What is the degree of alignment? ➤ What role can the application play in a Connected Health Framework aligned solution? ➤ What functionality can be “liberated” from the application for reuse elsewhere? ➤ Can the UI, User Processes, Business Processes, and Data Access functions of the application be changed?
	Inputs:
	<ul style="list-style-type: none"> ➤ Interoperability Capability Statement ➤ Connected Health Framework Business Pattern (Business Component and Service Specifications) ➤ Connected Health Framework Reference Architecture (Technical Component and Service Specifications)
	Process:
	<ul style="list-style-type: none"> ➤ Establish Business Mapping of the Application to the Connected Health Framework Business Pattern <i>Match the relevant capabilities of the application to the Connected Health Framework Business Pattern. Do this by cross-relating required features between the application and the Connected Health Framework Business Pattern <u>via the Connected Health Framework components and services</u>. This might best be done by constructing a functional decomposition and data model</i>

for the application and producing a set of business components and services offered by the application as in Part 2 of the Connected Health Framework guidance. Then compare these with the equivalent Connected Health Framework Business Pattern artifacts. Highlight and resolve gaps and overlaps. BEWARE of the temptation to accept vendor assurances that “my package does that.” Strictly speaking, we should only accept vendor offerings within an application architecture “layer”, for example as UI or business components, but not facilities that bridge across component layers. This approach avoids proprietary “lock in” and makes each component in the solution replaceable. Vendors must provide components that exhibit tight cohesion and loose coupling with NO component interdependencies. We do not want a situation in which a particular user interface, for example, has to operate with a particular set of business components.

- Establish Technical Mapping of the Application to the Connected Health Framework Reference Architecture

In a similar way, match the relevant capabilities to the Connected Health Framework Reference Architecture. If we are seeking to use the application within a larger integration scheme, we will want to use the technical facilities of the larger operational environment. Thus in this mapping, we are interested in the ability to replace the application-provided facility with another. If, however, we want to keep the application capability, we are interested in whether it can operate independently without clashing with other facilities, or in a federated way by cooperating with similar facilities in other applications.

- Correlate Business and Technical Mappings

Do the business and technical capabilities, taken together, still offer a coarse-grained service to other applications?

- Reengineer the Application to align with the Connected Health Framework Components and Services

Now specify the work needed to align the business aspects of the application with the Connected Health Framework. This work is likely to involve varying degrees of reconstruction of the application to align with the layered architecture and expose the required business components and services. This work might range from creating a wrapper, or façade, to make services available, to full componentization and service orientation.

- Describe the aligned Business Components and Services

Document the business components and the services now provided by the application. We suggest using the Business Component Specification template used in Part 2 of this guidance.

- Reengineer Application to align with the Connected Health Framework Reference Architecture

Specify the work needed to align the technical aspects of the application with the Connected Health Framework Reference Architecture. This work is likely to involve creating means of “unplugging” the appropriate current technical features of the application to enable the use of another, such as global privacy and security methods.

- Describe the aligned Technical Services

Document the revised technical capabilities of the application. We suggest doing this in a similar manner to that used in describing the Connected Health Framework Reference Architecture.

- Correlate the aligned Business Components and Services with the aligned Technical Services

Do the reengineered business and technical aspects of the application “gel”? Can the

	<p><i>application now be pictured in a similar way to the “joined-up” picture of the Connected Health Framework Business and Technical Frameworks?</i></p> <p><i>Given that the reengineering is an acceptable strategy, devise a work program and a migration plan that sequences the work to provide the most useful services first, recognizing essential prerequisites.</i></p> <p>➤ Document the Application Architecture</p> <p><i>Describe the revised application architecture highlighting application structure (monolith, 3-tier, or multilayered); functional and data content; business components and services; service access method (Web Service or interface); and technical environment requirements, and capabilities. In short, “what does the application do and how do I use it?”</i></p> <tr> <td colspan="2" data-bbox="164 688 316 741">Outputs:</td></tr> <tr> <td data-bbox="164 741 316 787"></td><td data-bbox="316 741 1573 787">➤ Proposed Application Architecture</td></tr>	Outputs:			➤ Proposed Application Architecture
Outputs:					
	➤ Proposed Application Architecture				

Table 11. Aligning an Application – Step 3 – Reengineering the Application

Step 4: Defining a Preferred Application Solution

ALIGNING AN APPLICATION WITH THE Connected Health Framework STEP 4 – DEFINING A PREFERRED APPLICATION SOLUTION	Objectives:
	<ul style="list-style-type: none"> ➤ The application now aligns with the Connected Health Framework. ➤ In terms of an overall solution to a larger requirement, how does the application “dovetail” with the other preferred applications? ➤ Document the application in the solution context.
	Inputs:
	<ul style="list-style-type: none"> ➤ Proposed Application Architecture ➤ Other Preferred Applications (Solution Description) ➤ Preferred Operational Environment (Solution Description)
	Process:
	<ul style="list-style-type: none"> ➤ Reconcile the Application Architecture (Business and Technical aspects) with other preferred applications and with the preferred Operational Environment <i>Our application now joins a potential inventory of applications, each of which aligns with the Connected Health Framework Business Pattern and Reference Architecture. As such, the applications will interoperate and enable the building of a major Health or Social Care systems solution at a national, regional, or local level. We have to ensure that our new application fits properly with the others. Are its services unique, encapsulated, and at an appropriate level of granularity? Are its services those that are needed in a wider solution? Will the application operate in the preferred operational environment using, and contributing, to the common technical services?</i> ➤ Describe the Application in the Business Solution Context <i>Now describe the role of the application within the provisional business solution – if one has been defined. What is the application going to do and how is it going to do it?</i> ➤ Describe the Application in the Technical Solution Context <i>Now describe how the application will operate in the overall Technical Solution. How is the application going to interoperate?</i>
	Outputs:
	<ul style="list-style-type: none"> ➤ Application Architecture description relative to a potential application inventory and operational environment.

Table 12. Aligning an Application – Step 4 – Defining a Preferred Application Solution

Outcomes and Deliverables

This scenario describes a suggested process for aligning a Health or Social Care application with the Connected Health Framework so it may be incorporated in a larger, multiapplication Health and Social Care systems environment. There may be two motivations for this process: first, to use an existing, trusted application more widely, and second, in the case of an application package, to make it interoperable with other applications and thus more widely acceptable in the marketplace.

We use a progressive series of steps in shaping an application to align with the Connected Health Framework and a portfolio of similarly aligned applications:

1. Understand the current and target capabilities of the application.
2. Understand the interoperability capabilities of the application.
3. Reengineer the application.
4. Define a preferred application solution.

The progressive deliverables are as follows:

First, by assessing what the application currently does and how it does it, and reviewing future development plans, we produce a Statement of Current and Target Capabilities. This enumerates business functionality and technical capabilities. This, of course, mainly addresses the “as-is” application with only a general assessment of the vision or “to-be” situation, and then only as a “stand-alone” application.

Second, we assess the structural capability of the application to interact with other applications. We do this by comparing the application with the Connected Health Framework Business and Technical Frameworks to establish its internal architecture, see how it handles transactions, and determine the degree to which its functionality and data are accessible from “outside”. We establish which coarse-grained business and technical services can be made available from the application. This assessment is summarized in a Statement of Interoperability Capabilities.

Third, we examine the application in more detail, mapping its business and technical capabilities to the Connected Health Framework Business Pattern and Reference Architecture. This provides a finer-grained picture of application capabilities focusing on the set of business components and services “owned” by the application, and their similarity, or otherwise, to the Connected Health Framework Business Pattern. We also examine how the application handles the technical capabilities described in the Connected Health Framework Reference Architecture. This provides a detailed picture of the anatomy of the application and indicates the work necessary to reengineer the application to align with the Connected Health Framework. This is documented as a Proposed Application Architecture.

Finally, we review how the application might fit into a portfolio of complementary applications, all of which align with the Connected Health Framework. We adjust and reconcile as necessary to define a clear contribution that the application might make to the portfolio. We assess how the application might fit into a wider operational environment. All this is documented as an Application Architecture Description relative to a potential application inventory within an operational environment.

Developing Solutions

The Scenario

Our Scenario is that a Request for Proposal has been received from a national, regional, or local Care Provider. The Responder is a System Integrator or a large Health or Social Care application vendor.

The request contains “Requirements” outlining business needs and technical facilities that the Provider considers necessary, and usually the request document will list these by functional area, such as patient demographics, patient care records, orders and results, and waiting lists and schedules. It will also specify the desired technical environment, such as whether the overall system topography is to be centralized, decentralized, or distributed; what security provisions are to be made; and what performance criteria will be applied.

We presume the scope of the requirements to be large-scale, probably national. We presume there are no constraints on the use of specific Health and Social Care applications, technical features, and facilities. If there are such constraints, we assume that they are compatible with the Connected Health Framework.

In this scenario we seek to produce an overall architectural solution. Clearly there will be substantial business and commercial factors, but these lie outside our scenario.

Our approach is to analyze the Statement of Requirements (RFP) to clarify and categorize requirements against the business and technical frameworks of the Connected Health Framework. This allows a comparison of requirements to be made against the Business Pattern and Reference Architecture and thus against available, aligned application software (as described in Scenario 3) and preferred operational environments (as described in Scenario 2). This enables identification of gaps and overlaps and provides a vehicle for a structured response to the RFP.

The Approach

Our approach is illustrated in [*Figure 4. Using the Connected Health Framework – Developing Solutions*](#), and a suggested procedure follows.

The procedure has four steps, described in [*Table 13*](#) to [*Table 16*](#):

1. [*Table 13. Developing Solutions – Step 1 – Understanding Scope and Boundaries*](#), in which we develop a view of the thrust and content of requirements.
2. [*Table 14. Developing Solutions – Step 2 – Understanding Architectural Features*](#), in which we analyze requirements in comparison to the Connected Health Framework to arrive at a First Pass Architectural Specification.
3. [*Table 15. Developing Solutions – Step 3 – Defining Business and Technical Architectures*](#), in which we carry out more detailed analysis against the Connected Health Framework Business Pattern and Reference Architecture to produce the Business and Technical Architecture Specification
4. [*Table 16. Developing Solutions – Step 4 – Defining and Documenting the Solution*](#), in which we select our preferred applications and operational environment and prepare the first-cut response to the RFP.

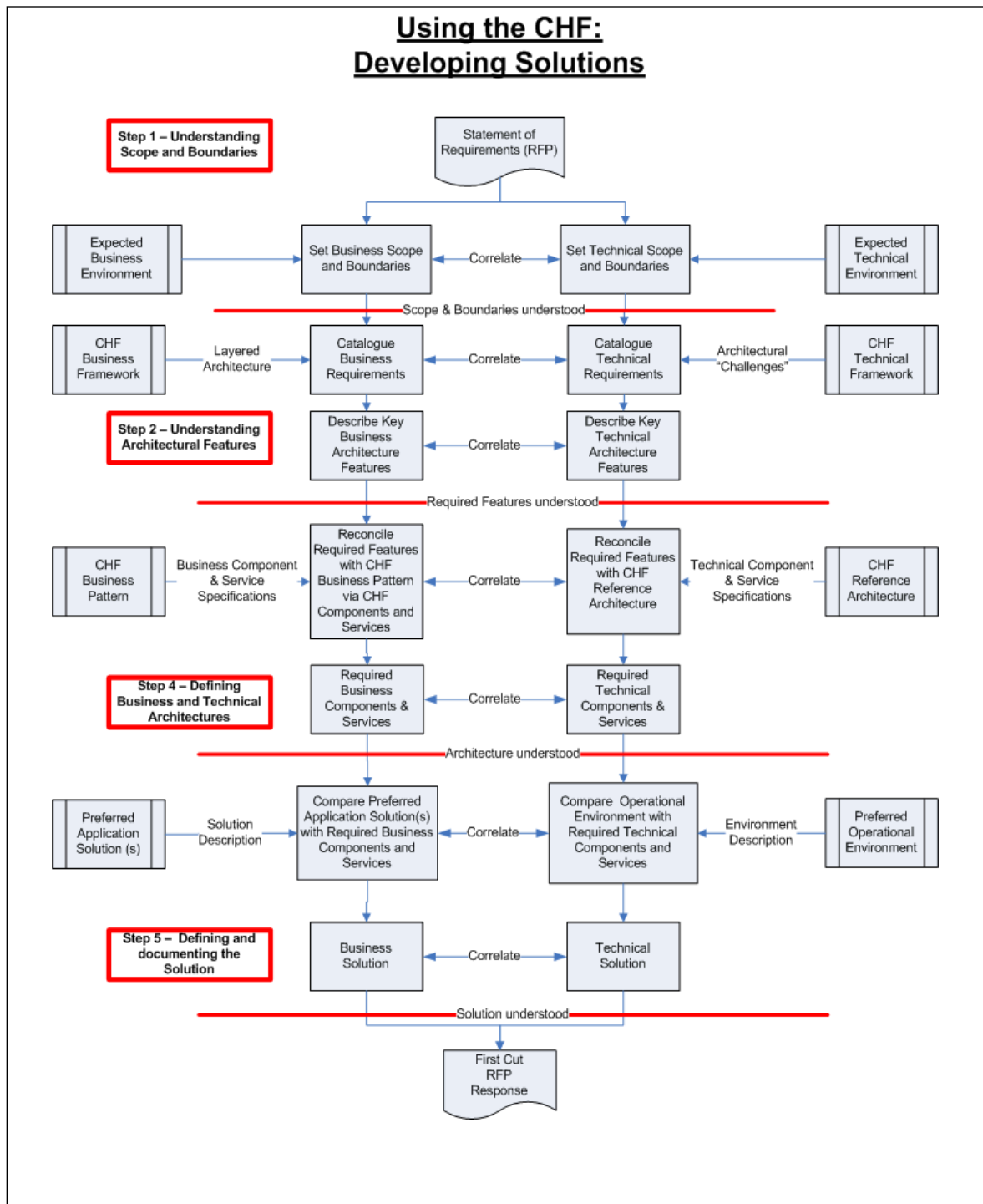


Figure 4. Using the Connected Health Framework – Developing Solutions

Step 1: Understanding Scope and Boundaries

DEVELOPING SOLUTIONS STEP 1 – UNDERSTANDING SCOPE AND BOUNDARIES	Objectives:
	<ul style="list-style-type: none"> ➤ What are the requirements? ➤ Are they reasonable? Can they be addressed with current capabilities? ➤ What's in and what's out? ➤ Are the inclusions feasible? Are the exclusions reasonable? ➤ Do the scope and boundaries make sense? ➤ Is a phased implementation possible? ➤ What would be the first release?
	Inputs:
	<ul style="list-style-type: none"> ➤ Statement of Requirements (RFP) ➤ Expected Business Environment ➤ Expected Technical Environment
	Process:
	<ul style="list-style-type: none"> ➤ Set Business Scope and Boundaries <i>What is the scope and thrust of the business requirements? Are they wide-ranging, covering the whole patient- or client-centric Health and Social Care spectrum, or are they more limited, focusing on a specific aspect of patient care, such as the care record or assessments and care plans? Does the scope make sense? Are we being asked to consider a self-contained solution that creates and manages all its own data, or is there a need to obtain data from other sources outside the immediate business scope? Similarly are the business processes contained entirely within the boundaries of the solution or do they involve excursions into other functional areas?</i> ➤ Set Technical Scope and Boundaries <i>Similar considerations apply to the technical scope. Is the solution expected to be self-contained or fit into an existing operational environment? What are the requirements for domain-wide facilities such as authentication, authorization, and security?</i> ➤ Correlate Business and Technical Factors <i>Bring the Business and Technical Scope and Boundary definitions together. Do they make a coherent picture? Are there contradictions? Can we see how the business needs can be enabled in the technical environment? If there are issues, resolve them.</i> ➤ Firm Up on Solution Scope and Boundaries <i>Is a phased implementation possible? What would be the phases? Devise an Implementation Plan and, if appropriate, a migration plan, moving from the current situation to the end vision.</i>
	Outputs:
	<ul style="list-style-type: none"> ➤ Solution Scope and Boundaries understood

Table 13. Developing Solutions – Step 1 – Understanding Scope and Boundaries

Step 2: Understanding Key Architectural Features

DEVELOPING SOLUTIONS

STEP 2 – UNDERSTANDING KEY ARCHITECTURAL FEATURES

Objectives:																			
<ul style="list-style-type: none"> ➤ Break down the requirements into candidate “features”. ➤ Assign each business requirement/feature to an architectural layer in the Connected Health Framework Framework—Business Framework. ➤ Assign each technical requirement to an architectural “challenge” addressed by the Connected Health Framework—Technical Framework. 																			
Inputs:																			
<ul style="list-style-type: none"> ➤ Solution Scope and Boundaries from Step 1 ➤ Connected Health Framework—Business Framework (Layered Architecture) ➤ Connected Health Framework—Technical Framework (Architectural “Challenges”) 																			
Process:																			
<ul style="list-style-type: none"> ➤ Catalogue Business and Technical Requirements <ul style="list-style-type: none"> We now work at a greater level of detail. The stated Requirements will be wide ranging, and each requirement will impact on a range of possible features both business-oriented and technical, such as providing secure access to the patient record and enabling clinician-to-clinician online conferencing regarding patient diagnosis, including the sharing of images and test results. A suggested analysis approach might be as follows: Allocate each requirement to a grouping corresponding to the “levels” in the layered architecture in the Business Framework (see Part 2) or the Architectural Challenges in the Technical Framework (see Part 3). 																			
<table> <tr> <th>Business Requirements</th> <th>Architectural “Challenges”</th> </tr> <tr> <td>a) User Interface Requirement</td> <td>h) Multiplicity</td> </tr> <tr> <td>b) User Process Requirement</td> <td>i) Identity Management</td> </tr> <tr> <td>c) Service Interface Requirement</td> <td>j) Integration Challenges</td> </tr> <tr> <td>d) Business Workflow Requirement</td> <td>k) Advanced e-Health Services (Messaging, Protocols, Web Services, Adapters)</td> </tr> <tr> <td>e) Business (Logic) Requirement</td> <td>l) Flexibility and Agility</td> </tr> <tr> <td>f) Business Entity Requirement</td> <td>m) Scalability, Performance, and Availability</td> </tr> <tr> <td>g) Data Access Logic Requirement (including external services)</td> <td>n) Disaster Recovery</td> </tr> <tr> <td></td> <td>o) Achieving the “Common Hub”</td> </tr> </table>	Business Requirements	Architectural “Challenges”	a) User Interface Requirement	h) Multiplicity	b) User Process Requirement	i) Identity Management	c) Service Interface Requirement	j) Integration Challenges	d) Business Workflow Requirement	k) Advanced e-Health Services (Messaging, Protocols, Web Services, Adapters)	e) Business (Logic) Requirement	l) Flexibility and Agility	f) Business Entity Requirement	m) Scalability, Performance, and Availability	g) Data Access Logic Requirement (including external services)	n) Disaster Recovery		o) Achieving the “Common Hub”	
Business Requirements	Architectural “Challenges”																		
a) User Interface Requirement	h) Multiplicity																		
b) User Process Requirement	i) Identity Management																		
c) Service Interface Requirement	j) Integration Challenges																		
d) Business Workflow Requirement	k) Advanced e-Health Services (Messaging, Protocols, Web Services, Adapters)																		
e) Business (Logic) Requirement	l) Flexibility and Agility																		
f) Business Entity Requirement	m) Scalability, Performance, and Availability																		
g) Data Access Logic Requirement (including external services)	n) Disaster Recovery																		
	o) Achieving the “Common Hub”																		
Environmental Requirements																			

	<p>p) Security Requirement</p> <p>q) Operations Management Requirement</p> <p>r) Communications Requirement</p>
	<p><i>Note that some requirements may impact more than one component type.</i></p>
	<p>➤ Correlate Requirements</p> <p><i>Under each of these headings, consolidate the allocated requirements to produce coordinated ideas on the functionality needed. This will lead to a structured definition of what is required by way of user interface; business workflows; identity management; scalability, performance, and availability; security; and so on.</i></p>
	<p>➤ Describe Key Business Architectural Features</p> <p><i>Now organize requirements to describe the key business architectural features that the solution has to provide.</i></p>
	<p>➤ Describe Key Technical Architectural Features</p> <p><i>Similarly, describe the key technical features to be provided by the solution.</i></p>
	<p>➤ Correlate Features</p> <p><i>Bring the key features together and produce a coordinated overview of requirements. Relate this back to the incoming Statement of Requirements from the Requestor. Is everything covered? What are the exclusions? Why? Are there alternative approaches to the excluded requirements? What are they?</i></p>
	<p>➤ Define First Pass Architecture</p> <p><i>Document the preliminary ideas as a First Pass architectural solution.</i></p>
	<p>Outputs:</p>
	<p>➤ First Pass Architecture Specification</p>

Table 14. Developing Solutions – Step 2 – Understanding Architectural Features

Step 3: Defining Business and Technical Architectures

DEVELOPING SOLUTIONS STEP 3 – DEFINING BUSINESS AND TECHNICAL ARCHITECTURES	Objectives:
	<ul style="list-style-type: none"> ➤ Having consolidated requirements, assess each set against the guidance offered by the Connected Health Framework Business Pattern and Reference Architecture. ➤ Can requirements be satisfied within the Connected Health Framework guidance? ➤ Describe each business and technical component and service required.
	Inputs:
	<ul style="list-style-type: none"> ➤ First Pass Architectural Specification from Step 2 ➤ Connected Health Framework Business Pattern (Business Component and Service Specifications) ➤ Connected Health Framework Reference Architecture (Technical Component and Service Specifications)
	Process:
	<ul style="list-style-type: none"> ➤ Reconcile required business features with Connected Health Framework Business Pattern via Connected Health Framework Components and Services <i>Now match the first pass architectural solution with the Connected Health Framework Business Pattern. Since we have categorized requirements against the business framework, the task here is to examine the requirements in the business layer. Break these requirements down further and establish which business components they apply to. Does this make sense? Is the allocation to business components complete? Are any requirements “hanging loose”? Resolve issues, either finding a home for the requirement or else adjusting the business components to accommodate the requirement.</i> ➤ Reconcile required technical features with Connected Health Framework Reference Architecture <i>Do a similar reconciliation of the categorized technical requirements against the Connected Health Framework Reference Architecture. Do they make sense and can we accommodate them? Are any mismatches minor and thus soluble, or do we have major divergence between requirements and the reference architecture? These need detailed study and resolution, and this will result in either recasting the requirement or defining a unique solution to meet the required features.</i> ➤ Correlate required features <i>Bring the business and technical features together. Do they “gel”?</i> ➤ Define required Business Components and Services <i>Now document the Business Components and Services to be provided. Use the Business Component Specification template for this (see Part 2).</i> ➤ Define required Technical Components and Services <i>Document the Technical Components and Services to be provided. Use the same format as used in the Connected Health Framework Reference Architecture (see Part 3).</i> ➤ Correlate and document required Components and Services <i>Document the results in the form of the Business and Technical Architecture Specification.</i>

	Outputs:
	➤ Business and Technical Architectural Specification

Table 15. Developing Solutions – Step 3 – Defining Business and Technical Architectures

Step 4: Defining and Documenting the Solution

DEVELOPING SOLUTIONS STEP 4 – DEFINING AND DOCUMENTING THE SOLUTION	Objectives:
	<ul style="list-style-type: none"> ➤ Match required components and services with preferred applications and operational environments. ➤ Choose business and technical solutions. ➤ Respond to request for proposal.
	Inputs:
	<ul style="list-style-type: none"> ➤ Business and Technical Architecture Specification from Step 3 ➤ Preferred Applications (Solution Description) ➤ Preferred Operational Environment (Environment Description)
	Process:
	<ul style="list-style-type: none"> ➤ Compare Application Solution(s) with Required Business Components and Services <i>Now locate application solutions (as defined in scenario 3) that address the required Business Components (as derived in step 3 of this scenario). Do we have any matches? Are they complete or partial? If partial, are the shortfalls addressed by other applications or is bespoke development indicated?</i> ➤ Compare Operational Environment with Required Technical Components and Services <i>Similarly locate suitable operational environment definitions (as defined in scenario 2) that accommodate the required technical components and services. Can we accommodate the technical requirements completely or only partially or not at all? If no suitable operational environment definition is available, define the suitable environment following the process defined in scenario 2.</i> ➤ Correlate Business and Technical Factors <i>Now compile an overall solution using the chosen applications and operational environment. Check that the solution meets all requirements, that the chosen applications provide the required functionality and data, and that the chosen operational environment will support the applications. Rerun the original statement of requirements through the solution. Resolve any issues.</i> ➤ Define Business Solution <i>Now document the Business Solution indicating how the solution (and its constituent applications) meets all requirements.</i> ➤ Define Technical Solution

	<p><i>Document the Technical Solution indicating how the solution provides a platform not only for the chosen applications but also for the non-functional requirements detailed in the original statement of requirements.</i></p> <p>➤ Document First Cut RFP Response</p> <p><i>Respond to the Request for Proposal in the prescribed form and manner.</i></p>
	<p>Outputs:</p>
	<p>➤ First Cut RFP Response</p>

Table 16. Developing Solutions – Step 4 – Defining and Documenting the Solution

Outcomes and Deliverables

This scenario describes a suggested process for responding to a request for proposal (RFP) from a care Provider. Our process delivers a considered, structured response to the request.

We use a progressive series of steps in marshalling and cataloguing requirements, comparing them to preferred applications and operational environments, devising architectural solutions, testing these against the requirements, and compiling a structured response:

1. Understand the scope and boundaries of the request.
2. Understand the key architectural features.
3. Define business and technical architectures.
4. Define and document the solution.

The progressive deliverables are as follows:

First, by studying the thrust and scope of the business requirements and the technical facilities, we create a Statement of Scope and Boundaries, giving our understanding of the requirements.

Second, by marshalling the stated requirements into a catalogue that aligns with the Connected Health Framework business and technical frameworks, we investigate the business and technical requirements in more detail and develop definitions of the key business and technical architectural features. We document this in the form of a First Pass Architectural Specification.

Third, given the First Pass Specification, we compare the required business and technical features with the more detailed Connected Health Framework Business Pattern and Reference Architecture to define the required Business and Technical Components and Services. This is documented as the Business and Technical Architecture Specification.

Finally, given this detailed specification, we are able to compare the architecture with our preferred application solutions and operational environments and make choices. This results in the formal definition of our architectural solution and the drafting of the first-cut Response to the RFP.