

MEDIPRISE

FINAL REPORT

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Executive Summary

With ever increasing availability to the Internet and access to all manner of information at all times, the health care industry is far behind many other industries in providing access to patient information. Patients expect privacy while at the same time gaining access to state of the art health care. Providing doctors and health care providers with access to a patient's complete medical record, no matter where the patient seeks treatment or preventive care, can aid in decreasing preventable medical errors.

Housecare seeks to provide a technical and business solution to the currently data-separated health care industry by first creating interoperability across several electronic medical record (EMR) standards as well as providing communication across hospital information systems.

The Technical approach to Mediprise will be to build a web service to hospitals already running EMR systems that will provide updated records and interoperability with other healthcare entities using different EMR standards. Mediprise is initially focused on providing interoperability for three major EMR standards: HL7, ANSI X12, and ASTM CCR. These are some of the more popular and complete standards currently used in major EMR management systems. Mediprise will provide continuous access to the Mediprise network, which will consist of a secure repository of Mediprise entity medical files. Mediprise will then provide healthcare entities with updates automatically and seamlessly with whatever physical EMR solution they are currently using, causing zero impact to their existing workflow. As Mediprise expands to more entities, Housecare will incorporate additional capabilities, adding additional file formats and expanding to laboratory and ambulatory records, as well as ultimately launching a Housecare EMR aimed at smaller doctors offices.

The business approach to implementing the Mediprise System is to focus initially on Not-for-Profit hospitals. Non-Profit hospitals are an ideal initial customer for Mediprise. Non-Profit's are eligible for federal grants for enhancing their EMR interoperability, and are already running some of the most sophisticated EMR's developed. Mediprise will be offered to them as a subscription, paid monthly to provide updates as well as access to all Mediprise records for 'secondary' use. (i.e. epidemiology studies, long term drug effects, etc.) As more hospitals join the Mediprise network, Housecare will expand to private hospitals and smaller doctors offices, as well as lowering prices to entice new customers.

Over a 10 year period, Housecare predicts a cumulative NPV of \$28,000,000, while simulations show a 0% probability of a negative NPV over 10 years, there is a 17% probability of negative NPV in the first 5 years. Mediprise is a good long-term prospect, but risky if goals cannot be met within the first years.

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1 Introduction

1.1 Background

In 1999, the Institute of Medicine (IOM) used the results of two major studies, one based on data from Colorado and Utah and the other from New York to report on the extent of adverse events in the health care industry. Extrapolating those results over the 33.6 million hospital admissions per year, it was estimated that 44,000 people die and \$17 billion are lost each year due to preventable medical errors. "An adverse event is defined as an injury caused by medical management rather than by the underlying disease or condition of the patient." [1]

In the New York report, it was found that adverse events that required prolonged hospitalization or disability occurred in 3.7 percent of the hospitalizations. Of those, 58 percent were due to errors and 27.6 percent were due to negligence. "Although most of these adverse events gave rise to disability lasting less than six months, 13.6 percent resulted in death and 2.6 percent caused permanently disabling injuries. Drug complications were the most common type of adverse event (19 percent), followed by wound infections (14 percent) and technical complications (13 percent)." [1]

This represents only a small portion of the problem since the sample population was limited only to admitted hospital patients and did not include ambulatory, outpatient, physicians offices, pharmacies, etc. [1]

1.2 Problem Statement

The healthcare industry is primarily still dependent on paper based medical records that are decentralized, poorly accessible, and redundant.

A myriad of tools are already available to manage medical records electronically, but lack of national standards, lack of trust in the ability to secure data, and poor interoperability has hampered the industry from adopting Electronic Medical Records (EMRs) and has prevented the medical industry from delivering the best quality services to patients.

The current system has resulted in the loss of important patient medical information, the inability of doctors to collaborate, medical errors, and an often negative experience for patients and health care providers alike.

Disconnects in health care communication systems can result in consequences ranging from inconveniences to fatalities and cost upward of \$17 billion annually.

1.3 Team Role

The HouseCare Team is a small Systems Integration and Software IT company specializing in solutions for the healthcare industry.

1.4 Mission Statement

The HouseCare Mission Statement is to develop an architecture and business plan for a fully integrated and standardized electronic healthcare management system (Mediprise) to be used by patients, healthcare providers, and pharmacies. Initial functionality should be delivered in the early 2010 timeframe and extend through 2018.

2 Project Definition

2.1 Scope

The HouseCare Mediprise Architecture will:

- Provide Patients with access to medical records and patient information
- Provide Hospitals and Hospital with access to up-to-date Medical Records, Collaboration tools, and Cross-Facility Communication across hospital enterprises
- Provide non-EMR hospitals with recommendations as to what systems to adopt to interface with our system
- Provide Pharmacies with access to prescription information for the purpose of filling patient prescriptions as requested by the patient.

2.2 Project Intent

The HouseCare group is taking on the responsibility of developing an initial architecture for a federated healthcare information system aimed at value for better patient services and better access to complete medical records in addition to a business plan and roadmap for the best way to implement the architecture. In order to limit the complexity of our project to one that is achievable within 14 weeks, we have chosen the following limitations for our project:

- The HouseCare team will not develop a physical information system. Instead it will deliver an architecture only.
- The Mediprise system will support only a few, currently only three, of the medical industry standard systems for handling medical data.
- The Mediprise system will be targeted towards hospitals that already maintain medical record information systems that are compatible with the HouseCare system.
- For hospitals without HouseCare compatible information systems, the HouseCare team will only recommend system packages that include third party systems. These recommended packages will provide the capability for the hospital to maintain their medical records, interface with the HouseCare system, and collaborate with other hospitals already on the HouseCare system.
- The HouseCare group will also deliver an executable model of the system modeled with Petri Nets and using the CPN Tools package.

- The HouseCare group will provide an analysis of possible business strategies to rollout the Mediprise system, and based on that analysis, choose the best strategy to maximize early adoption and extend capabilities and services over the next 10 years.

Using these limitations the HouseCare group will be able to deliver a feasible architecture capable of accomplishing our mission statement.

2.3 Approach

Housecare will develop both a technical solution, following the Project Development Process outlined in Section 4.1. The technical case will address the physical implementation of Mediprise, while the business care will address the financial and marketing strategy.

In determining how to approach the technical implementation of the Mediprise service, two main choices were considered: creating a new Health Information Standard, or letting Hospitals keep their existing standards and providing conversion services between hospitals.

One of the major obstacles in implementing a fully integrated national Electronic Medical Record and Health Information system is that there is no single approved standard used in the industry at this time. One of the solutions HouseCare considered was to implement a new standard to ensure compatibility between Mediprise entities. Technically, this would be the simplest solution, guaranteeing seamless and quick inter-Mediprise entity communications. However, after discussing the impact this would have on Hospitals that have already invested millions into sophisticated EMR systems, introducing a new standard provides no advantage to the customer, and would in fact incur additional costs and disruption to existing workflow.

The second option HouseCare discussed was providing a service that would convert common standards. Since there are numerous EMR systems that are already designed, built, and in use all over the country, HouseCare feels that this is best strategy for long-term success in the Health IT industry. HouseCare's initial product will provide a way in which systems using different EMR software with different standards can share medical records, without disrupting or changing the existing systems a hospital may use, at a low cost while providing sufficient information assurance. HouseCare envisions once this initial communications framework is implemented, we can expand into additional capabilities, such as including additional standards, expanding to laboratory or ambulatory records, providing direct online doctor-to-doctor collaboration, etc., with the ultimate goal to transform healthcare, and achieve market dominance of the Healthcare IT industry.

From a business perspective, since the healthcare providers (hospitals, pharmacies) will ultimately be responsible for purchasing and maintaining HouseCare IT services, we will investigate the ways in which the HouseCare Mediprise can be sold feasibly. The current 2009 stimulus package incentives, in

addition to partnerships, and marketing potential value to medical research are all methods HouseCare can potentially leverage to make Mediprise successful.

2.4 Expected Result

The expected result is a complete architecture and a feasible business case for HouseCare services to maximize early adoption and expand capabilities and services over the next 10 years.

2.5 HouseCare Guiding Principles

HouseCare's guiding principles include:

- To provide improvements to the existing Healthcare IT infrastructure by connecting hospitals, pharmacies and patients
- To reduce the wasted time, labor, and materials associated with entering medical records data
- To aid in the overall reduction of preventable medical errors by making EMR systems more effective and interoperable
- To continue the success of our initial project and expand our services into additional sectors of the healthcare industry, slowly incorporating ambulatory, laboratory, and additional communication systems, potentially partnering with an EMR provider to achieve market dominance.

3 Stakeholder Analysis

3.1 Identified Stakeholders

The HouseCare Team identified the following key stakeholders of the Mediprise:

- Healthcare Professionals (Doctors)
- Patients
- Hospital Management
- HouseCare Corporate Office
- Healthcare Staff (Nurses)
- Board of Trustees
- Federal Government
- Elected Public Officials
- Pharmacies
- Students/Teachers/Trainers
- Software/System Vendors
- GMU SEOR Faculty

The needs and wants of the Mediprise stakeholders have been identified for the purposes of performing a stakeholder value mapping. This stakeholder value mapping will ensure that HouseCare is designing Mediprise to meet the needs and

wants of our stakeholders. Assurance that the project is consistent with the values associated with the above-identified stakeholders will be achieved by using a cyclical Project Development Process (PDP), so as we add or change functionality, we re-visit and re-evaluate valid stakeholders and their needs/wants.

3.2 Stakeholder Needs/Wants Analysis

Once the stakeholders were identified, HouseCare took each stakeholder and identified the basic needs and wants as identified in Table 1 -Stakeholder Needs/Wants Analysis.

Table 1 -Stakeholder Needs/Wants Analysis

Stakeholders	Needs	Wants
Health Care Professionals	Accurate Medical History Accountability Access to accurate drug information	Better communication with other doctors
		Better Technology (Innovation)
		Better relationships with patients
		More individuals interested in the field
		Healthier Patients
		Fewer malpractice lawsuits
		More resources (equipment, staff)
		More control of practices
		Patient Satisfaction
		Streamlined Process
Patients	Access to healthcare Access to prescribed medication Confidentiality and Security Privacy Protection from harm and/or injury Reliability Safety	Availability
		Coverage for uninsured
		Improved quality of care and reduced medical errors
		Less paperwork
		Less wait time to see doctors
		More affordable healthcare/medication
		More efficiency in hospitals
		Online accessibility
		Good Customer Service
		On-time scheduled appointments
		Equipped facilities
		Assurance that they will receive proper care
		Benevolence when sick
High quality healthcare		
Communication		
Hospital Management	Cost containment Accountability Auditability	Better Hospital Recognition
		Better Technology
		More Funding
		More Staff
		Better Facility
Corporate Office	Cost containment	Satisfied Patients
		Better Hospital Recognition Increased Reputation
Health Care Staff (Nurses)	Accurate Medical History Accurate Treatment Instructions	Better communication with doctors
		Better relationships with patients
		Healthier Patients
		Better Technology
		Fewer working hours
		More resources (equipment, staff)
		Patient Satisfaction
		Fewer responsibilities
Board of Trustees	Profitability Adhering to required regulations	Clear understanding of roles
		More funding from government or private investors
		Better oversight of hospital
		Better management of assets
		Better management of funds
Federal Government/Elected Public Officials	Accountability	Ethical Responsibility
		Cooperation with the healthcare industry Satisfied Citizens
Pharmacies	Accountability Reliability Safety	Ability to detect when patient needs prescription refilled
		Ability to detect when different medicine may pose a problem to patient
Students/Teachers/Trainers	Access educational information	More useful tools
		Better technology
		Good training material
Software/System Vendors	Reliability Safety Access to healthcare industry Capital	More Consumers
		Greater profits
SEOR Faculty	Executable projects	Successful project execution

3.3 Stakeholder Needs Analysis Matrix

In the Stakeholder Needs Analysis Matrix, we have weighed the individual stakeholder groups based on their importance to the Mediprise System and

normalized their weights. Using the Wisdom of Crowds method [2], we then determined the ranking of each need for each stakeholder group. The Stakeholder values were then scored based on the stakeholder group weights. This resulted in a weighted list of values (See Table 2). The highest-ranking stakeholder values are listed below:

1. Information Security – Need to ensure that sensitive medical records can be secured and only accessed by authorized individuals.
2. Streamlined Process–Interactions between patients, doctors, pharmacists across separate organizations should be streamlined and less cumbersome resulting in reduction in costs as well as improved healthcare.
3. High Healthcare Quality – Providing access to electronic medical records that are up to date and complete will aid in higher quality healthcare and diagnostic capabilities with fewer errors.
4. Innovations–Transform the manner in which the healthcare community communicates to push the healthcare industry to utilize 21st century technology and communicate seamlessly across enterprises.
5. Access to Healthcare – Empower patients to take increased ownership into their own healthcare and become more informed. Ease of use.

HouseCare will continually evaluate the architecture against these most critical stakeholder values to ensure that stakeholder needs are met. Performing the Quality Function Deployment (QFD) shown in Section 3.6, the functions are then ranked with respect to the values that the stakeholder groups find most important. Continually returning to the Stakeholder needs and ensuring they are properly ranked, as well as, ensuring the functions of Mediprise are properly aligned with the values of each stakeholder group will ensure that Mediprise meets the needs and wants of the stakeholder.

Table 2 - Stakeholder Needs Analysis Matrix

Stakeholder	Healthcare Professionals	Patients	Hospital Management	Corporate Office	Healthcare Staff (nurses, techs)	Board of Trustees	Federal Government	Elected Public Official	Pharmacies	Students, Interns, Teachers	Software Vendors	SEOR Faculty	Needs Score
Importance (1 - 100)	80	90	20	20	60	10	40	10	40	10	20	70	
Importance (Normalized)	17.0%	19.1%	4.3%	4.3%	12.8%	2.1%	8.5%	2.1%	8.5%	2.1%	4.3%	14.9%	
Stakeholder Needs													
High Healthcare Quality	5	5	4	2	5	3	3	3	2	3	1	3	3.8
Innovations	4	2	4	2	3	3	3	2	1	5	5	4	3.1
Streamlined Process	4	3	4	3	4	2	4	3	4	4	4	5	3.9
Access to Healthcare	5	5	2	1	4	2	4	2	1	4	1	0	3.1
Empowerment over medical decisions	0	4	1	0	0	0	0	1	0	0	0	0	0.8
Education	3	4	2	0	2	0	0	1	1	5	0	5	2.6
Profitability	2	1	5	5	2	5	0	2	4	1	5	0	1.9
Cost Containment	4	1	5	5	4	5	0	3	3	1	4	0	2.4
Personal Safety	2	5	3	0	2	2	3	2	2	1	0	3	2.7
Information Security	4	5	4	4	4	3	4	3	5	4	5	5	4.4
Maintaining regulations	3	1	4	4	3	4	5	5	3	1	5	0	2.5
Increased Communications	4	3	4	3	4	2	2	3	4	4	3	0	2.9

Need Ranking

0 Not used

1 Not useful

2 Useful to some extent

3 Satisfactory

4 Good

5 Excellent

Note : Rankings of Importance were determined using the "Wisdom of Crowds" Method

3.4 IDEF0

The IDEF0 shows the inputs, outputs, mechanisms and controls of the Mediprise System (See Figure 1 - IDEF0). For inputs, Mediprise will receive Prescription Data, Patient Information Data, and Medical Diagnosis Data. Controls for the Mediprise system are Privacy Laws and Security, since these are vital to delivering a usable system. The output then provides Centralized Medical Records that can push updates to hospitals which in turn, leads to improved patient care since medical records will be more complete and accessible.

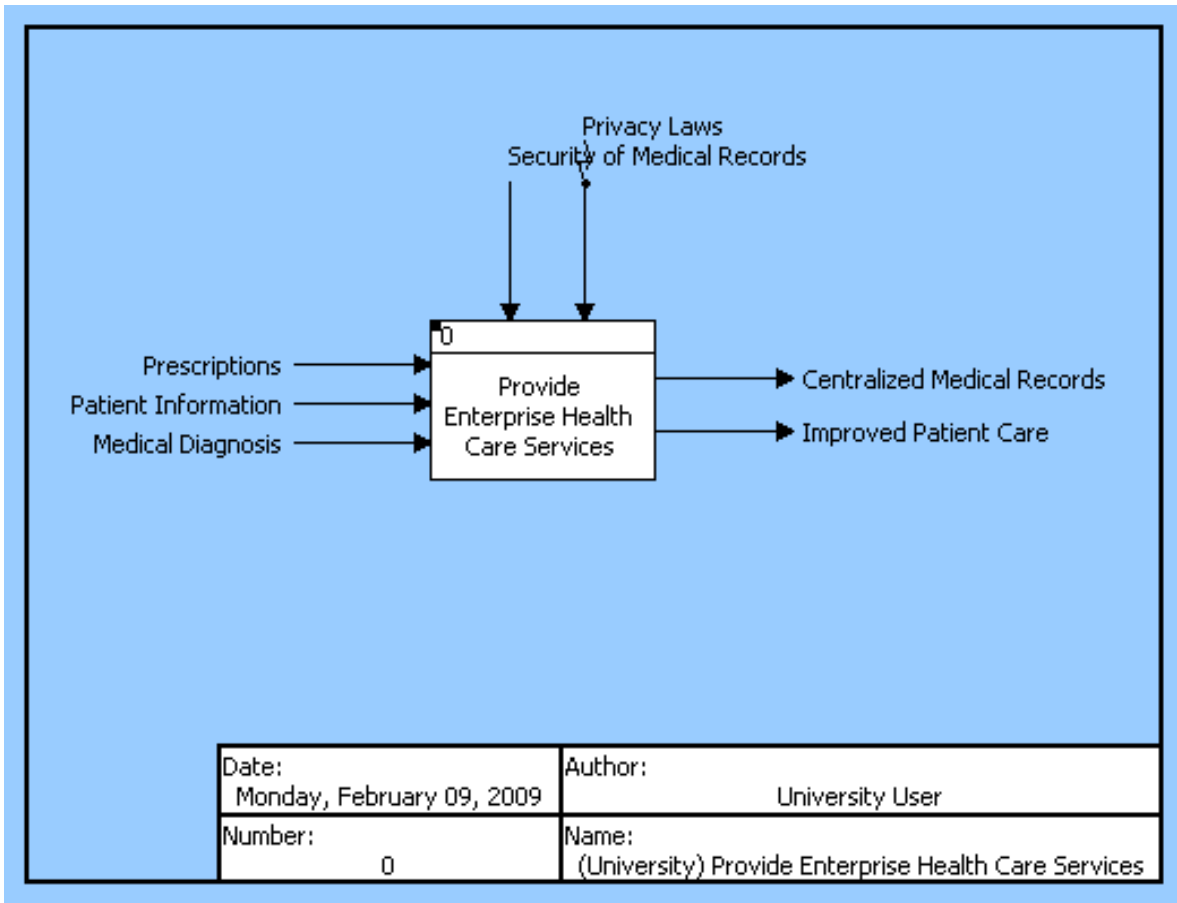


Figure 1 - IDEF0

3.5 Functional Decomposition

The functional decomposition breaks the Mediprise System into its individual functions in order to describe the overall functionality of the System. Initial functionality was derived from the stakeholder needs and wants. HouseCare decomposed the Mediprise functionality to up to five levels.

The highest level functional decomposition, the Level 1, is simply the 'Provide Enterprise Health Care Services' Function (See Figure 2 – Level 1 & 2 Functional Decomposition). Level 2 breaks down that single function into its 5 main components:

- *Provide Communication Services* – This function handles all the Mediprise to Mediprise entity communication, from updates to alerts.
- *Provide Information Assurance Services* – This is the function that handles all information security, authentication, and encryption to ensure that no data is compromised or given to the wrong person,
- *Provide Prescription Services* – This is the Prescription services function, handling all functions associated with electronic prescription services.

- *Maintain Patient Information* - This is the Patient data services function, handling all functions associated with medical record services.
- *Provide User Interfaces* - This function provides the interface for the patients who will access the system and be able to review, edit, and manage their medical information online.

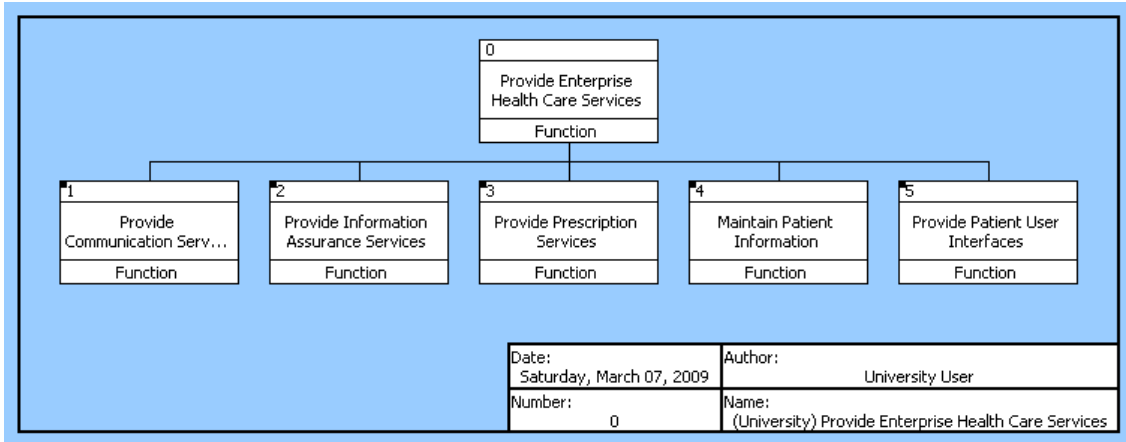


Figure 2 – Level 1 & 2 Functional Decomposition

3.5.1 Provide Communications Services

The Provide Communication Services Function is broken down further into levels 3-5. The Communication layer provides 2 basic communication functions, transferring Medical data, and managing alerts and reminders. The transfer of Medical data is further broken down into 3 functions:

- *Transferring Medical Data to Entities Outside the Mediprise:* This covers the scenario when a patient goes to a doctor or hospital that is not currently part of the Mediprise service, but instead of re-entering in all the medical history information, Mediprise will allow the patient to export the patient's records in a format that non-Mediprise entities can read.
- *Transferring Medical Data to a Mediprise Entity:* This covers one of the core services of Mediprise which is transferring data stored on the Mediprise servers to entities (Hospitals, Pharmacies, etc.) with the Mediprise service.
- *Transfer to Mediprise:* This covers the communication from Mediprise entities back up to the Mediprise servers, so that up-to-date data is always available on the Mediprise servers.

The communication layer also handles the issuing of alerts and reminders in whatever format a user has designated as the preferred method in their patient information.

The rest of the functional decomposition can be seen in Appendix II: Functional Decomposition. See Figure 25 – Level 3-5 Function Decomposition of Communications Service.

3.5.2 Provide Information Assurance Services

The Provide Information Assurance Function is broken down further into 3rd and 4th layers. The information assurance layer handles Confidentiality, Authenticity, Availability and Non-repudiation functions to ensure the data is secure, the user is the person they say they are, and the right people are given access to the right data. See Figure 26 – Level 3-4 Functional Decomposition of Information Assurance.

3.5.3 Provide Prescription Services

The Provide Prescription Services Function is broken down further into 3rd and 4th layers. This layer handles the Mediprise services associated with prescription management. This function updates and monitors existing prescriptions, checks for expiration or interaction issues as well as possible prescription abuse. See Figure 27 – Level 3-4 Functional Decomposition of Provide Prescription Services.

3.5.4 Maintain Patient Information

The Maintain Patient Information Function is broken down further into 3rd and 4th layers. This layer handles the Mediprise services associated with Patient Information Management. This consists of three main functions:

- *Maintain Patient Medical Records:* This covers the basic functions associated with creating and keeping a Mediprise Medical Records up to date. This function schedules and executes updates to the Mediprise Patient file, as well as creating a new Mediprise Record, and performing the internal data format conversion if necessary.
- *Maintain Patient Preferences:* This handles keeping track of a particular patient's preferred method of communication for alerts (email, page, text, etc), maintains the calendar of reminders like upcoming appointments or expiring prescriptions, and also maintains who has access to a particular patient record. (Guardians, family members, etc.)
- *Backup Patient Information:* This function creates a backup of all Mediprise Patient Information in the case of server failure or data loss.

See Figure 28 – Level 3-4 Functional Decomposition of Maintain Patient Information.

3.5.5 Provide Patient User Interfaces

The Provide Patient User Interfaces Function is broken down further into a third layer. This function gives the patient an interface in which to specify their alert method, add events to or view their calendar, view their Medical data, and update their information. See Figure 29 – Level 3 Function Decomposition of Provide Patient User Interfaces.

3.6 Stakeholder QFD Analysis

HouseCare performed a Quality Function Deployment (QFD) analysis of the top ranked stakeholder values against the functions developed from the Mediprise functional decomposition. The following chart shows the relationship between stakeholder needs and the identified characteristics of the proposed Mediprise system and classifies each to determine the level of correlation between the need, and the technical function. The House of Quality helped Housecare to ensure that our functions adequately met stakeholder needs. The QFD diagram can be seen in Appendix III: QFD Analysis.

3.7 Stakeholder Value Mapping

HouseCare developed a stakeholder value mapping from our problem statement all the way to our functional decomposition and morphological boxes. The Stakeholder Value Mapping diagram can be seen in Appendix IV: Stakeholder Value Mapping.

4 Systems Engineering Methodology

4.1 Project Development Process

The project development process for the HouseCare Mediprise project will follow a cyclical systems development process consisting of five phases. Each phase of the development process will include a set of tasks that need to be accomplished before that phase is completed. Once again, this process is cyclical and with each iteration of the process the HouseCare system will increase in maturity and gain functionality. In addition, with each iteration of the cycle the stakeholder analysis task, within the planning phase, will be revisited. This will ensure that our stakeholders, their wants, and needs are always kept up to date. The PDP can be seen in Figures 3 – 7.

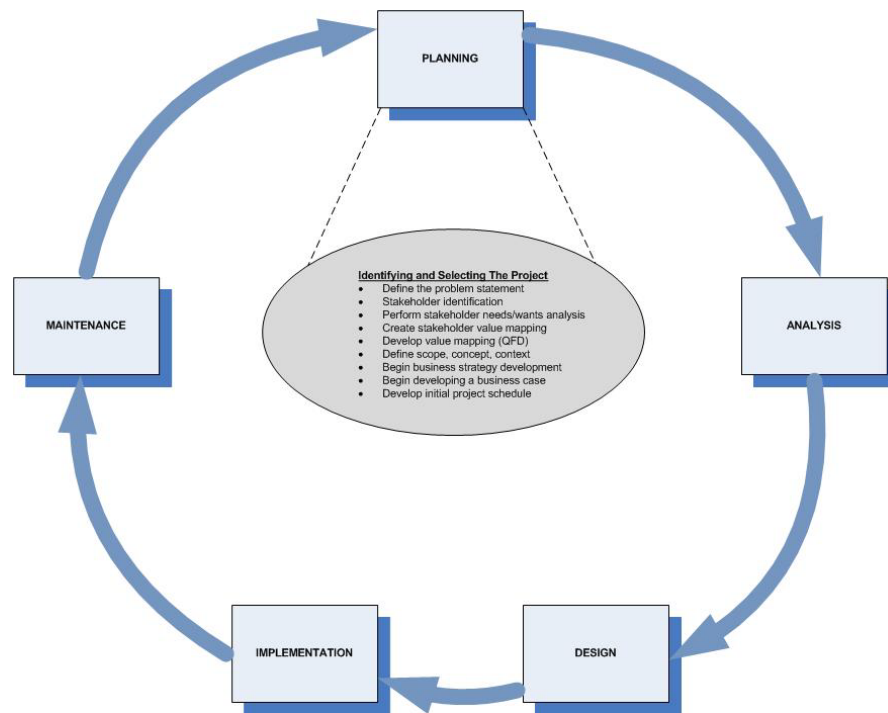


Figure 3 - PDP Planning Phase

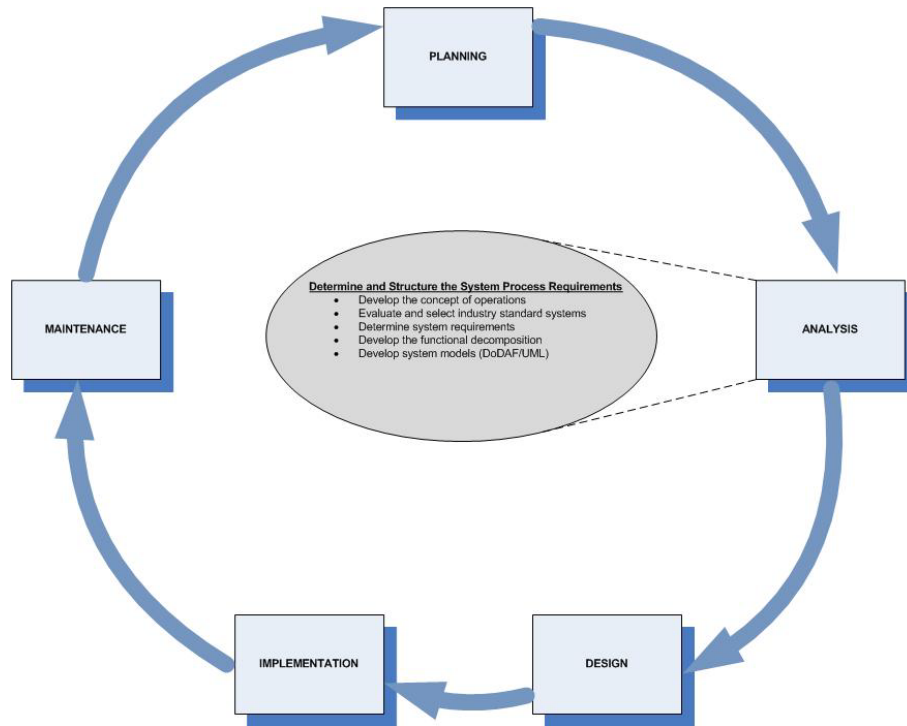


Figure 4 - PDP Analysis Phase

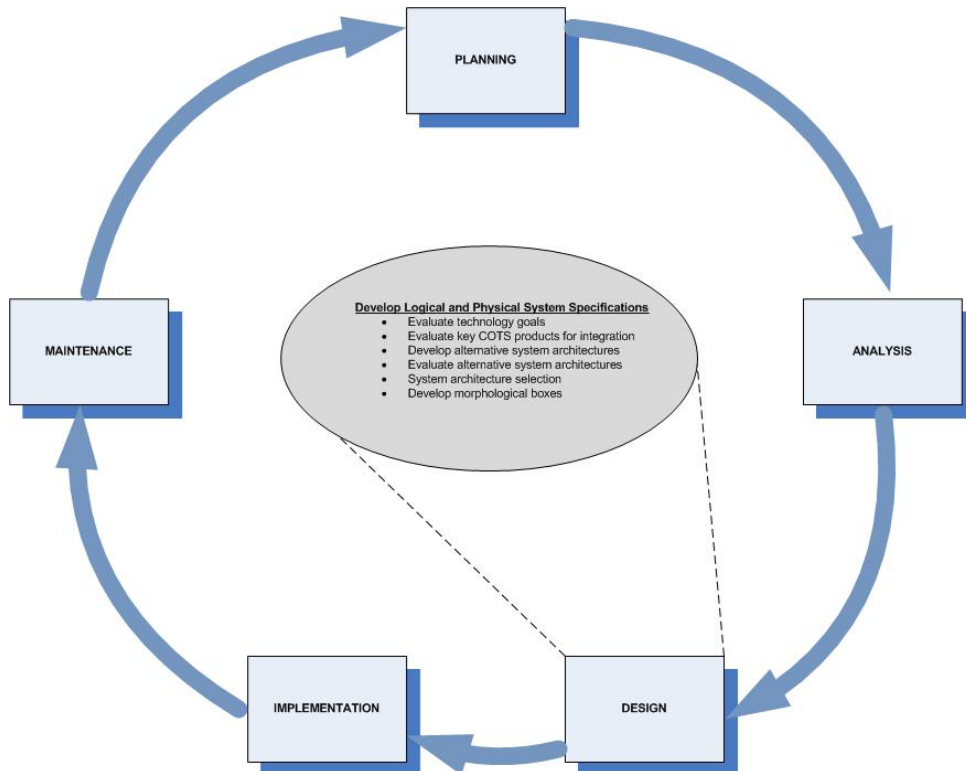


Figure 5 - PDP Design Phase

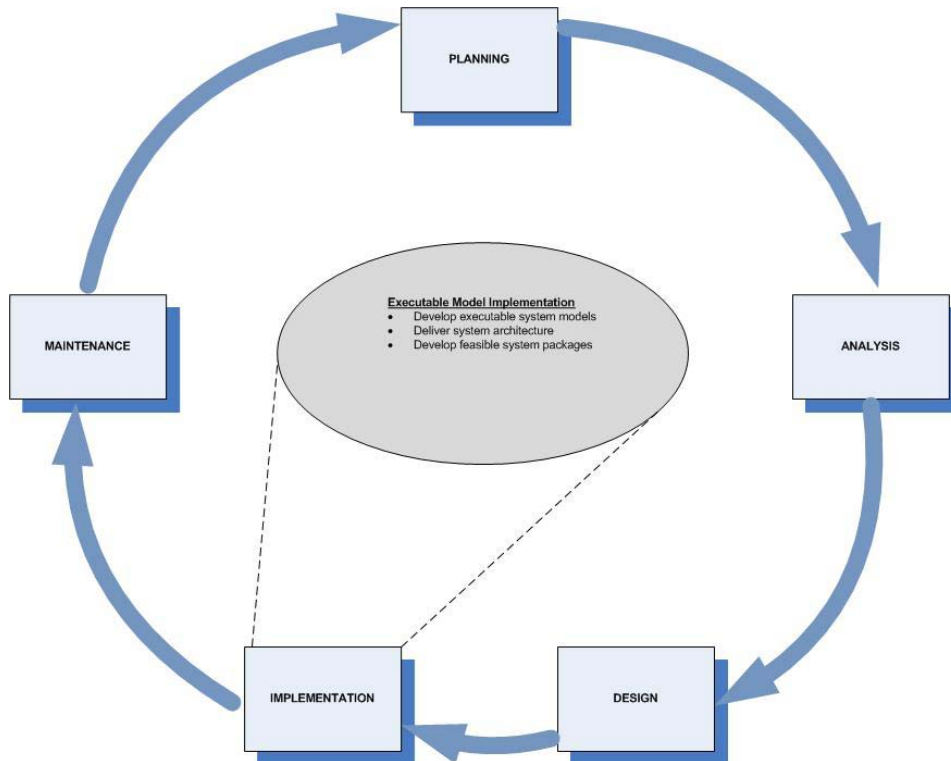


Figure 6 - PDP Implementation Phase

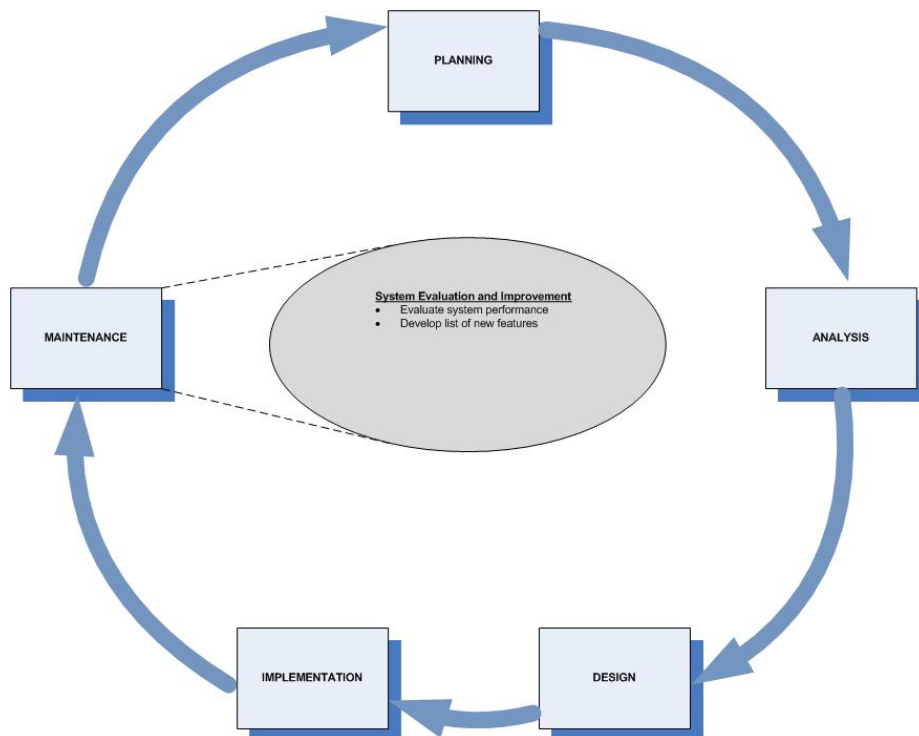


Figure 7 - PDP Maintenance Phase

4.2 Mediprise Parameter Diagram

The following Figure 8 shows the p-diagram describing the scope and context of the Mediprise system.

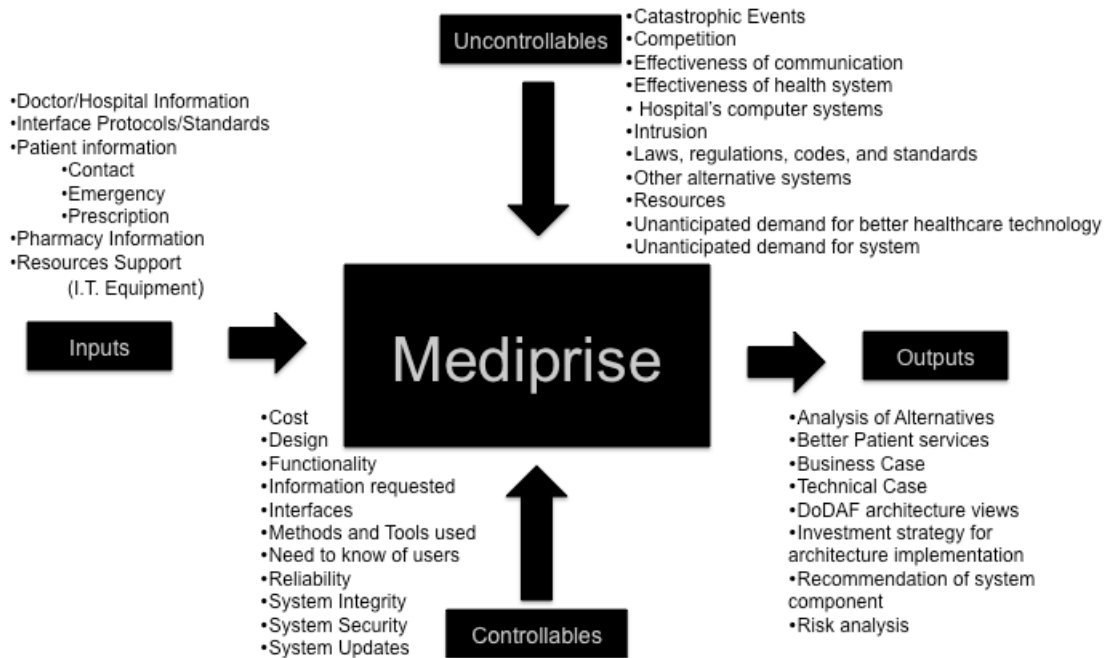


Figure 8 - P-Diagram

4.3 Architecture Evaluation

In identifying and choosing what architecture forms we would use for the Mediprise system, HouseCare used morphological boxes to rank form options by the following goals:

- Confidentiality
- Ease of Use
- Speed
- Efficiency
- Access
- Accuracy
- Use of Standards
- Cost
- Feasibility

For every mechanism, the different forms were identified and then ranked from 1 – 5, 5 being excellent, 1 being Poor, and 0 is used for goals which are Not Applicable.

Goals were also weighted so that goals that are more important get more consideration than others. In cases where more than one form was valid and the effort to implement the additional form was not significant, more than one form was chosen. For example, Mediprise will export in all 5 different formats identified versus only one. For the Mediprise systems, Confidentiality was ranked as the most important goal.

The Architecture Evaluation spreadsheet can be seen in Appendix V: Architecture Evaluation.

5 Technical Case

5.1 HouseCare Mediprise Operational Concept

Mediprise has several objectives:

- Provide Secure Electronic Access to Up-to-Date Medical History
- Provide Electronic Prescription Services
- Provide Healthcare Management Tools, Alerts and Reminder Services

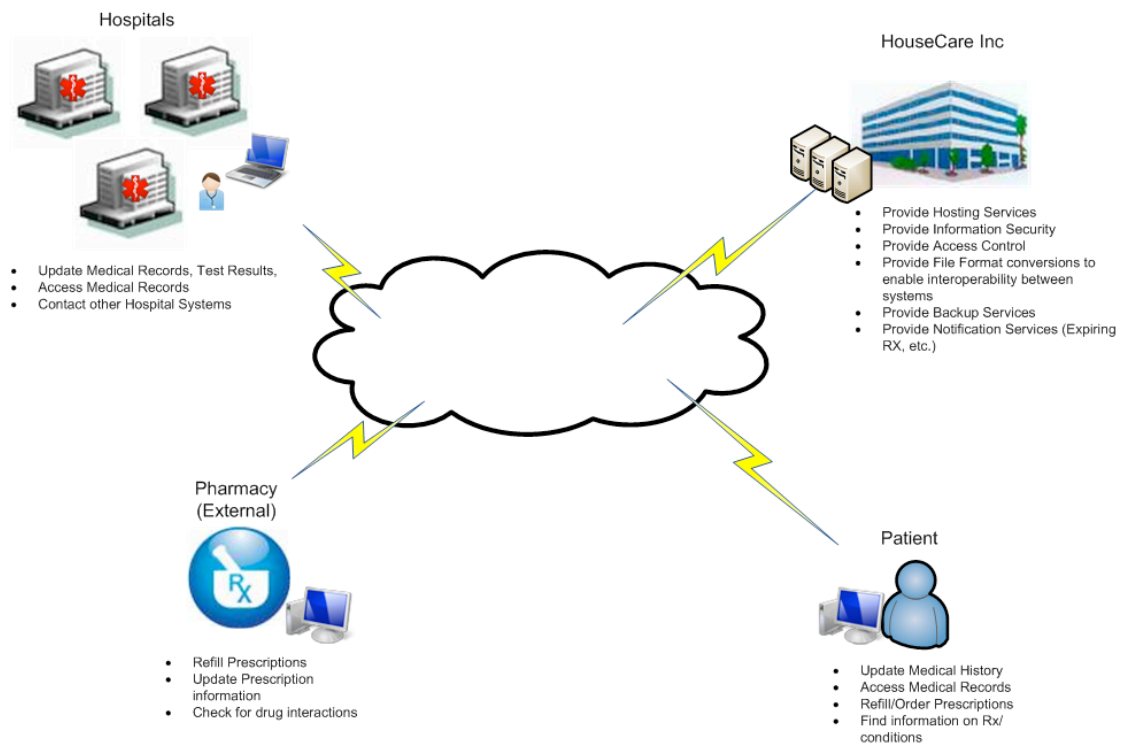


Figure 9 - Mediprise Operational Concept

The primary focus for HouseCare’s Mediprise is on providing enterprise wide solutions across hospitals that already use some form of Electronic Healthcare Records. As hospitals enroll in Mediprise, HouseCare will provide cross-enterprise access enabling different hospital systems to share information and facilitate

communication. Performing integration in this manner will provide an accomplishable solution for integrated electronic medical records, bringing patient's medical history and medical records across separate hospitals and hospital organizations. This in turn, provides the basis for HouseCare Mediprise's secondary focus of providing patients the ability to access parts of those records, to more effectively manage their healthcare and stay informed.

Currently, HouseCare is limited to providing solutions to hospitals that are currently utilizing systems that conform to industry standards such as Health Level 7 (HL7), ASTM International Continuity of Care Record (CCR), and ANSI X12 (EDI). HouseCare can provide recommendations for software solutions that meet these standards to hospitals that do not currently have systems that conform to these standards.

The Concept of Operations diagram can be seen in Figure 9.

5.1.1 Provide Secure Electronic Access to Medical History

Mediprise will provide secure access for patients, doctors, and nurses to a patient's medical history. Mediprise will be required to protect this sensitive data from unauthorized access while ensuring that authorized users can access it in a timely manner. Mediprise will also be required to comply with HIPAA regulations.

Mediprise can currently only be implemented in organizations that have implemented software solutions within the hospital that conform to HL7, ASTM International Continuity of Care Records (CCR), and ANSI X12 standards for Health Information Exchange (HIE). Mediprise will ensure medical records are encrypted locally as well as when transmitted over secure connections.

Hospital staff throughout the organization will have access to view and update patient records as required and authorized. Unlike traditional EHR systems, the Mediprise will provide hospitals not only with the patient's medical record, but also updates/changes that were made at any other Mediprise hospital system, ensuring up-to-date information on patients.

HouseCare will ensure patient records are regularly backed up to prevent any loss of data. HouseCare will also provide communication and data exchange tools for use between hospitals that utilize Mediprise, allowing doctors to collaborate and easily provide referrals across hospitals.

Patients will also be provided access to their records, as well as to records of consenting persons in the case of dependent care, spouses, etc. Users will be able to utilize Mediprise to review and to update pertinent medical history information in order to make more informed healthcare decisions. Mediprise will also enable a patient to export their records, in order to provide a detailed medical history to organizations that do not currently use Mediprise.

Several methods of patient identification could be used to authenticate identities and provide vital information in cases of emergency: a unique identifier, similar to a social security number, an RFID enabled device, or a smart card.

5.1.2 Provide Electronic Prescription Services

Mediprise will provide electronic access to prescriptions. Doctors can enter new prescriptions and refill prescriptions through Mediprise. Mediprise will perform validations against drug interaction information and alert the doctor in the event that a potential drug interaction may occur. The patient can then pick up the prescription from their preferred pharmacy (so long as that pharmacy conforms to the standards listed above) without having to bring a paper prescription. The pharmacy will receive the prescription electronically from Mediprise. If the patient's preferred pharmacy does not support standardized formats, the patient will be provided the option to print or receive a paper prescription or send an alert to the doctor in order for the prescription to be called into the pharmacy.

5.1.3 Provide Alerts and Reminder Services

Mediprise will provide various alerts and reminders for appointments, prescription expirations, or emergency alerts. Patients and doctors will be able to customize their preferred methods of receiving alerts and reminders and update their calendars of alerts and reminders. Doctors could also enter reminders for patients to receive preventive care. This will enable more seamless patient care as well as more effective preventive care. Mediprise will also provide customizable alerts associated with articles, information, or studies related to conditions or prescriptions associated with the patient's record.

5.2 System Requirements Specification

A Systems Requirement Specification (SRS) document was developed for the Mediprise systems to determine and document the specific functional and non-functional requirements for Mediprise. This document is appended to this report in its entirety in Appendix I: System Requirements Specification.

5.3 DODAF Diagrams

5.3.1 Intended Use

The intended use of the Mediprise architecture is to assess the feasibility of HouseCare's vision for providing integrated electronic medical records (EMR) between hospital systems. The Mediprise architecture will demonstrate the method for interoperability of currently disparate hospital systems. The goal is to assess the feasibility of the concept of operations for Mediprise and to demonstrate that Mediprise will be capable of securely transferring medical records between Mediprise and Mediprise hospital systems.

5.3.2 Scope

The Mediprise architecture diagrams depict the operational concept detailed in Section 5.1 HouseCare Mediprise Operational Concept. The architecture diagrams depict the To-Be architecture for Mediprise for Phase 1 of the HouseCare timeline

in which the initial Mediprise capability is delivered to hospitals with existing EMR systems in 2010.

5.3.3 Viewpoint

The viewpoint of the architecture is from the perspective of the Mediprise developers to aid in the development of Mediprise.

5.3.4 Architecture Artifacts

The architecture artifacts are located in Appendix VI: DoDAF Artifacts. HouseCare decided to utilize DoDAF views to document the architecture as most members were familiar with DoDAF. As DoDAF can be utilized with both structured analysis and object orientation, HouseCare determined that object orientation was the most ideal format for documenting Mediprise. Mediprise is a software development project with software services and interoperability between existing software products. Thus, object orientation and UML, which is widely used to document software design, and architecture is suited best to documenting the Mediprise architecture.

The DoDAF views were developed using the process described by Wagenhals and Levis in their “DoDAF Architecture Case Study.” Figure 10 depicts the six stages of the object-oriented process for DoDAF. HouseCare determined which views to develop based on the recommendation in DoDAF version 1.5 for interoperability architectures.

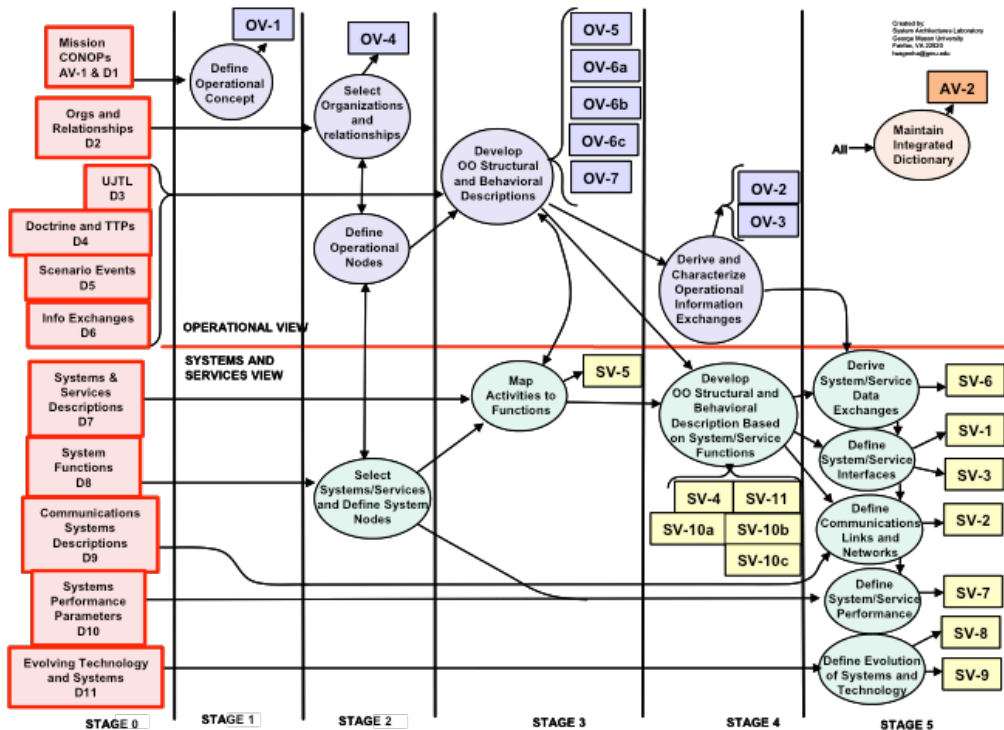


Figure 10 - Six Stages of DoDAF Process using Object Orientation[26]

The UML based DoDAF artifacts were developed using Sparx Enterprise Architect (EA). EA allowed all the UML artifacts across Operational and Systems views to be contained in a single file. Because all the UML diagrams were contained in a single file, maintaining concordance among the diagrams was provided automatically. EA also provided folders within which the views could be organized allowing intuitive navigation among views and diagrams. Figure 11 shows the organization HouseCare created within EA. Any diagrams not covered in UML were documented in Excel or Visio.

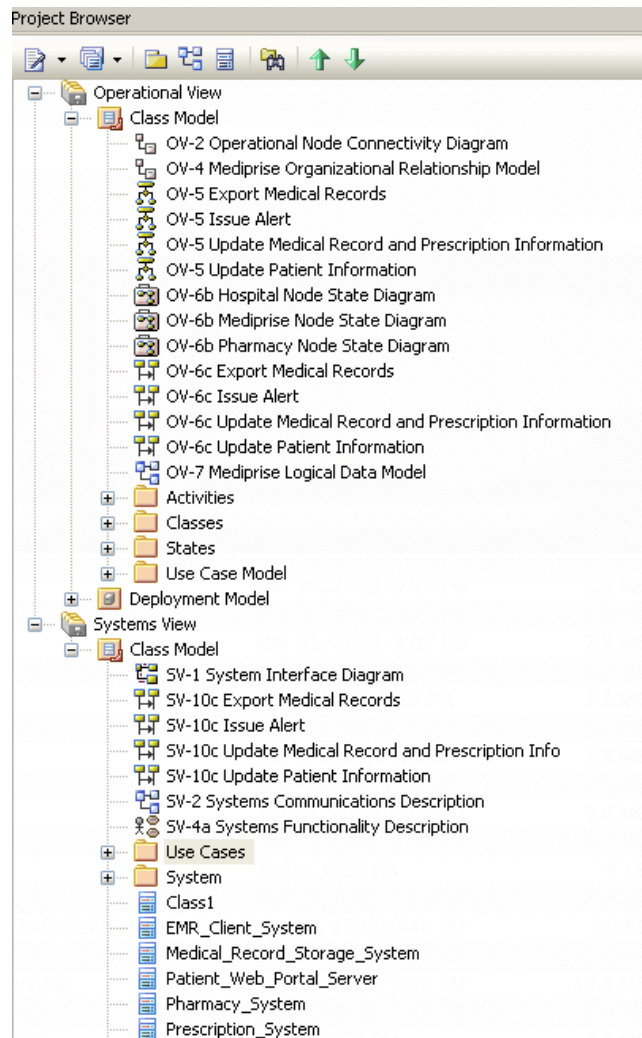


Figure 11 - Enterprise Architect Organization

5.4 Executable Architecture

An executable architecture was developed to aid in the verification of the Mediprise architecture and to simulate a scenario in which a patient goes to two different hospital systems and those systems are capable of retrieving the most current medical record from Mediprise. The executable architecture demonstrates the sending of prescriptions as well as determining drug interactions and alerting the

doctor when an interaction is detected. The executable architecture was developed using CPN Tools and can be found in Appendix X: Executable Architecture.

6 Business Case

6.1 Current Market

6.1.1 Hospital EMR

While the advantages of using electronic medical records are numerous, the adoption rate of such systems in hospitals is surprisingly low for reasons explained below. From a Healthcare Information and Management Systems Society (HIMSS) study conducted in 2008 (Figure 12), the percentage of US hospitals using some form of Healthcare IT services was calculated at only .3% of 5000 hospitals surveyed classified at Stage 7, meaning a complete paperless networked environment, while 15.6% had no automation of even basic services. [9] This leaves a significant amount of progress still needed in the implementation of Electronic Medical Record (EMR) Systems in the US Healthcare industry.

EMR Adoption Model SM			
Stage	Cumulative Capabilities	2007 Final	2008 Final
Stage 7	Medical record fully electronic; HCO able to contribute CCD as byproduct of EMR; Data warehousing in use	0.0%	0.3%
Stage 6	Physician documentation (structured templates), full CDSS (variance & compliance), full R-PACS	0.3%	0.5%
Stage 5	Closed loop medication administration	1.9%	2.5%
Stage 4	CPOE, CDSS (clinical protocols)	2.2%	2.5%
Stage 3	Clinical documentation (flow sheets), CDSS (error checking), PACS available outside Radiology	25.1%	35.7%
Stage 2	Clinical Data Repository, Controlled Medical Vocabulary, Clinical Decision Support, may have Document Imaging	37.2%	31.4%
Stage 1	Ancillaries – Lab, Rad, Pharmacy – All Installed	14.0%	11.5%
Stage 0	All Three Ancillaries Not Installed	19.3%	15.6%
Total Hospitals		n = 5073	n = 5166

Data from HIMSS Analytics Database N = 5073/5166 ©2009 HIMSS Analytics

Figure 12 – 2007/2008 Adoption Rates [9]

Some of the reasons for the delay in EMR adoption are:

- **Lack of Standards:** No national standard exists dictating the format or taxonomy associated with Electronic Medical Records, making interoperability difficult.
- **Cost:** Implementing EMRs can be costly. One study found that initial costs of EMR systems for a Solo/Small Group Practice are over \$40,000 with an annual

upkeep of \$8000. [11] These costs are almost entirely the hospital or physicians responsibility.

- *Privacy:* Securing Sensitive medical data is a large concern, and sufficient steps must be taken to secure data and prevent unauthorized access in order to make a true interoperable EMR network possible.

HouseCare believes that with renewed focus on overcoming these challenges, the goal of fully computerized medical records within five years is achievable, and that HouseCare can play a part in meeting that goal. With \$19 billion of 2009 stimulus money going towards Health IT efforts, HouseCare feels it can make an impact in the healthcare industry, providing an architecture to allow for interoperability of existing EMR systems to enhance the ability for EMRs to reduce costs over time, reduce medical errors, and improve patient care over all.

According to the American Hospital Association (AHA), there are currently 5,708 registered U.S. Hospitals.[19] Figure 13 below outlines the breakdown of those hospitals by type.

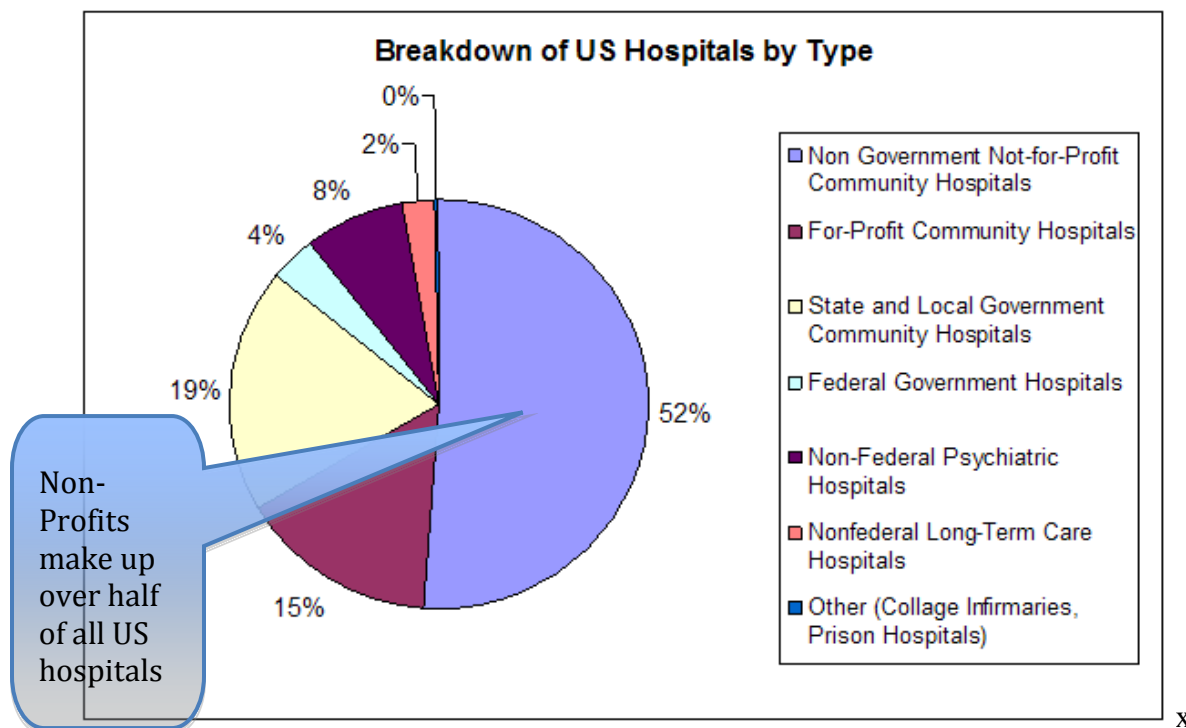


Figure 13 - Breakdown of US Hospitals by Type

As shown above, over half of US hospitals are not-for-profit community hospitals, which means they are organized as a non-profit organization and are therefore tax exempt, can operate at lower cost than their for-profit counterparts, and typically are educational and research centers with large budgets dedicated to cutting edge research and health innovations. For example, the Cleveland Clinic's total research budget from both internal and external sources was \$255.9 million in 2007: \$159

million from grants and contract revenue, and \$96.9 million from federal funding alone. [20] These Not-for-Profit organizations also have developed and maintained some of the most sophisticated EMR systems in the US. Of the 19 hospitals listed by US News and Reports as achieving Honor Roll status, all 19 are not-for-profit research and teaching hospitals and 12 are confirmed to be currently operating an EMR system. [21]

It is Healthcare's intent to focus our initial Mediprise deliverable to this category of hospital, leveraging their existing EMR systems, and enhancing their existing capabilities. Doing this has several advantages:

- *Cost to Implement:* The cost of implementing the Mediprise service will be lower for these customers, since the local EMR application will already be in place, and Mediprise is a service application that interfaces with the existing application. These hospitals also have substantial budgets, tax-exempt status, and therefore more money at their disposal for funding interoperability services.
- *Federal Government Initiatives:* These institutes also have the greatest incentive to quickly achieve interoperability with other hospitals. As noted above, they receive large amounts of money directly from the federal government, and it is a federal government initiative to make all US healthcare providers adopt electronic medical records and be interoperable. According to Ashish k. Jhu MD MPH from the Harvard School of Public Health in Boston, "Methods to speed the adoption of health information technology have received bipartisan support among U.S. policymakers, and the American Recovery and Reinvestment Act of 2009 has made the promotion of a national, interoperable health information system a priority." [22]
- *Secondary Use:* Grant and Research funding also plays a role. The use of medical records for epidemiology, long-term drug effects or other research studies also accounts for a substantial portion of large not-for-profit hospital budgets. Gaining access to additional records for what is termed 'secondary use' would potentially help these institutions in increasing funding for these studies as well as improve the quality/quantity of data available. Since the Mediprise will automatically handle confidentiality issues by removing private data protected by HIPAA, Hospitals will be able to access these records quickly, legally, and securely.

6.1.2 Competition

There are currently several efforts underway to address interoperability among EMR systems. HouseCare intends to handle the threat of competing efforts by beating the competition to market, providing interoperability among several standards and providing a low cost solution that does not interfere with a hospital's current operating procedures and information systems. Because HouseCare is utilizing a spiral development process, updates and additional capabilities will regularly available to existing Mediprise customers.

6.1.3 Patient Portal

Currently, the ability for individuals to access and update their medical records online is extremely limited. While some of the larger Hospital systems provide a portal for patients to enter medical history information, make appointments, etc., the information is specific to that hospital system and not accessible to outside entities. The advantages of providing patients with an internet accessible portal to view and review their health records are that patients will be more educated on their state of health, medical histories will be more complete and consistent, and patients will be more empowered to make better or more informed healthcare decisions.

With the implementation of the Mediprise, individuals will be able to access, view, and edit their medical records to any Mediprise entity. Mediprise will also support exporting medical records to a variety of file formats in order to simplify transferring records to a non-Mediprise entity.

6.2 Market Introduction Approach

One of the biggest challenges of implementing the Mediprise successfully is that the value to hospitals and healthcare providers is directly proportional to the number of entities that subscribe to the service. Therefore the market introduction approach is critical since HouseCare must secure a sufficient number of customers to provide value. Maximizing early adoption of the Mediprise service is a priority. In this vein, HouseCare will initially provide Mediprise as a relatively low-cost subscription service to a research not-for-profit hospital. The Mediprise Patient Portal will be a free service to registered patients, and to generate revenue, HouseCare will ask patients when registering if they wish to receive email notifications of items of interest, including advertisements. Patients will be able to opt out of this service if indicated. As technical capabilities are developed, HouseCare will evaluate which capabilities and core competencies can be considered intellectual property to protect HouseCare's investment. HouseCare will also work closely with Certification Commission for Healthcare Information Technology (CCHIT) to ensure that Mediprise is CCHIT certified.

6.3 Roadmap

Figure 14 shows the Healthcare Mediprise Roadmap for 2009 – 2018.

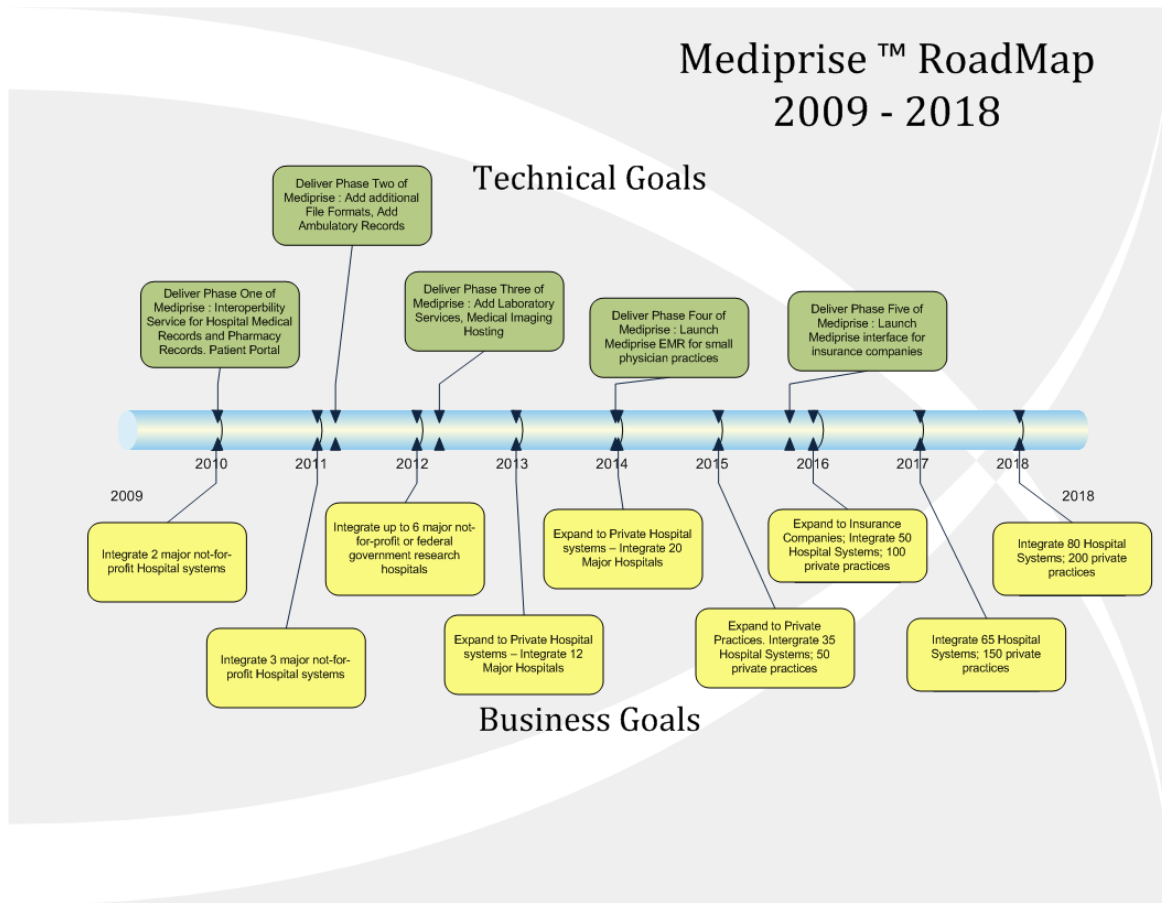


Figure 14 – HouseCare 10 Year Roadmap

6.3.1 Technology Goals

Mediprise v1.0: This is the initial release of the Mediprise service. Mediprise 1.0 will provide hospitals and pharmacies with a service to communicate with other Mediprise entities to retrieve up-to-date medical records. Mediprise will initially support interoperability for three major EMR standards: ANSI X12, HL7, and ASTM CCR. HouseCare chose these standards to implement first as they are widely accepted and used. They are all also CCHIT approved. Mediprise 1.0 will also deliver a free patient portal for patients to view, edit, and export portions of their medical records. Expected Launch date for Mediprise 1.0 is 1QFY2010.

Mediprise v2.0: This is the second major release of the Mediprise service. Mediprise 2.0 will expand its services to additional EMR standards as well as to ambulatory records. Expected Launch date for Mediprise 2.0 is 1QFY2011.

Mediprise v3.0: This is the third major release of the Mediprise service. Mediprise 3.0 will expand its services to laboratory records as well as to medical imaging. Expected Launch date for Mediprise 3.0 is 1QFY2012.

Mediprise v4.0: This is the fourth major release of the Mediprise service. Mediprise

4.0 will focus on bringing smaller physician offices into the Mediprise network. Mediprise will launch their own low cost EMR service tailored for small offices that can't afford the traditional EMR services. Expected Launch date for Mediprise 4.0 is 1QFY2014.

Mediprise v5.0: This is the fifth major release of the Mediprise service. Mediprise 5.0 will launch a service to help streamline insurance claim processing for Mediprise entities. Expected Launch date for Mediprise 5.0 is 4QFY2015.

6.3.2 Business Goals

4QFY2010: By the close of FY2010, Mediprise will integrate no less than 2 not-for-profit research hospital systems.

4QFY2011: By the close of FY2011, Mediprise will integrate no less than 3 not-for-profit research hospital systems.

4QFY2012: By the close of FY2012, Mediprise will integrate no less than 6 not-for-profit or government hospital systems.

4QFY2013: By the close of FY2013, Mediprise will integrate no less than 12 not-for-profit, government, or private hospital systems.

4QFY2014: By the close of FY2014, Mediprise will integrate no less than three 20 not-for-profit research hospital systems.

4QFY2015: By the close of FY2015, Mediprise will integrate no less than 35 hospital systems and 50 private practices.

4QFY2016: By the close of FY2016, Mediprise will integrate no less than 50 hospital systems, 100 private practices.

4QFY2017: By the close of FY2017, Mediprise will integrate no less than 65 hospital systems, 150 private practices.

4QFY2018: By the close of FY2018, Mediprise will integrate no less than 80 hospital systems, 200 private practices, and provide seamless interfacing with 2 major health insurance providers.

6.4 Supporting System-Life Cycle

The lifecycle HouseCare will use to execute and manage the Mediprise Product Development will be a modified Spiral, since this is a large, fairly complex system with easily identifiable interim deliverables.

6.5 Cost and NPV Analysis

6.5.1 Function Point Analysis

In order to determine the estimated number of developers needed to develop the initial Mediprise v1.0 deliverable and meet the goal of an approximately 15 month schedule, HouseCare will use COCOMO II to do a function point analysis. The

detailed numbers used for the analysis are located in Appendix VII: Function Point Analysis Values, but in short, a Median SLOC value of 24,916 was calculated. Using a monthly labor rate of \$7000 per person (based on an \$80,000 yearly salary) and a short schedule, COCOMO II calculated that the Most Likely schedule will take 16.8 months with a staff of 12.5. The cost estimate was calculated to be \$1,406,562 to develop the Mediprise software. [25] This validates that our original goal of a 1QFY10 delivery is feasible, but it will require a development staff of at least 12.5 coders.

6.5.2 Assumptions

In developing a Cost Analysis for HouseCare's Mediprise system, we made several assumptions to determine our estimations. We assumed that HouseCare will start out as an approximately 20-person company, increasing over the 10-year period. This allows for a 12.5 person development team with 7.5 FTEs working on business development, advertising, sales, etc. We also assumed that we would be renting a space using the base price of \$20/sq foot to estimate rental costs. Initial Capital Expenses for furnishing the office and initial set-up will be depreciated. Furniture is depreciated over 10 years, and computer and servers, are replaced every 3 years. In calculating the discount rate for the Net Present Value (NPV) analysis, HouseCare used a discount rate of 20% to account for the moderate risk associated with this project. We are also assuming that we get the full 2009-year to start the company in order to meet our technological and business goals.

6.5.3 Baseline Case Cost Analysis

In the Baseline Case, HouseCare is pursuing an aggressive growth goal of reaching over 100 employees by close of FY2018, and 121,000 healthcare provider users, while maintaining a small price point. Average salary of the HouseCare employees is set at \$80,000, and there are three identified sources of cash inflow for Mediprise: Small Business Loan, Revenue from selling Mediprise to Hospitals or starting in 2015, the Mediprise EMR for Small Doctors Offices, and Revenue from advertising from the Mediprise Patient Portal.

The Small Business Loan is assumed to be a \$750,000 loan with a 5% interest over a 30-year repayment period.

Mediprise is a constantly changing networked service. As such it made sense that a subscription price model be used, based on the number of physicians in a hospital.

Revenues from Hospital businesses will come from the One-Time Set-Up fee, and then from ongoing monthly subscriptions. It is assumed that on average, hospitals have 1500 physicians, and small doctor's offices have 5 physicians. Using these assumptions in conjunction with the business goals, revenue was initially set on a per user basis using the following low-cost baseline pricing structure:

Set-Up Costs per Physician	\$200
Monthly Subscription fees per Physician	\$25

This means that, in the first year, a large hospital would spend \$1,050,000 the first year and \$750,000 in subsequent years on the Mediprise Service.

Revenue from the Patient Portal web advertising will be from a Cost-per-Click system. HouseCare will charge \$.75 per click in the baseline case.

Table 3 shows the detailed Breakdown of the Cash Inflow sources over the next 10 years based on these assumptions:

Fiscal Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cash Inflow (Detail)										
Small Business Loan										
Loan Amount	750000									
Mediprise Revenue										
Expected Number of Major Hospitals	0	2	3	6	12	20	35	50	65	80
Expected Number of Small Doctors Offices	0	0	0	0	0	0	50	100	150	200
Expected Number of Users	0	3000	4500	9000	18000	30000	52750	75500	98250	121000
Set Up Costs per Physician	200	200	200	200	200	200	200	200	200	200
Subscription Fee per Physician	25	25	25	25	25	25	25	25	25	25
Revenue from Set Up		\$600,000	\$900,000	\$900,000	\$1,800,000	\$2,400,000	\$4,550,000	\$4,550,000	\$4,550,000	\$4,550,000
Revenue from Subscription		\$900,000	\$1,350,000	\$2,700,000	\$5,400,000	\$9,000,000	\$15,825,000	\$22,650,000	\$29,475,000	\$36,300,000
Revenue from Hospitals	\$0	\$1,500,000	\$2,250,000	\$3,600,000	\$7,200,000	\$11,400,000	\$20,375,000	\$27,200,000	\$34,025,000	\$40,850,000
Advertising Revenue										
Expected Number of patients on Portal		200000	300000	600000	1200000	2000000	3550000	5100000	6650000	8200000
Expected Number of Patients Ad Clicks		3	3	3	3	3	3	3	3	3
Pay-for-Click Price		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Revenue from Advertising		\$450,000	\$675,000	\$1,350,000	\$2,700,000	\$4,500,000	\$7,987,500	\$11,475,000	\$14,962,500	\$18,450,000
Gross Margin	\$750,000	\$1,950,000	\$2,925,000	\$4,950,000	\$9,900,000	\$15,900,000	\$28,362,500	\$38,675,000	\$48,987,500	\$59,300,000
Assumptions										
Avg # of physicians/hospital		1500								
Avg # of physicians/doctors office		5								
Expected Number of Patients Ad Clicks		3								
Setup Costs Per Physician		200								
Subscription Fee per Physician		25								

Table 3 – Baseline Cash Inflow

Using these estimated cash inflow figures, the following 10 year cost estimate analysis was developed for the baseline case (Table 4).

Fiscal Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sales										
Other Income (Loans, etc)	\$750,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from Hospitals	\$0	\$1,500,000	\$2,250,000	\$3,600,000	\$7,200,000	\$11,400,000	\$20,375,000	\$27,200,000	\$34,025,000	\$40,850,000
Revenue from Advertising	\$0	\$450,000	\$675,000	\$1,350,000	\$2,700,000	\$4,500,000	\$7,987,500	\$11,475,000	\$14,962,500	\$18,450,000
Gross Margin	\$750,000	\$1,950,000	\$2,925,000	\$4,950,000	\$9,900,000	\$15,900,000	\$28,362,500	\$38,675,000	\$48,987,500	\$59,300,000
Assumptions										
Average Base Salary	80000	80000	83200	86528	89989	93589	97332	101226	105276	109486
Estimated Workforce Size	20	25	30	40	50	60	70	80	110	120
Operating Expenses										
Salary (Office & Overhead)	\$1,600,000	\$2,000,000	\$2,496,000	\$3,461,120	\$4,499,456	\$5,615,321	\$6,813,256	\$9,110,297	\$11,580,200	\$13,138,263
Payroll (taxes etc.)	\$320,000	\$400,000	\$499,200	\$692,224	\$899,891	\$1,123,064	\$1,362,651	\$1,822,059	\$2,316,040	\$2,627,653
Outside Services	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Supplies (off and operation)	\$5,000	\$5,300	\$5,618	\$5,955	\$6,312	\$6,691	\$7,093	\$7,518	\$7,969	\$8,447
Repairs/ Maintenance	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Advertising	\$300,000	\$250,000	\$250,000	\$250,000	\$250,000	\$300,000	\$250,000	\$200,000	\$200,000	\$200,000
Car, Delivery and Travel	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Accounting and Legal	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Rent	\$50,000	\$50,000	\$50,000	\$50,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Telephone	\$3,600	\$3,708	\$3,819	\$3,934	\$4,052	\$4,173	\$4,299	\$4,428	\$4,560	\$4,697
Utilities	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200
Insurance	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
Taxes (real estate etc.)	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
Loan Payments	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398
Depreciation	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Servers/Hardware	\$100,000	\$0	\$0	\$100,000	\$0	\$0	\$100,000	\$0	\$0	\$10,000
Other expense (specify)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Expenses	\$2,624,198	\$2,854,606	\$3,450,236	\$4,708,831	\$5,905,310	\$7,294,848	\$8,782,897	\$11,389,900	\$14,354,367	\$16,224,658
Net Profit Before Tax	(\$1,774,198)	(\$904,606)	(\$525,236)	\$241,169	\$3,994,690	\$8,605,152	\$19,579,603	\$27,285,100	\$34,633,133	\$43,075,342
Income Taxes	(\$620,969)	(\$316,612)	(\$183,832)	\$84,409	\$1,398,142	\$3,011,803	\$6,852,861	\$9,549,785	\$12,121,596	\$15,076,370
Net Profit After Tax	(\$1,153,229)	(\$587,994)	(\$341,403)	\$156,760	\$2,596,549	\$5,593,349	\$12,726,742	\$17,735,315	\$22,511,536	\$27,998,972
Baseline Yearly Net Cash	(\$1,153,229)	(\$587,994)	(\$341,403)	\$156,760	\$2,596,549	\$5,593,349	\$12,726,742	\$17,735,315	\$22,511,536	\$27,998,972
Baseline Cumulative Cashflow	(\$1,153,229)	(\$1,741,223)	(\$2,082,626)	(\$1,925,866)	\$670,682	\$6,264,031	\$18,990,773	\$36,726,088	\$59,237,624	\$87,236,596
Cumulative NPV	(\$1,153,229)	(\$1,643,224)	(\$1,880,309)	(\$1,789,592)	(\$289,368)	\$1,710,443	\$5,972,603	\$10,922,204	\$16,157,668	\$21,584,056

Table 4 – Baseline Cash Analysis

From the results above, it is easy to see that a negative NPV is maintained up until year 6 of the project. Figure 15 below shows the yearly cash flow, cumulative NPV and cumulative cash flow. This shows that after 10 years, HouseCare predicts that the Cumulative NPV value for the Mediprise system is approximately \$28,000,000 for the Baseline business case.

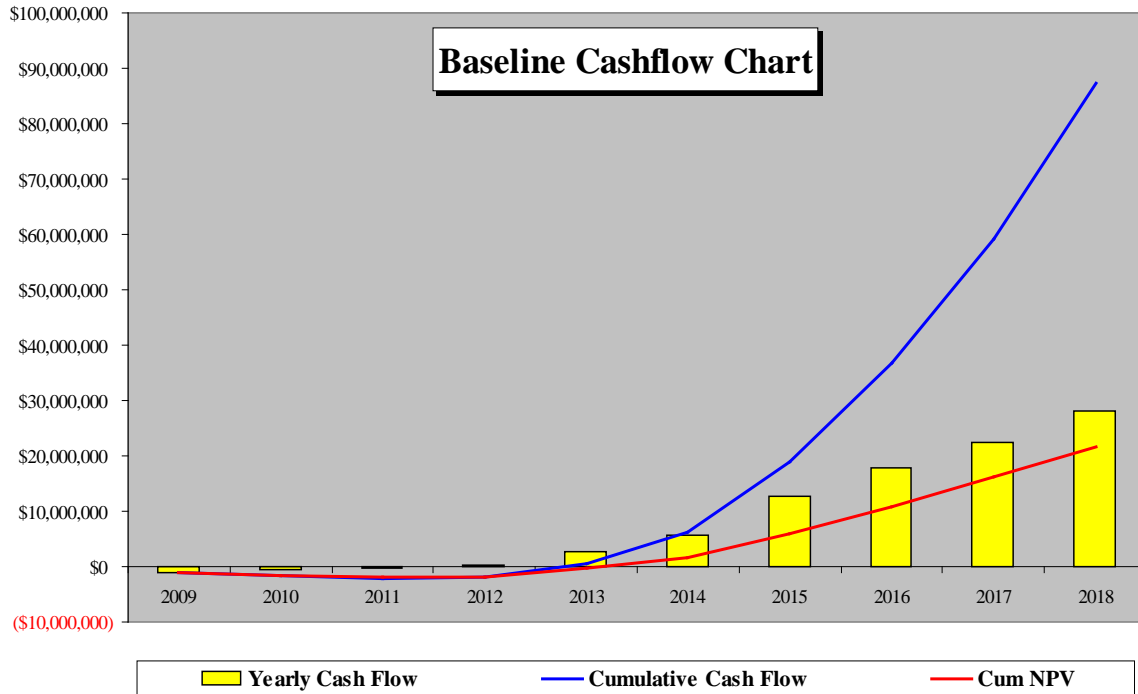


Figure 15 – Mediprise Baseline Cash flow 2009-2018

Using the Oracle tool Crystal Ball [24], a Monte Carlo simulation was run to determine the likelihood of a negative NPV after the first 10 years by identifying which values are uncertain and specifying the probability distribution and range of those variables. HouseCare chose to use a Monte Carlo to ensure randomness and independence between runs. HouseCare chose to use 1000 runs as that seemed sufficient.

In Tables 3 and 4, cells that are highlighted in green are assumptions in which a range of values is possible. The other ability of Crystal Ball is to designate decision points. Data points identified as decision points have a range of uncertainty, but one that HouseCare has some control over. For our simulation, our price points, loan amount, and initial average base salary are all aspects that are variable based on our goals, but also controllable. These cells are highlighted in yellow.

To see a full report of the assumptions and their probability distributions, see Appendix VIII: Cost Analysis Assumptions Data – Baseline.

Figure 16 shows the results of the Crystal Ball simulation:

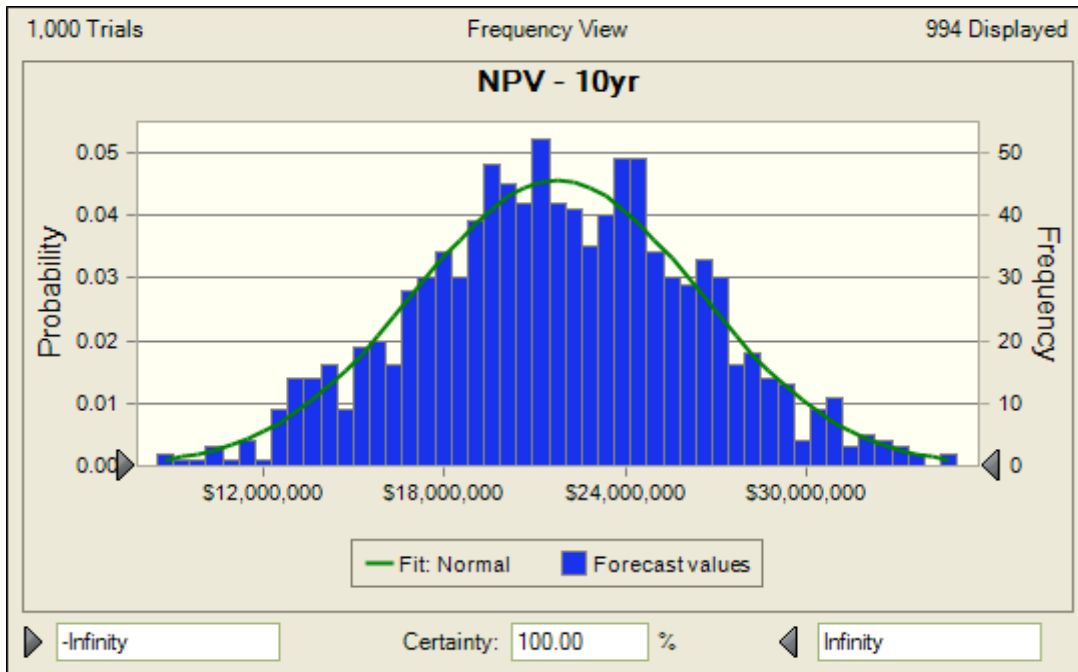


Figure 16 - 10 Year NPV Monte Carlo Simulation Histogram

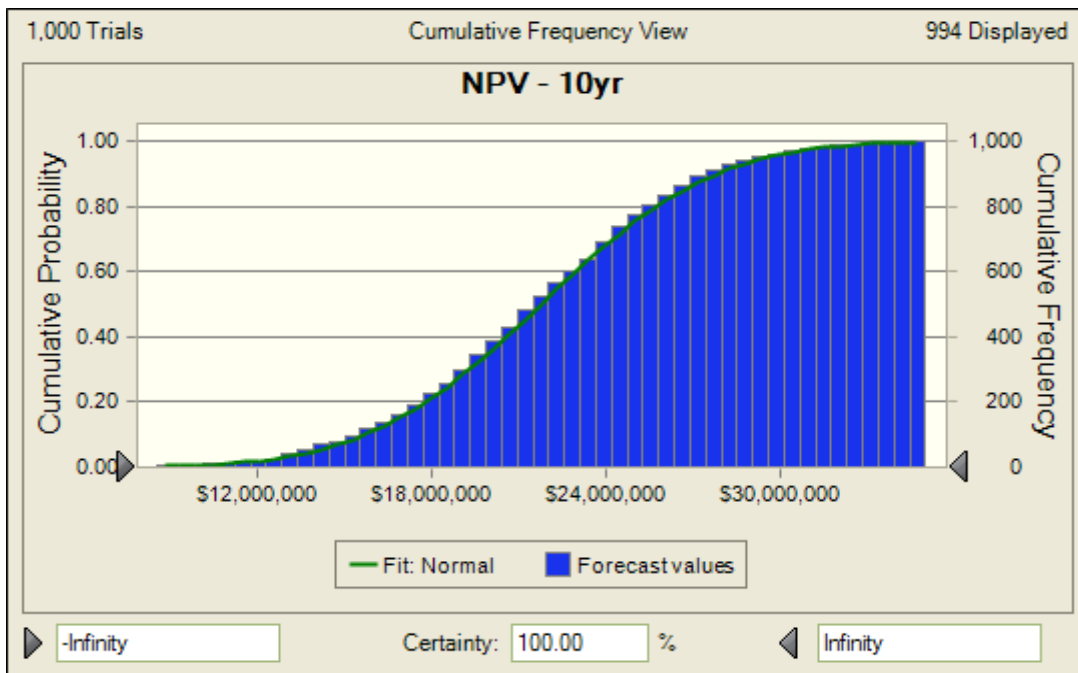


Figure 17 - 10 Year NPV Cumulative Distribution

Running the simulation shows that there is a 0% probability that after ten years, HouseCare will have a negative NPV based on this baseline cost model (Figure 17). However, HouseCare doesn't begin to see a profit until Year 6, and in most cases, new businesses need to show a profit within the first 2-3 years. The cost model needs to be modified in order to achieve this goal.

Looking at the results of the Sensitivity Analysis (Figure 18) in Crystal Reports, the top 5 variables that have the biggest impact on the 10-year NPV value are the expected number of ad clicks per patient, the average number of physicians per hospital, and the expected number of hospitals in the Mediprise system in years 2018, 2017, and 2015.

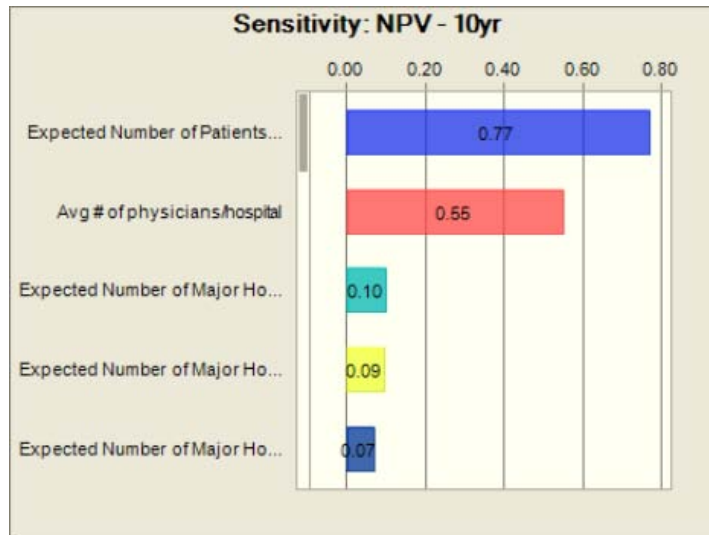


Figure 18 – Sensitivity (10 year Cumulative NPV)

The Tornado Diagram (Figure 19) shows the top 5 variables and their potential impact on the NPV, depending on their value. What this shows is by far, the adjustment of the monthly subscription fee per physician will have the largest impact to the NPV, followed up by the average or expected number of ads a patient will click on from the patient portal.

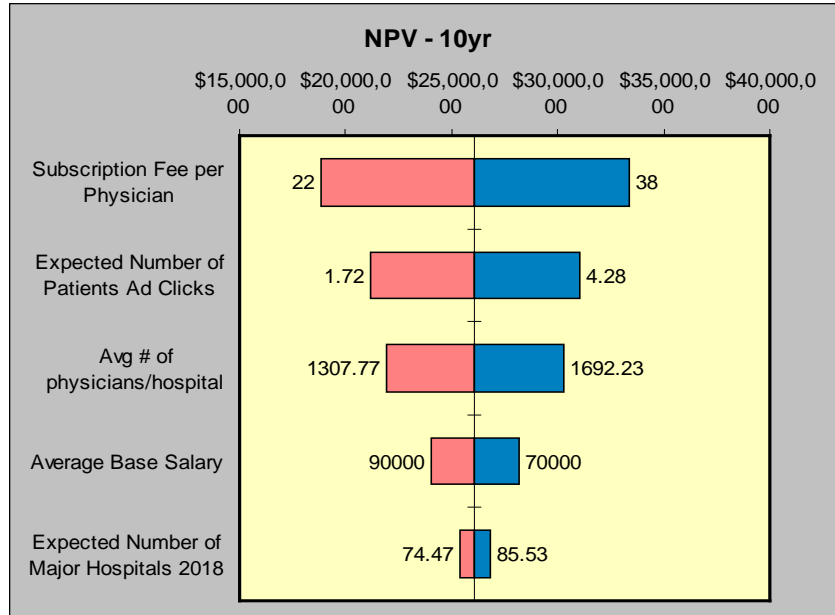


Figure 19 – Tornado Diagram (10 year Cumulative NPV)

6.5.4 Modified Case Cost Analysis

In order to achieve a positive cumulative NPV within the first 2-3 years of establishing HouseCare, we looked at the Tornado Diagram from the analysis from the baseline case and saw that the monthly subscription fee has the largest impact on NPV. In order to raise our cumulative NPV in the first years of operating the business, HouseCare will have to raise the price point. In the modified Cost analysis, HouseCare will keep the initial Set-Up fees to \$200/physician, and raise the monthly subscription to \$40. However, HouseCare will begin to drop pricing on both within 4 years, and continue to drop prices to customers. In doing this, HouseCare hopes to increase the likelihood of a solid financial foundation in the early years, but give incentives to our customers to stay with the service. Figure 20 outlines the Pricing structure over the first 10 years of HouseCare.

Housecare also altered the assumption and distributions of the variables to make it more likely that we would fall below our projected business goals in order to make the simulation results more realistic. To see a full report of the assumptions and their probability distributions, see Appendix IX: Cost Analysis Assumptions Data – Modified.

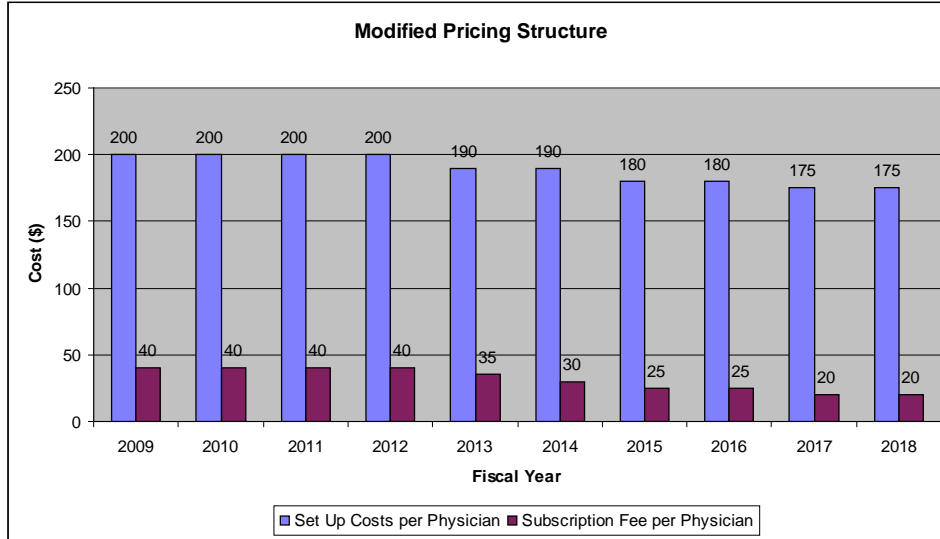


Figure 20 – Modified Pricing Structure

Table 5 shows the detailed Breakdown of the Cash Inflow sources over the next 10 years based on these assumptions:

Table 5 - Modified Cash Inflow

Fiscal Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cash Inflow (Detail)										
Small Business Loan										
Loan Amount	750000									
Mediprise Revenue										
Expected Number of Major Hospitals	0	2	3	6	12	20	35	50	65	80
Expected Number of Small Doctors Offices	0	0	0	0	0	0	50	100	150	200
Expected Number of Users	0	3000	4500	9000	18000	30000	52750	75500	98250	121000
Set Up Costs per Physician	200	200	200	200	190	190	180	180	175	175
Subscription Fee per Physician	40	40	40	40	35	30	25	25	20	20
Revenue from Set Up		\$600,000	\$900,000	\$900,000	\$1,710,000	\$2,280,000	\$4,095,000	\$4,095,000	\$3,981,250	\$3,981,250
Revenue from Subscription		\$1,440,000	\$2,160,000	\$4,320,000	\$7,560,000	\$10,800,000	\$15,825,000	\$22,650,000	\$23,580,000	\$29,040,000
Revenue from Hospitals	\$0	\$2,040,000	\$3,060,000	\$5,220,000	\$9,270,000	\$13,080,000	\$19,920,000	\$26,745,000	\$27,561,250	\$33,021,250
Advertising Revenue										
Expected Number of patients on Portal		200000	300000	600000	1200000	2000000	3550000	5100000	6650000	8200000
Expected Number of Patients Ad Clicks		3	3	3	3	3	3	3	3	3
Pay-for-Click Price		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Revenue from Advertising		\$450,000	\$675,000	\$1,350,000	\$2,700,000	\$4,500,000	\$7,987,500	\$11,475,000	\$14,962,500	\$18,450,000
Gross Margin	\$750,000	\$2,490,000	\$3,735,000	\$6,570,000	\$11,970,000	\$17,580,000	\$27,907,500	\$38,220,000	\$42,523,750	\$51,471,250
Assumptions										
Avg # of physicians/hospital		1500								
Avg # of physicians/doctors office		5								
Expected Number of Patients Ad Clicks		3								

Using these estimated cash inflow figures, the following 10 year cost estimate analysis was developed for the modified case (Table 6).

Table 6 - Modified Cash Analysis

Fiscal Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sales										
Other Income (Loans, etc)	\$750,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from Hospitals	\$0	\$2,040,000	\$3,060,000	\$5,220,000	\$9,270,000	\$13,080,000	\$19,920,000	\$26,745,000	\$27,561,250	\$33,021,250
Revenue from Advertising	\$0	\$450,000	\$675,000	\$1,350,000	\$2,700,000	\$4,500,000	\$7,987,500	\$11,475,000	\$14,962,500	\$18,450,000
Gross Margin	\$750,000	\$2,490,000	\$3,735,000	\$6,570,000	\$11,970,000	\$17,580,000	\$27,907,500	\$38,220,000	\$42,523,750	\$51,471,250
Assumptions										
Average Base Salary	70000	70000	72800	75712	78740	81890	85166	88572	92115	95800
Estimated Workforce Size	20	25	30	40	50	60	70	90	110	120
Operating Expenses										
Salary (Office & Overhead)	\$1,400,000	\$1,750,000	\$2,184,000	\$3,028,480	\$3,937,024	\$4,913,406	\$5,961,599	\$7,971,510	\$10,132,675	\$11,495,980
Payroll (taxes etc.)	\$280,000	\$350,000	\$436,800	\$605,696	\$787,405	\$982,681	\$1,192,320	\$1,594,302	\$2,026,535	\$2,299,196
Outside Services	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Supplies (off and operation)	\$5,000	\$5,300	\$5,618	\$5,955	\$6,312	\$6,691	\$7,093	\$7,518	\$7,969	\$8,447
Repairs/ Maintenance	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Advertising	\$300,000	\$250,000	\$250,000	\$250,000	\$250,000	\$300,000	\$250,000	\$200,000	\$200,000	\$200,000
Car, Delivery and Travel	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Accounting and Legal	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Rent	\$50,000	\$50,000	\$50,000	\$50,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Telephone	\$3,600	\$3,708	\$3,819	\$3,934	\$4,052	\$4,173	\$4,299	\$4,428	\$4,560	\$4,697
Utilities	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200	\$4,200
Insurance	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
Taxes (real estate etc.)	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
Loan Payments	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398	\$36,398
Depreciation	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Servers/Hardware	\$100,000	\$0	\$0	\$100,000	\$0	\$0	\$100,000	\$0	\$0	\$0
Other expense (specify)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Expenses	\$2,284,198	\$2,554,606	\$3,075,836	\$4,189,663	\$5,230,391	\$6,452,550	\$7,760,909	\$10,023,356	\$12,617,338	\$14,253,919
Net Profit Before Tax	(\$1,534,198)	(\$64,606)	\$659,164	\$2,380,337	\$6,739,609	\$11,127,450	\$20,146,591	\$28,196,644	\$29,906,412	\$37,217,331
Income Taxes	(\$536,969)	(\$22,612)	\$230,708	\$833,118	\$2,358,863	\$3,894,608	\$7,051,307	\$9,868,825	\$10,467,244	\$13,026,066
Net Profit After Tax	(\$997,229)	(\$41,994)	\$428,457	\$1,547,219	\$4,380,746	\$7,232,843	\$13,095,284	\$18,327,819	\$19,439,168	\$24,191,265
Baseline Yearly Net Cash	(\$997,229)	(\$41,994)	\$428,457	\$1,547,219	\$4,380,746	\$7,232,843	\$13,095,284	\$18,327,819	\$19,439,168	\$24,191,265
Baseline Cumulative Cashflow	(\$997,229)	(\$1,039,223)	(\$610,766)	\$936,453	\$5,317,199	\$12,550,041	\$25,645,326	\$43,973,144	\$63,412,312	\$87,603,578
Cumulative NPV	(\$997,229)	(\$1,032,224)	(\$734,684)	\$160,697	\$1,224,098	\$5,180,042	\$9,565,626	\$14,680,584	\$19,201,514	\$23,889,943

Figure 21 shows that after 10 years, HouseCare predicts that the Cumulative NPV value for the Mediprise system is approximately \$24,000,000 for the modified business case.

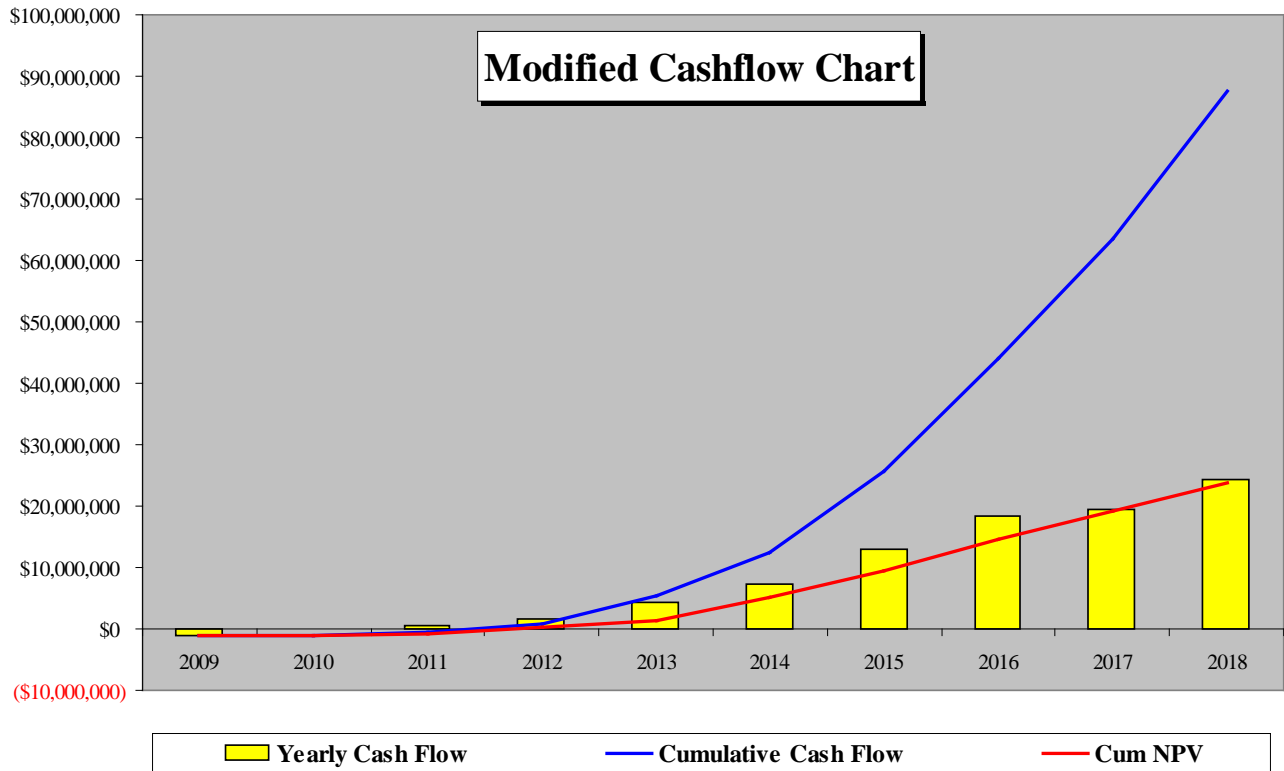


Figure 21 - Modified Cashflow Chart

Figure 22 and Figure 23 show the results of the Crystal Ball simulation:

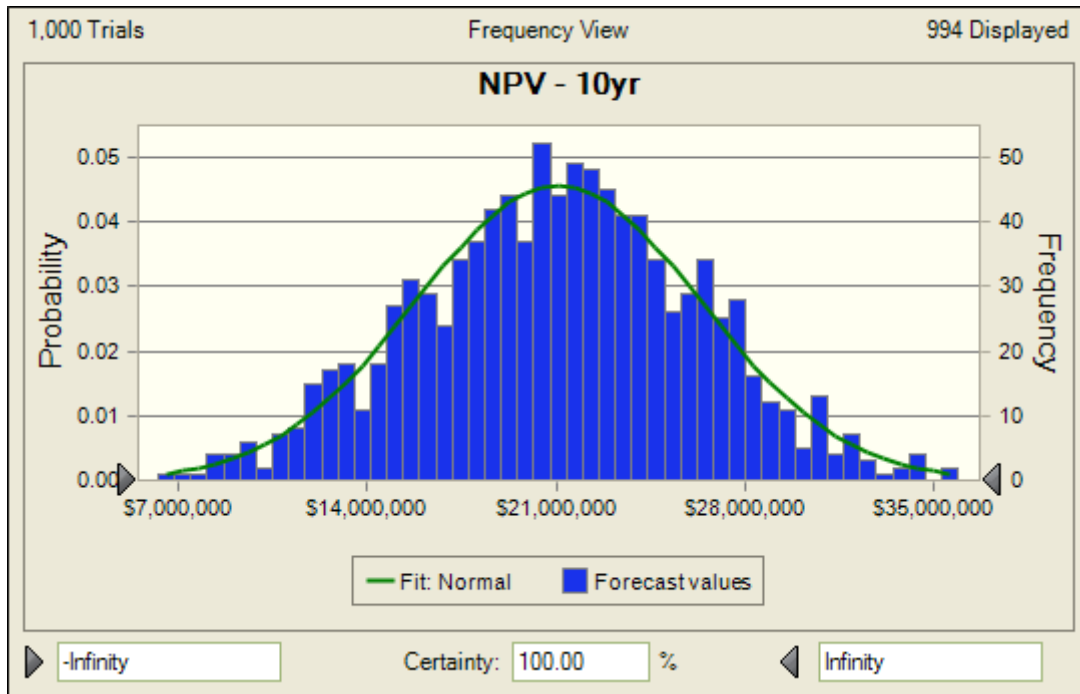


Figure 22 - Modified 10 Year NPV Monte Carlo Simulation Histogram

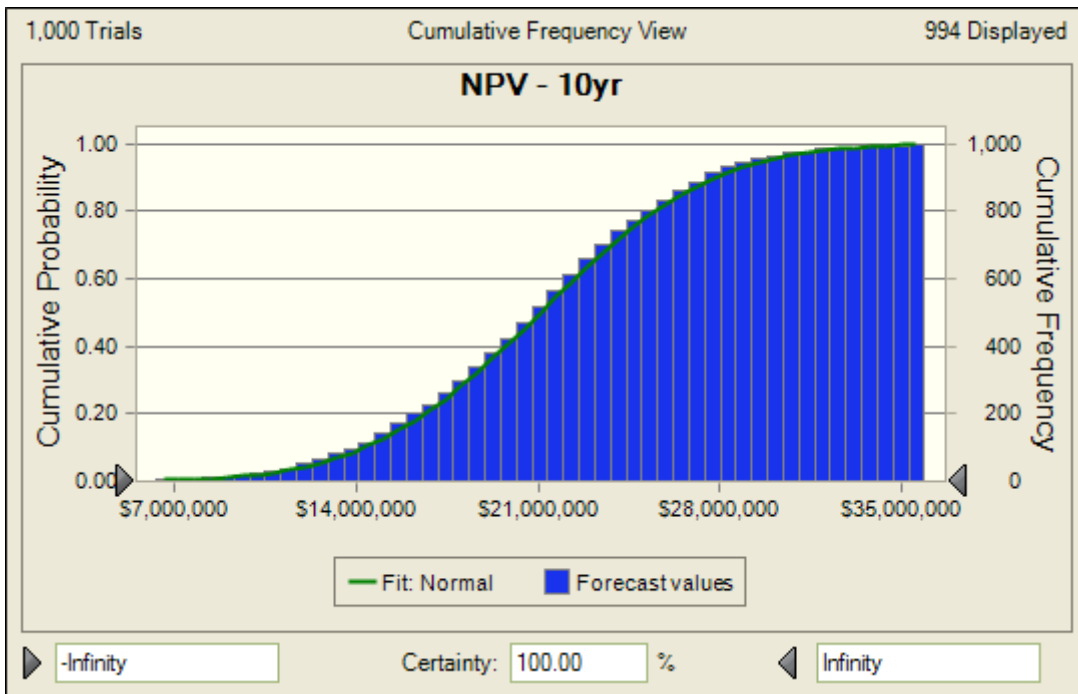


Figure 23 – Modified 10 Year NPV Cumulative Distribution

Running the simulation shows that there is still a 0% probability that after ten years, HouseCare will have a negative NPV based on this modified cost model. However, the lowest NPV value in the modified simulation is around \$7,000,000 instead of \$12,000,000 with the baseline case. Housecare has however, reached a breakeven point in Year 4, versus Year 6 in the baseline case.

Since the probability of a negative NPV is 0 for 10 years, HouseCare conducted a simulation to determine the cumulative NPV for 5 years, in order to give a better understanding of how risky an enterprise the Mediprise system is. The following figure shows the 5 Year Cumulative NPV distribution.

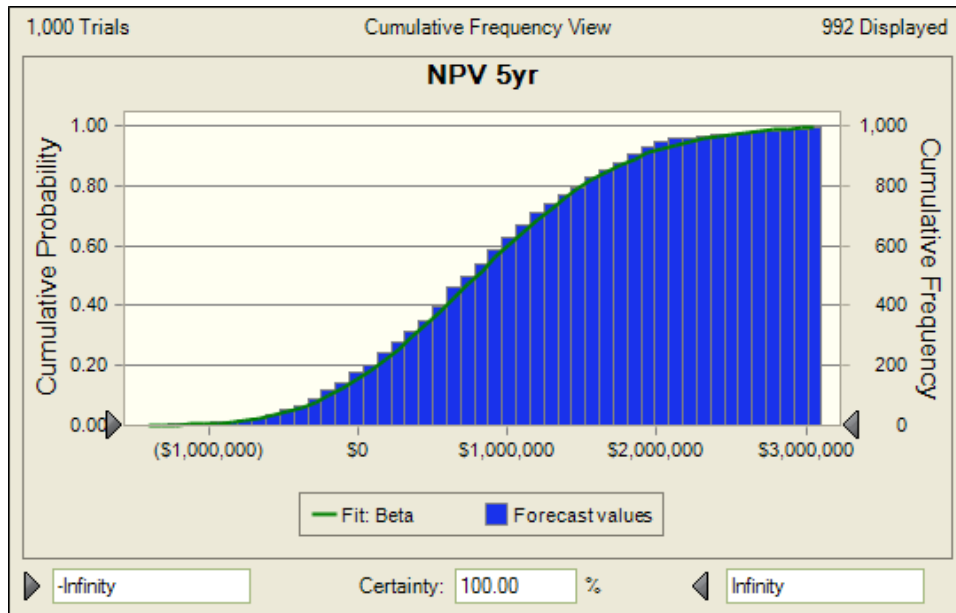


Figure 24 - Modified 5 Year NPV Cumulative Distribution

In Figure 24, it is easy to see that there is close to a 17% probability of a negative NPV in the first 5 years of HouseCare. What this implies is that the risk of failure is high in the beginning, but if HouseCare can reach the 10 year mark, there is a 0% probability of negative NPV. This is due in part to the incremental nature of the Mediprise solution, in that HouseCare will be constantly updating Mediprise and rolling out new features to entice customers to join.

6.6 Risk Analysis

The HouseCare group conducted a risk analysis to identify potential risks within the Mediprise system. Before doing the risk analysis we decided that there was possible uncertainty within our system that we should analyze. Thinking about these risks helped us to determine ways to strategize and plan for the unknown. It was determined that a risk analysis would help to discover the consequences of the risks identified, as well as, alternative measures to mitigate these risks. We identified technical, schedule, and performance risks that could possibly affect the system. Once the risks were identified they were given a letter rating according to the probability of occurrence, and the result of the consequences where scored.

We used the following process when examining risks (Table 7). The risks were put in a numerical order, so that we could identify them easily. First we categorized the risk as cost, performance, or schedule. Next we determined the Probability of Occurrence, which ranged from A – E. The probabilities were as follows: A (80 – 100), B (60 – 80), C (40 – 60), D (40 – 20), and E (20 – 0). The Consequence of Occurrence ranged from A – E as well. A was minimal to no impact, B was considered acceptable with some reduction in margin, C was acceptable with significant reduction in margin, D was acceptable with no remaining margin, and E was unacceptable. When the probability and consequence were scored they formed an overall level of risk, which was Low, Medium, or High. Afterwards the

consequences of these risks were defined, and a risk mitigation plan was developed (Table 8).

After conducting the risk analysis it was determined that a great number of risk were associated with performance. This helped us look at different ways to test the performance of our system. We decided it is very imperative to treat all risks, regardless of effect as a serious risk. All have the ability to affect our rapport with consumers. Based on our observations, we can explore different alternatives for implementing Mediprise.

Table 7 - Risk Rating Matrix

		Consequence				
		Minimal to No Impact	Acceptable with some reduction in margin	Acceptable with significant reduction in margin	Acceptable. No margin remaining	Unacceptable
Probability		A	B	C	D	E
80-100	A	M	M	H	H	H
60-80	B	L	M	M	H	H
40-60	C	L	L	M	M	H
20-40	D	L	L	L	M	M
0-20	E	L	L	L	L	M

Table 8 - Risk Analysis Matrix

Risk ID	Risk Category (Cost, Schedule, Performance)	Risk Event	Consequence	Probability of Occurrence (A - E)	Consequence of Occurrence (A - E)	Overall Risk Level (H-M-L)	Risk Mitigation Plan
R1	Performance	Medprise Software is not compatible with Medprise Entity Legacy Software	System will not be operational with other EMR systems. Patient records will be in influx.	C	D	M	Test all known EMR software systems against our interface to ensure system software compatibility.
R2	Cost/Schedule	New Standards will be adopted or existing Standards are changed	System will not meet new standards, and will not be government compliant.	D	B	L	Update system to meet new standards. Keep abreast of major Standard releases and changes through participation in Health IT organizations like HIMSS, CCHIT, HHS, etc.
R3	Cost	System security is inadequate, loopholes are exploited.	Patient data is compromised, and system access and availability may be denied.	B	E	H	Ensure sufficient firewalls are implemented, and data transfers are well encrypted. Re-visit security plan annually and update accordingly.
R4	Performance	Lack of Training/education of Housecare Employees	May unintentionally expose viable data, that could lead to a more major problem.	E	B	L	Train all employees, on the system. Develop training materials, and operating procedures. Also, have an emergency contact list for individuals to call regarding system issues.
R5	Performance	Loss of power	System down for an undetermined amount of time, updates aren't received at Medprise Entities.	E	A	L	Install a backup power system.
R6	Schedule	Poor integration	System incompatibility (user interfaces, functionality, system architecture).	D	D	M	Test all systems against our standards to ensure system software compatibility.
R7	Performance	Technology reliability (availability)	Loss of support for system.	E	E	M	Conduct several tests to determine system reliability (establish MTBF, MTTR calculations). Establish alternatives to support system reliability.
R8	Cost	Proprietary hardware/software, and database applications needed for Medprise are unavailable or late	Can cause schedule delay for implementation.	E	C	L	Identify alternative vendors.
R9	Cost/Performance	Hackers gain access to the Medprise Network	Data is illegally accessed and distributed.	A	E	H	Require all user accounts to have strong passwords. Make sure Medprise data is protected with adequate encryption and file sharing permissions. Make sure Housecare employees have access on a need to know basis.
R10	Performance	Insufficient or poor Service and Support provided to Medprise users	Displeased customers.	C	E	H	Ensure adequate funding and staffing for Customer Service Reps for both Patient and Healthcare Provider Users.
R11	Performance	Distributed Development Organization	Lack of information sharing.	E	A	L	Require Customer Reps to go through annual training to ensure quality and consistency of service.
R12	Performance	Fire or Theft at Housecare office locations.	Medprise Network unavailable, updates not received at Medprise entities.	E	B	L	Ensure system interoperability and integration.
R13	Performance	Employee misuse of computer	Can introduce viruses, or security flaws. May expose patient data.	E	B	L	Ensure Housecare Office spaces adhere to regional fire and safety codes, installing sprinklers, smoke alarms, fire extinguishers, etc. Conduct quarterly fire drills for evacuation and test safety equipment. Secure physical office spaces using door locks or cypher locks for highly sensitive locations. Consider also that most damage from a fire occurs from water sprinkler systems and the fire department. You may choose to cover your computers with tarps when the fire alarm goes off.
R14	Performance	Medprise is infected with a Computer Virus	May expose system vulnerabilities, personal information, and disrupt communication to Medprise Entities.	A	E	H	Train all employees, on the system. Develop Information Assurance training materials, and operating procedures to show what happens when systems are misused. Conduct annual required training. Also, have contact list for Security Personnel available.
R15	Performance	Acts of God (hurricanes, tornadoes, earthquakes)	Medprise Servers are physically destroyed, service is disrupted.	D	C	L	Perform regular system updates(antivirus, patches,etc). Backup information nightly so records can be restored in case of data corruption.
R16	Performance	Partial EMR systems	Lack of functionality.	C	B	L	Physically separate offsite backups will be maintained in the case of catastrophic events.
R17	Performance	Data Conversions	Lack of information sharing.	D	B	L	Reduction in all capabilities.
R18	Cost	Corporate Espionage	Loss of technical information and business information	D	B	M	Implement generic data conversion format that all systems can use.
R19	Cost	Beat to Market by Competition	Loss of business and value.	A	A	H	Have employees sign non-disclosure statements and develop intellectual property.
							Keep initial functionality simple and deliver incrementally.

7 Conclusions

The Healthcare industry has been slow to adopt electronic standards, and those who have still suffer from many of the issues of their paper predecessors. Lack of communication between Electronic Medical Record (EMR) entities can lead to incomplete or inaccurate medical histories, which can in turn lead to injury, or even death. It is a high priority for the Administration to encourage healthcare professionals to adopt EMR systems, but just as importantly is establishing a method to inter-communicate with other entities.

Housecare believes that Mediprise is a feasible solution to this problem. Without a common standard, a hosting and translating service is the best solution to provide communication without disrupting existing workflow. This also allows Housecare to provide access to its services at a relatively low cost. Additional incentives exist for hospitals to adopt a service like Mediprise in order to gain access to medical files for 'secondary use', epidemiology and research studies. With the proposed technical solution and business strategy, Housecare believes that Mediprise can be a major player in providing Health IT services.

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Appendix I: System Requirements Specification

1 Introduction

The healthcare industry is for the most part, still dependent on paper based medical records that are decentralized, poorly accessible, and redundant.

A myriad of tools are already available to manage medical records electronically, but lack of national standards, lack of trust in the ability to secure data, and poor interoperability has hampered the industry from adopting Electronic Medical Records (EMRs) and has prevented the medical industry from delivering the best quality services to patients.

The current system has resulted in the loss of important patient medical information, the inability of doctors to collaborate, medical errors, and an often negative experience for patients and health care providers alike.

Disconnects in health care communication systems can result in consequences ranging from inconveniences to fatalities and cost upward of \$17 billion annually.

2 Overall Description

The current focus for HouseCare's Mediprise is on providing enterprise wide solutions across hospitals. As hospitals invest in Mediprise, HouseCare will provide access across these separate enterprises. Performing integration in this manner will provide an accomplishable solution for integrated electronic medical records, bringing patient's medical history and medical records across separate hospitals and hospital organizations.

Currently, HouseCare is limited to providing solutions to hospitals that are currently utilizing systems that conform to standards such as Health Level 7 (HL7), ASTM International Continuity of Care Record, and ANSI X12 (EDI). HouseCare can provide recommendations for software solutions that meet these standards to hospitals that do not currently have systems that conform to these standards.

3 Specific Requirements

3.1 External interface requirements

3.1.1 User interfaces

3.1.1.1 Patient User Interfaces

3.1.1.1.1 All user interfaces shall be compatible with the three most common web browsers:

- Internet Explorer
- Firefox
- Safari

3.1.1.1.2 Patient user interfaces shall be fully compliant with section 508 of the United States Rehabilitation Act.

3.1.1.1.3 The initial screen for all interfaces shall prompt the user for their login credentials.

3.1.1.1.4 The initial screen for all interfaces shall display system administrator contact information.

3.1.1.1.5 All user interfaces shall provide the user with feedback indicating if their input was accepted.

3.1.1.1.6 All user interfaces shall provide the user with feedback indicating if their input was rejected.

3.1.1.1.7 All user interfaces shall provide the user with feedback indicating if their input was invalid.

3.1.1.1.8 The interface shall provide the patient with a means to enter their contact information.

3.1.1.1.9 The interface shall provide the patient with the means to enter the contact information for other consenting patients, (spouse, dependents, etc.) if any.

3.1.1.1.10 The interface shall provide the patient with the means to enter their emergency contact information.

3.1.1.1.11 The interface shall provide the patient with the means to enter their known medical history.

3.1.1.1.12 The interface shall provide the patient with the capability to enter alerts and reminders into their calendar.

- 3.1.1.1.13 The interface shall provide the patient with the capability to enter a preferred alert method.
- 3.1.1.1.14 The interface shall provide the patient with the capability to enter a preferred pharmacy for filling prescriptions.
- 3.1.1.1.15 The interface shall provide the patient with the means to review all of their contact information.
- 3.1.1.1.16 The interface shall provide the patient with the means to review all of their other consenting patients contact information.
- 3.1.1.1.17 The interface shall provide the patient with the means to review all of their emergency contact information.
- 3.1.1.1.18 The interface shall provide the patient with the means to review their complete medical history.
- 3.1.1.1.19 The interface shall provide the patient with the capability to review alerts and reminders into their calendar.
- 3.1.1.1.20 The interface shall provide the patient with the capability to review a preferred alert method.
- 3.1.1.1.21 The interface shall provide the patient with the capability to review a preferred pharmacy for filling prescriptions.
- 3.1.1.1.22 The interface shall provide the patient with the means to modify all of their contact information.
- 3.1.1.1.23 The interface shall provide the patient with the means to modify all of their other consenting patients contact information.
- 3.1.1.1.24 The interface shall provide the patient with the means to modify all of their emergency contact information.
- 3.1.1.1.25 The interface shall provide patients with the means to authorize and manage which entities will have access to their medical records.
- 3.1.1.1.26 The interface shall provide patients with the capability to view their prescription drug history.
- 3.1.1.1.27 The interface shall provide patients with the capability to request prescription refills.

3.1.2 Hardware interfaces

N/A

3.1.3 Software interfaces

- 3.1.3.1 Mediprise shall implement a software interface that is fully compliant with the Health Level 7 (HL7) standards.
- 3.1.3.2 Mediprise shall implement a software interface that is fully compliant with the ASTM International Continuity of Care Record standards.
- 3.1.3.3 Mediprise shall implement a software interface that is fully compliant with the ANSI X12 (EDI) standards.

3.1.4 Communications interfaces

- 3.1.4.1 Mediprise shall utilize Transmission Control Protocol/Internet Protocol (TCP/IP) to communicate with existing software systems.
- 3.1.4.2 Mediprise shall utilize Transport Layer Security (TLS) to communicate across hospital systems.

3.2 Functional requirements

3.2.1 Provide Communications Services

3.2.1.1 *Transfer Medical Data*

- 3.2.1.1.1 Mediprise shall be capable of exchanging patient medical record data with any medical information system that implements the HL7 standards.
- 3.2.1.1.2 Mediprise shall be capable of exchanging patient medical record data with any system that implements the ASTM International Continuity of Care Record standards.
- 3.2.1.1.3 Mediprise shall be capable of exchanging patient medical record data with any system that implements the ANSI X12 (EDI) standards.
- 3.2.1.1.4 Mediprise shall provide the capability to export an individual patient's medical record as a PDF Report file.
- 3.2.1.1.5 Mediprise shall provide the capability to export an individual patient's medical record as an HL7 Formatted file.
- 3.2.1.1.6 Mediprise shall provide the capability to export an individual patient's medical record as an ASTM International Continuity of Care Formatted file.

- 3.2.1.1.7 Mediprise shall provide the capability to export an individual patient's medical record as an ANSI X12 Formatted file.
- 3.2.1.1.8 Mediprise shall provide the capability to export an individual patient's medical record as a printed report.
- 3.2.1.1.9 Mediprise shall provide the capability to export an individual patient's current prescriptions as a PDF Report file.
- 3.2.1.1.10 Mediprise shall provide the capability to export an individual patient's current prescriptions as an HL7 Formatted file.
- 3.2.1.1.11 Mediprise shall provide the capability to export an individual patient's current prescriptions as an ASTM International Continuity of Care Formatted file.
- 3.2.1.1.12 Mediprise shall provide the capability to export an individual patient's current prescriptions as an ANSI X12 Formatted file.
- 3.2.1.1.13 Mediprise shall provide the capability to export an individual patient's current prescriptions as a printed report.
- 3.2.1.1.14 Mediprise shall provide the capability to export a doctor's prescriptions as a PDF Report file.
- 3.2.1.1.15 Mediprise shall provide the capability to export a doctor's prescriptions as an HL7 Formatted file.
- 3.2.1.1.16 Mediprise shall provide the capability to export a doctor's prescriptions as an ASTM International Continuity of Care Formatted file.
- 3.2.1.1.17 Mediprise shall provide the capability to export a doctor's prescriptions as an ANSI X12 Formatted file.
- 3.2.1.1.18 Mediprise shall provide the capability to export a doctor's prescriptions as a printed report.
- 3.2.1.1.19 Mediprise shall provide the capability to export a doctor's medical records as a PDF Report file.
- 3.2.1.1.20 Mediprise shall provide the capability to export a doctor's medical records as an HL7 Formatted file.
- 3.2.1.1.21 Mediprise shall provide the capability to export a doctor's medical records as an ASTM International Continuity of Care Formatted file.

- 3.2.1.1.22 Mediprise shall provide the capability to export a doctor's medical records as an ANSI X12 Formatted file.
- 3.2.1.1.23 Mediprise shall provide the capability to export a doctor's medical records as a printed report.
- 3.2.1.1.24 Mediprise shall provide the capability to export de-identified medical records as a PDF Report file.
- 3.2.1.1.25 Mediprise shall provide the capability to export de-identified medical records as an HL7 Formatted file.
- 3.2.1.1.26 Mediprise shall provide the capability to export de-identified medical records as an ASTM International Continuity of Care Formatted file.
- 3.2.1.1.27 Mediprise shall provide the capability to export de-identified medical records as an ANSI X12 Formatted file.
- 3.2.1.1.28 Mediprise shall provide the capability to export de-identified medical records as a printed report.
- 3.2.1.1.29 Mediprise shall be capable of transferring medical records from an EMR System to the Mediprise data store.
- 3.2.1.1.30 Mediprise shall query the Mediprise data store for medical records associated with a specified doctor.
- 3.2.1.1.31 Mediprise shall query the Mediprise data store for de-identified medical records.
- 3.2.1.1.32 Mediprise shall query the Mediprise data store for patient's prescriptions.
- 3.2.1.1.33 Mediprise shall query the Mediprise data store for patient's medical record.
- 3.2.1.1.34 Mediprise shall transfer newly entered prescriptions to the patient's preferred pharmacy.
- 3.2.1.1.35 Mediprise shall transfer an existing patient's medical record to a Mediprise entity (i.e. a hospital with Mediprise capabilities).
- 3.2.1.1.36 Mediprise shall transfer new patient's medical record to a Mediprise entity (i.e. a hospital with Mediprise capabilities).
- 3.2.1.1.37 Mediprise shall transfer existing patient's prescriptions to a Mediprise entity (i.e. a hospital with Mediprise capabilities).
- 3.2.1.1.38 Mediprise shall convert prescription information to HL7 standard format.

3.2.1.1.39 Mediprise shall convert prescription information to ASTM International Continuity of Care Record standard format.

3.2.1.1.40 Mediprise shall convert prescription information to ANSI X12 (EDI) standard format.

3.2.1.2 User Alert and Reminder Services

3.2.1.2.1 Mediprise shall provide users with configurable alerts and reminders.

3.2.1.2.2 Mediprise shall query the Mediprise data store for patient's preferred alert method.

3.2.1.2.3 Mediprise shall query the Mediprise data store for patient's calendar of reminders.

3.2.1.2.4 Mediprise shall send alerts and reminders based on patient's calendar of alerts and reminders and patient's preferred alert method.

3.2.2 Provide Information Assurance Services

3.2.2.1 Confidentiality and Integrity Services

3.2.2.1.1 Mediprise shall provide a secure login utilizing OS Logins and SecureLogin SSO to all users prior to providing access to any information.

3.2.2.1.2 Mediprise shall determine a user's level of access after verifying a user's login credentials.

3.2.2.1.3 Mediprise shall provide access to authorized data based on the user's level of access.

3.2.2.2 Authenticity Services

3.2.2.2.1 Mediprise shall protect user names and passwords by encrypting the data using Blowfish.

3.2.2.2.2 Mediprise shall protect medical information by encrypting the data using Blowfish.

3.2.2.2.3 Mediprise shall verify digital signatures of incoming data using the Digital Signature Algorithm (DSA) standard.

3.2.2.3 Availability Services

3.2.2.3.1 Mediprise shall monitor network traffic using Wireshark to determine network loads.

3.2.2.3.2 Mediprise shall determine whether there is excessive load on the Mediprise network and thus limit network traffic to prevent network outages.

3.2.2.3.3 Mediprise shall provide secure network communication utilizing Transport Layer Security (TLS/SSL).

3.2.2.4 Availability Services

3.2.2.4.1 Mediprise shall provide digital signatures using DSA standard format on any data transferred.

3.2.2.4.2 Mediprise shall verify the origin of data received using asymmetrical digital signatures.

3.2.2.4.3 Mediprise shall provide public and private key authentication to validate transferred data using Pretty Good Privacy (PGP).

3.2.3 Maintain Patient Medical Records

3.2.3.1 Backup Services

3.2.3.1.1 Mediprise shall maintain primary and secondary copies of electronic medical records.

3.2.3.1.2 The secondary set of medical records shall mirror the primary set of medical records.

3.2.3.1.3 To prevent data loss due to malicious software, natural disasters, or other acts of God an emergency backup of all medical records shall be maintained.

3.2.3.1.4 The emergency backup shall not be collocated with either the primary or secondary set of medical records.

3.2.3.1.5 The emergency backup shall be updated on a weekly basis.

3.2.3.2 Patient Record Creation

3.2.3.2.1 Mediprise shall provide patients with the ability to create their initial medical record.

3.2.3.2.2 Mediprise shall provide doctors with the ability to create a patient's initial medical record.

3.2.3.2.3 Mediprise shall prevent patients from creating a more than one personal medical record.

- 3.2.3.2.4 Mediprise shall prevent doctors from creating more than one medical record for a particular patient.
- 3.2.3.2.5 Mediprise shall create new patient records in the Mediprise data store when new patient data is received.
- 3.2.3.2.6 Mediprise shall provide a complete medical record to a Mediprise entity that does not contain any information for a requested patient.

3.2.3.3 Patient Record Update

- 3.2.3.3.1 Mediprise shall provide patients with the capability to modify their medical history.
- 3.2.3.3.2 Mediprise shall provide doctors with the capability to modify patient medical records.
- 3.2.3.3.3 Mediprise shall prevent patients from modifying information entered into their medical records by a physician.
- 3.2.3.3.4 Mediprise shall update the Mediprise data store upon receipt of newly entered medical information.
- 3.2.3.3.5 Mediprise shall convert received medical data to Mediprise's internal data format from HL7 standard format.
- 3.2.3.3.6 Mediprise shall convert received medical data to Mediprise's internal data format from ASTM International Continuity of Care standard format.
- 3.2.3.3.7 Mediprise shall convert received medical data to Mediprise's internal data format from ANSI X12 (EDI) standard format.

3.2.3.4 Patient Record Removal or Deletion

- 3.2.3.4.1 Mediprise shall prevent users from deleting medical records.

3.2.3.5 Patient Preferences Maintenance

- 3.2.3.5.1 Mediprise shall maintain a calendar per patient of alerts and reminders.
- 3.2.3.5.2 Mediprise shall maintain each patient's preferred alert method.
- 3.2.3.5.3 Mediprise shall maintain a list of authorized viewers of each patient's medical record.

3.2.4 Provide Prescription Services

3.2.4.1 Prescription Management Services

- 3.2.4.1.1 Mediprise shall update a patient's medical record with newly entered prescriptions.
- 3.2.4.1.2 Mediprise shall modify existing prescription records in the Mediprise data store when modified by authorized users.
- 3.2.4.1.3 Mediprise shall monitor and warn prescribing doctor and patient when prescriptions are expired.
- 3.2.4.1.4 Mediprise shall convert prescription information to Mediprise's internal data format from HL7 standard format.
- 3.2.4.1.5 Mediprise shall convert prescription information to Mediprise's internal data format from ASTM Continuity of Care Record standard format.
- 3.2.4.1.6 Mediprise shall convert prescription information to Mediprise's internal data format from ANSI X12 (EDI) standard format.

3.2.4.2 Potential Drug Interactions Monitor

- 3.2.4.2.1 Mediprise shall crosscheck all active prescriptions for an individual to determine the potential for dangerous drug interactions.
- 3.2.4.2.2 Mediprise shall issue an alert to the prescribing doctor and patient if a potentially dangerous drug interaction is identified.
- 3.2.4.2.3 Mediprise shall provide alternative drug options to a doctor if a potential drug interaction is detected.

3.2.4.3 Alternative Drug Options

- 3.2.4.3.1 Mediprise shall notify the pharmacist and patient if a generic version of the prescribed drug is available.
- 3.2.4.3.2 Mediprise shall provide notification if a patient is allergic to a drug that is prescribed.
- 3.2.4.3.3 Mediprise shall provide alternative drug options to a doctor if a patient is allergic to the prescribed drug.

3.2.4.4 Database of Drugs and Potential Interactions

- 3.2.4.4.1 Mediprise shall maintain a data repository of drug and interaction information.
- 3.2.4.4.2 The drug and interaction data repository shall be updated daily to ensure that only the most up-to-date information is used.
- 3.2.4.4.3 Mediprise shall maintain a data repository of alternative drug options for drugs in the drug data repository.

3.3 Performance requirements

- 3.3.1 Mediprise shall provide access to patient records within 3 seconds of the user request.

3.4 Design constraints

3.4.1 Accessibility Constraints

- 3.4.1.1 User interfaces must conform to section 508 of the United States Rehabilitation Act.
- 3.4.1.2 Patient user interfaces should be reasonably accessible via an Internet connection as slow as 56kbps.

3.4.2 Data Exchange Constraints

- 3.4.2.1 Data exchange between hospital systems will be limited to implementations specified in the HL7, ASTM, and ANSI X12 standards.

3.5 Software system attributes

3.5.1 Reliability

- 3.5.1.1 Mediprise shall acknowledge receipt of data to ensure delivery of data to requesting users.
- 3.5.1.2 Mediprise shall provide a Mean Time Between Failure (MTBF) of 6 months.

3.5.2 Availability

- 3.5.2.1 Mediprise shall be available 95% of the time where availability is defined as $MTBF / (MTBF - MTTR)$ where MTBF is Mean Time Between Failure and MTTR is Mean Time To Repair.

3.5.3 Scalability

- 3.5.3.1 Mediprise shall be scalable to additional organizations by adding additional resources (servers, data centers, etc).

Appendix II: Functional Decomposition

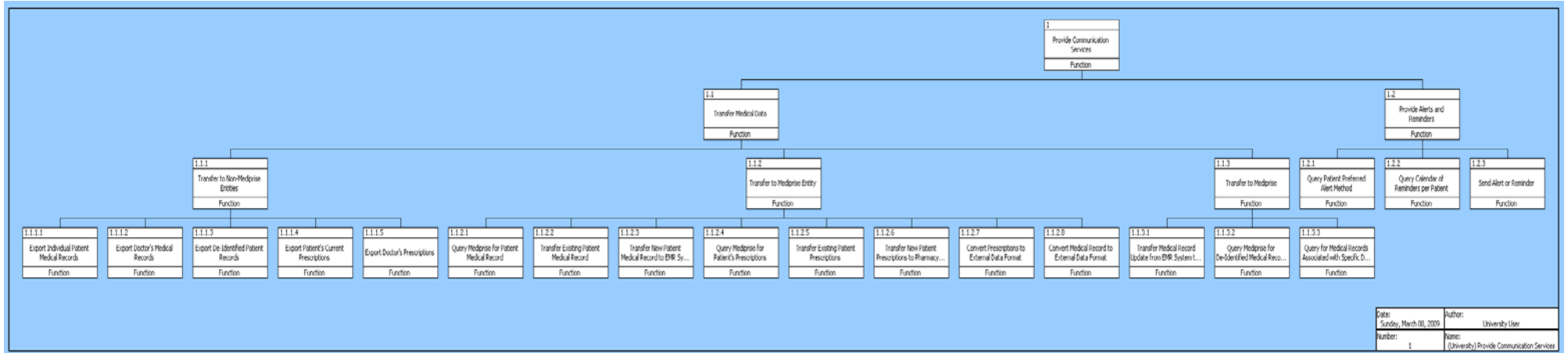


Figure 25 – Level 3-5 Function Decomposition of Communications Service

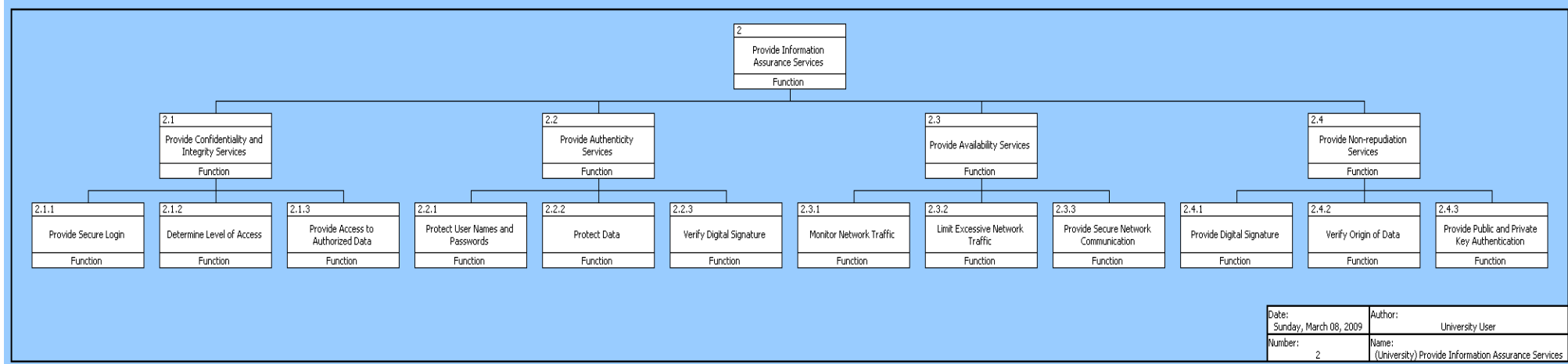


Figure 26 – Level 3-4 Functional Decomposition of Information Assurance

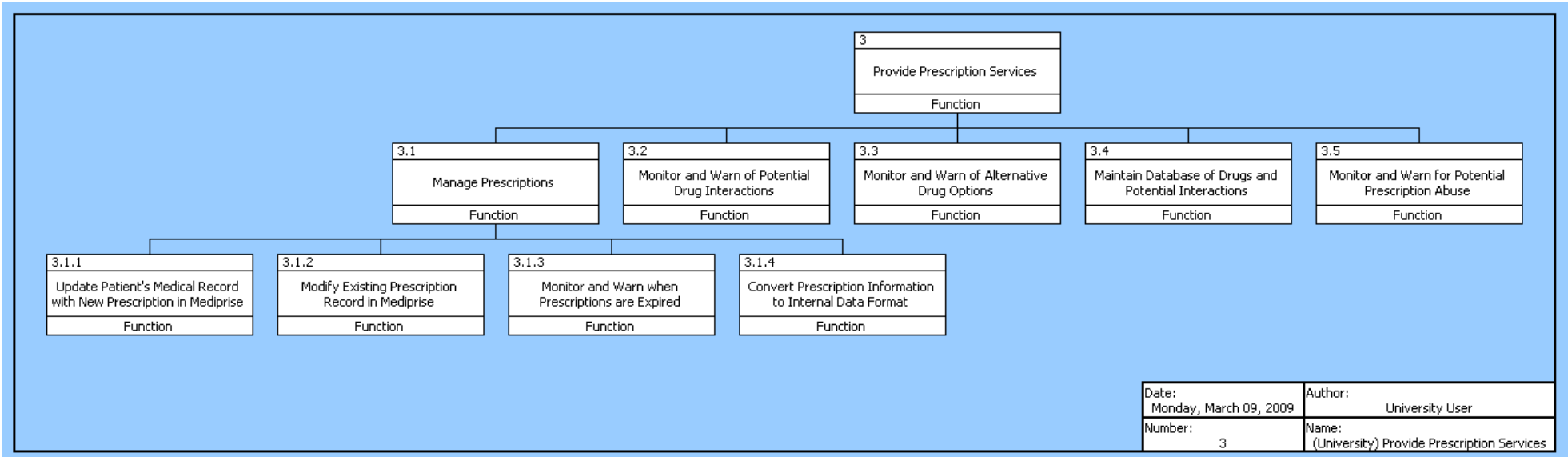


Figure 27 – Level 3-4 Functional Decomposition of Provide Prescription Services

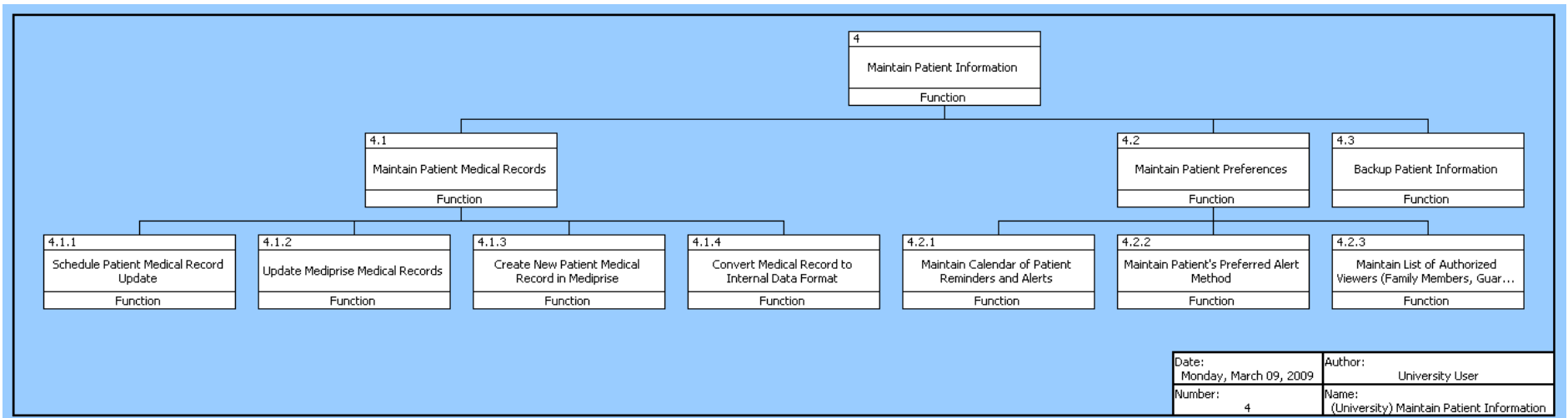


Figure 28 – Level 3-4 Functional Decomposition of Maintain Patient Information

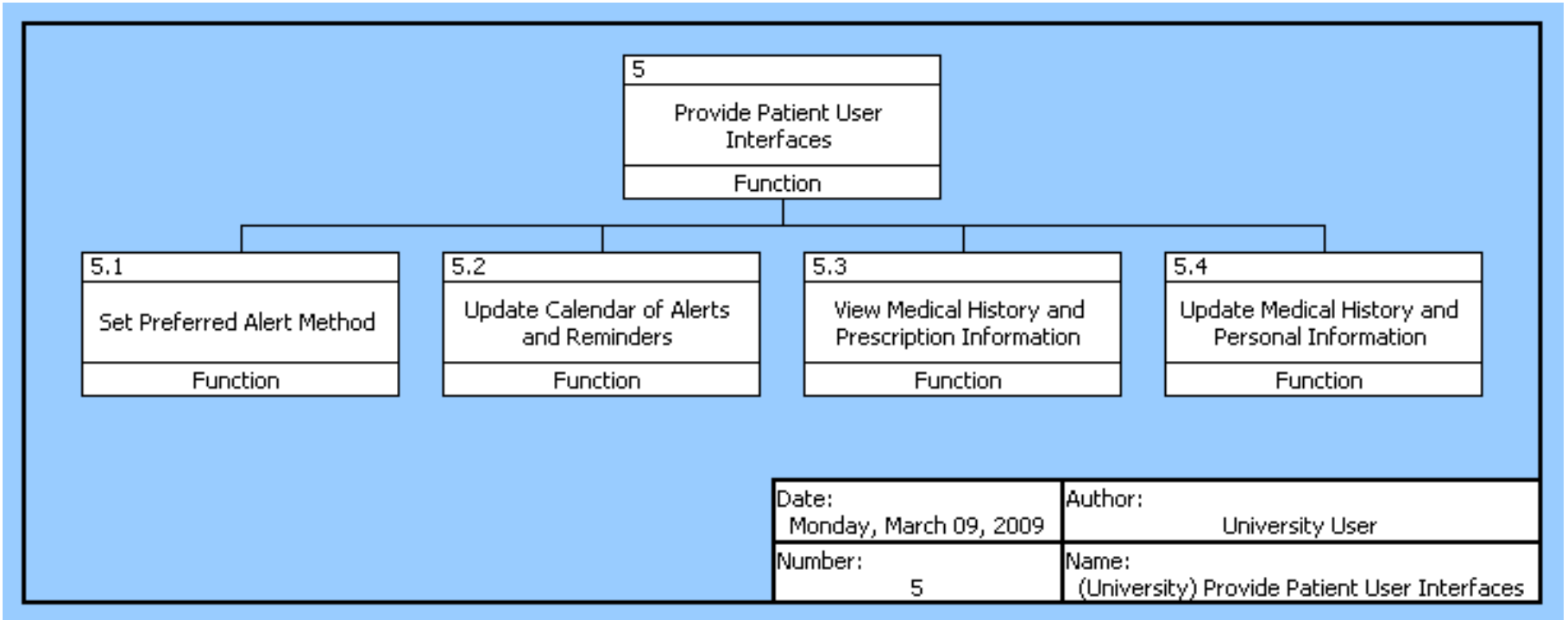


Figure 29 – Level 3 Function Decomposition of Provide Patient User Interfaces

Appendix VI: DoDAF Artifacts

1 Operational View

1.1 OV-1 Operational Concept

See Section 5.1 HouseCare Mediprise Operational Concept for the OV-1.

1.2 Mediprise Use Cases

Figure 32: Mediprise Operational Use Case Diagram

1.2.1 Update Medical Record

1. Patient arrives at a Mediprise Hospital.
2. Doctor enters patient identifying information into EMR system.
3. EMR System queries date of last change for the patient's medical record in its internal data store.

4. Mediprise queries date of last change for the patient's medical record in its data store.
5. Mediprise sends the date of last update to the EMR System.
6. EMR System compares the dates and determines if internal record is up to date.
7. If record is not up to date, request medical record from Mediprise.
8. Mediprise queries data store for entire medical record.
9. Mediprise determines EMR System's Standard Format.
10. If the format is not the same internal format that Mediprise uses, Mediprise converts to EMR System's Standard Format.
11. Mediprise sends the medical record securely to the EMR System.
12. EMR System receives medical record and updates the internal data store with the updated record.
13. EMR System displays medical record to the doctor.
14. Doctor updates the medical record with patient's diagnosis and treatment.
15. EMR System appends medical record with entered information.
16. EMR System sends updated information to Mediprise.
17. Mediprise determines if data format requires conversion.
18. If so, converts received information to internal data format.
19. Mediprise updates internal data store with updated information.

1.2.2 Update Prescription Information

1. Doctor enters patient information and prescription details.
2. EMR System sends patient information and prescription details to Mediprise.
3. Mediprise checks for adverse drug interactions.
4. If adverse reactions are detected, issue an alert to the doctor.
5. Mediprise queries patient's preferred pharmacy.
6. Mediprise determines the Standard Format of the patient's preferred pharmacy.
7. If the pharmacy's Standard Format is not the internal format of Mediprise, convert the prescription information to the pharmacy's standard format.
8. Mediprise sends the prescription information to the pharmacy.
9. Pharmacy received the prescription information and fills the prescription.
10. Pharmacy updates the prescription information.
11. Pharmacy sends updated prescription information to Mediprise.
12. If the prescription information requires conversion, Mediprise converts the prescription information.
13. Mediprise updates the patient's prescription information.

1.2.3 Update Patient Information

1. Patient enters Mediprise web address into web browser.
2. Mediprise presents secure login to patient.
3. Patient enters login credentials.
4. Mediprise validated login credentials.
5. If the login credentials are valid, retrieve patient information that the Mediprise determines is accessible to patient.
6. Patient modifies patient information.
7. Mediprise updates patient information with entered information.

1.2.4 Issue Alert

1. Mediprise determines an alert condition exists (expired prescription, drug interaction, etc).
2. Mediprise queries for the preferred alert method for the receiver of the alert.
3. Mediprise sends the alert using the preferred method.

1.2.5 Export Medical Records

1. Patient enters Mediprise web address into web browser.
2. Mediprise presents secure login to patient.
3. Patient enters login credentials.
4. Mediprise validated login credentials.
5. If the login credentials are valid, retrieve information the user is granted access to.
6. User requests to export medical records in PDF report, printed report, HL7, ANSI X12, or ASTM format.

7. Mediprise converts the medical record in the desired format.
8. Mediprise sends the formatted record or report to the user.

1.3 OV-2 Operational Node Connectivity Diagram

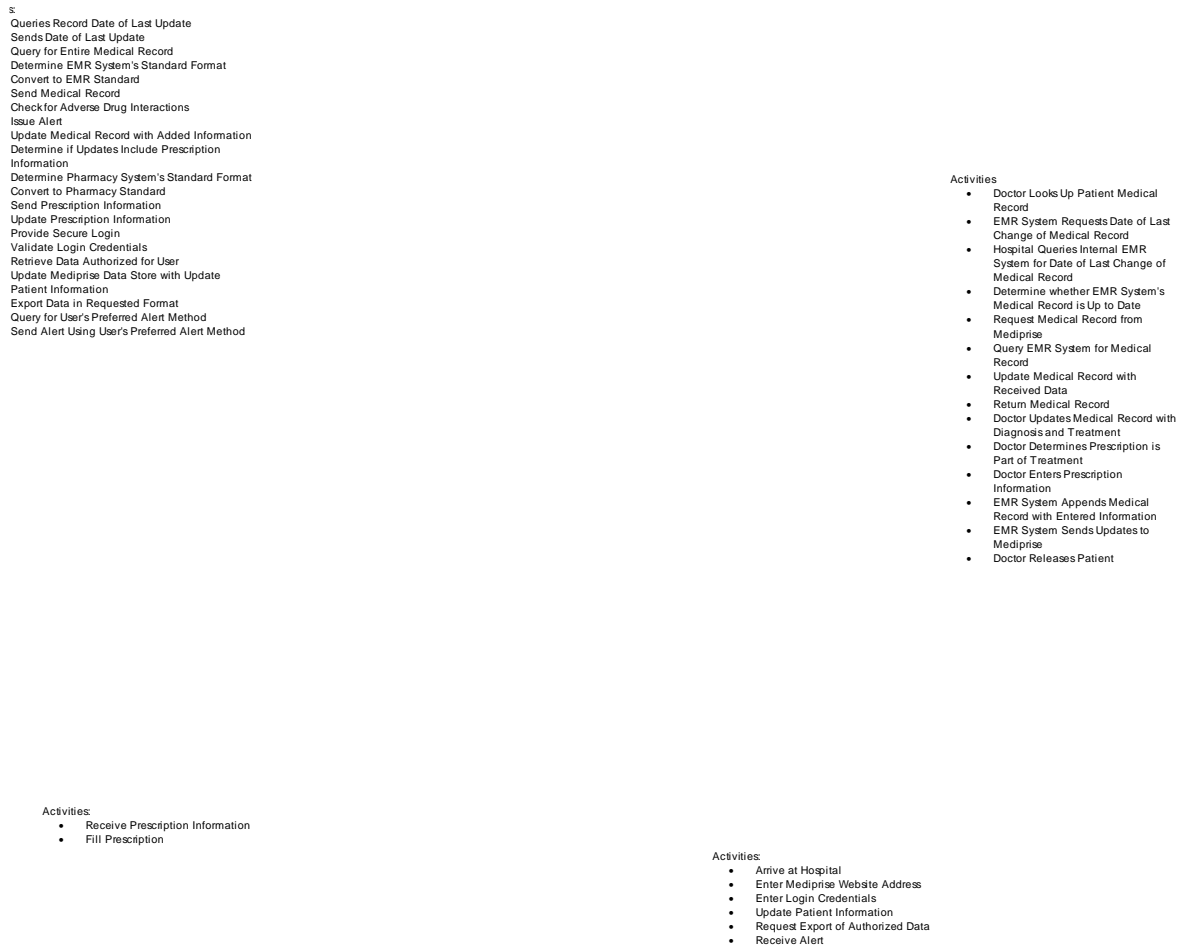


Figure 33: OV-2 Operational Node Connectivity Diagram

1.4 OV-3 Operational Information Exchange Matrix

Table 9 - OV-3 Operational Information Exchange Matrix

Needline Identifier	Information Element Description					Producer		Consumer		Performance		Information Assurance				Security	
	Information Element Name and Identifier	Content	Scope	Accuracy	Language	Sending Op Node Name and Identifier	Sending Op Activity Name and Identifier	Receiving Op Node Name and Identifier	Receiving Op Activity Name and Identifier	Periodicity	Timeliness	Access Control	Availability	Confidentiality	Dissemination Control	Classification	Classification Caveat
Mediprise::Hospitals	Medical Record	Patient Medical Data	Patient Medical History	100%	HL7/ASTM/ANSI X12	Mediprise	Send Medical Record	Hospital	Update Medical Record with Received Data	Discrete Event	< 10 Secs	EMR Access Controls & Mediprise Access Controls	99.50%	Transport Layer Security	Encryption	Confidential/HIPAA Protected	None
Hospitals::Mediprise	Medical Record	Patient Medical Data	Patient Medical History	100%	HL7/ASTM/ANSI X12	Hospital	EMR System Sends Updates To Mediprise	Mediprise	Mediprise Updates Medical Record With Added Information	Discrete Event	< 60 Secs	EMR Access Controls & Mediprise Access Controls	99%	Transport Layer Security	Encryption	Confidential/HIPAA Protected	None
Hospitals::Mediprise	Prescription	New/Updated Prescription	Current Prescription	100%	HL7/ASTM/ANSI X12	Hospital	Doctor Enters Prescription Information	Mediprise	Check For Adverse Drug Interactions	Discrete Event	< 60 Secs	EMR Access Controls & Mediprise Access Controls	99%	Transport Layer Security	Encryption	Confidential/HIPAA Protected	None
Mediprise::Hospitals	Alert	Drug Interaction Information	Current Prescription	100%	HL7/ASTM/ANSI X12	Mediprise	Issue Alert	Hospital	EMR System Appends Medical Record with Entered Information	Discrete Event	< 5 Secs	EMR Access Controls & Mediprise Access Controls	99.50%	Transport Layer Security	Encryption	Confidential/HIPAA Protected	None
Mediprise::Patients	Alert	Drug Interaction Information	Current Prescription	100%	HTML	Mediprise	Issue Alert	Patient	Receive Alert	Discrete Event	< 5 Secs	Mediprise Access Controls & Patient User Name and Password	99.50%	Transport Layer Security	Encryption	Confidential/HIPAA Protected	None
Mediprise::Patients	Patient Information	Individual Patient Information	Individual Patient	100%	HTML	Mediprise	Retrieve Data Authorized for User	Patient	Request Export of Authorized Data	Discrete Event	< 10 Secs	Mediprise Access Controls & Patient User Name and Password	95%	Transport Layer Security	Encryption	Confidential/HIPAA Protected	None
Patients::Mediprise	Patient Information	Individual Patient Information	Individual Patient	100%	HTML	Patient	Update Patient Information	Mediprise	Update Mediprise Data Store with Updated Patient Information	Discrete Event	< 10 Secs	Mediprise Access Controls & Patient User Name and Password	99%	Transport Layer Security	Encryption	Confidential/HIPAA Protected	None
Mediprise::Pharmacies	Prescription	New/Updated Prescription	Current Prescription	100%	HL7/ASTM/ANSI X12	Mediprise	Send Prescription Information	Pharmacy	Receive Prescription Information	Discrete Event	< 10 Secs	Mediprise Access Controls & Pharmacy System Access Controls	99.50%	Transport Layer Security	Encryption	Confidential/HIPAA Protected	None
Mediprise::Pharmacies	Alert	Drug Interaction Information	Current Prescription	100%	HL7/ASTM/ANSI X12	Mediprise	Issue Alert	Pharmacy	Receive Alert	Discrete Event	< 5 Secs	Mediprise Access Controls & Pharmacy System Access Controls	99.50%	Transport Layer Security	Encryption	Confidential/HIPAA Protected	None

1.5 OV-4 Mediprise Organizational Relationship Model

Figure 34: OV-4 Organizational Relationship Model

1.6 OV-5 Operational Activity Model

1.6.1 Export Medical Records

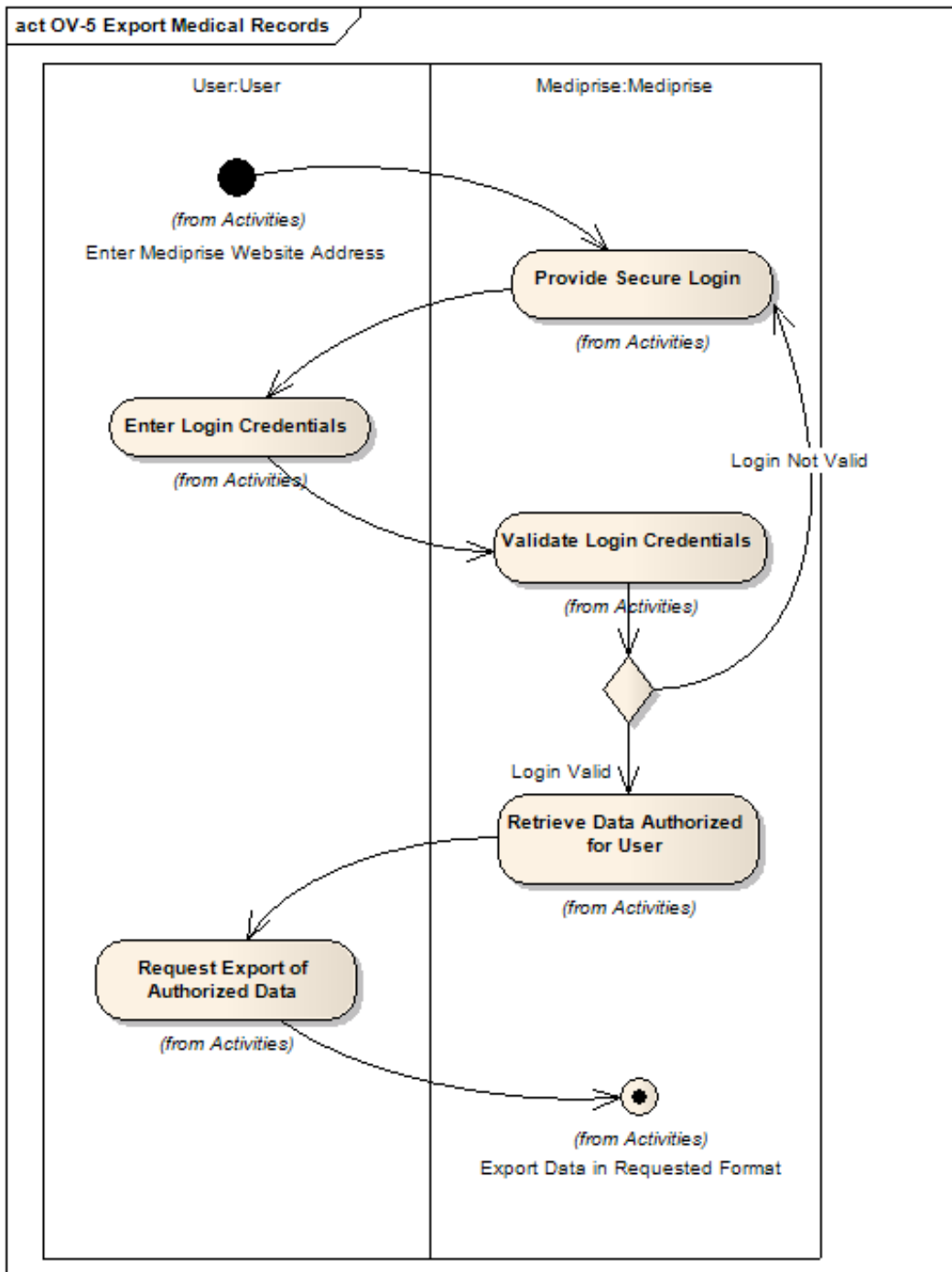


Figure 35: OV-5 Export Medical Records

1.6.2 Issue Alert

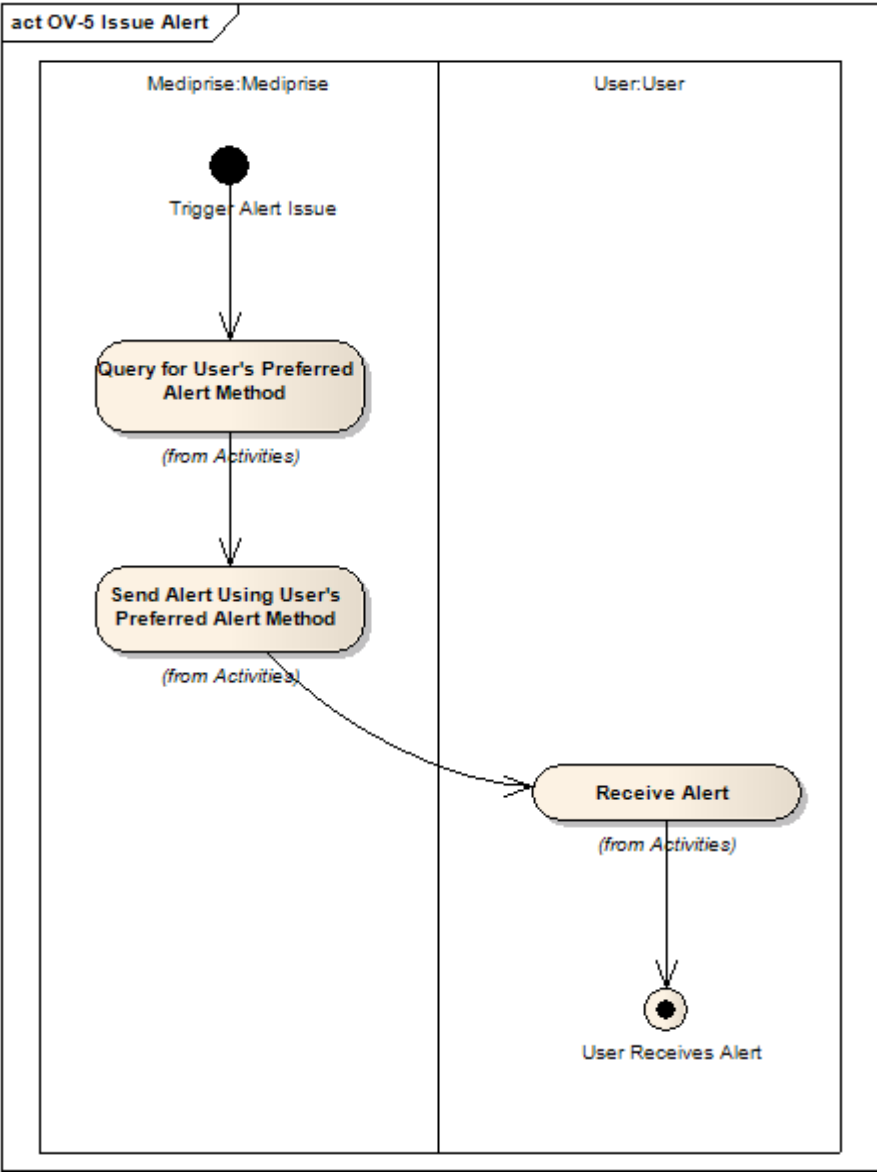


Figure 36: OV-5 Issue Alert

1.6.4 Update Patient Information

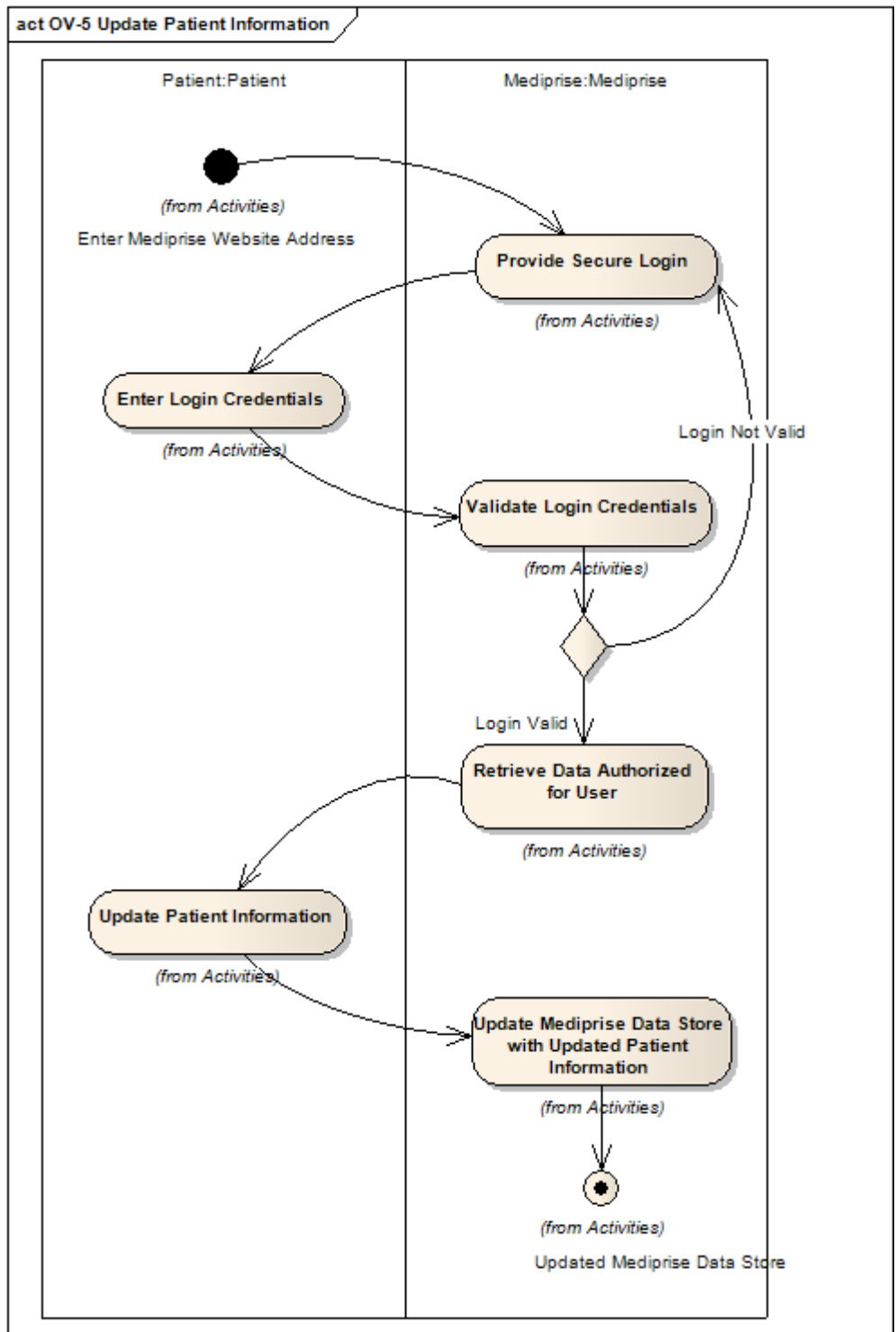


Figure 38: OV-5 Update Patient Information

1.7 OV-6b Operational State Transition Diagram

1.7.1 Hospital Node State Diagram

Figure 39: OV-6b Hospital Node State Diagram

1.7.2 Mediprise Node State Diagram

Figure 40: OV-6b Mediprise Node State Diagram

1.7.3 Pharmacy Node State Diagram

Figure 41: OV-6b Pharmacy Node State Diagram

1.8 OV-6c Operational Event-Trace Description

1.8.1 Export Medical Records

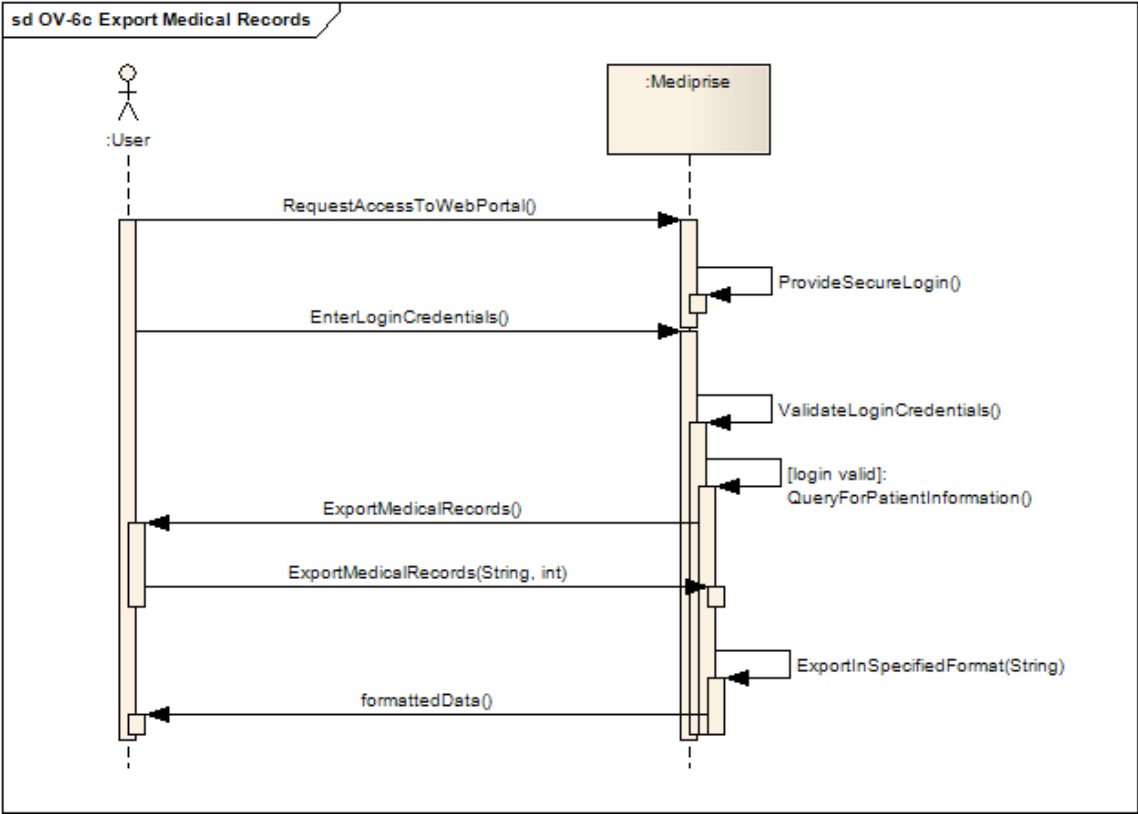


Figure 42: OV-6c Export Medical Records

1.8.2 Issue Alert

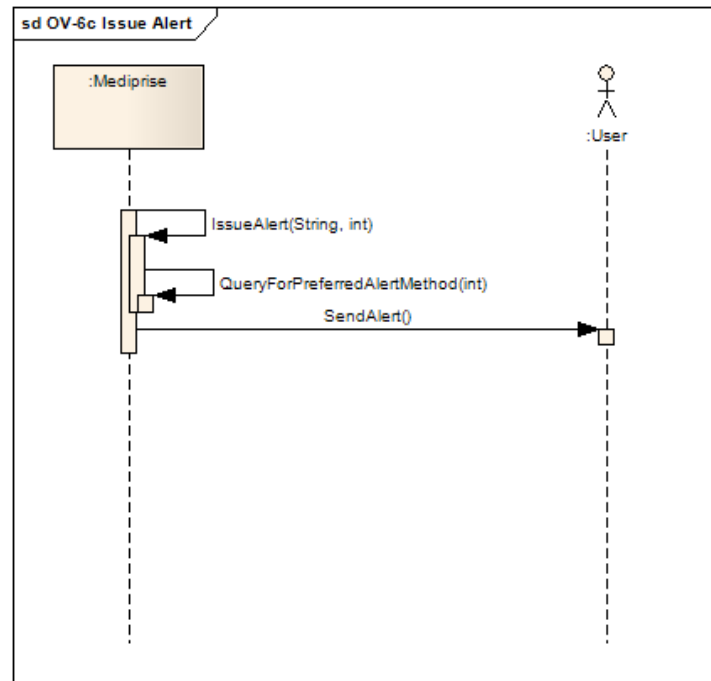


Figure 43: OV-6c Issue Alert

1.8.3 Update Medical Record and Prescription Information

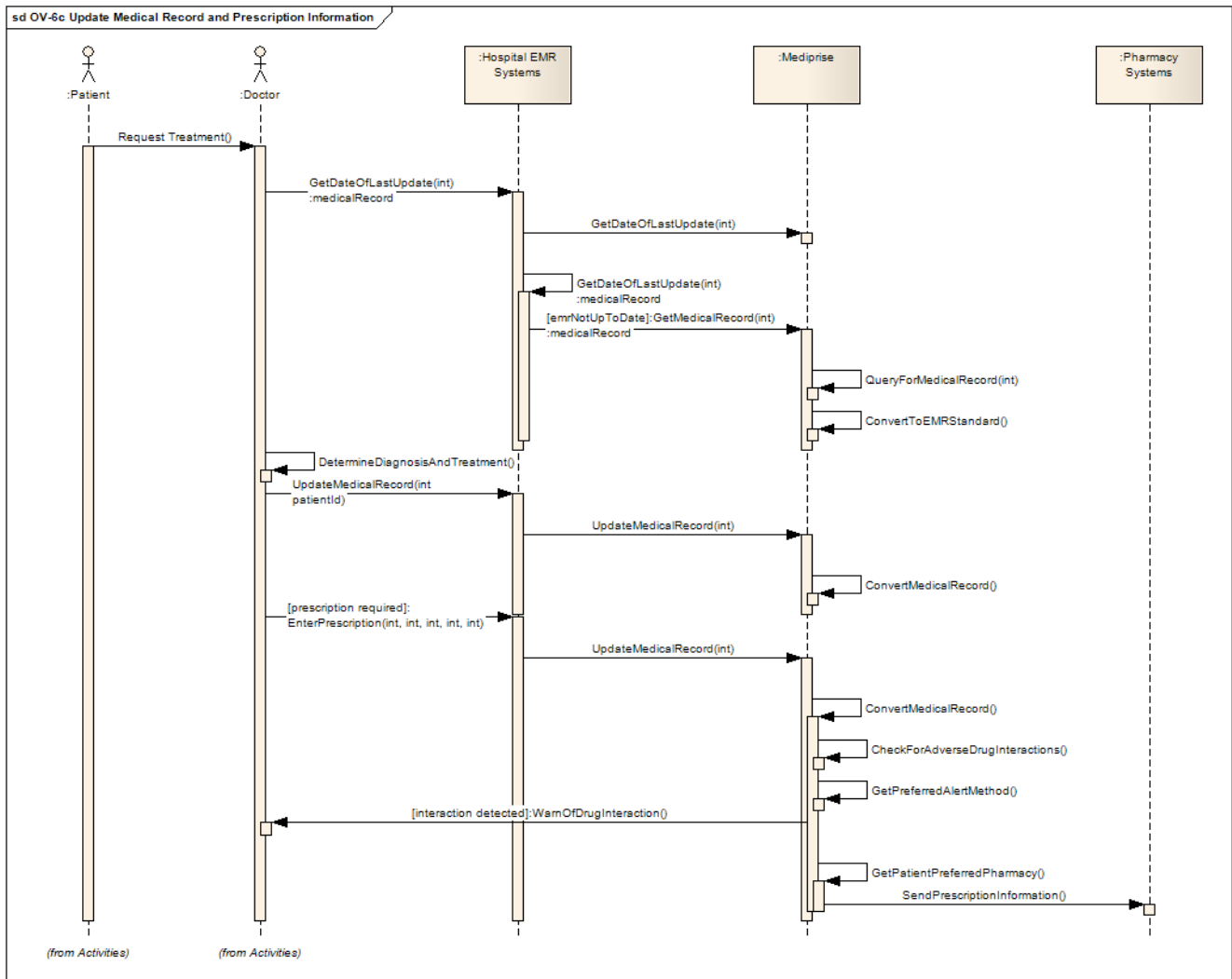


Figure 44: OV-6c Update Medical Record and Prescription Information

1.8.4 Update Patient Information

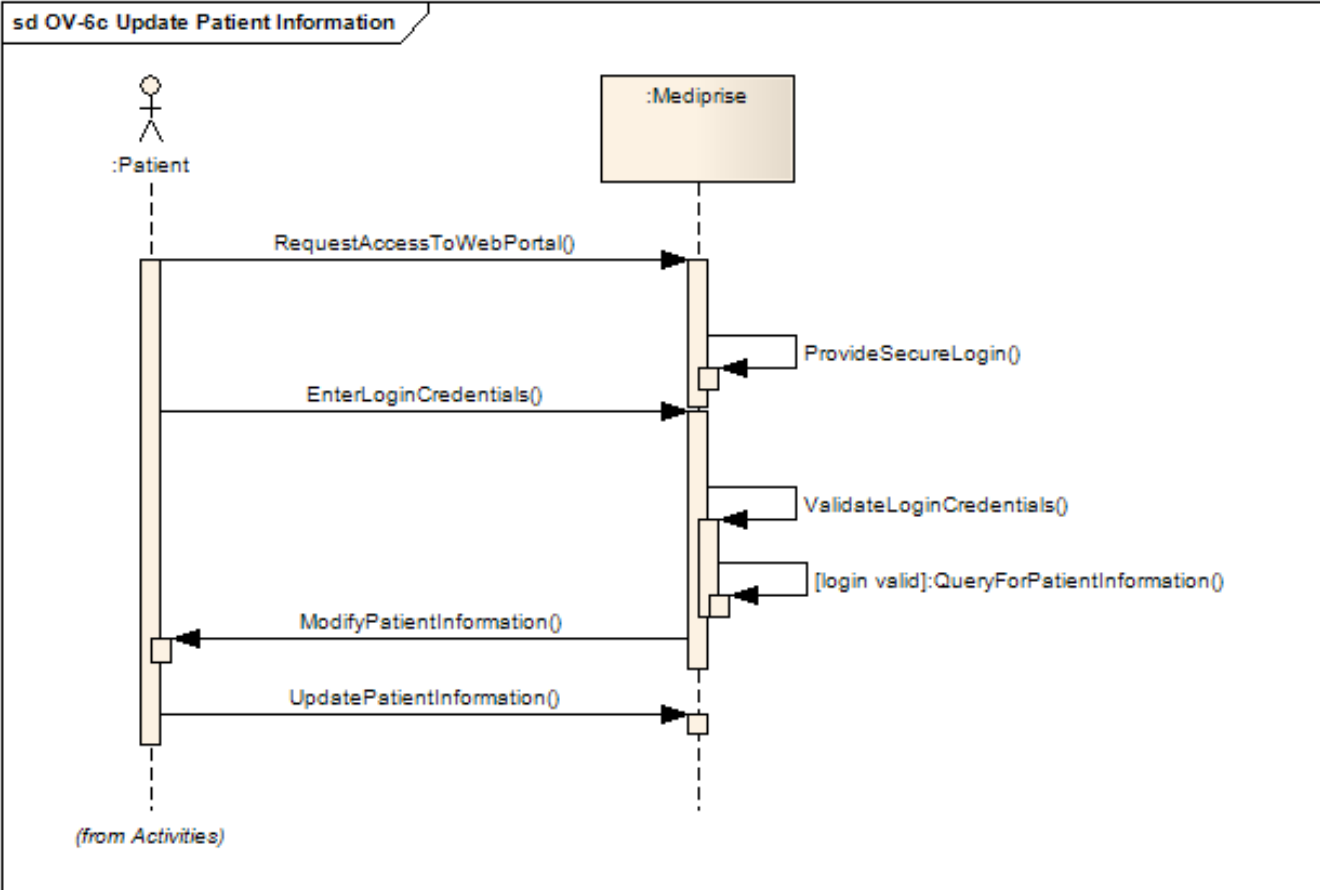


Figure 45: OV-6c Update Patient Information

1.9 OV-7 Mediprise Logical Data Model

Figure 46: OV-7 Logical Data Model

2 Systems View

2.1 SV-1 Systems Interface Description

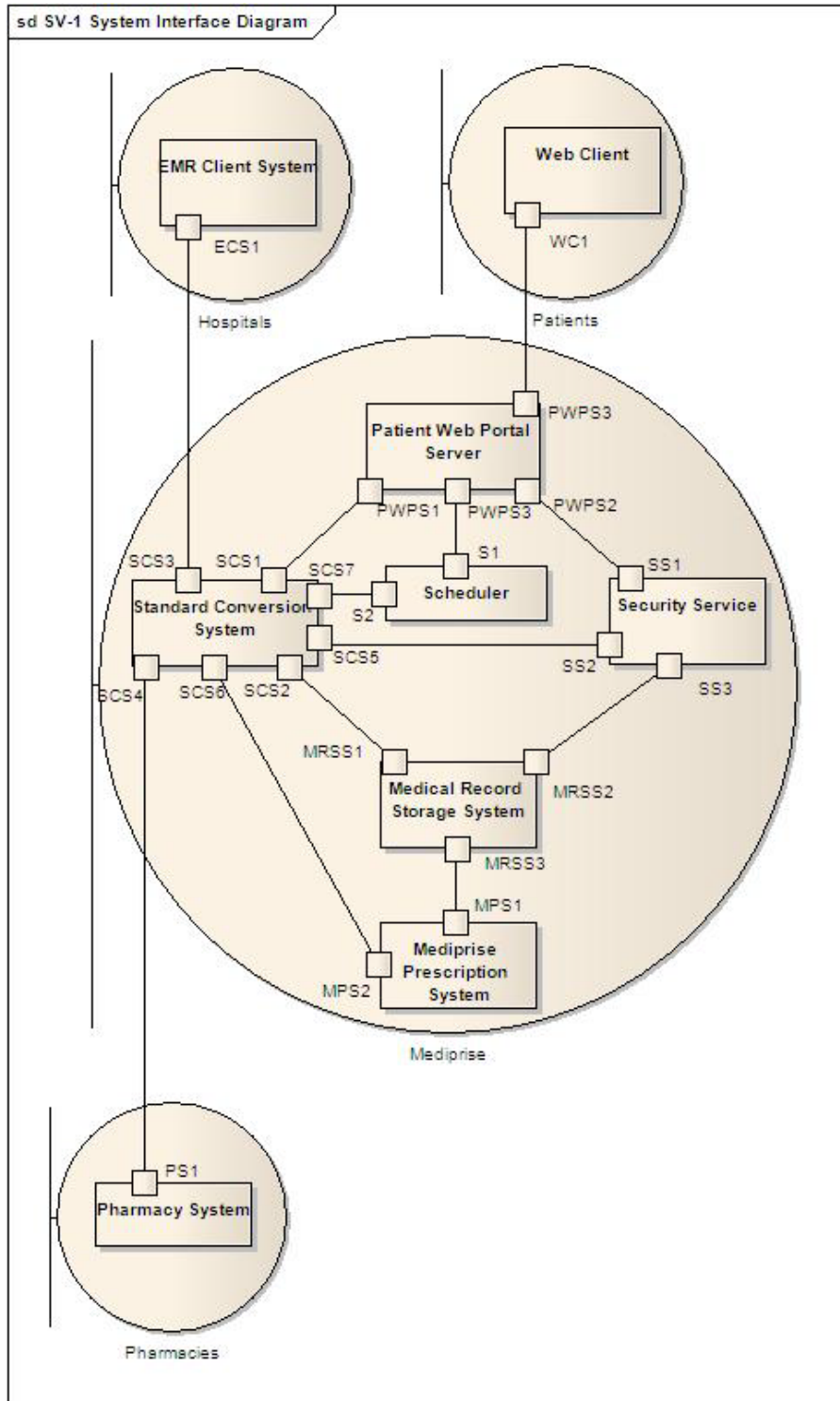


Figure 47: SV-1 Systems Interface Description

2.2 SV-2 Systems Communications Description

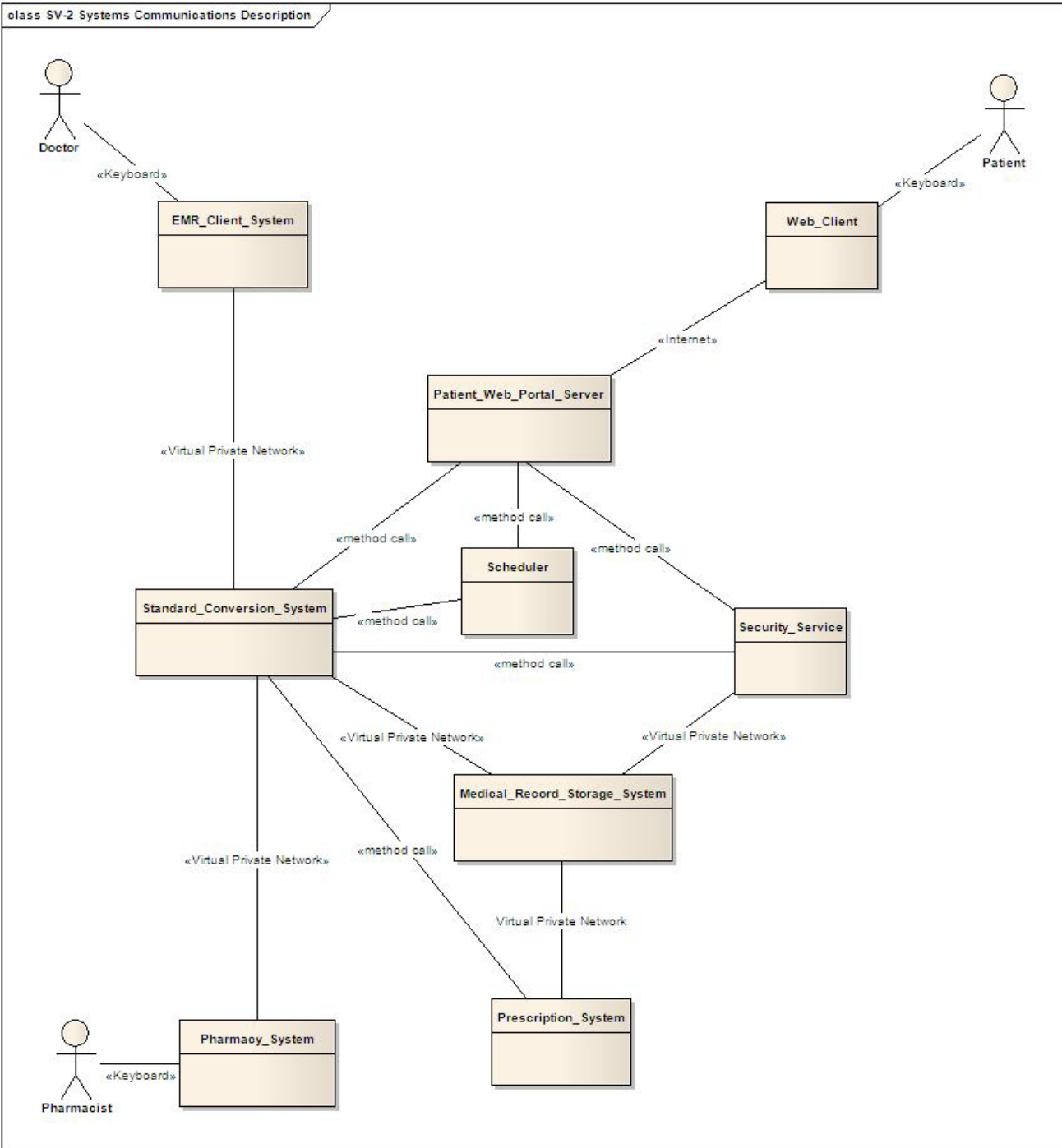


Figure 48: SV-2 Systems Communications Description

2.3 SV-3 Systems-Systems Matrix

Table 10 - SV-3 Systems-Systems Matrix

	Mediprise						Hospital	Patient	Pharmacy
	Patient Web Portal Server	Standard Conversion System	Scheduler	Security Service	Medical Record Storage System	Mediprise Prescription System	EMR Client System	Web Client	Pharmacy System
Patient Web Portal Server		Event based method call	Event based method call	Event based method call	N/A	N/A	N/A	HTML over TCP/IP. Secured using TLS/SSL	N/A
Standard Conversion System	Event based method call		N/A	Event based method call	VPN over TCP/IP	Event based method call	VPN over TCP/IP. Signed using DSA.	N/A	VPN over TCP/IP
Scheduler	Event based method call	N/A		N/A	N/A	N/A	N/A	N/A	N/A
Security Service	Event based method call providing user authentication	Event based method call providing Blowfish encryption	N/A		N/A	N/A	N/A	N/A	N/A
Medical Record Storage System	N/A	VPN over TCP/IP	N/A	N/A		VPN over TCP/IP	N/A	N/A	N/A
Mediprise Prescription System	N/A	Event based method call	N/A	N/A	VPN over TCP/IP		N/A	N/A	N/A
EMR Client System	N/A	VPN over TCP/IP. Signed using DSA.	N/A	N/A	N/A	N/A		N/A	N/A
Web Client	HTML over TCP/IP. Secured using TLS/SSL	N/A	N/A	N/A	N/A	N/A	N/A		N/A
Pharmacy System	N/A	VPN over TCP/IP	N/A	N/A	N/A	N/A	N/A	N/A	

2.4 SV-4a Systems Functionality Description

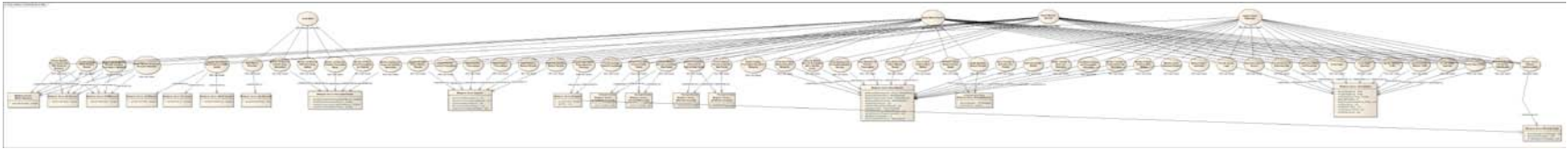


Figure 49: SV-4a Systems Functionality Description

2.6 SV-6 Systems Data Exchange Matrix

Table 12 - SV-6 Systems Data Exchange Matrix

Interface ID	System Interface Name and Identifier	Data Element Name and Identifier	Data Description			Producer		Consumer		Nature of Transaction		Performance Attributes		Information Assurance		Security	
			Content	Format Type	Accuracy	Data Standard	Sending System Name and Identifier	Sending System Function Name and Identifier	Receiving System Name and Identifier	Receiving System Function Name and Identifier	Criticality	Triggering Event	Periodicity	Timeliness	Access Control	Availability	Classification
PWPS2::SS1	User Credentials	User Identification Information	String	100%	N/A	Patient Web Portal System	Provide Login	Security Service	verifyUser	High	Patient Command	Discrete	< 1 secs	N/A	95%	Highly Confidential	HIPAA
PWPS3::S1	Event	Scheduled Event Information	String	100%	N/A	Patient Web Portal System	Schedule Event	Scheduler	Updating Patient Schedule	Medium	Patient Command	Discrete	< 2 Secs	N/A	95%	Highly Confidential	HIPAA
PWPS1::SCS1	Patient Input	Initial Patient Medical Information	String	100%	HTML	Patient Web Portal System	Update Patient Information	Standard Conversion System	Update Patient Info	High	Patient Command	Discrete	< 1 secs	N/A	95%	Highly Confidential	HIPAA
SCS1::PWPS1	Patient Medical Information	Patient Medical Information	String	100%	HTML	Standard Conversion System	Convert Outgoing Message	Patient Web Portal System	Display Patient Information	Medium	Patient Command	Discrete	< 1 secs	N/A	95%	Highly Confidential	HIPAA
SCS2::MRS51	Medical Record	Patient Medical Data	String	100%	HL7	Standard Conversion System	Update Patient Record	Medical Record Storage System	Update Patient Info	High	Patient/Hospital Command	Discrete	< 1 secs	N/A	99%	Highly Confidential	HIPAA
MRSS1::SCS2	Medical Record	Patient Medical Data	String	100%	HL7	Medical Record Storage System	Get Patient Medical Record	Standard Conversion System	Convert Outgoing Message	High	Patient/Hospital Command	Discrete	< 1 secs	N/A	99%	Highly Confidential	HIPAA
NP52::SCS6	Prescription	Patient Prescription Information	String	100%	HL7	Medprise Prescription System	Retrieving Prescription	Standard Conversion System	Convert Outgoing Message	High	Pharmacy Command	Discrete	< 1 secs	N/A	99%	Highly Confidential	HIPAA
SCS6::MPS2	Updated Prescription	Updated count of prescription refills available	String	100%	HL7	Standard Conversion System	Update Prescription	Medprise Prescription System	Update Patient Prescription	High	Pharmacy Command	Discrete	< 1 secs	N/A	99%	Highly Confidential	HIPAA
SCS7::S2	Event	Scheduled Event Information	String	100%	N/A	Standard Conversion System	Schedule Event	Scheduler	Updating Patient Schedule	High	Patient/Hospital Command	Discrete	< 1 secs	N/A	99%	Highly Confidential	HIPAA
SCS5::S52	Medical Record	Patient Medical Data	String	100%	HL7	Standard Conversion System	Secure Record	Security Service	Encrypt Record	High	Patient/Hospital/Pharmacy Command	Discrete	< 1 secs	N/A	99%	Highly Confidential	HIPAA
SS2::SCS5	Encrypted Record	Encrypted Patient Medical Data	String	100%	HL7/ASTM/ANSI X12	Security Service	Encrypt	Standard Conversion System	Send Message	High	Patient/Hospital/Pharmacy Command	Discrete	< 1 secs	N/A	99%	Highly Confidential	HIPAA
MPS1::MRS53	Prescription	Patient Prescription Information	String	100%	HL7	Medprise Prescription System	Get Prescription	Standard Conversion System	Send Message	High	Pharmacy Command	Discrete	< 1 secs	N/A	99%	Highly Confidential	HIPAA
MRS52::SS3	User Credentials	User Identification Information	String	100%	N/A	Medical Record Storage System	Provide Credentials	Security Service	verifyUser	High	Patient/Hospital Command	Discrete	< 1 secs	N/A	99%	Highly Confidential	HIPAA
WC1::PWPS3	Patient Credentials	System access credentials	String	100%	HTML	Web Client	Provide Login	Patient Web Portal System	Verify User	Medium	Patient Command	Discrete	< 10 Secs	User Name and Password	95%	Highly Confidential	HIPAA
WC1::PWPS3	Patient Info	Patient Information	String	100%	HTML	Web Client	Update Patient Information	Patient Web Portal System	Update Patient Info	Medium	Patient Command	Discrete	< 10 Secs	User Name and Password	95%	Highly Confidential	HIPAA
PWPS3::WC1	Medical Record	Patient Medical Data	String	100%	HTML	Patient Web Portal System	Send Patient Information	Web Client	Display Patient Information	Medium	Patient Command	Discrete	< 10 Secs	N/A	95%	Highly Confidential	HIPAA
EC51::SCS3	Update Request	Patient ID	int	100%	HL7/ASTM/ANSI X12	EMR Client System	Get Date of Last Update	Standard Conversion System	Get Medical Record Date	High	Hospital Command	Discrete	< 5 Secs	EMR Access Controls	99%	Highly Confidential	HIPAA
EC51::SCS3	Medical Record	Patient Medical Data	String	100%	HL7/ASTM/ANSI X12	EMR Client System	Send Medical Record	Standard Conversion System	Get Medical Record	High	Hospital Command	Discrete	< 5 Secs	EMR Access Controls	99%	Highly Confidential	HIPAA
EC51::SCS3	Prescription	Patient Prescription Information	String	100%	HL7/ASTM/ANSI X12	EMR Client System	Send Prescription	Standard Conversion System	Convert Incoming Message	High	Hospital Command	Discrete	< 5 Secs	EMR Access Controls	99%	Highly Confidential	HIPAA
SCS3::EC51	Medical Record	Patient Medical Data	String	100%	HL7/ASTM/ANSI X12	Standard Conversion System	Convert Outgoing Message	EMR Client System	Send Message	High	Hospital Command	Discrete	< 5 Secs	N/A	99%	Highly Confidential	HIPAA
SCS3::EC51	Alert	Potential Drug Interactions	String	100%	HL7/ASTM/ANSI X12	Standard Conversion System	Convert Outgoing Message	EMR Client System	Send Alert	Extremely High	Hospital Command	Discrete	< 1 Secs	N/A	99%	Highly Confidential	HIPAA
PS1::SCS4	Patient Id	Patient ID	int	100%	HL7/ASTM/ANSI X12	Pharmacy System	Request Prescription	Standard Conversion System	Convert Incoming Message	High	Pharmacy Command	Discrete	< 5 Secs	Pharmacy Access Controls	99%	Highly Confidential	HIPAA
PS1::SCS4	Updated Prescription	Updated count of prescription refills available	String	100%	HL7/ASTM/ANSI X12	Pharmacy System	Update Prescription	Standard Conversion System	Convert Incoming Message	Medium	Pharmacy Command	Discrete	< 5 Secs	Pharmacy Access Controls	99%	Highly Confidential	HIPAA
SCS4::PS1	Prescription	Patient Prescription Information	String	100%	HL7/ASTM/ANSI X12	Standard Conversion System	Convert Outgoing Message	Pharmacy System	Display Prescription	High	Pharmacy Command	Discrete	< 5 Secs	N/A	99%	Highly Confidential	HIPAA
SCS4::PS1	Alert	Potential Drug Interactions	String	100%	HL7/ASTM/ANSI X12	Standard Conversion System	Convert Outgoing Message	Pharmacy System	Send Alert	Extremely High	Pharmacy Command	Discrete	< 1 Secs	N/A	99%	Highly Confidential	HIPAA

2.7 SV-7 System Performance Parameters Matrix

Table 13 - SV-7 Systems Performance Parameters Matrix

System Name - Mediprise	
Hardware Element 1 - Application Server	
Mean Time To Recovery	8 hours
Availability	0.99
System Initialization Time	< 300 seconds
Architecture Data Transfer Rate	1000mb/s
Program Restart Time	< 300 seconds
Software Element 1.1 - Patient Web Portal Server	
Architecture Data Capacity (e.g. throughput or # processed/unit time)	500K Simult. Patients
Patient Interaction Response Times	< 5 seconds
Availability	0.95
Effectiveness	0.99
Mean Time Between S/W Failures	2,200 hours
Software Element 1.2 - Scheduler	
Architecture Data Capacity (e.g. throughput or # processed/unit time)	1M Events/second
Operator Interaction Response Times	N/A
Availability	0.95
Effectiveness	0.99
Mean Time Between S/W Failures	1,440 hours
Software Element 1.3 - Standard Conversion System	
Architecture Data Capacity (e.g. throughput or # processed/unit time)	1000 Medical Records/second
Operator Interaction Response Times	N/A
Availability	0.99
Effectiveness	1
Mean Time Between S/W Failures	2,200 hours
Software Element 1.4 - Security Service	
Architecture Data Capacity (e.g. throughput or # processed/unit time)	1000 Encrypted Medical Records/second + 10K Authentications/second
Operator Interaction Response Times	N/A
Availability	0.99
Effectiveness	1
Mean Time Between S/W Failures	2,200 hours
Hardware Element 2 - (Database) Storage Server	
Mean Time To Recovery	8 hours
Availability	0.99
System Initialization Time	< 300 Seconds
Architecture Data Transfer Rate	1000mb/s
Program Restart Time	< 300 seconds
Software Element 2.1 - Database Software	
Architecture Data Capacity (e.g. throughput or # processed/unit time)	10K queries per second
Operator Interaction Response Times	N/A
Availability	0.99
Effectiveness	1
Mean Time Between S/W Failures	2,200 hours
Hardware Element 3 - Patient Computer System	
Mean Time To Recovery	N/A
Availability	N/A
System Initialization Time	N/A
Architecture Data Transfer Rate	N/A
Program Restart Time	N/A
Software Element 3.1 - Patient Web Client	
Architecture Data Capacity (e.g. throughput or # processed/unit time)	N/A
Operator Interaction Response Times	N/A
Availability	N/A
Effectiveness	0.99
Mean Time Between S/W Failures	N/A
Web Browser Requirements	IE 6+, Firefox, Safari
Hardware Element 4 - EMR Client Server	
Mean Time To Recovery	3 hours
Availability	0.99
System Initialization Time	< 120 seconds
Architecture Data Transfer Rate	1000mb/s
Program Restart Time	< 120 seconds
Software Element 4.1 - EMR Client System Software	
Architecture Data Capacity (e.g. throughput or # processed/unit time)	100 Medical Records/second
Operator Interaction Response Times	< 3 seconds
Availability	0.99
Effectiveness	1
Mean Time Between S/W Failures	2,200 hours
Hardware Element 5 - Pharmacy System Server	
Mean Time To Recovery	8 hours
Availability	0.99
System Initialization Time	< 120 seconds
Architecture Data Transfer Rate	100mb/s
Program Restart Time	< 120 seconds
Software Element 5.1 - Pharmacy System Software	
Architecture Data Capacity (e.g. throughput or # processed/unit time)	100 Prescriptions/second
Operator Interaction Response Times	< 5 seconds
Availability	0.99
Effectiveness	1
Mean Time Between S/W Failures	1,440 hours

2.8 SV-8 Systems Evolution Description

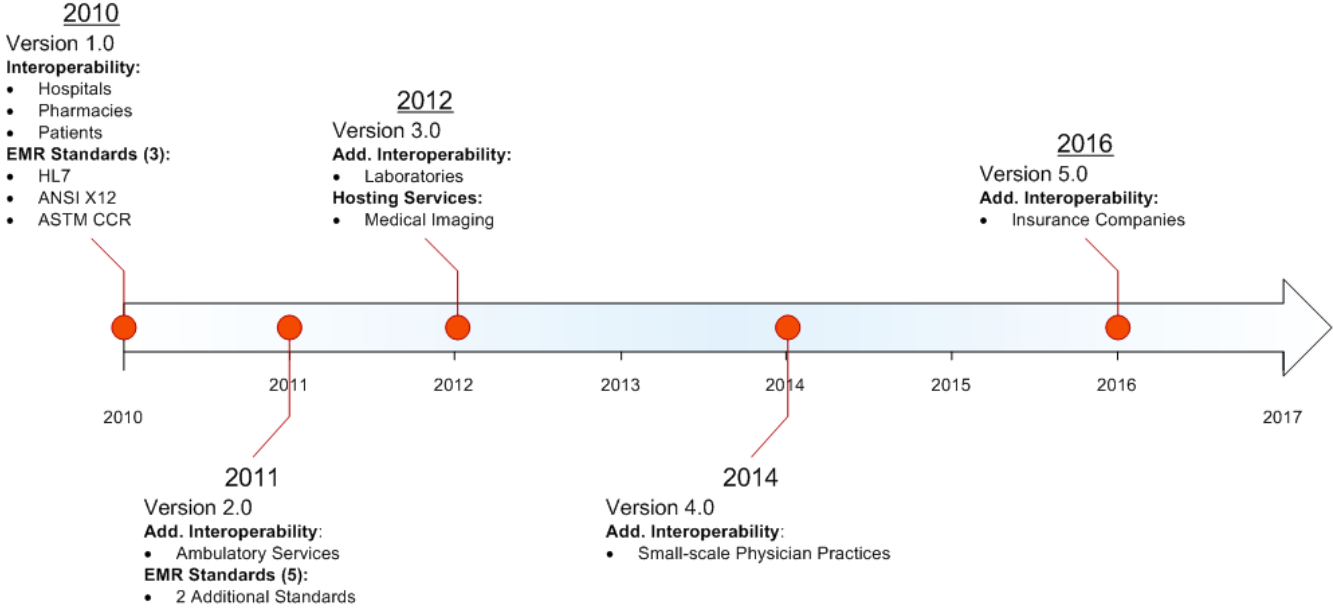


Figure 50: SV-8 Systems Evolution Description

2.9 SV-10c Systems Event Trace Description

2.9.1 Export Medical Records

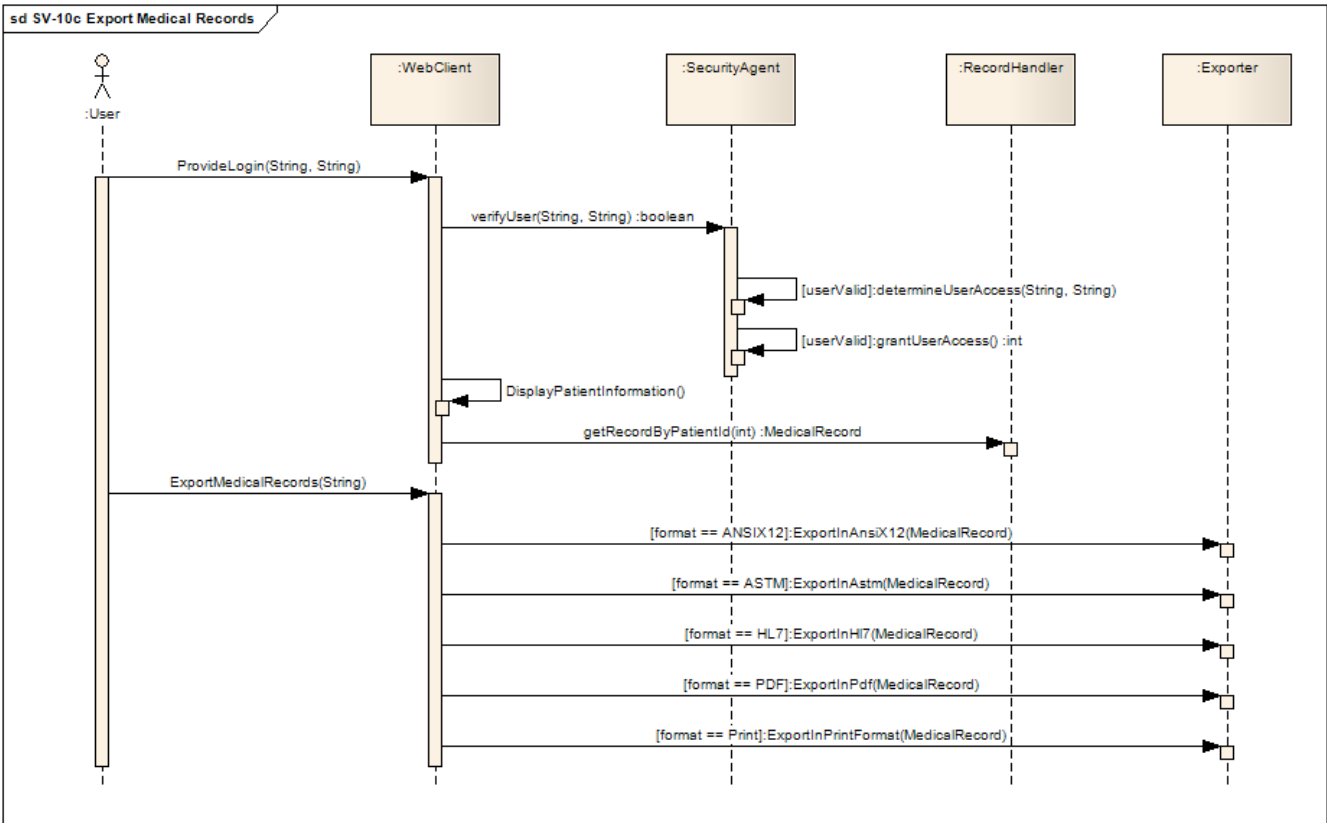


Figure 51: SV-10c Export Medical Records

2.9.2 Issue Alert

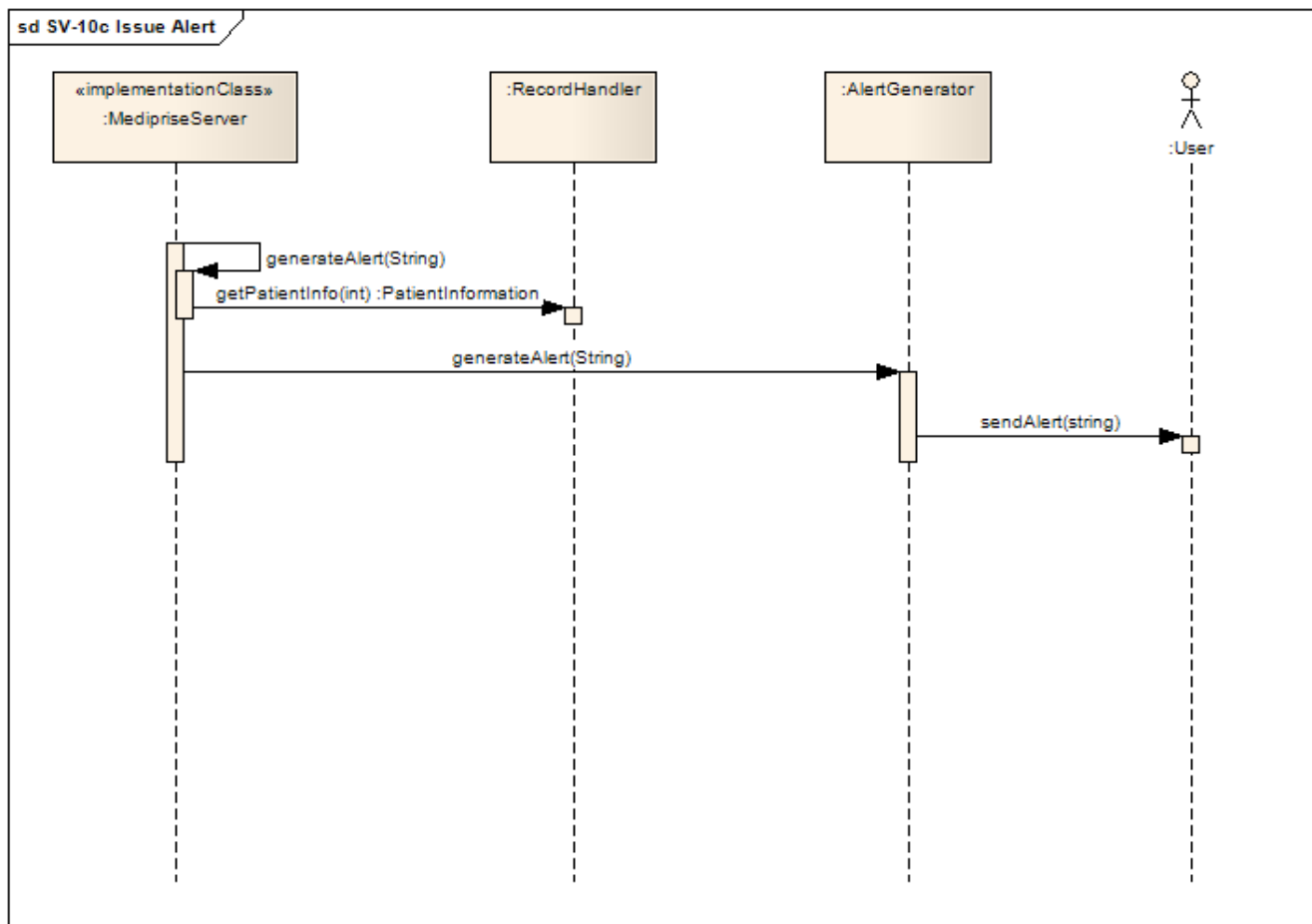


Figure 52: SV-10c Issue Alert

2.9.3 Update Medical Record and Prescription Information

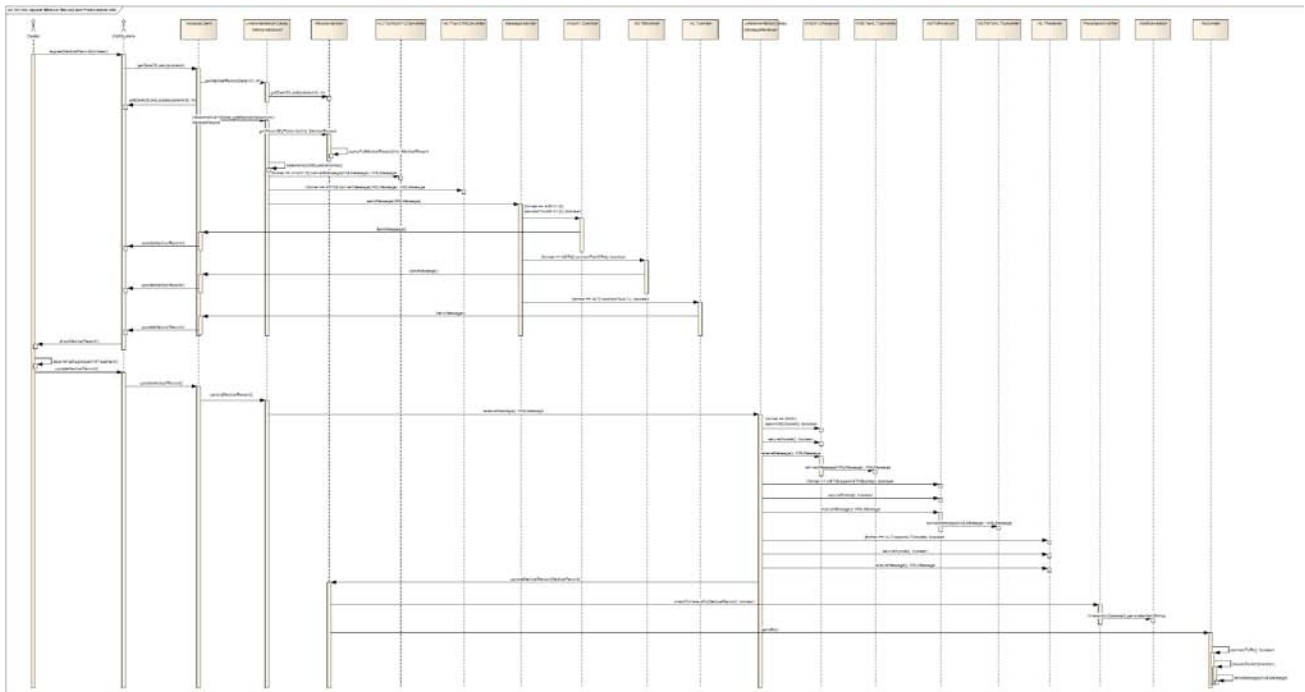


Figure 53: SV-10c Update Medical Record and Prescription Information

2.9.4 Update Patient Information

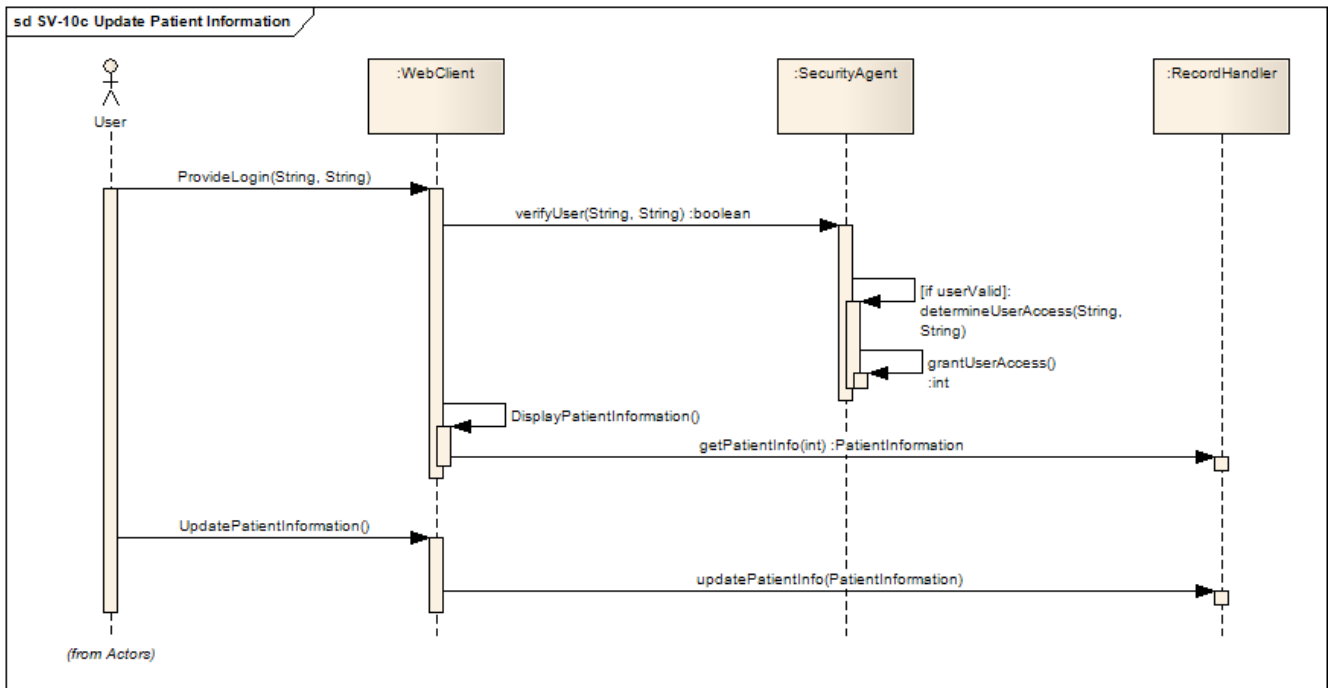


Figure 54: SV-10c Update Patient Information

2.10 SV-11 Physical Schema

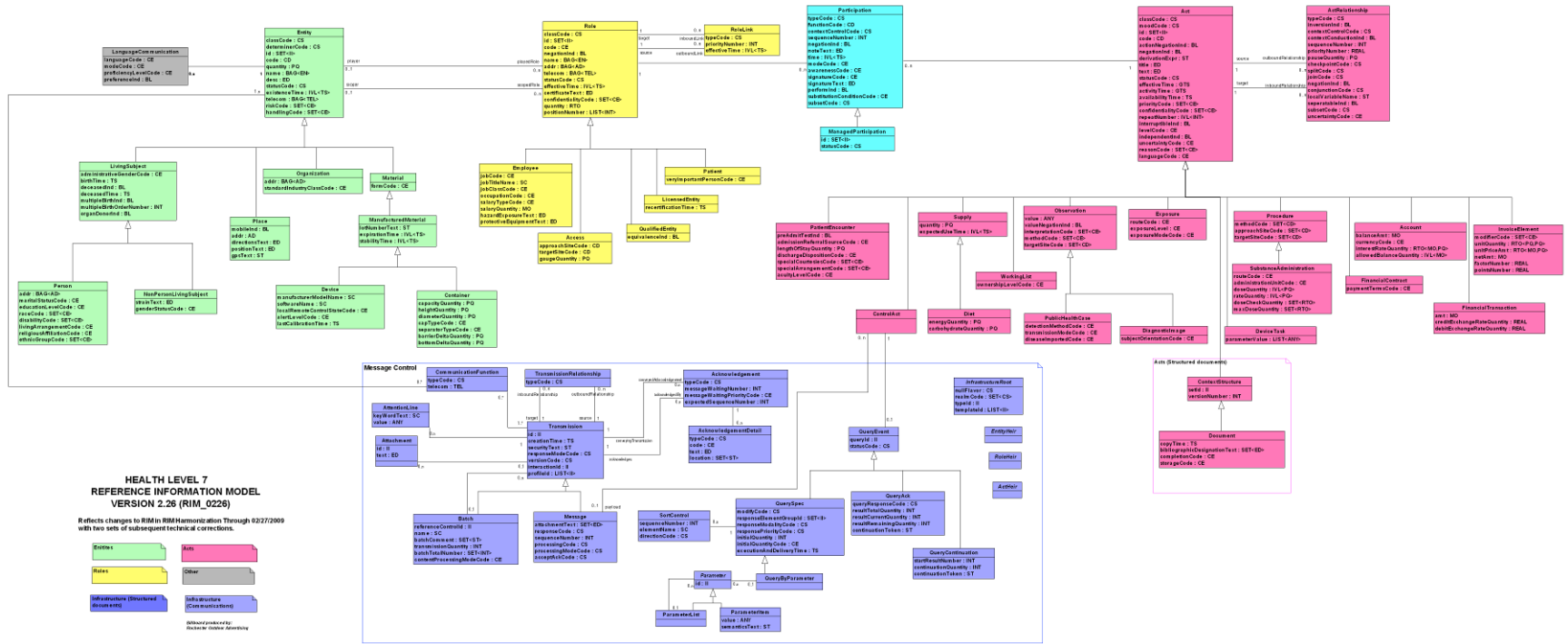


Figure 55: SV-11 Physical Schema¹

¹ HL7 Reference Information Model, http://www.hl7.org/Library/data-model/RIM/modelpage_mem.htm

2.11 TV-1 Technical Standards Profile

Table 14 - TV-1 Technical Standards Profile

Technology Service Area	Technical Service	Standards
Service Interface and Integration	Data Exchange	Portable Document Format (PDF) - ISO 32000-1:2008
		HL7 version 3.0 - ISO 10781
		ASTM Continuity of Care (CCR) - ASTM E2369-05
		ANSI ASC X12N 278:2002
	Data Transfer	VPN over TCP/IP
	Alert	Email
		SMS - Short Message Service
Page - FLEX protocol		
Data Conversion	Mirth - converts HL7 and X12	
	BOTS - converts EDI	
Database Management System	Data Store	Oracle RDBMS
	Calendar	iCalendar RFC 2445
Access Control	Authentication	Windows Authentication
		SecureLogin SSO
	Data Encryption	Blowfish
	Digital Signature	Digital Signature Standard (DSA) - FIPS 186
	Origin Authentication	Assymetric Signatures
Key Encryption	PGP Universal 2.10	
Network Management	Monitor	Wireshark
	Secure Communication	Transport Layer Security (TLS/SSL)

2.12 TV-2 Technical Standards Forecast

Table 15 - TV-2 Technical Standards Forecast

Technology Service Area	Technical Service	Standards	Forecast
Service Interface and Integration	Data Exchange	Digital Imaging and Communications in Medicine (DICOM)	2012
		ISO TC 215	2014
		openEHR	2011
		HITSP	2011

Appendix VII: Function Point Analysis Values

1 Function Point Analysis – Mediprise

1.1 Function Points

1.1.1 External Inputs

1. ANSIX12 Medical Records
2. ASTM Medical Records
3. HL7 Medical Records
4. ANSIX12 Prescriptions
5. ASTM Prescriptions
6. HL7 Prescriptions

1.1.2 External Outputs

1. ANSIX12 Medical Records
2. ASTM Medical Records
3. HL7 Medical Records
4. Printed Reports
5. PDF Report
6. ANSIX12 Prescriptions
7. ASTM Prescriptions
8. HL7 Prescriptions
9. Patient Information
10. SMS Messaging
11. Page Messaging
12. Email Messaging

1.1.3 External Inquiries

1. Medical Record Updated Message
2. Request Medical Record Message

1.1.4 External Interfaces

1. None

1.1.5 Internal Files

1. Medical Records
2. Prescriptions
3. User Information
4. Patient Information

1.2 Function Count Weighting²

	Count	Low	Average	High
External Input	6	18	24	36
External Output	12	48	60	84
Internal File	2	14	20	30
External Interface	0	0	0	0
External Inquiry	4	12	16	24
			Sum	410

Total Sum = 410

1.3 Adjustment Factor

Data Communications: 5

Distributed Functions: 4

Performance: 3

Heavily used configuration: 2

Transaction Rate: 3

Online data entry: 1

End user efficiency: 5

Online update: 1

Complex processing: 0

Reusability: 4

Installation ease: 0

Operational ease: 4

Multiple sites: 5

Facilities change: 1

² <http://brad.touesnard.com/docs/SWE4103-report.pdf>. Viewed on April 18, 2009.

$$VAF = 0.65 + 0.01 \times \sum_{i=1}^{14} c_i$$

$$VAF = 1.03$$

1.4 Adjusted Function Point

$$AFP = UFP \times VAF$$

$$AFP = 422.3$$

1.5 Java UFP Values³

Average: 60

Median: 59

Low: 14

High: 97

1.6 SLOC Values

Average = 25,338

Median = 24,916

Low = 5,912

High = 40,963

1.7 COCOMO II Analysis

Using the median SLOC value above, Mediprise was entered into COCOMO II to determine a cost and schedule estimate. Utilizing a monthly labor rate of \$7000 per person and a short schedule, COCOMO II calculated that the Most Likely schedule would take 16.8 months with a staff of 12.5. The cost estimate was calculated to be \$1,406,562. HouseCare utilized COCOMOII to develop a cost analysis because the first installation of Medprise is primarily software based.

³ <http://www.qsm.com/FPGearing.html>. Viewed on April 18, 2009.

Appendix VIII: Cost Analysis Assumptions Data – Baseline

Crystal Ball Report - Full

No Simulation Data

Assumptions

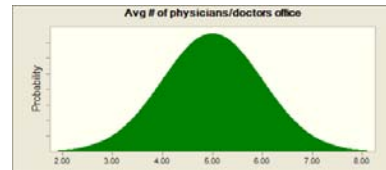
Worksheet: [Cost_Analysis_10yr_v7.xls]Base Income

Assumption: Avg # of physicians/doctors office

Cell: B32

Normal distribution with parameters:

Mean	5.00
Std. Dev.	1.00

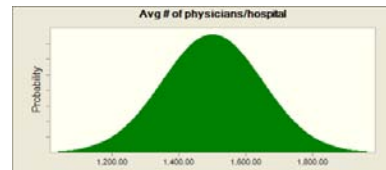


Assumption: Avg # of physicians/hospital

Cell: B31

Normal distribution with parameters:

Mean	1,500.00
Std. Dev.	150.00

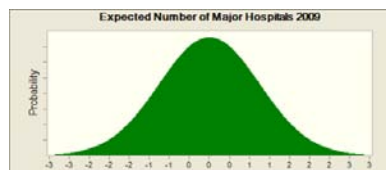


Assumption: Expected Number of Major Hospitals 2009

Cell: B9

Normal distribution with parameters:

Mean	0	(=B9)
Std. Dev.	1	



Assumption: Expected Number of Major Hospitals 2010

Cell: C9

Triangular distribution with parameters:

Minimum	1.00
Likeliest	2.00
Maximum	3.00



Assumption: Expected Number of Major Hospitals 2011

Cell: D9

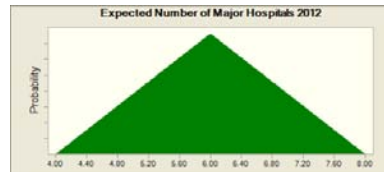
Triangular distribution with parameters:
Minimum 2.00
Likeliest 3.00
Maximum 4.00



Assumption: Expected Number of Major Hospitals 2012

Cell: E9

Triangular distribution with parameters:
Minimum 4.00
Likeliest 6.00
Maximum 8.00



Assumption: Expected Number of Major Hospitals 2013

Cell: F9

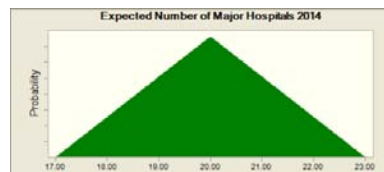
Triangular distribution with parameters:
Minimum 10.00
Likeliest 12.00
Maximum 14.00



Assumption: Expected Number of Major Hospitals 2014

Cell: G9

Triangular distribution with parameters:
Minimum 17.00
Likeliest 20.00
Maximum 23.00



Assumption: Expected Number of Major Hospitals 2015

Cell: H9

Triangular distribution with parameters:
Minimum 30.00
Likeliest 35.00
Maximum 40.00



Assumption: Expected Number of Major Hospitals 2016

Cell: I9

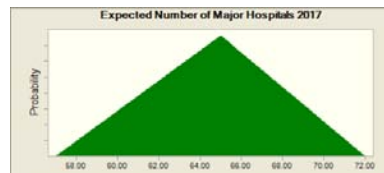
Triangular distribution with parameters:
Minimum 44.00
Likeliest 50.00
Maximum 56.00



Assumption: Expected Number of Major Hospitals 2017

Cell: J9

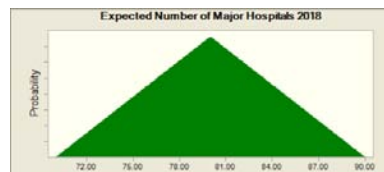
Triangular distribution with parameters:
Minimum 57.00
Likeliest 65.00
Maximum 72.00



Assumption: Expected Number of Major Hospitals 2018

Cell: K9

Triangular distribution with parameters:
Minimum 70.00
Likeliest 80.00
Maximum 90.00

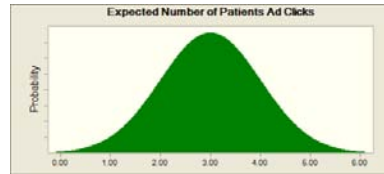


Assumption: Expected Number of Patients Ad Clicks

Cell: B33

Normal distribution with parameters:

Mean 3.00
Std. Dev. 1.00

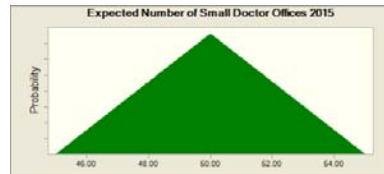


Assumption: Expected Number of Small Doctor Offices 2015

Cell: H10

Triangular distribution with parameters:

Minimum 45.00
Likeliest 50.00
Maximum 55.00

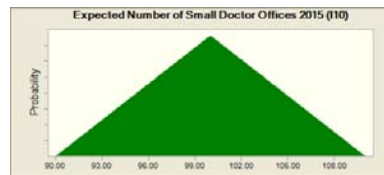


Assumption: Expected Number of Small Doctor Offices 2015 (I10)

Cell: I10

Triangular distribution with parameters:

Minimum 90.00
Likeliest 100.00
Maximum 110.00

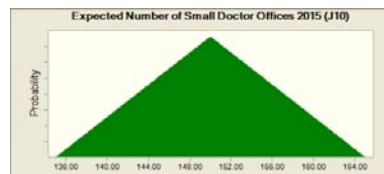


Assumption: Expected Number of Small Doctor Offices 2015 (J10)

Cell: J10

Triangular distribution with parameters:

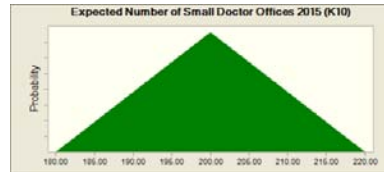
Minimum 135.00
Likeliest 150.00
Maximum 165.00



Assumption: Expected Number of Small Doctor Offices 2015 (K10)

Cell: K10

Triangular distribution with parameters:
Minimum 180.00
Likeliest 200.00
Maximum 220.00



Worksheet: [Cost_Analysis_10yr_v7.xls]Baseline Cost

Assumption: C12

Cell: C12

Triangular distribution with parameters:
Minimum 20
Likeliest 25
Maximum 30



Assumption: D12

Cell: D12

Triangular distribution with parameters:
Minimum 25
Likeliest 30
Maximum 35



Assumption: E12

Cell: E12

Triangular distribution with parameters:
Minimum 35
Likeliest 40
Maximum 45



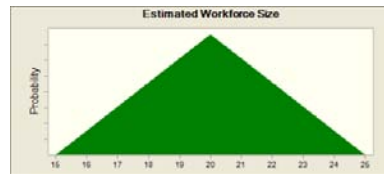
Assumption: Estimated Workforce Size

Cell: B12

Triangular distribution with parameters:

- Minimum
- Likeliest
- Maximum

- 15
- 20
- 25



Assumption: F12

Cell: F12

Triangular distribution with parameters:

- Minimum
- Likeliest
- Maximum

- 45
- 50
- 55



Assumption: G12

Cell: G12

Triangular distribution with parameters:

- Minimum
- Likeliest
- Maximum

- 55
- 60
- 65



Assumption: H12

Cell: H12

Triangular distribution with parameters:

- Minimum
- Likeliest
- Maximum

- 65
- 70
- 75



Assumption: I12

Cell: I12

Triangular distribution with parameters:

- Minimum
- Likeliest
- Maximum

- 81
- 90
- 99



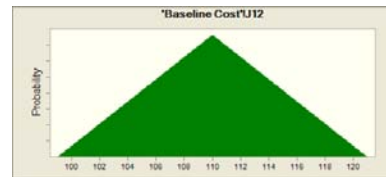
Assumption: J12

Cell: J12

Triangular distribution with parameters:

- Minimum
- Likeliest
- Maximum

- 99
- 110
- 121



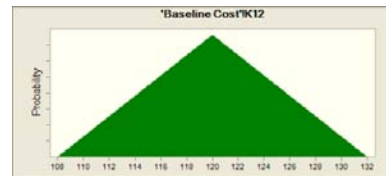
Assumption: K12

Cell: K12

Triangular distribution with parameters:

- Minimum
- Likeliest
- Maximum

- 108
- 120
- 132



End of Assumptions

Decision Variables

Worksheet: [Cost_Analysis_10yr_v7.xls]Base Income

Decision Variable: Setup Costs Per Physician

Cell: B34

Variable bounds:

Lower	180.00
Upper	220.00

Variable type: Discrete

Step size:	10.00
------------	-------

Decision Variable: Subscription Fee per Physician

Cell: B35

Variable bounds:

Lower	20.00
Upper	40.00

Variable type: Discrete

Step size:	1.00
------------	------

Worksheet: [Cost_Analysis_10yr_v7.xls]Baseline Cost

Decision Variable: Average Base Salary

Cell: B11

Variable bounds:

Lower	70000
Upper	90000

Variable type: Discrete

Step size:	10000
------------	-------

Decision Variable: Small Business Loan

Cell: B4

Variable bounds:

Lower	\$500,000
Upper	\$1,000,000

Variable type: Discrete

Step size:	\$50,000
------------	----------

Appendix IX: Cost Analysis Assumptions Data – Modified

Assumptions

Worksheet: [Cost_Analysis_10yr_v3_Modified.xls]Modified Cost

Assumption: Estimated Workforce Size - 2009

Cell: B12

Triangular distribution with parameters:

Minimum	15
Likeliest	20
Maximum	25



Assumption: Estimated Workforce Size - 2010

Cell: C12

Triangular distribution with parameters:

Minimum	20
Likeliest	25
Maximum	30



Assumption: Estimated Workforce Size - 2011

Cell: D12

Triangular distribution with parameters:

Minimum	25
Likeliest	30
Maximum	35



Assumption: Estimated Workforce Size - 2012

Cell: E12

Triangular distribution with parameters:

Minimum	35
Likeliest	40
Maximum	45



Assumption: Estimated Workforce Size - 2013

Cell: F12

Triangular distribution with parameters:

Minimum	45
Likeliest	50
Maximum	55

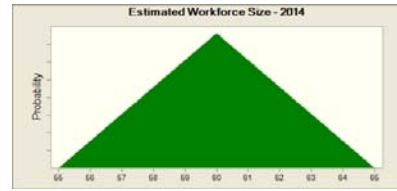


Assumption: Estimated Workforce Size - 2014

Cell: G12

Triangular distribution with parameters:
Minimum
Likeliest
Maximum

55
60
65



Assumption: Estimated Workforce Size - 2015

Cell: H12

Triangular distribution with parameters:
Minimum
Likeliest
Maximum

65
70
75



Assumption: Estimated Workforce Size - 2016

Cell: I12

Triangular distribution with parameters:
Minimum
Likeliest
Maximum

81
90
99



Assumption: Estimated Workforce Size - 2017

Cell: J12

Triangular distribution with parameters:
Minimum
Likeliest
Maximum

99
110
121



Assumption: Estimated Workforce Size - 2018

Cell: K12

Triangular distribution with parameters:
Minimum
Likeliest
Maximum

108
120
132

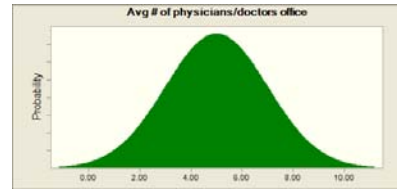


Assumption: Avg # of physicians/doctors office

Cell: B32

Normal distribution with parameters:

Mean 5.00
Std. Dev. 2.00

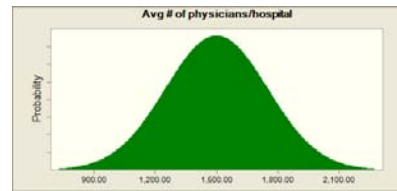


Assumption: Avg # of physicians/hospital

Cell: B31

Normal distribution with parameters:

Mean 1,500.00
Std. Dev. 250.00

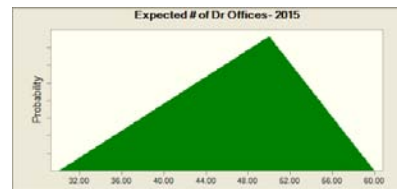


Assumption: Expected # of Dr Offices- 2015

Cell: H10

Triangular distribution with parameters:

Minimum 30.00
Likeliest 50.00
Maximum 60.00

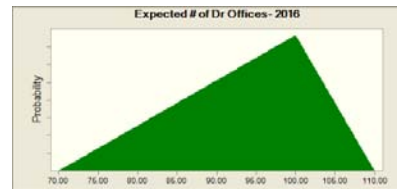


Assumption: Expected # of Dr Offices- 2016

Cell: I10

Triangular distribution with parameters:

Minimum 70.00
Likeliest 100.00
Maximum 110.00

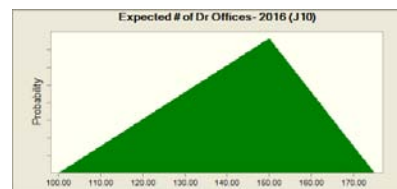


Assumption: Expected # of Dr Offices- 2016 (J10)

Cell: J10

Triangular distribution with parameters:

Minimum 100.00
Likeliest 150.00
Maximum 175.00

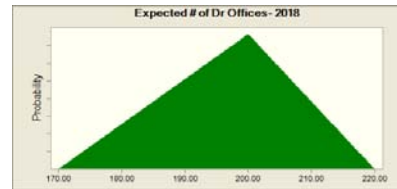


Assumption: Expected # of Dr Offices- 2018

Cell: K10

Triangular distribution with parameters:

Minimum	170.00
Likeliest	200.00
Maximum	220.00

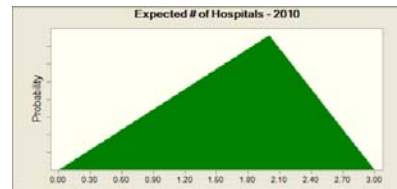


Assumption: Expected # of Hospitals - 2010

Cell: C9

Triangular distribution with parameters:

Minimum	0.00
Likeliest	2.00
Maximum	3.00

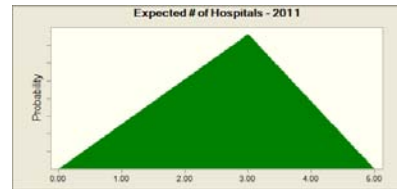


Assumption: Expected # of Hospitals - 2011

Cell: D9

Triangular distribution with parameters:

Minimum	0.00
Likeliest	3.00
Maximum	5.00



Assumption: Expected # of Hospitals - 2012

Cell: E9

Triangular distribution with parameters:

Minimum	3.00
Likeliest	6.00
Maximum	8.00



Assumption: Expected # of Hospitals - 2013

Cell: F9

Triangular distribution with parameters:

Minimum	9.00
Likeliest	12.00
Maximum	15.00

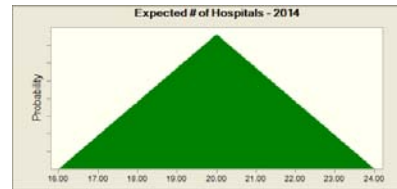


Assumption: Expected # of Hospitals - 2014

Cell: G9

Triangular distribution with parameters:

Minimum 16.00
Likeliest 20.00
Maximum 24.00

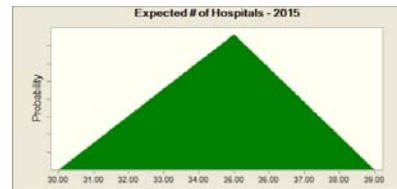


Assumption: Expected # of Hospitals - 2015

Cell: H9

Triangular distribution with parameters:

Minimum 30.00
Likeliest 35.00
Maximum 39.00

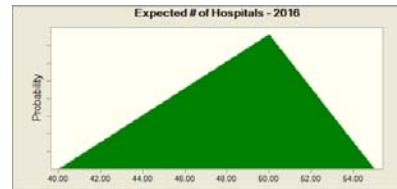


Assumption: Expected # of Hospitals - 2016

Cell: I9

Triangular distribution with parameters:

Minimum 40.00
Likeliest 50.00
Maximum 55.00

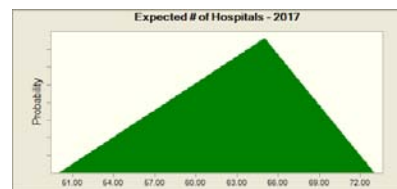


Assumption: Expected # of Hospitals - 2017

Cell: J9

Triangular distribution with parameters:

Minimum 50.00
Likeliest 65.00
Maximum 73.00

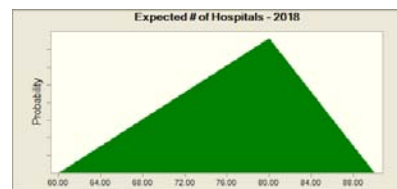


Assumption: Expected # of Hospitals - 2018

Cell: K9

Triangular distribution with parameters:

Minimum 60.00
Likeliest 80.00
Maximum 90.00

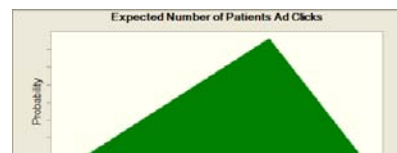


Assumption: Expected Number of Patients Ad Clicks

Cell: B33

Triangular distribution with parameters:

Minimum 118 of 123
Likeliest 3.00
Maximum 4.00



Appendix X: Executable Architecture

See external file Mediprise.cpn.

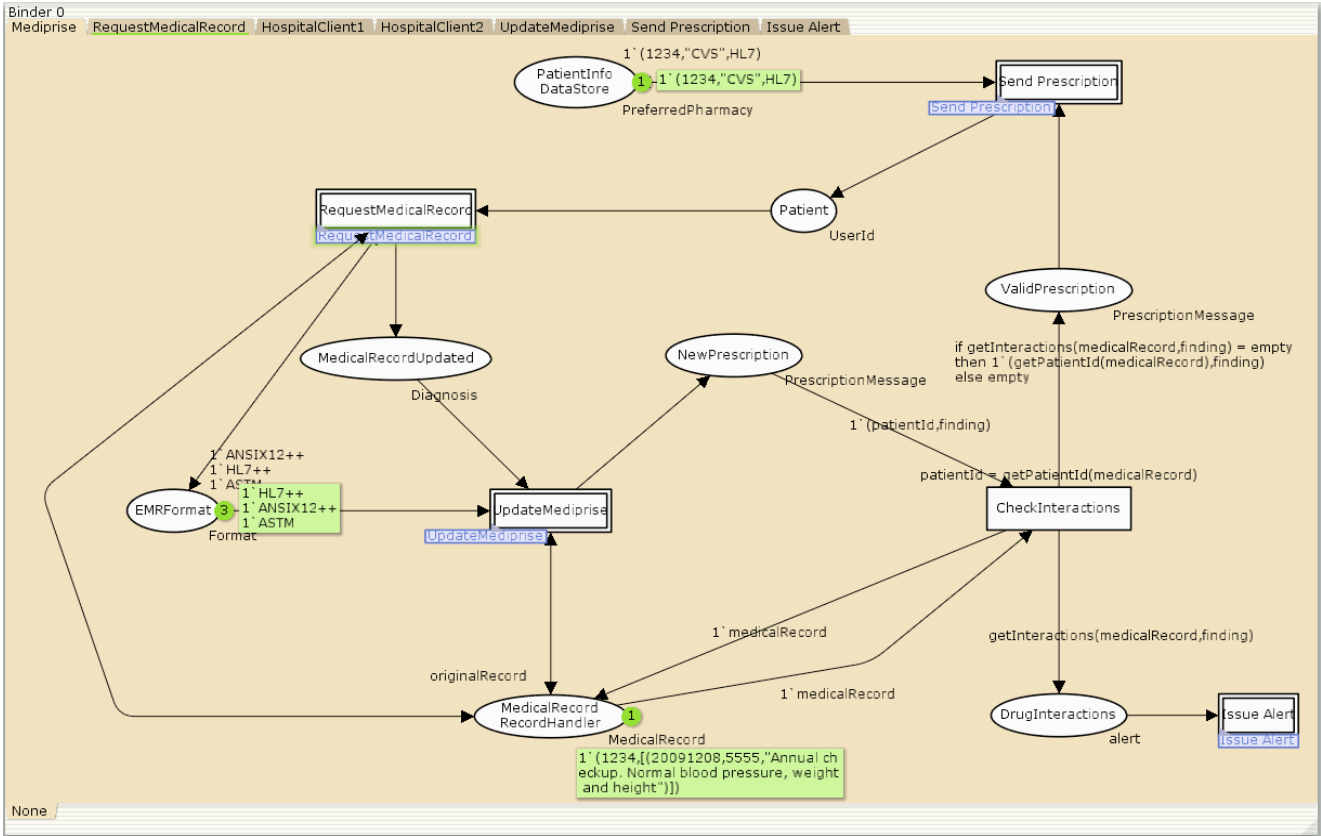


Figure 56: Mediprise System

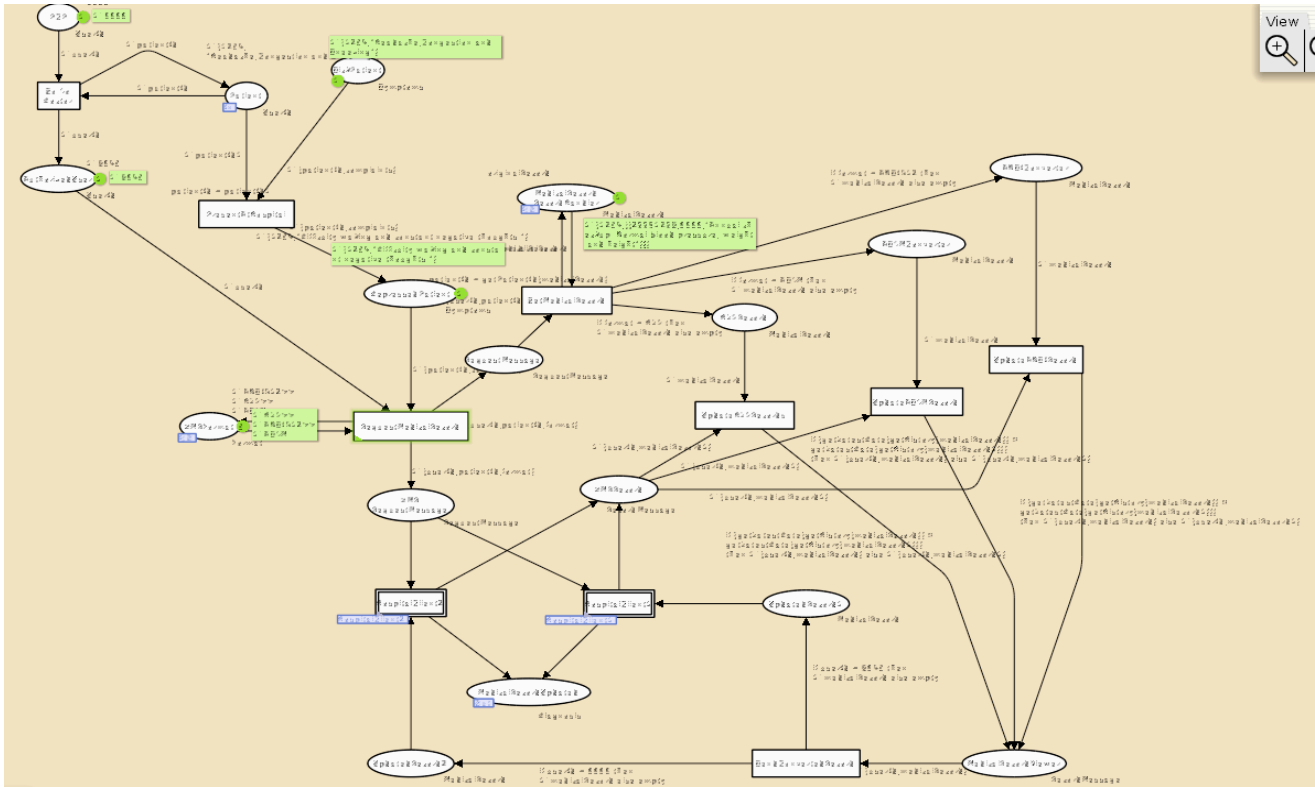


Figure 57: Request Medical Record

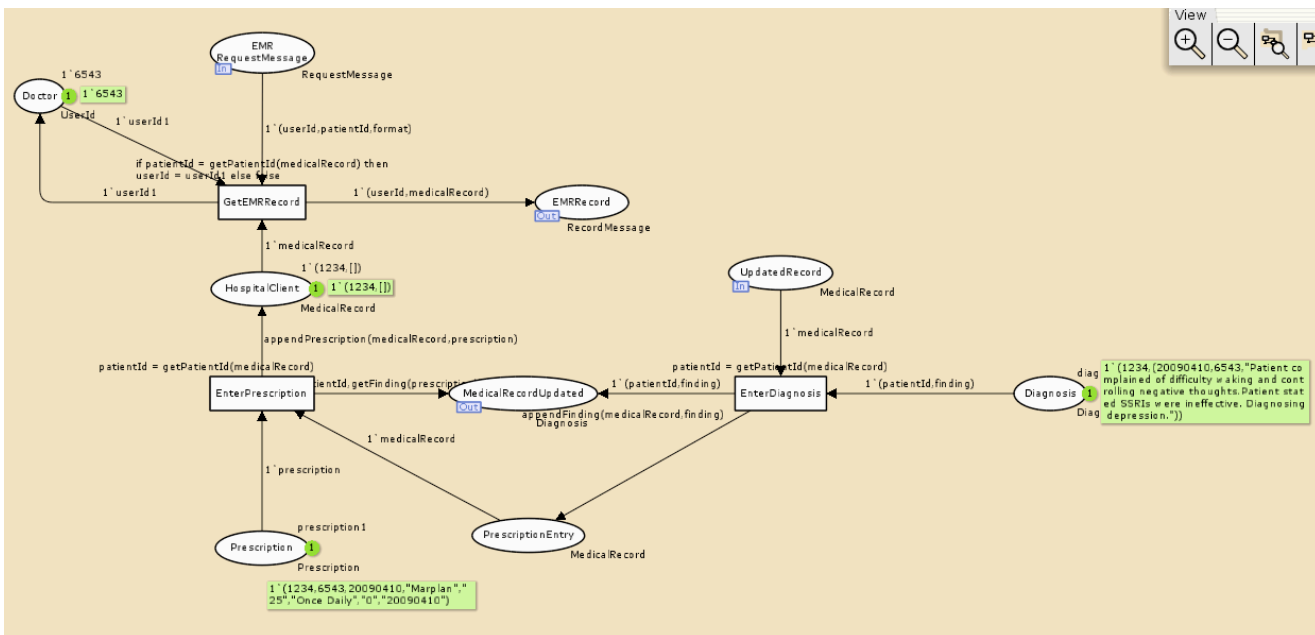


Figure 58: Hospital Client 1

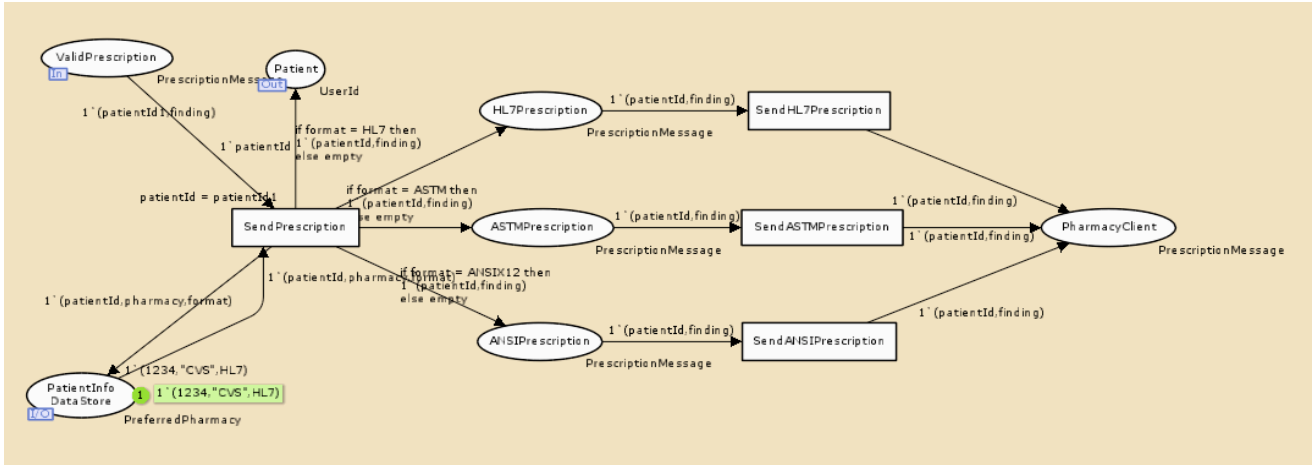


Figure 61: Send Prescription

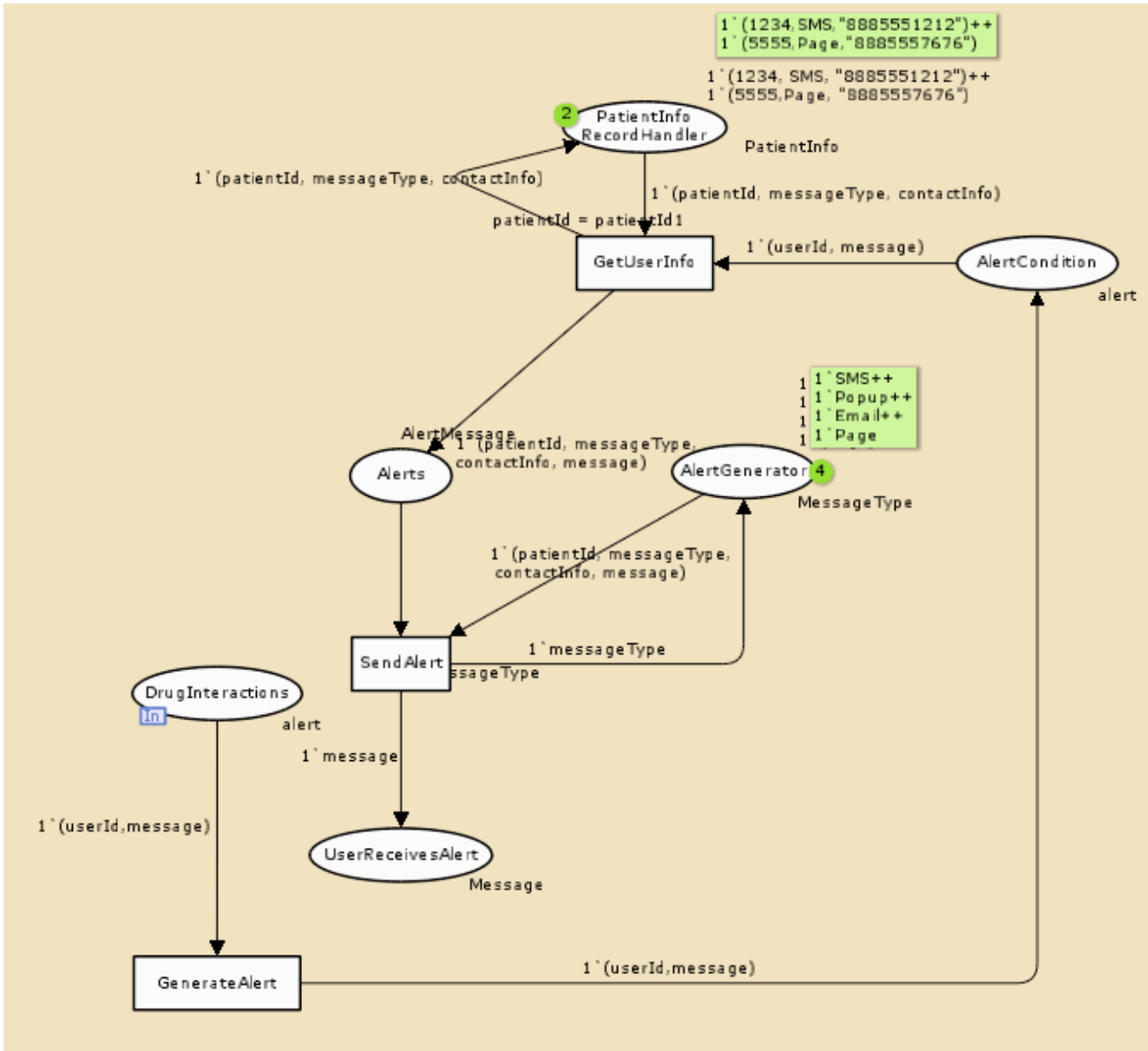


Figure 62: Issue Alert