

REAL-TIME HEALTH BENEFITS VERIFICATION

(HealthEcheck)

Ravi Gottumukkala

**Problem Report Submitted to the
College of Engineering and Mineral Resources
at West Virginia University
in partial fulfillment of the requirements
for the degree of**

**Master of Science
in
Software Engineering**

Approved by

**V (Juggy) Jagannathan, Ph.D. Chair
Yenumala V Reddy, Ph.D.
James D Mooney, Ph.D.**

Computer Science and Electrical Engineering

**Morgantown, West Virginia
2008**

**Keywords: Health, Insurance, Eligibility, Benefits, real-time, pharmacy, magnetic card, web service, provider,
carrier, patient, hospital
Copyright 2008 Ravi Gottumukkala**

ABSTRACT

The benefits of automating eligibility verification by improvising real-time methodology into the health Insurance industry: results of a longitudinal study.

By Ravi Gottumukkala

Though automation has been making progress in the Health Insurance industry, the progress has been sluggish at best. The factors that impact this slow growth mainly constitute of such variables as the slow response of legacy systems, the rigidity of the systems to handle more functionality, the large volume of data that is stored in the systems and the inflexibility of having the ability to access this data easily. These systems are restricted in their absorption of technology due to the complex nature of data flow and data synchronization. They also do not cater to today's growing need to connect and access data at ones' finger tips. Moreover, health data for patients resides and is utilized by many entities with heterogeneous systems at various levels of automation. These entities include health care providers, insurance carriers, patients, pharmacy retailers, health record keepers and government regulatory and compliance agencies. Some of the technological applications in the industry to date include electronic real-time claims submission, real-time claims processing and real-time pharmacy transaction approval. Much of this type of real-time automation has not been applied to eligibility systems and leaves a lot of room for growth.

In its current state, eligibility verification has become increasingly important due to the changes in healthcare insurance, from consumer-directed plans to pricing transparency. With the changes occurring in the health insurance arena, eligibility is becoming a wave that will force its way through healthcare organizations with disastrous results if not prepared for. Unfortunately, eligibility verification is one of the most neglected elements in the revenue cycle.

This project proposes a pilot solution for eligibility automation of Health related data by undertaking some of the implementation challenges that are currently faced by the Health Industry. This solution provides a one-stop resource that can interface with most existing systems to automate eligibility verification at a provider's location. The pilot project is focused mainly on a technical solution for implementing eligibility checks within the different types of health eligibility systems. It will propose the desirable technology to store data in a cohesive environment, improve speed of data access, and then bring together different types of data related to a member's eligibility in one refined unit.

DEDICATION

To my parents, for their un-compromising will and sacrifice to give their children the education, that could have been otherwise impossible.

ACKNOWLEDGMENTS

Dr. Juggy Jagannathan has inspired the creation of this project in unspoken words demonstrated by his own penchant for application of emerging technological principles to real-life solutions.

Dr James D Mooney and Dr. Ramana Reddy, for their support and guidance of the technology and architecture choice.

I would like to acknowledge Linda Cox, for her immense patience in guiding me through the administrative procedures.

TABLE OF CONTENTS

ABSTRACT	ii
DEDICATION	iii
ACKNOWLEDGMENTS	iv
TABLE OF CONTENTS	v
INTRODUCTION	1
1. <i>Statement of Problem</i>	1
2. <i>Objectives</i>	2
CHAPTER 1: BACKGROUND	3
1. <i>Types of Health Insurance</i>	3
A. Traditional	3
B. Consumer Driven Plans	3
C. Government Managed	3
2. <i>Typical Components of Health Insurance Systems</i>	4
3. <i>Quantification of Insurance Coverage</i>	5
4. <i>HealthEcheck Eligibility Verification Message Standards</i>	5
CHAPTER 2: HEALTHCHECK	6
1. <i>Introduction and Scope of HealthEcheck</i>	6
2. <i>HealthEcheck: Advanced Solution to Existing Systems</i>	6
A. Automation	6
B. Connectivity	6
C. Extensibility	7
D. Scalability	7
E. Technology	7
3. <i>Entities in HealthEcheck and Their Roles</i>	7
A. Insurance Carriers	7
B. Health Care Providers	8
C. Members	8
4. <i>Benefits Derived by Entities</i>	8
A. Insurance Carriers	8
B. Health Care Providers	8
C. Members	8
CHAPTER 3: TECHNOLOGY BACKGROUND	9
1. <i>Database:</i>	9
2. <i>Web Service:</i>	10
3. <i>User Interface:</i>	10
CHAPTER 4: USE CASES	11
1. <i>Actors/Roles</i>	11

2.	<i>Preconditions</i>	11
3.	<i>Eligibility Flow</i>	11
4.	<i>Error Flow</i>	11
CHAPTER 5: DESIGN		12
1.	<i>Software Platform and Technologies</i>	12
2.	<i>System Architecture and Modules</i>	12
A.	<i>Database</i>	13
B.	<i>Web Server</i>	13
C.	<i>Web Service Client</i>	13
D.	<i>Web Site</i>	13
E.	<i>Simulator Web Service for Health Carrier</i>	13
F.	<i>Generic Utility and Common Libraries</i>	13
G.	<i>Class Libraries and Interfaces:</i>	13
H.	<i>Database Design</i>	15
I.	<i>Database and Table Structure</i>	16
J.	<i>API Signatures</i>	20
CHAPTER 6: USER GUIDE AND SCREEN SHOTS		22
USER GUIDE		22
1.	<i>Browser Requirements</i>	22
2.	<i>Access HealthEcheck</i>	22
3.	<i>HealthEcheck Eligibility Search Page</i>	22
4.	<i>HealthEcheck Eligibility Results Page</i>	24
CHAPTER 7: THE HealthEcheck ADVANTAGE		27
1.	<i>Real-Time Response</i>	27
2.	<i>Intuitive User Interface</i>	27
3.	<i>Better Informed Customers</i>	27
4.	<i>Coordination of Benefits</i>	27
5.	<i>Data Analytics</i>	27
CHAPTER 8: FUTURE ENHANCEMENTS		28
1.	<i>Claims</i>	28
2.	<i>Magnetic Cards</i>	28
3.	<i>Security</i>	28
4.	<i>Exception Handling</i>	28
5.	<i>Queuing and Asynchronous Calls</i>	28
CONCLUSION		29
BIBLIOGRAPHY		30

INTRODUCTION

Health cost management has taken a center stage in the last two decades with spiking costs and its consequences to employee sponsored group insurance plans as well as government sponsored retirement benefits. Many innovations have been introduced from private health insurance carriers as well as the government to address the alarming effects of health costs.

Some of these include:

- 1) HSA plans introduced by the Bush administration¹
- 2) Consumer driven health plans which were greeted by tremendous success since late 90's²
- 3) Various awareness/incentives programs introduced by employers to educate and encourage healthy life styles and more responsible use of health insurance plans
- 4) Automation in Health Insurance Industry³

The application of Information technology in these initiatives has been very successful. Claims submission and processing is being handled real-time electronically reducing the cost and errors of manual transaction. HIPAA legislation has addressed the privacy, security and accuracy concerns of health transaction automation. Consumers are equipped with more tools and information at their disposal in choosing providers with lowest cost, making better decisions to search for better quality of health care and finding alternative generic drugs.

1. *Statement of Problem*

One notable area in Health Industry where there is much scope of automation is eligibility verification. Most of the physician facilities use manual methods of verifying the eligibility. The metrics of the coverage is done manually via a phone call supported by an IVR system. The information exposed through this method is very limited and doesn't uncover all the hidden out-of-pocket expenses that the member could be responsible for. The manual method also lacks adaptability to the variety of new flavors of health insurance plans introduced in the recent years.

The growing changes of the health industry call for an urgent need for seamless, integrated eligibility and benefit verification solution. It also manifests steps the provider organizations should be taking to prepare for standard, automated eligibility verification.⁴

The problem can not have been defined better than as stated in the article that focuses greatly on the problems of manual eligibility verifications, "Lack of proper eligibility verification could cause downstream impacts. These can include delayed payment, decreased patient satisfaction, increased errors, and, potentially, nonpayment. Incomplete eligibility verification creates problematic ripples in many areas:

1 "Bush's HSA plan", 13 April. 2005 <http://www.legalmemorandom.com/legalmemorandom/2005/04/bushs_hsa_plan.html>

2 "Early Experience With High-Deductible and Consumer-Driven Health Plans: Findings From the EBRI/Commonwealth Fund Consumerism in Health Care Survey", Paul Fronstin, Ph.D., and Sara R. Collins, Ph.D., The Commonwealth Fund, December 2005

3 "Information technology payoff in the health-care industry: a longitudinal study," Journal of Management Information Systems, March 2000: 41-67

4 "From a Ripple to a Wave: Why Eligibility Matters", hfm magazine, Pamela M. Waymack and Gwendolyn Lohse, November 2006.

- Plan identification
 - Erroneous plan billing
 - Failure to identify out-of-network patients
 - Failure to meet correct plan's timely filing requirements
- Benefit coverage
 - Inability to identify excluded benefits
 - Inability to determine benefits requiring pre-certification
 - Failure to preauthorize with correct plan
- Patient satisfaction
 - Incorrect filing of claims
 - Inability to verify insurance benefits with initial registration information
 - Incorrect identification of patients' financial responsibilities"⁵

2. Objectives

The objective of this research is to propose a simple and scalable solution for Health eligibility check that is:

1. Transactional in method and
 - a. Supports all models of health insurance
 - b. Supports real-time response through a web service call
 - c. Provides ready scalability and customizability
 - d. Supports browser-based applications as well other end clients
2. Adaptable and extensible to
 - a. Provide connectivity to the carriers by one of several methods which would include a web service call or
 - b. an asynchronous database call through a direct connection or through a daily batch load of raw data files
3. Will document areas of improvement that are necessary but are ignored to achieve simplicity of a pilot project to include:
 - a. End user security and roles
 - b. User Interface Input validation and Error Handling
 - c. Data encryption and other transmittal security
 - d. Support for wider technologies of magnetic storage of data
 - e. Support for wider range of end user applications

⁵ Pamela M. Waymack and Gwendolyn Lohse, [From a Ripple to a Wave: Why Eligibility Matters](#), November 2006 *hfm* magazine

CHAPTER 1: BACKGROUND

This chapter is an introduction to the health insurance industry and its components. In each of the sections, the focus is narrowed down to the context of this research.

1. *Types of Health Insurance*

A majority of Americans are covered by group health plans sponsored by their employers. These packages are usually referred to as “Managed Care”. The most popular flavors of managed care are:

A. *Traditional*

HMO: (*Health Maintenance Organizations*) **HMOs** require their members to get their medical services approved by a Primary Care Physician.

PPO: (*Preferred Provider Organizations*) Typically a **PPO** allows one to see any doctor the member wishes. The member does not have to designate a primary care physician, and can usually see any specialist without referral. The PPO offers choice and flexibility, but is often more expensive.⁶

FSA: (*Flexible Savings Account*) **Flexible Savings Account**, or FSA, is an employee benefit program that allows you to set aside money, on a pre-tax basis, for certain health care and dependent care expenses.

B. *Consumer Driven Plans*

HRA: (*Health Reimbursement Account*) **Health Reimbursement Accounts**, are a type of health insurance plan that reimburses employees for qualified medical expenses. “The U.S. Department of the Treasury issued guidance on health reimbursement accounts in a revenue ruling in June 2002. Because these plans are just emerging, their designs are still evolving.”⁷

HSA: (*Health Savings Account*) **Health Savings Account** is a tax-favored savings account combined with a qualifying high-deductible health insurance plan that allows a member to deposit tax-deductible funds into an account that he/she can use to cover medical costs.⁸

C. *Government Managed*

Medicare: Medicare is health insurance offering for people over the age of 65, under age 65 with certain disabilities, and any age with End-Stage Renal Disease.⁹

⁶ “What is the difference between HMO and PPO?”, Tricia Ellis-Christenson, <http://www.wisegeek.com/what-is-the-difference-between-a-hmo-and-ppo.htm>

⁷ “Health Spending Accounts”, Haneefa T Saleem, US Department of Labor, Labor Bureau Statistics, October 29, 2003

⁸ “The Health Savings Account Debate”, Wiley Long, HSA for America, 2008

⁹ “Medicare & You”, Michael O’Levitt, Centers for Medicaid and Medicare Services, 2003

2. **Typical Components of Health Insurance Systems**

Health systems typically involve independent and loosely connected players. The key players of the Health Industry are:

- a) Providers (physicians, hospitals, facilities and pharmacy retailers)
- b) Patients (Insurance subscribers & beneficiaries)
- c) Insurance carriers
- d) Administrative support (provider networks, Clearing houses, banks, fulfillment vendors, health record keepers)

These different participants transmit, analyze and share information on a regular basis in order to utilize the data for benefits administration and payment management.

The health insurance systems setup is achieved through a series of steps explained below:

- *Health Plan design and setup:*
Setup of comprehensive listing of the qualitative and quantitative benefits in the health plan, network of providers available in the plan and policy accumulator limits (deductible, co-insurance, co-pay, annual maximum, life time maximum etc.)
- *Enroll members in the Plan and setup benefits (Eligibility administration)*
Setup of demographic and customized accumulator information of a member and enroll the member under a health plan. This typically repeats after every policy cycle (usually a calendar year) to reset the accumulators to annual limits.
- *Patient receives Health Benefits:*
The patient visits a doctor's office, provides proof of insurance coverage to obtain health benefits. The doctor's front office verifies the patient's benefits under the policy and advises the cost share of each party responsible (Insurance carrier, network discount and patient's responsibility). Later, the doctor's office prepares a medical claim with the line items of services rendered and transmit to the carrier electronically (can be through paper means though rare).

This function is currently of mixed nature in terms of response time and data integrity. Most facilities and hospitals do this via IVR systems or proprietary web interfaces provided by the carrier. However, pharmacies do the eligibility check mostly using the real-time method or PBM (pharmacy benefit management) systems¹⁰. These are mostly based on VPN networks (Medco, Caremark, Pharmacare and APM etc). In most cases, the services and/or medicines are not provided until a patient's benefits can be verified.

- *Process Claims*
-

¹⁰ "PBMs The basics and an Industry View", John Richardson., The Health Strategies Consultancy, LLC, June 2003

Receive claims from the provider's office and adjudicate them against the health plan rules and the policy holder's status in the current enrollment period

- *Process Payments (to providers, patients and retailers)*
Use the results of the claims adjudication to remit the providers (send them a remittance advice) and send an EOB (explanation of benefits) to the policy holder including the patient's responsibility of the cost of service

3. Quantification of Insurance Coverage

Eligibility verification response is scanned for three pieces of information:

- The person covered (subscriber and dependents)
- Coverage for the Benefit being rendered.
- The extent of coverage. (network discount, out-of-pocket expense etc)

A patient's coverage towards a service he/she received at any given point is measured by the Annual limits of the following industry standard attributes of the plan under his insurance plan terms and also his current cumulative progress towards this limit.

- **Deductible** : maximum out-of-pocket exposure
- **CO-Pay** : A fixed amount paid for every visit in a PPO model
- **HRA/HSA** : Tax deferred dollars that can be used for payment towards deductible
- **Co-Insurance**: partial coverage based on pre-defined percentage after a deductible is met
- **Out-of-pocket**: Derived information based on above factors
- **Max OOP**: maximum out of pocket exposure irrespective of all other factors
- **LifeTimeMax**: maximum cumulative coverage by a carrier in a member's life time

4. HealthEcheck Eligibility Verification Message Standards ¹¹

There are several standards for eligibility verification systems. The traditional ANSI X12 syntax (270) and EDIFACT syntax based on EDI (271). The newer standards developed are Interactive healthcare eligibility benefit inquiry (ICHEBI) and interactive healthcare eligibility benefit response (IHCEBR) standard. These standards have not caught up with the recent innovations in health plan models and lack the flexibility and scalability of XML based standards.

¹¹ Healthcare Financial Management, Jan, 1997 by James J. Moynihan

CHAPTER 2: HEALTHCHECK

1. Introduction and Scope of HealthEcheck

HealthEcheck system is designed to propose a solution to some of the shortcomings of existing eligibility verification systems. The goal is to be able to expose a variety of interfaces to health institutes based on their capability and redirect their legibility responses to the point of care packaged in a standard format. The scope of this project is limited to demonstrating the use of web services and lightweight browser clients in an adaptable and scalable architecture.

2. HealthEcheck: Advanced Solution to Existing Systems

In this section, HealthEcheck will be compared to existing systems in their current state. Although other systems have been proposed to attack the problem of eligibility verification, HealthEcheck proposes a simpler and more flexible approach.

A. Automation

For example, U.S. Pat. No. 5,964,700 issued Oct 12, 1999 to [Joseph P. Tallman et al.](#) introduces the use of medical network management system (NMS) where health plan patients access a team of healthcare professionals over the telephone to help them assess their health needs and select appropriate care. The NMS (20) is implemented with an article of manufacture for use with a data processing system. A storage medium has stored therein a medical provider information stored program and a medical provider database. The medical provider database describes clinical services or procedures available from each provider by clinical codes or procedure codes. The data processing system is configured by the medical provider information stored program when executed by the data processing system to use the clinical codes or procedure codes to identify a medical provider from the medical provider database for providing a specific medical service to a beneficiary. This gathering of information and capturing of information is more of a data clearing house to store data about the beneficiaries. HealthEcheck, however, has the ability to connect to health insurance carriers and PBM carriers, and automatically collect this data and get the up to date data about the patients in real-time.

B. Connectivity

U.S.Pat. No. 5,832,447 issued Nov 3, 1998 to [Edward C. Rieker et al](#) focused on gathering data from a health care provider computer system and automatically request real-time electronic insurance eligibility verification information from health care insurance carriers. The beneficiary health insurance verification computer system is operatively connected to a beneficiary registration computer system. The data output stream is verified by the computer system and prints an image from the registration computer system. This image is broken into several eligibility related data fields. Among some of the fields identified is information such as the insurance carrier is determined, and the verification computer system determines which electronic data source to request beneficiary eligibility data from. The verification computer system reformats the captured data to fit the data format required by the data source, establishes a communications link to the data source, and sends the reformatted data to the data source. The data source sends responsive beneficiary specific to the output. The data is stored in the eligibility system based on data that was input by the administrator in the previous visit. Though this is close to HealthEcheck, HealthEcheck consists of eligibility checks specific to Consumer Driven Health Plan with the multiple insurance carriers, PBM carriers and other third party clearing houses. It requires the capability to connect to multiple carriers and get data for the most current eligibility information.

C. Extensibility

In another study, U.S. Pat. No. 6,343,271 issued Jan 9, 2002 to [Brian E. Peterson et al](#), a claims processing system for electronically reviewing and adjudicating medical insurance claims was issued. The Eligibility check in this system was merely a small module and not very intuitive. The system focused more on the claims processing systems where the members' claims are adjudicated against eligibility and claims processing. Using the automated adjudication system, health care providers may electronically prepare and the ability for providers to submit claims for payment. Before a claim is submitted, a claims pre-check process is used to determine whether the claim may be automatically adjudicated or instead must be manually adjudicated. The payment system initiates payment to the health care provider accessing using the access terminal, the beneficiary and benefit information stored by the health care benefit component such that the health care provider can ascertain beneficiary information in preparation for submitting a claim for treatment provided to a beneficiary; creating, using the access terminal, the claim by entering information regarding treatment provided to said beneficiary into an electronic claim form that can be submitted for payment. While HealthEcheck does have the ability to build up on its current module to include claims processing, it currently handles the eligibility check in a greater detail to determine the beneficiary's historical data, ensure that the beneficiary is currently eligible and goes to greater detail of what type of services or programs the beneficiary is eligible for. It gives the Provider and Beneficiary full understanding of what type of services will be covered and the type of amount the beneficiary can expect to have to pay based on the current eligibility.

D. Scalability

U.S.Pat. No. 5,557,514, issued Sep 17, 1996 by [Jerry G. Seare et al](#) focuses on a system for analyzing historical medical provider billings to statistically establish a normative utilization profile. It includes a method for generating a medical provider profile using a general purpose computer that stores information about the provider, the codes offered by the provider, a system for establishing medical provider profiles, and the provider billing records. Though this feature is a part of the HealthEcheck system, it is stored in one database of HealthEcheck. Other components include communicating with the insurance carrier, the PBM carrier and other third party clearing houses and the ability to get the up to date eligibility data of the beneficiary in question.

E. Technology

U.S.Pat. No. 6,088,677, issued Jul 11, 2000 by [Loren J. Spurgeon](#), the proposed solution includes an information-exchange system that controls the exchange of business and clinical information between an insurer and multiple health care providers. This is very similar to HealthEcheck in that in this system an information-exchange computer is connected over a local area network to an insurer computer using a proprietary database and over the Internet to health-care provider computers using open database-compliant databases. This particular technology solution is very similar to HealthEcheck in nature. The information-exchange computer receives subscriber insurance data from the insurance computer database, translates the insurance data into an exchange database, and pushes the subscriber insurance data out over the Internet to the computer operated by the health-care provider assigned to each subscriber. The information-exchange system stores the data in the provider database. The information-exchange system also provides for the preparation, submission, processing, and payment of claims over the local area network and with push technology over the Internet. The key difference between this system and Health E-check is the data exchange in HealthEcheck is performed with the latest technology using Web Services and XML which is real time and is real-time in nature.

3. Entities in HealthEcheck and Their Roles

The different entities that participate and derive benefits in the HealthEcheck system are:

A. Insurance Carriers

Carriers typically include Health Insurance companies, PBM (Pharmacy benefit management) administrators and other third party clearing houses. These are the back end Insurance carriers who originally sell or administer the

health plan to the consumer. Carriers create and maintain the health benefits of the consumers and provide the benefit information on demand to the interested health care providers

B. Health Care Providers

Providers are typically anyone who is involved in providing healthcare. They include physicians, pharmacy retailers, Para medical staff etc. providers in the HealthEcheck system are the initiators of benefits inquiry and receivers of the response from the carrier. These may also be referred to 'point-of-care' entities.

C. Members

Members are the subscribers and their family members who are insured either individually or in group insurance coverage. Members are the end receivers of services from providers. Members are provided with a unique ID by the health plan administrator usually the carrier or another ASO company that the carrier has hired for their process.

4. Benefits Derived by Entities

Each of the entities described are poised to derive many advantages and benefits from the HealthEcheck application. These participants need very little change to their standard operating procedures and systems to adapt to HealthEcheck. Some of the main advantages they enjoy are listed under each of those entities:

A. Insurance Carriers

Carriers can communicate back to clients through automated systems instead of manual telephone operator. They can also make use of the common standard of response that HealthEcheck will transmit to client irrespective of the type of health plan. Carriers will automatically derive all new enhancements of HealthEcheck response to the client. Carriers can also make use of the several different methods of connectivity that HealthEcheck exposes. They can also benefit from the statistical data that HealthEcheck can provide about the nature and metrics of the requests made over time. This information can be used for their own business intelligence analysis. Carriers can also become clients of HealthEcheck to inquire benefits acquired by a member through another carrier. This is particularly useful in situations where the claim cost by multiple carriers in a '*Coordination of benefits*' fashion.

B. Health Care Providers

Healthcare providers, i.e. physical offices, pharmacy retailers and paramedical staff, can make use of the data rich user interface with absolutely zero deployment or installation. They only need a browser application with internet connectivity. They can make use of the coverage information for the member for each of the services rendered before admitting the patient. They can advice the patient about cost savings of network discounts, generic drugs etc, by checking and comparing the coverage for comparable alternatives of treatment. Providers can check the coverage from two different carriers that a member can simultaneously be covered. They can also provide a printed response to the member for future reference.

C. Members

Members though directly are not involved in the process cycle, stand beneficiary of several advantages. They can compare network discounts provided by different physicians and be more responsible with their health care dollars. They can build more awareness of the way health plans work and make an educated decision about their future health plans. They can avoid personal information being displayed on their ID cards by use of magnetic cards (possible future enhancement).

CHAPTER 3: TECHNOLOGY BACKGROUND

This chapter explains the choice of technology used in the project as well as the of pros and cons of the technology used. The factors considered are as follows:

1. Support for Service Oriented Architecture
2. Support for high volume Online Transaction Processing (OLTP systems)
3. The availability of rich libraries
4. Support for web services with variety of communication channels
5. Support for Asynchronous calls using queues
6. Support for Smart cards and other media cards
7. Ready Integration with majority of Carriers and providers
8. Ease of deployment and distribution packaging
9. Easy learning curve for end users
10. The availability of developer groups and support

The Tools and Software used in different components of HealthEcheck are described below:

1. Database:

The chosen database for HealthEcheck is Microsoft SQL Server. For HealthEcheck, this database most satisfies the need to support Online Transaction Processing system (OLTP). The database needs to be easily available and have the ability to handle high volume of concurrent connections. It needs to have a support locking of data at record level so as to aid concurrency. It needs to have query optimization and table partition features to support many lightweight transactions. It need not support customization of deployment for thousands of small transactions but instead support few batch processes. The choice of Microsoft SQL Server also ties in closely with Web Services which was the other choice of technology used for this project. The highly compatible connectivity between Web services software using Microsoft Visual Studio .Net and Microsoft SQL Server made this type of a database a natural choice. This combination provides fast connection due to native client libraries between database and core system. Moreover, SQL Server has come out of age in its Transaction-SQL procedural language with its recent version. It now also has better exception handling. SQL server also supports replication and clustering to handle future data loads.

Though there are other databases that could have been used such as Oracle, or open-source databases like MySQL or PostgreSQL, these were limiting in their functionality for this project. Open-source databases give the best connectivity and compatibility with other open-source application server software like PHP. Their connectivity libraries like ODBC are not very feature-rich. They lack good transaction handling and replication or clustering features. Their lack support for rapid development data objects in Visual studio. Oracle on the other hand is as feature-rich as SQL Server but is very expensive for medium-sized databases. Oracle has better transaction handling and locking mechanism in terms of concurrency and data manipulation. However, the fact that Oracle is not very programmer-friendly makes it a less desirable choice for this type of an implementation. Oracle is more robust for that reason.

Though the current choice of database server is SQL Server, the interface with the web services and web client components of HealthEcheck is limited to few stored procedure calls. This makes it very easy to port the application to database server software.

2. Web Service:

W3C defines a web service as:

“A Web service is a software system identified by a URI, whose public interfaces and bindings are defined and described using XML. Its definition can be discovered by other software systems. These systems may then interact with the Web service in a manner prescribed by its definition, using XML based messages conveyed by Internet protocols”

Usage of web services in commercial application development gives a wealth of interoperability, scalability and reusability advantages. Web services are lightweight components which encapsulate discrete business functionality in a distributed fashion and render them over standard internet protocols. With use of Web Services, HealthEcheck can interface with any carrier, provider or client, by providing communication channel that is platform independent (operating systems and networking systems), language-independent (Java, C, C++, .Net, Perl etc) and programming-style-independent (Objects Vs non-Objects). Web services do not require heavy libraries loaded into memory and can easily provide a Web exposure to any service using the HTTP protocol. This provides a workaround for the firewalls and also browser availability. Security can be moved from application level to network level through usage of Virtual private networks if need be.

Web services provide loose coupling with non-HTML (XML, etc.) message to any client as opposed to traditional web services, which can only send an HTML and is limited to transmitting to a browser application. Web services in HealthEcheck use standard XML specifications to standardize the business content of the communication. This makes it very easy to account for new requirements or provide flexibility to different external entities and dynamically change the content of the message only to available data.

An existing enterprise can easily make its internal applications and data available for throwing a web service to an existing application. It allows for clean and real-time integration with HealthEcheck. These Carriers and Clients can use HealthEcheck provided and packaged information in their own internal systems or vendors by making use of web services. This allows them from developing internal tools for services HealthEcheck can accomplish.

HealthEcheck project was implemented with Web services using Microsoft Internet Information Server with the underlying applications developed using Microsoft Visual Studio .net. The strongest reason for the choice of this technology is the developer familiarity with the languages in .Net. C# is the chosen language, although all .net languages share the same runtime engine. C# has few advantages of its own such as static interfaces, iterators, the 'yield' keyword and unsafe code blocks for improved performance making C# a great choice for this project.

3. User Interface:

The user interface in HealthEcheck is developed using ASP.Net which provides good compatibility with the application code, also developed in Visual Studio. It makes debugging and tracing job a no-brainer with highly interactive IDE. Other Tools used in Web development are the Infragistics Web Grids. These provide a better data interactive user interface than the web controls provided with Visual Studio. The user interface is developed as a collection of individual “user controls” that display a section of business information. These user controls can be readily placed on any UI with no loss of functionality.

CHAPTER 4: USE CASES

1. Actors/Roles

The following roles will be used to explain this use case, as these are the main players that would be involved in using the HealthEcheck system.

Table 1.0

A	Actors – Users
	Health Care Administrator Member (Beneficiary)
B	Actors – Systems
	HealthEcheck System Carrier (Eligibility System)

2. Preconditions

- Carrier Eligibility System will be accessible via the HealthEcheck System
- Connectivity credentials between the Carrier Eligibility System and HealthEcheck System will be pre-established
- Health Care Provider must have software accessibility to HealthEcheck system
- Permissions to HealthEcheck will be predefined and pre-established prior to use
- Member's data and benefits are always available in the carrier's system

3. Eligibility Flow

- Health Care Administrator logs on to HealthEcheck Web Browser
- Health Care Administrator enters data in the required fields and clicks "Submit"
- HealthEcheck System triggers Eligibility request from the Health Care Provider system via a web service
- Data submitted will be for a specific type of benefit code. Possible values are related to a type of service, diagnosis or procedure
- Carrier Eligibility system will respond to the Eligibility request with demographic data, eligibility data for the member, and data related to the specific type of benefit codes
- This data will be displayed on the HealthEcheck screens
- Health Care Administrator prints the screen with member data
- Member verifies the data
- Health Administrator creates the folder for the member with the printout derived from HealthEcheck

4. Error Flow

- Health Administrator logs on to HealthEcheck Web Browser
- Member provides the Health Admin with the Health Plan Card with a readable magnetic strip
- Health Administrator enters the ID card information

CHAPTER 5: DESIGN

1. Software Platform and Technologies

Hardware: Intel Pentium 4 with a Network and Internet connectivity

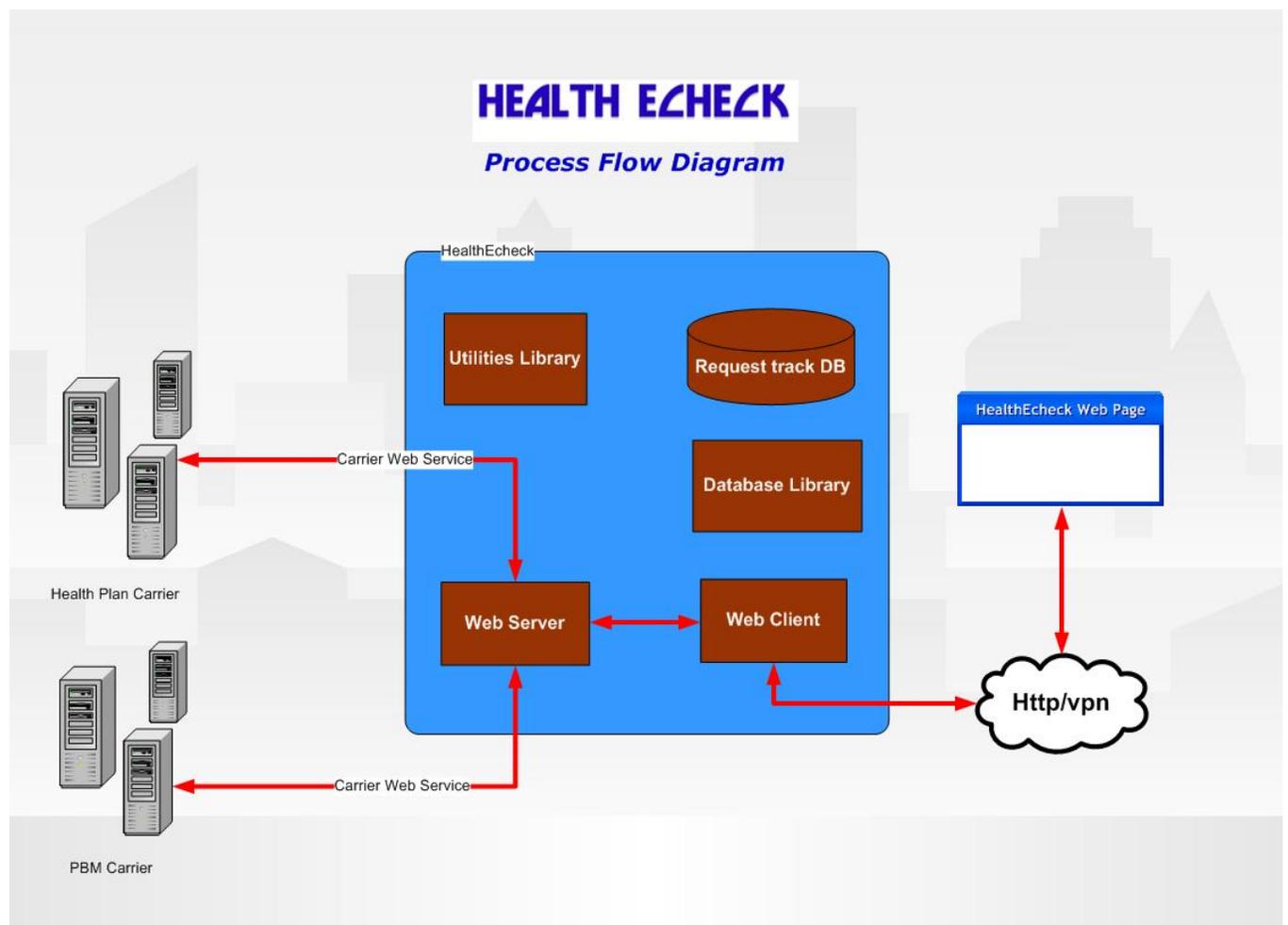
Operating system: Windows XP for the HealthEcheck. Client and carrier machines can have any OS

Development Tools: Microsoft Visual studio .NET, Microsoft SQL server, Microsoft Internet Information server, Microsoft Visio, Case Studio

2. System Architecture and Modules

HealthEcheck is composed of four tier architecture. These are database with Data Access library, Web server library, web server client library and User Interface component. All of the libraries can be deployed in separate machines or can reside in the same machine. The libraries are also supported by generic libraries for database, error handling and common classes.

Figure 1.0: Process Flow Diagram



A. Database

The database component provides all the data necessary for HealthEcheck application. It has connectivity information of the carriers, authentication information of clients and also their demographic information. It also stores all the information of a request and the response for audit and analysis purposes. The database also has stored procedures that return data to the web server. This provides a way to connect clients that can interface with the database directly with a stored procedure. This support helps extensibility of the application to clients who do not currently have a web service or cannot create a web based solution.

B. Web Server

I. Web server component

The web server component exposes all data request and response methods on an IIS web service. The web servers talk to the external web server from the carrier. The web server is dynamically routed to a web server that is assigned to the current request's carrier. It is implemented using Microsoft IIS server. Refer to HSAMonitor component in Figure 1.1 class diagram below.

II. Database component

The database component of web server library isolates all database stored procedure calls and acts as an independent library. This database component needs connectivity to the database server.

C. Web Service Client

The web service client is designed to isolate the user interface from direct web service calls. It acts as a layer of isolation for web service calls. This provides capability to direct to a back up web service in times of failure and also load balance between several web servers in times of heavy traffic. The client is required to have connectivity to the web server methods

D. Web Site

The web site provides all the web pages for the end user. It makes use of web service client library for request and response handling. It is made of several user controls that can be readily plugged into different web page.

E. Simulator Web Service for Health Carrier

The simulator web service acts as a substitute for the health carrier's web service for prototyping purposes.

F. Generic Utility and Common Libraries

The generic utility libraries provide common application tasks of database connectivity and error logging. The execution flow is initiated from the web page with a user click to make an eligibility request. This invokes the web site page's click events. The event instantiates the web service client and makes several calls to get different information of the request.

The web service client invokes the methods on the web service which opens the database connection to create data for the response.

G. Class Libraries and Interfaces:

Figure 1.1: Class Libraries

HSAMonitorDB
Static Class

- Fields
 - gConnectionString
- Methods
 - Create_Request
 - CreateDateTimeParameter
 - CreateIntParameter
 - CreateSmallIntParameter
 - CreateVarCharParameter
 - Get_Carrier_Demographic
 - Get_Client_Demographic
 - Get_Member_Demographic
 - Get_Request_Header
 - Get_Request_LineItems
 - Get_Request_Master
 - GetAppStatus

HSAMonitor
Class
→ SoapHttpClientProtocol

- Fields
- Properties
- Methods
 - CancelAsync
 - Create_Request
 - Create_RequestAsync (+ 1 overload)
 - GetAppStatus
 - GetAppStatusAsync (+ 1 overload)
 - GetCarrierDemographic
 - GetCarrierDemographicAsync (+ 1 overload)
 - GetClientDemographic
 - GetClientDemographicAsync (+ 1 overload)
 - GetMemberDemographic
 - GetMemberDemographicAsync (+ 1 overload)
 - GetRequestHeader
 - GetRequestHeaderAsync (+ 1 overload)
 - GetRequestLineItems
 - GetRequestLineItemsAsync (+ 1 overload)
 - GetRequestMaster
 - GetRequestMasterAsync (+ 1 overload)
 - HSAMonitor
 - IsLocalFileSystemWebService
 - OnCreate_RequestOperationCompleted
 - OnGetAppStatusOperationCompleted
 - OnGetCarrierDemographicOperationCompleted
 - OnGetClientDemographicOperationCompleted
 - OnGetMemberDemographicOperationCompleted
 - OnGetRequestHeaderOperationCompleted
 - OnGetRequestLineItemsOperationCompleted
 - OnGetRequestMasterOperationCompleted
- Events

DBUtility
Class

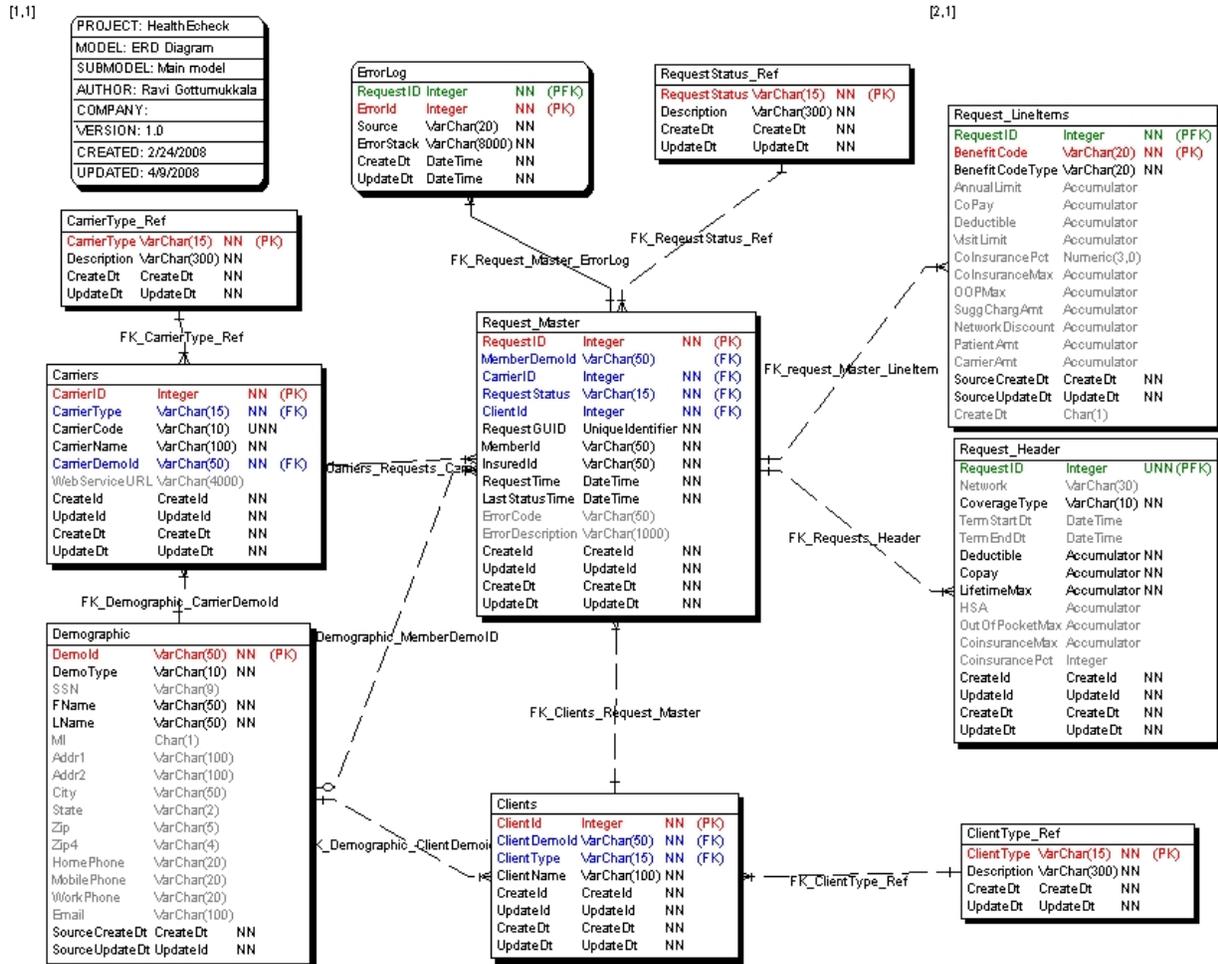
- Fields
 - gHSAMonitorWSCient
- Methods
 - Create_Request
 - DBUtility
 - GetCarrierDemographic
 - GetClientDemographic
 - GetMemberDemographic
 - GetRequestHeader
 - GetRequestLineItems
 - GetRequestMaster

HSAMonitor_WS
Class
→ WebService

- Methods
 - Create_Request
 - GetAppStatus
 - GetCarrierDemographic
 - GetClientDemographic
 - GetMemberDemographic
 - GetRequestHeader
 - GetRequestLineItems
 - GetRequestMaster
 - HSAMonitor_WS

H. Database Design

Figure 1.2 Entity Relationship Diagram



The database for HealthEcheck is hosted in Microsoft SQL Server. The simple Express edition was used for this prototype purposes. The entity relationship diagram is created in Case Studio. The user authentication is made by a database user object rather than windows authentication method. The connection string for database connectivity to be used by clients is stored in registry.

- I. **Entities:** the entities in the database are Carriers, Clients, requests and benefits
- II. **Relations:** the relation between a client and a carrier is by a request. A client initiates a request through the browser client which has the carrier's id from which it is seeking information. A client can initiate different requests to different carriers, but cannot spawn the same request to more than on carrier. A carrier can handle many requests from different clients. A request has belongs to a single client and a single carrier. A request can have multiple benefits in its request.
- III. **Tables:**

I. Database and Table Structure

CARRIERS

This table stores all master information of all carriers. The carrier type describes if the carrier is a Health Insurance Carrier or a Pharmacy benefits administrator or another third party clearing house. The carrier code is a short character code and acts as an alternative to CarrierID. Carrier demold is a pointer to the address and contact information in the demographic table. Webservice URL defines the exact URL that HealthEcheck would use to ping the carrier for a member's benefit information.

Table 2.0: Carrier

Column	Datatype	Attributes
CarrierID	int	AutoNumber, PK
carrierType	varchar(15)	not null
CarrierCode	varchar(10)	not null
CarrierName	varchar(100)	not null
CarrierDemold	varchar(50)	not null
WebServiceURL	varchar(4000)	Null
CreateId	varchar(30)	default 'SYSTEM'
UpdateId	varchar(30)	default 'SYSTEM'
CreateDt	datetime	default system date
UpdateDt	datetime	default system date

CARRIERTYPE_REF

This table defines the different carrier types. Currently there are three of them as stated in the table:

Table 2.1: CarrierType Ref

CarrierType	Description
CH	Clearing Houses and other ACS facilities
IC	Insurance Carriers
PBM	Pharmacy Benefit Managers

CLIENTS

This table defines all clients that can connect and use HealthEcheck system. A client has to be pre-configured in this table before he can gain access to the system.

Table 2.2: Clients

Column	Datatype	Attributes
ClientId	int	AutoNumber, PK
ClientDemold	varchar(50)	not null
ClientType	varchar(15)	not null
ClientName	varchar(100)	not null
Createld	varchar(30)	default 'SYSTEM'
Updateld	varchar(30)	default 'SYSTEM'
CreateDt	datetime	default system date
UpdateDt	datetime	default system date

CLIENTTYPE_REF

This table is a master list of different types of clients. Any client has to belong one of the following types: a health facility(HF) is a physician's office or any place where actual health services are rendered. Insurance information (IP) providers are ASO companies that only act as providers of information and don't directly involve in any insurance or health providing. Pharmacy (PH) providers are retailers or kiosks that track the pharmacy benefits, prescription and associated data. Para medical (PM) providers are providers of ambulance and emergency care or other lab testing services

Table 2.3: ClientType Ref

Client Type	Description
HF	Health Facilities. Physician's office, Laboratory services etc
IP	Insurance Information provider
PH	Pharmacy providers including online and mail order filling
PM	EMS and other Para medical service providers

DEMOGRAPHIC

This table stores all address and contact information for any entity that belongs to HealthEcheck. The demoid is randomly generated and is unique across the HealthEcheck System. Demotype describes the type of entity the current address belongs to. SSN is only populated where available. In case of health institute, SSN will be the tax-id assigned by IRS for the business. This is useful in generating relevant tax forms to the business at the end of the year. FName is the first name of the member or the complete name of the business. LName represents last name of the member and is blank in case of businesses. MI represents the middle initial and is always the first initial of the middle name. Addr1 represents the street number and street name of the address of the member or client or carrier. Addr2 represents the second line in an address. This can be apartment no. or unit no. in case of individuals. It represents suite no. or other relevant 'Attn' or maildrop # of a contact in case of a business address. City, state, zip, zip4, Home Phone, Mobile Phone, Work Phone and Email represent the corresponding information for individuals or businesses. One condition is that the system will only accept US originated addresses including APO, FPO. SourceCreatDt and SourceUpdateDt represent the corresponding creation and updation date and time in the origination source of this address. The demographic type should be one of the following : 'Carrier', 'Member' or 'Client'.

Table 2.4: Demographic

Column	Datatype	Attributes
Demold	varchar(50)	PK
DemoType	varchar(10)	not null, check.
SSN	varchar(9)	Null
FName	varchar(50)	not null
LName	varchar(50)	null
MI	char(1)	null
Addr1	varchar(100)	null
Addr2	varchar(100)	null
City	varchar(50)	null
State	varchar(2)	null
Zip	varchar(5)	null
Zip4	varchar(4)	null
HomePhone	varchar(20)	null
MobilePhone	varchar(20)	null
WorkPhone	varchar(20)	null
Email	varchar(100)	null
SourceCreateDt	datetime	default system date
SourceUpdateDt	datetime	default system date

REQUEST_MASTER

This table has the master information about a request. It only identifies the client, carrier and current status of the request. It has no benefit related information about the request.

Table 2.4: Request Master

Column	Datatype	Attributes
RequestID	int	Auto number, PK
MemberDemold	varchar(50)	not null, FK
CarrierID	int	null
RequestStatus	varchar(15)	not null
ClientID	int	not null
RequestGUID	uniqueidentifie	null
MemberId	varchar(50)	null
InsuredId	varchar(50)	null
RequestTime	datetime	default system date
LastStatusTime	datetime	default system date
ErrorCode	varchar(50)	null
ErrorDescription	varchar(1000)	null
CreateId	varchar(30)	null
UpdateId	varchar(30)	null
CreateDt	datetime	default system date
UpdateDt	datetime	default system date

REQUESTSTATUS_REF

This table stores the master information of different statuses of a request during its life cycle.

Table 2.5: RequestStatus Ref

Request Status	Description
COMPLETED	The request response is successfully sent to the Web Interface
RECEIVED	The request is received from the web interface
REQUEST	The request is sent to Carrier and waiting for response
RESPONSE	Request Response received from the Carrier

REQUEST_HEADER

Table 2.6: Request Header

Column	Datatype	Attributes
RequestID	int	PK
Network	varchar(30)	not null, FK
CoverageType	varchar(10)	null
TermStartDt	datetime	not null
TermEndDt	datetime	not null
Deductible	numeric(9,2)	null
Copay	numeric	null
LifetimeMax	numeric	null
HSA	numeric(9,2)	null
OutOfPocketMax	numeric(9,2)	null
CoinsuranceMax	numeric(9,2)	null
CoinsurancePct	int	null
CreateId	varchar(30)	default 'SYSTEM'
UpdateId	varchar(30)	default 'SYSTEM'
CreateDt	datetime	default system date
UpdateDt	datetime	default system date

REQUEST_LINEITEMS

Table 2.7: Request LineItems

Column	Datatype	Attributes
RequestID	int	PK
BenefitCode	varchar(20)	PK
BenefitCodeType	varchar(20)	null
AnnualLimit	numeric(9,2)	not null
CoPay	numeric(9,2)	not null
Deductible	numeric(9,2)	null
VisitLimit	numeric(9,2)	null
CoInsurancePct	numeric(3)	null
CoInsuranceMax	numeric(9,2)	null
OOPMax	numeric(9,2)	null
SuggChargAmt	numeric(9,2)	null
NetworkDiscount	numeric(9,2)	null
PatientAmt	numeric(9,2)	null
CarrierAmt	numeric(9,2)	null
SourceCreateDt	datetime	default system date
SourceUpdateDt	datetime	default system date
CreateDt	datetime	default system date

ERRORLOG

Table 2.8: ErrorLog

Column	Datatype	Attributes
RequestID	int	PK
ErrorId	int	PK
Source	varchar(20)	not null
ErrorStack	varchar(8000)	not null
CreateDt	datetime(8)	default system date
UpdateDt	datetime(8)	default system date

J. API Signatures

a. Create_New_Request

Input Parameter: MemberId, ClientId, CarrierId, BenCode1, Bencode2

Output Parameter: RequestID

b. Get_AppStatus

Input Parameter: RequestId

Output Parameter: Date

c. Get_Carrier_Demo

Input Parameter: RequestId

Output Resultset : CarrierID, CarrierType, CarrierCode, CarrierName, WebServiceURL, Addr1, Addr2, City, State, Zip, Zip4, WorkPhone, email

d. Get_Client_Demo

Input Parameter: RequestId

Output ResultSet : ClientId, ClientType, C.ClientName, SSN as TaxIdNum, FName, LName, D.MI, Addr1, Addr2, City, State, Zip, Zip4, workphone, Email

e. Get_Member_Demo

Input Parameter : RequestId

Output ResultSet : Demoid, DemoType, SSN, FName, LName, MI, Addr1, Addr2, City, State, Zip, Zip4, HomePhone, MobilePhone, WorkPhone, SourceCreateDt, SourceUpdateDt

f. Get_Request_header

Input Parameter: RequestId

Output ResultSet : Network , "Coverage Type", "Benefit Term start Dt", "Benefit Term End Dt", "Annual Deductible", "Co Pay", "Life Time Max Coverage", "HSA \$", "Max Out of Pocket", "Max Co Insurance", "Max Co Insurance %"

g. Get_Request_LineItems

Input Parameter : RequestId

Output ResultSet : RequestID, BenefitCode, BenefitCodeType, AnnualLimit, CoPay, Deductible, VisitLimit, CoInsurancePct, CoInsuranceMax, OOPMax, SuggChargAmt, NetworkDiscount, PatientAmt, CarrierAmt, SourceCreateDt, SourceUpdateDt, CreateDt

h. Get_Request_master

Input Parameter : RequestId

Output ResultSet: RequestID, MemberDemoid, CarrierID, RequestStatus, ClientId, RequestGUID, MemberId, InsuredId, RequestTime, LastStatusTime, ErrorCode, ErrorDescription, CreateId, UpdateId, CreateDt, UpdateDt

CHAPTER 6: USER GUIDE AND SCREEN SHOTS

HEALTH ECHECK

USER GUIDE

1. Browser Requirements

To use HealthEcheck, your browser must be one of these.

- Internet Explorer 6 or later (IE 7 is preferred)
- Firefox 2.x or later
- Netscape 8.0.2 or later. (Netscape 9.x is preferred)
- Also, for optimal use, we suggest the following.
- Enable browser pop-up blockers to allow popup from <http://HealthEcheck.ovid.com/>.
- Install the Adobe Acrobat Reader plug-in to view PDF files.
- Enable your system to permit video (.mpeg, .mov, .avi), audio (wav), and other common multimedia file formats.
- Set your monitor's resolution between 1024 x 768 and 1280 x 1024 pixels.

2. Access HealthEcheck

Access the HealthEcheck webpage from a URL provided by your site administrator.

3. HealthEcheck Eligibility Search Page

The HealthEcheck Search Screen will be primarily be used by the Health Care Provider to check member eligibility for a given type of service, procedure, or diagnosis.

Figure 1.3 illustrates the Search screen for the member eligibility request for certain types of benefit codes

- ClientID will be automatically populated with the HealthCare Provider's ID in the HealthEcheck database
- The parameters required for the eligibility search are: MemberID, CarrierID, BenefitCode1, BenefitCode2
 - MemberID: HealthPlan ID on the HealthPlan Card
 - CarrierID: Current HealthCare Carrier for the member
 - BenefitCode1: Code of the procedure, diagnosis or service being requested by the member
 - BenefitCode2: Code of the procedure, diagnosis or service being requested by the member
- Click on Submit

Figure 1.3: HealthEcheck Search Screen



4. HealthEcheck Eligibility Results Page

The HealthEcheck Results Page will be returned with eligibility data from the Member's Carrier.

Figure 1.4 illustrates the Results screen for the member eligibility response for certain types of benefit codes. As shown in Figure 1.4, the search screen shows data segmented into five sections.

1. **Request Credentials: This data segment displays all the fields that were sent on the eligibility request to the carrier.**
 - **RequestID:** ID of the particular request; usually a sequential number in the database
 - **MemberDemOID:** Member's demographic ID in the demographic table in the database
 - **CarrierID:** Specific CarrierID defined in the database
 - **RequestStatus:** 4 possible values: Request, Response, Received and Completed depending on the particular request state at that point in time
 - **ClientID:** ID of the Health Care Provider requesting the information
 - **ClientName:** Name of the Health Care Provider requesting the information
 - **RequestGUIDID:** The ID of the GUI that is requesting the web service; this is generally a web address
 - **MemberID:** Member's Health Plan ID
 - **InsuredID:** Member's Insurance ID
 - **RequestTime:** Time of the eligibility request
 - **LastStatusTime:** Last time the eligibility was requested
 - **ErrorCode:** This will be populated if one of the validations failed in the request or if an error was generated during the response of the request
 - **Error Description:** Description of the error that was encountered during the request, response, received or completed state
 - **CreateID:** Create ID by which the data was posted in the database
 - **UpdateID:** Update ID by which the data was posted to the database
 - **CreateDt:** Date data was posted
 - **UpdateDt:** Date data was updated
2. **Client Information: This segment displays data related to the Health Care Provider that currently is requesting the data**
 - **ClientID:** ID of the Health Care Provider requesting the information
 - **Client Type:** Type of the Health Care Provider requesting the information
 - **Client Name:** Name of the Health Care Provider requesting the information
 - **TaxID Number:** Tax ID of the Health Care Provider requesting the information
 - **Address Line 1:** Address of the Health Care Provider requesting the information
 - **Address Line 2:** Address Line 2 of the Health Care Provider requesting the information
 - **City:** City of the Health Care Provider requesting the information
 - **State:** State of the Health Care Provider requesting the information
 - **Zip:** Zip of the Health Care Provider requesting the information
 - **Zip4:** Last four digits of the Zip of the Health Care Provider requesting the information
 - **Work Phone:** Work Phone of the Health Care Provider requesting the information
 - **Email:** Email Address of the Health Care Provider requesting the information
3. **Carrier Information: This segment displays all the data related to the Health Insurance Carrier that currently stores the Member eligibility information. This is the carrier that the provider would ping for eligibility via HealthEcheck**
 - **CarrierID:** ID of the Carrier responding with the member eligibility information
 - **Carrier Type:** Type of the Carrier responding with the member eligibility information
 - **Carrier Code:** Carrier Code of the Carrier responding with the eligibility information

- **Carrier Name:** Carrier Name of the Carrier responding with the member eligibility information
 - **Webservice URL:** URL that was used to generate the response of the data with the member eligibility information
 - **Address Line 1:** Address Line of the Carrier responding with the member eligibility information
 - **Address Line 2:** Address Line 2 of the Carrier responding with the eligibility information
 - **City:** City of the Carrier responding with the eligibility information
 - **State:** State of the Carrier responding with the eligibility information
 - **Zip:** Zip of the Carrier responding with the eligibility information
 - **Zip4:** The last 4 zip code data of the Carrier responding with the eligibility information
 - **Work Phone:** Work Phone of the Carrier responding with the eligibility information
 - **Email:** Email ID of the Carrier responding with the eligibility information
- 4. Member Eligibility: This section as shown in the Red Circle below shows all member health plan related information.**
- **Network:** Carrier Name
 - **Coverage Type:** Who is covered under this plan? Possible values: Single vs. Family
 - **Benefit Term Start Date:** Since when has this member been eligible for this plan
 - **Benefit Term End Date:** Upto what date is this member covered under this plan
 - **Annual Deductible:** Dollar amount of the Deductible for a benefit year
 - **Co-Pay:** Amount of Co-Pay at time of visit
 - **Life Time Max Coverage:** Maximum Dollar amount for the lifetime
 - **HSA \$s:** What amount of dollars the member has available in their HSA account
 - **Max Out of Pocket:** If there is a maximum limit for out of pocket expense and the amount
 - **Max Co Insurance:** Maximum dollar amount for Co Insurance
- 5. Benefit Line Items: This segment relates specifically to the Benefits that were requested by the Health Care Provider for the member's plan at the point of request.**
- **RequestID:** RequestID of the Health Care Provider requesting the information
 - **BenefitCode:** Specific type of Benefit code for which the data was requested
 - **Benefit Code Type:** Type of Benefit Code can be: Diagnosis, Service or procedure
 - **Amount Limit:** Limit of Amount offered for this type of Benefit Code for the Health Plan offered to the member at the time of request
 - **Co-pay:** Co-Pay required for this type of Benefit Code for the Health Plan offered to the member at the time of request
 - **Deductible:** Deductible to be met in order to be eligible for this type of Benefit Code for the Health Plan offered to the member at the time of request
 - **Visit Limit:** Limitation of number of Visits for this type of Benefit Code for the Health Plan offered to the member at the time of request
 - **CoinsurancePct:** Coinsurance of the Health Care Provider requesting the information
 - **Coinsurance Max:** Coinsurance Maximum Dollar for this type of Benefit Code for the Health Plan offered to the member at the time of request
 - **OOP Max:** Out of Pocket Maximum for this type of Benefit Code for the Health Plan offered to the member at the time of request
 - **SuggChargeAmt:** Suggested Charge Amount by the Health Care Carrier for this type of Benefit Code for the Health Plan offered to the member at the time of request
 - **Network Discount:** Network Discount Amount offered by the Health Care Carrier for this type of Benefit Code for the Health Plan offered to the member at the time of request
 - **PatientAmt:** Patient Responsibility Amount for this type of Benefit Code for the Health Plan offered to the member at the time of request
 - **CarrierAmt:** Carrier Responsibility Amount for this type of Benefit Code for the Health Plan offered to the member at the time of request

- **SourceCreatedDt:** Date this information was created in the Source System
- **SourceUpdateDt:** Date this information was updated in the Source System
- **CreatedDt:** Date this information was shared

Figure 1.4: HealthEcheck Results Screen

HEALTH ECHECK

Request Credentials :

RequestId : 1082
 MemberFormId : HB001
 CarrierID : 2000
 RequestStatus : RECEIVED
 ClientId : 1000
 Client Name :
 RequestGUID : c700c610-a8df-4bb1-b228-d32a5e640b87
 MemberId : 123456789
 InsuredId : 123456789
 RequestTime : 6/11/2008 10:16:31 PM
 LastStatusTime : 06/11/2008
 ErrorCode :
 ErrorDescription :
 CreatedDt : 1000
 UpdatedDt : 1000
 Created Date : 6/11/2008 10:16:31 PM
 Updated Date : 6/11/2008 10:16:31 PM

Client Information :

Client Id : 1000
 Client Type : HF
 Client Name : Fairfax Hospitals
 Tax ID Number :
 Address Line1 : 121 Main St
 Address Line2 :
 City : Fairfax
 State : VA
 Zip : 22033
 Zip4 :
 Work Phone :
 Email : Operations@FairfaxHospitals.com

Carrier Info :

CarrierID : 2000
 Carrier Type : PBM
 Carrier Code : WM
 Carrier Name : Walmart
 WebService URL : localHost\HSA\Monitor_WS2
 HSA\Monitor2.asmx
 Address Line1 : 899 King st
 Address Line2 :
 City : Herndon
 State : VA
 Zip : 20191
 Zip4 :
 Work Phone :
 Email : customerservice@walmart.com

Annual Plan Info

Network	Coverage Type	Benefit Term Start Dt	Benefit Term End Dt	Annual Deductible	Co Pay	Life Time Max Coverage	HSA \$s	Max Out of Pocket	Max Co Insurance	Max Co Insurance %
BlueCross Blue Shield Family		1/1/2008 12:00:00 AM	12/31/2008 12:00:00 AM	1500.00	30.00	999999.00	500.00	25000.00	5000.00	80

Benefit Line Items

Request	BenefitCode	BenefitCodeType	AnnualCost	CoPay	Deductible	VisitLimit	CoinurancePct	CoinuranceMax	COI\$Max	SupplChargAmt	NetworkDiscount	PatientAmt	CarrierAmt	SourceCreatedDt	SourceUpdateDt	CreatedDt
1082	OPT901	Diagnosis	0.00	30.00	1234.98	2.00	80	1200.00	2000.00	2199.23	219.80	376.60	1402.30	3/13/2008 10:16:31 PM	6/1/2008 10:16:31 PM	
1082	BVC891	Procedure	0.00	30.00	1234.98	2.00	80	1200.00	2000.00	89.00	12.00	9.00	68.00	3/13/2008 10:16:31 PM	6/1/2008 10:16:31 PM	

CHAPTER 7: THE HealthEcheck ADVANTAGE

1. Real-Time Response

The single most distinguishing benefit of HealthEcheck is its real-time response. This has a profound impact on today's provider's administrative work. It helps patients make more informed decisions about the differences in discounts they can receive from different providers at the point of service.

2. Intuitive User Interface

With a contemporary look-and-feel, HealthEcheck provides a central single page view of all relevant information throughout the session. Multiple windows can be used for multiple requests. They can also include multiple benefit codes in a single request. HealthEcheck prevents the possibility of human data entry errors and related conflicts. Office administration personnel at the provider's office can better handle customer conflicts by saving a 'snap-shot' of benefits at the time of service by filing a printed copy of the information in the patient's records.

3. Better Informed Customers

HealthEcheck provides the fastest way for a patient to understand the dollars and benefits of his/her health plan. A history of the claims from the beginning of the current term can be viewed. Each of these claims can show how the dollars were used and if they were settled. The patient can contact the authority for their past pending claims in order to avoid paying redundant dollars from their pocket for the current services. Patients can also understand how their current health plan is designed by looking at their annual accumulator limits. They can also plan their non-critical medical expenses to be advanced or postponed across insurance plan periods for better savings.

4. Coordination of Benefits

One of the distinctive features of HealthEcheck is to provide a means for carriers to share the claims process of a service received by a patient when he has a simultaneous coverage's. A typical example for this is when a spouse has his/her own health plan while he is also a dependent in his spouse's health plan. This makes him eligible to extend his medical cost across both health plans. In situations like this, a request can be made to the secondary carrier by marking it as a 'COB' request.

5. Data Analytics

HealthEcheck has its own database that stores the information of every request made at a point of service. This is unparalleled repository of data as carriers rarely store or share information about their eligibility enquiries. These enquiries are usually non-digital in nature as they are mostly done over voice lines. HealthEcheck debuts into storing this data and make it available for statistical analysis. Carriers can use this information to better understand the insurance usage of their patients by slicing and dicing this information. One such study would be to find out the percentage of people that avoid a service after they inquire their benefits about it..

CHAPTER 8: FUTURE ENHANCEMENTS

Some of the future enhancements that can make HealthEcheck a more integrated tool with other major operational requirements of Health care institutes:

1. Claims

Although integration of claims appears to be much more complicated than eligibility, it is be far from reality. Most of the carrier proprietary systems have matured more in claims handling than eligibility, in terms of external interfacing and real-time capability. This can be leveraged by HealthEcheck to transfer much of the process logic to source systems and limit itself as a communication and response standardization areas.

2. Magnetic Cards

Use of magnetic cards has spread beyond financial institutions in the recent decade. Health institutes are no exception. HealthEcheck can be interfaced with magnetic card readers at the point-of-care by a simple library that can communicate to the user interface. This eliminates manual entry and human errors. The challenge though would be to have the magnetic card reader API to communicate with a 'stateless' client like a browser. This may necessitate the use of a medium weight client technology like 'Microsoft smart client'

3. Security

Security is one major enhancement that can make HealthEcheck commercially viable. Currently HealthEcheck uses a simple OS level security like VPN and firewall and https calls. More control can be given to patients provided by providing logins to individual patients rather than just carriers and providers. They can be provided with ability to selectively lock their claim history for reasons of privacy and trust.

4. Exception Handling

Owing to the 'conceptual proof' nature of the current project, exception handling is totally limited only to logging in a database table. This can be improved to more gracefully communicate exceptions to the end user. Also, all business errors can also be meaningfully displayed on the screen.

5. Queuing and Asynchronous Calls

Queuing can be implemented for support of systems that want to receive asynchronous responses from the web server in case of network failures or high load on web services. This can be achieved by putting the requests in a queue and responding in FIFO manner. This helps recovery from a network failure and better fault tolerance and reliability. It also helps in increasing the number of web servers by working the requests from a common queue by load balancing.

CONCLUSION

HealthEcheck prototype is an invaluable and inexpensive tool to implement at any physician's or pharmacy to allow for real-time eligibility checks. This tool and its resulting concepts can be easily integrated into existing health systems to better utilize the innovative, distributed, light weight, and asynchronous messaging architecture of modern IT systems. All that would be required to implement such a model would be a basic browser, internet connectivity and authentication into the system. With the advent of eligibility systems that are currently being introduced in the Health Industry, it is highly recommended that an automated solution for eligibility check is put in place. The advantages with respect to implementation simplicity, installation flexibility and technical requirements and ease of usability of HealthEcheck far outweigh the risks of experimenting.

BIBLIOGRAPHY

1. Christine L. Keller, Gary S. Lesser, William F. Sweetnam, Susan D. Diehl, Health Savings Account (HSA) Answer Book, Third Edition, Aspen MD, 2007.
2. Robyn C Morris, Flexible Benefits Answer Book, Aspen Law & Business Publishers; 4th Edition, December 2002.
3. "Bush's HSA plan", Legal Memorandum, 13 April. 2005.
4. "Early Experience With High-Deductible and Consumer-Driven Health Plans: Findings From the EBRI/Commonwealth Fund Consumerism in Health Care Survey", The Commonwealth Fund, Paul Fronstin, Ph.D., and Sara R. Collins, Ph.D., December 2005.
5. "Information technology payoff in the health-care industry: a longitudinal study," Journal of Management Information Systems, March 2000.
6. "From a Ripple to a Wave: Why Eligibility Matters", hfm magazine, Pamela M. Waymack and Gwendolyn Lohse, November 2006.
7. "PBMs The basics and an Industry View", The Health Strategies Consultancy, LLC, John Richardson., June 2003.
8. "What is the difference between HMO and PPO?", Tricia Ellis-Christenson, 2005.
9. "Health Spending Accounts", US Department of Labor, Labor Bureau Statistics, Haneefa T Saleem, October 29, 2003.
10. "The Health Savings Account Debate", HSA for America, Wiley Long, 2008.
11. "Medicare & You", Centers for Medicaid and Medicare Services, Michael O'Levitt, October 2003.
12. "Healthcare Financial Management", James J. Moynihan, Jan, 1997.
13. Joseph P Tallman et al, Medical network management article of manufacture, *U.S. Patent #5,964,700*, Oct 12, 1999.
14. Edward C Rieker et al, Automated system and method for providing real-time verification of health, *U.S. Patent #5,832,447* Nov 3, 1998.
15. Brian E. Peterson et al, Electronic creation, submission, adjudication, and payment of health, *U.S. Patent #6,343,271*, Jan 29, 2002.
16. Jerry G. Seare et al, Method and system for generating statistically-based medical provider, *U.S. Patent #5,557,514*, Sep 17, 1996.
17. Loren J. Spurgeon, System for exchanging health care insurance information, *U.S. Patent #6,088,677*, July 11, 2000.