HealthNet *Infrastructure*

A 21st Century Approach to Health Care

Institute of Design
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Overview

Background

Signs everywhere point to the fact that the existing model of healthcare delivery in the United States is not working. Americans spend more on average for healthcare and health-related expenses—$5,400 each year—than citizens of any nation. (BCBS 2003, 5). Health expenses in 2002 totaled an estimated $1.5 trillion, an astounding 12.6% of GDP (BCBS 2003, 6). Yet 44 million Americans have no health insurance and lack access to treatment. Millions more worry that they will loose care benefits if they are laid off from their jobs. This anxiety is compounded by reports of high error rates in hospitals and soaring malpractice fees. Hospital closures are commonplace as are extremely long waits at overburdened ERs. Newspaper headlines are filled by Congressional disputes over spending more federal money on senior drug benefits as the politicians fight nasty legal battles over living wills and patients right to die.

Many have pointed to technological developments as the primary means of repairing the nation's massive system of health delivery. Advocates have long called for electronic health records, electronic claim submission, online patient information and evidence-based medical decision-making. Recent developments suggest that the medical community is beginning to embrace these and other technologies, both as a means to reduce cost and increase the quality of care. Yet evidence also suggests that these changes are being made too slowly and too myopically. Government agencies, professional organizations and corporations push competing standards and technologies. Hospitals and HMOs invest in competing systems and too often discover that they are difficult to install, maintain and integrate. This technological stumbling illustrates the findings of a Blue Cross Blue Shield study showing technology spending to be one of the main contributors to increased healthcare costs in 2002 (BCBS 2003, 3).

Opportunities

A systematic, integrated solution

Current efforts to improve healthcare through information technology are hampered by the fact that they are focused on solving problems inside a single organization as opposed to across organizations. After all, healthcare takes place in an enormous number of locations beyond the doctor's office and hospitals. Homes, ambulances, community clinics, pharmacies, HMOs and health clubs are a sampling of the environments where people seek and receive health care and information. The complexity of the healthcare economy and the sheer number of players involved in delivering care necessitates an infrastructure that can streamline interaction between organizations—not just inside them.

Real-time healthcare

Developing this infrastructure will allow health management at all levels to become much more flexible and responsive. Outbreaks and supply shortages can be identified before they become acute. Massive data stores can be mined to identify adverse drug interactions. Patients can be directed to facilities based on patient load and available expertise.

Empowerment of individuals

Digital technologies can also alter the way that medical services are delivered. A nationwide healthcare network can allow individuals to receive diagnoses in the comfort of their own home, get relevant information from caregivers and even receive sophisticated monitoring services without taking up hospital beds.

Focus on prevention

A robust, integrated information technology infrastructure can help move the current healthcare environment's focus from acute care to prevention. Individual health habits can be tracked and analyzed. Incentives for health behavior can be issued

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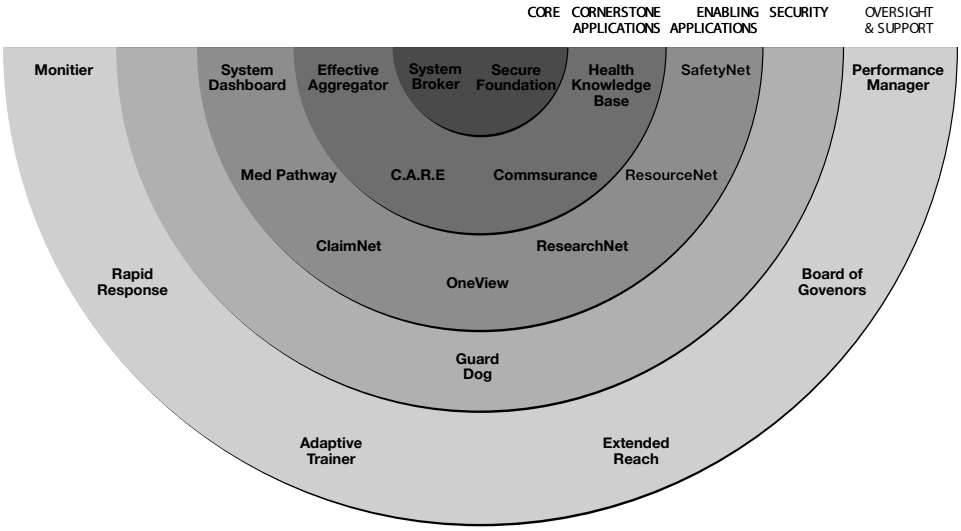
Blue Cross Blue Shield Association. **What's Behind The Rise: A Comprehensive Analysis of Health Care Costs.** Chicago: Blue Cross Blue Shield, 2002.

Overview



and monitored. Patients can receive information on possible conditions far in advance. The impact of disease outbreaks can be diminished by rapid, coordinated response.

Solution

HealthNet Infrastructure is a vision the many systems – technical, organization and financial – needed to support a nationwide healthcare network and the enormous possibilities enabled by such a network. This vision assumes that public and private healthcare organizations need a common infrastructure that allows them to share information and resources. It also assumes that this infrastructure must include more than technology, embracing a range of critical challenges including funding, governance, privacy, access to care and ongoing support. The elements of HealthNet Infrastructure are best described by a series of six concentric circles as seen in the diagram above.

Core

The technical building blocks for HealthNet including networking hardware, configuration tools and data storage.

Cornerstone Applications

Pivotal applications including communications management, data aggregation and indexing, and knowledge bases of medical information. Cornerstone Applications provide a rich, flexible foundation of information and services for other applications residing on HealthNet's infrastructure.

Enabling Applications

A series of enabling applications that show how healthcare changes in a network environment. Some enabling applications emphasize the efficiencies gained from interconnected network services like ResourceNet, a supply web management system that integrates caregivers and suppliers into an online marketplace. Other applications like System Dashboard allow healthcare at the micro and macro levels to be managed in real-time with powerful decision support and visualization tools.

Security

A robust security layer that protects the system from unauthorized access and data misuse and seeks to minimize damage when breeches do occur.

Oversight and Support

Governing mechanisms, outreach programs and systems that support the day-to-day management of HealthNet, provide outreach and support programs for underserved communities, and provide clear strategic direction for the network to meet its many ambitious goals.

system elements

Brief Descriptions

Core

Secure Foundation

A highly distributed, redundant network and system architecture including hardware, bandwidth and software. Secure Foundation provides a set of tools that allow users to add infrastructure pieces modularly through the installation of a common code base, enabling autonomic repair and a standard means of classification, identification and monitoring.

Health NOC (sub-element)

A command center for HealthNet administration. Health NOC provides management and administration of HealthNet systems as well as centralized management tools for epidemic and crisis management.

System Broker

HealthNet's underlying system logic that coordinates storage and processing needs with available resources. The System Broker's Clearinghouse prioritizes requests for storage and processing, and then the requests are fulfilled via the Procurer. System Broker's Choreographer is capable of organizing massive storage grids and processing grids with significant capacities.

Object Directory (sub-element)

A real-time catalog of all of the existing hardware and software objects resident in HealthNet. The Object Directory supports other HealthNet systems in locating and validating the identity of these system objects.

Cornerstone Applications

Commsurance

Assures secure and timely communication via multiple media types: text, voice, or video. Commsurance intelligently connects resources via Comm Coordinator and mitigates the risk of corruption or miscommunication via Comm QA.

Context-Aware Rendering Engine (C.A.R.E)

An application serving and rendering platform that facilitates user requests for data. During each data request, C.A.R.E determines the type of data requested, the communication platform, and the rendering requirements for the platform. C.A.R.E is capable of presenting data dynamically, allowing the user to specify data presentation by region of the body, such as head, chest, below knee, etc.

Effective Aggregator

An integrated set of software tools and procedures that identifies and indexes data stored within the various systems connected via HealthNet. Effective Aggregator goes beyond the simple indexing of a web-based search engine, seeking to both understand and classify information based on content and it's structure. In doing so, the system "effectively" integrates disperse systems in HealthNet without going through the laborious, costly efforts of custom integration.

Health Knowledge Base

A digital repository of the most recent and factual knowledge generated by medical science and medical services. This compilation of carefully vetted information serves as a reference desk for Enabling Applications and their end users—the patients and healthcare professionals applying medical knowledge to real world problems.

Enabling Applications

ResourceNet

An integrated system of tools that provides means to acquire and allocate the broad range of physical and human resources needed by hospitals and healthcare organizations participating in HealthNet. In addition to aggregating suppliers, ResourceNet enables health entities to share and trade resources with each other. ResourceNet also includes capabilities to quickly re-distribute resources in critical situations.

Brief Descriptions

Talent pool (sub-element)
An integrated set of procedures and tools that lowers the cost of identifying and screening candidates for open job requisitions. Talent Pool automatically matches profiles, checks background history, standardizes interviews and establishes performance ranking among existing and potential employees.

Supply pool (sub-element)
A physical resource supply system that provides hospitals and healthcare specialized institutions with access to an enormous marketplace of physical resources. Supply Pool reduces transaction costs by automating the resource acquisition and allocation process. In addition, it provides more effective ways to intercept and allocate resources in emergency situations.

ResearchNet
Tools that allows health and medical researchers to perform analyses across HealthNet's user populations while protecting the privacy of individuals.

SafetyNet
Systems and financial tools designed to drive medical costs down while increasing access to healthcare coverage. SafetyNet has three constituent parts: (1) tools that provide accurate data on the personal and financial costs of not taking preventive measures and treating the uninsured, (2) means to create powerful incentives to increase positive health behaviors and (3) programs to increase health coverage to a larger percentage of the US population. SafetyNet is managed in partnership with HHS and Medicaid/Medicare grants are used to fund many of the programs.

ClaimNet
Provides HealthNet participants with a single gateway for transferring claims and payments. For a small per-transaction fee, participants will be able to send and receive claim information by performing a single integration to the ClaimNet standard. ClaimNet's capabilities extend beyond that of a payment clearinghouse through its use of automated error checking and correction tools, e-payment tracking capabilities and a transparent claim management process.

Med Pathway
When patients or doctors are faced with medical decisions, Med Pathway coordinates available expertise via an Expertise Knowledge Base to map out alternatives and support informed decision-making using a Decision Map. Med Pathways' Financier function provides users with financial facts to support informed decision-making. Med Pathway increases the level of care while decreases costs through reducing the expenses of delivering expertise.

System Dashboard
Presents service capabilities, demands, and risks to network and health administrators. Using System Dashboard, administrators can de-risk the nation's health infrastructure in real-time by quickly identifying risks via the Visualizer, diagnosing causal relationships via the PastCaster, and evaluating potential mitigations using the Trend Modeler and Health Levers.

OneView
A matching engine integrated with HealthNet applications to provide them with robust, sophisticated searching functionality. OneView is a web service that works with Effective Aggregator to handle a range of search inputs-text, keywords, images and audio—and knows how to translate that information into a query that delivers quick, high-quality results.

Security
Guard Dog
An integrated set of security tools, hardware and protocols designed to protect HealthNet users and data from security breeches and improper use. Unlike general security systems, Guard Dog is

Brief Descriptions

specifically tailored to the needs of the healthcare environment, balancing the need for quick information access and security while minimizing the risks of unauthorized access.

Oversight and Support

Monitier

Ensures a rock-solid HealthNet infrastructure through aggressive monitoring of critical services and systematic monitoring of the entire system. Monitier coordinates the monitoring of all system objects (i.e., hardware and software) preventing the deterioration of optimal service. Monitier prioritizes and coordinates monitoring activities a Tiered Scheduler. The execution of the monitoring work and the analysis of the resulting data is performed by Monitier's Active Observer functionality.

Rapid Response

A dedicated team of system administrators that takes proactive as well as reactive measures to ensure the sustainability of HealthNet's infrastructure. Working in conjunction with Secure Foundation and Monitier, it takes action once it becomes apparent that a system disruption has the potential for occurring or has already occurred.

Board of Governors

A heterogeneous unit designed to govern HealthNet, ensure its political independence and maintain its sensitivity to divergent concerns. HealthNet's Board of Governors is led by a chairman and nine members nominated from three different healthcare sectors. The Board of Governors works closely with a Board of Directors representing each of HealthNet's seven divisions.

Performance Manger

Enables HealthNet administrators to understand current resource allocations and plan for more effective reallocation strategies. Performance Manager collects data about how people, money and system objects are being used, presents that information to administrators, generates models of hypothetical resource allocations, and produce recommendations on how to achieve optimal allocations.

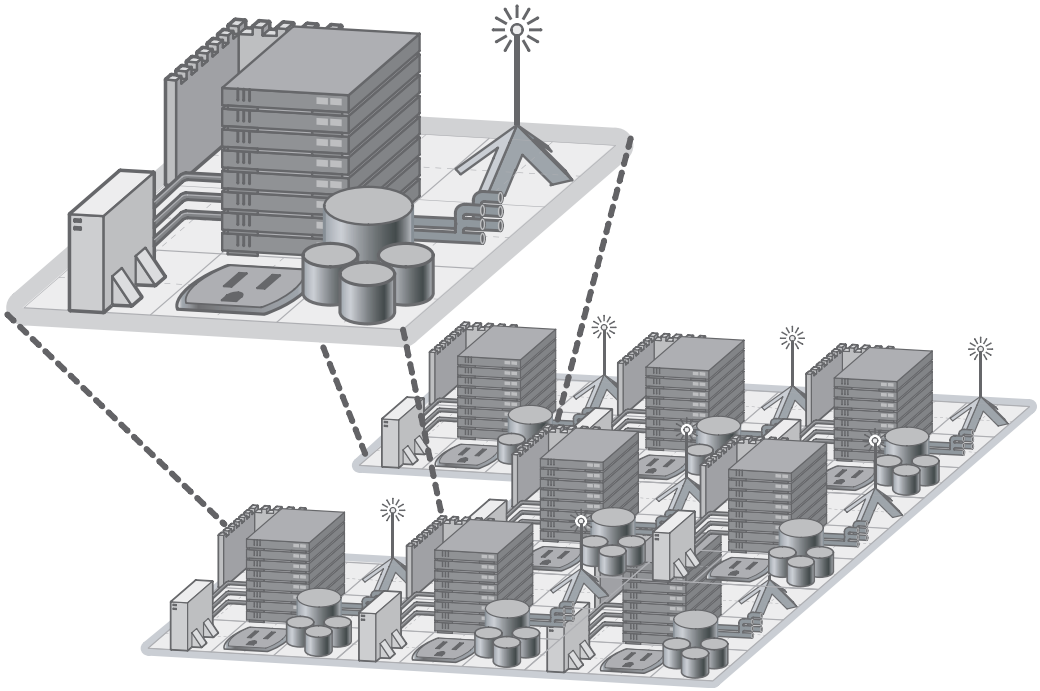
Extended Reach

An organization committed to expanding the use of HealthNet by practitioners and underserved populations. Extended Reach uses an integrated system of tools that provides the means to identify populations, to reach out to them via diverse communication channels, and to educate and encourage them to adopt HealthNet.

Adaptive Trainer

Provides users with the training tools and information to develop expertise in a wide-range of health-related subject areas. This includes learning how to use HealthNet's services, acquiring training in medical procedures and learning about preventative care.

Secure Foundation



A highly distributed, redundant network and system architecture including hardware, bandwidth and software. Secure Foundation provides a set of tools that allow users to add infrastructure pieces modularly through the installation of a common code base, enabling autonomic repair and a standard means of classification, identification and monitoring.

Discussion

Secure Foundation includes a set of directly managed geographically-distributed server farms including servers, routers and hubs. These server farms are highly redundant and disaster resistant. They are underground, encased in concrete and have backup power generators that run on a large store of diesel fuel.

These server farms are augmented to be resources already used in healthcare organizations across the country. They are able to extend their own infrastructure to HealthNet by applying a common set of software tools and image management routines that will make disparate hardware highly modular. These tools are critical to ensuring that HealthNet doesn't become an operational hodgepodge of complexity. They include tools to identify devices, monitor them and validate their performance. Secure Foundation also includes a set of tools to centrally provision software and track configuration changes. This system automates many system administration tasks and provides for

Secure Foundation

tight coordination across geographically dispersed data centers. These systems are partially autonomic, meaning that they will be able to preform basic self-healing through automated configuration management. Tools that automatically map hardware and software environments complement these tools by providing an up-to-date picture of the network environment and its many constituent parts.

HealthNet servers and end users are connected using a combination of today's Internet as well as two proprietary networks created solely for HealthNet. The first features a pair of fiber optic backbones that connect major metropolitan health centers with each other, allowing for extremely rich, fast data transfer. The second network is satellite-based and is used mainly in times of emergency. It allows for basic network traffic and all healthcare provider wireless communication devices to communicate through leased communication satellites.

Secure Foundation's infrastructure is protected by firewalls and many forms of connection can only take place via secure, encrypted tunnels. Users and machines gain access to these tools via Guard Dog.

Properties

- Networking hardware: Linux blade servers, routers and hubs
- Network attached storage (NAS)
- Firewalls and VPN management
- Geographically dispersed server farms
- Health Networking Operations Centers (Health NOC)
- Wireless and high-speed network bandwidth
- Redundant fiber optic connectivity between major metropolitan areas
- Backup satellite communication system for disaster recovery
- Massively redundant and distributed architecture
- Centralized software repository
- Centralized provisioning management
- Autonomic software for self-diagnosis and repair
- Standard hardware identification protocol

Features

- Reduces single point of failure risks
- Allows for high speed access in main metropolitan areas
- Provides additional bandwidth as needed
- Eases management of heterogeneous environment through centralized provisioning
- Ensures that network hardware meets basic performance and ongoing management criteria
- Works with Monitier to attempt pro-active repair instead of basic failure
- Provides robust security through firewalls and encrypted VPNs
- Allows for hardware to be easily added and removed from the foundation while maintaining consistency

Secure Foundation

Scenario

HealthNet's central server farm is located just outside Omaha, Nebraska in a former Strategic Air Command bunker 500 feet below ground The farm contains two categories of equipment a set of routers and servers that manage connectivity for HealthNet's many institutional participants and a vast farm of linux blade servers that store and serve HealthNet's core applications and data. Overall the farm contains more than 5,000 servers, all quietly humming away. The Omaha farm is one of five main data centers of HealthNet infrastructure, the others can be found in places like central Pennsylvania, Wisconsin, the California valley and upstate New York.

It's 2 AM and Dave Blaettler sits in the Health NOC located just outside of Chicago. Dave is in charge of a team that deploys application patches and upgrades to the HealthNet system. He and his team are about to release an upgraded patch of Effective Aggregator, a core system component. Rolling out patches to 25,000 servers would be extremely challenging without tools that are part of Secure Foundation. Dave can rest assured that these servers are clearly identified and have been centrally managed from day one; they have the same operating systems, configurations and software patches The release code itself is staged on a small set of dedicated servers at each of the data centers. These servers are equipped with software that tracks the image and configuration of each server in its cluster and are responsible for propagating changes across the data center

Dave executes the release commands and looks up at the large plasma screen readouts as Secure Foundation's replication processes start. Back in Omaha, the replication servers take four thousand HealthNet boxes identified through the Object Directory out of service The remaining one thousand boxes are more than ample to handle HealthNet's traffic and data requests. As the code updates propagate, each machine receives an individual performance check and a configuration analysis. Upon successful completion of these checks, the replicating servers update the Object Directory. After an hour, the deployment is complete. Before returning these boxes to service, however, Blaettler runs a load simulation and uses Monitier to ensure that the system will perform correctly. Any time Blaettler sees an error, he can use the replication severs to run the reverse process and regress each server to its previous functioning state. Luckily, this deployment passed its test with flying colors. The replicating servers uses the Object Directory to rotate the severs into production, taking the remain one thousand servers out of use. The processes are repeated with these servers.

Health NOC

A command center for HealthNet administration. Health NOC provides centralized management and administration of HealthNet systems as well as management tools for epidemic and crisis management.

Discussion

Health NOC is the equivalent of central command for HealthNet. From this well fortified location, HealthNet administrators can centrally manage both day-to-day network operations via Monitier and manage healthcare challenges real-time. Health NOC includes a large bank of LCD monitors that project images from System Dashboard and Monitier. These images allow for very broad pattern recognition and can be quickly zoomed into to identify trouble spots like service degradation or a flu outbreak.

Health NOC is designed to support HealthNet administrators in times of crisis. The location itself is a hardened, well-protected structure that has back up power supply and can exist “off the grid.” From this location, HealthNet administrators can use the many tools at their disposal to react to an epidemic or bio-terrorist attack. Using Commsurance and Secure Foundation’s satellite network, they can quickly establish communication links with other agencies and affected parties. They can coordinate quarantines and re-allocate human and physical supplies using ResourceNet. They can quickly broadcast warning and bulletins to the general public.

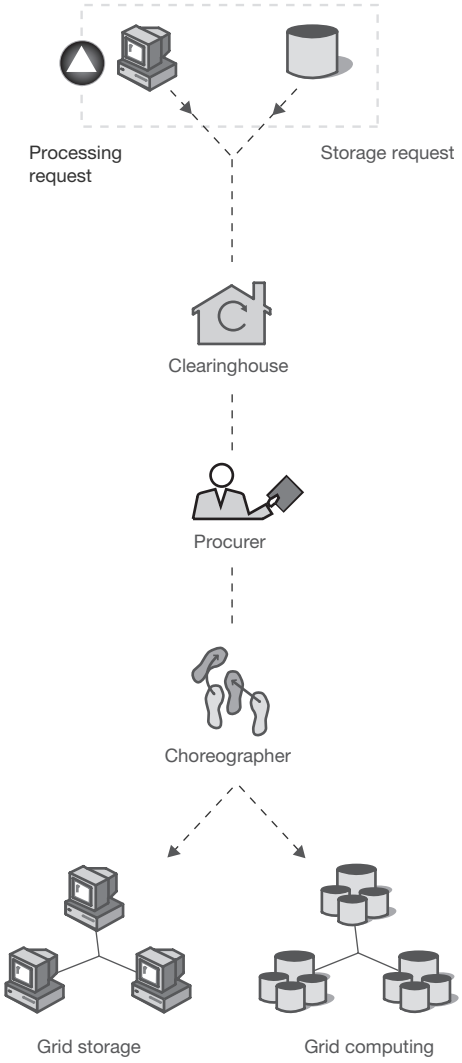
Properties

- Hardened, physical structure
- Separate power generation capabilities
- Redundant, backup location
- Large LCD panels
- Visualization tools for Monitier and System Dashboard
- Support staff
- Linux blade server farm

Features

- Allows for centralized management of HealthNet operations
- Enables effective crisis management and coordination
- Ensures stable, day-to-day operations of the system

System Broker



HealthNet's underlying system logic that coordinates storage and processing needs with available resources. The System Broker's Clearinghouse prioritizes requests for storage and processing, and then the requests are fulfilled via the Procurer. System Broker's Choreographer is capable of organizing massive storage grids and processing grids with significant capacities.

Discussion

HealthNet will dramatically improve the condition of healthcare by creating an ever-increasing body of health information. The reliable storage and processing of information such as Patient Health Records (PHRs), medical research data, and educational material will elevate the standard of care by providing greater knowledge of patients, practices, resources, public health and much more. System Broker is the underlying system logic that makes the storage and processing of such valuable sources of health information possible. System Broker coordinates storage and processing needs with available resources to retain and manipulate information as needed.

As storage or processing power is needed, requests are received by the Clearinghouse. The Clearinghouse first evaluates the request and the source of the request. Guard Dog and Monitier are consulted to ensure the source's identity can be validated and the request is in keeping with the source's authority. The Clearinghouse then prioritizes current requests based on time-sensitivity. The Clearinghouse is responsible for evaluating both the storage requests and the processing requests given that such requests are often issued in pairs from the same source. When requests are paired, the evaluation can be both more efficient and have greater context for the request.

System Broker

Once the requests are processed, they are passed on to the Procurer, which is responsible for brokering the best allocation of resources to the storage and processing needs. To perform its function, the Procurer must know the current availability of all available resources and their capabilities. Matching of requests to resources requires the Procurer to exhibit adept reasoning skills so that the most capable resources for a request can be found. The Procurer has the ability to archive or terminate data deemed of little or no use. Like the Clearinghouse, the Procurer considers storage and processing requests in pairs, as proximity of the storage resources to the processing resources can in many cases be advantageous.

Once storage and processing requests are matched with resources, the Choreographer coordinates the actions, details, and execution of the decision. Given that HealthNet is a massively distributed network, multiple storage or processing resources may be used in combination to satisfy larger requests and to best leverage all of the networked resources. The Choreographer is especially critical for these requests that use multiple resources, playing the role of a host in a computing grid or a storage grid.

As conceptually discussed above, the System Broker centralizes storage and processing requests and fulfills them in a methodical, serial process. However, in practice the System Broker is a distributed and parallel process, coordinating resources and fulfilling multiple requests in parallel throughout the network.

Properties

- Storage and processing request clearinghouse
- Data source validation
- Data quarantine procedures
- Storage and processing allocation logic
- Data archiving and termination procedures

Features

- Receives and fulfills storage requests
- Validates identity and authority of data source
- Quarantines unverifiable data
- Terminates and archives superfluous data
- Allocates storage resources to storage requests
- Secures storage of data
- Maps associated data that is distributed across multiple storage resources

System Broker

Scenario

Dr. Bidlesbee is performing his two-hundred-and-eleventh non-evasive bypass surgery on Sven Koneig. Among the data being collected during Sven's bypass is a video taken from inside his arterial passages. Once the operation is complete, the arterial video and other data is packaged for storage as a part of Sven's Personal Health Record (PHR). The System Broker's Clearinghouse is notified of the storage need, giving the request a medium-level priority because of it's non-emergency status. Once the Procurer has first handled high-priority requests, it then matches Sven's data with a network storage device that was chosen because it contains some of his other PHR data. The Choreographer updates Sven's root PHR file with the network location of these new files.

Later that week, Dr. Denise Lowery of Mass General was in the midst of a research study on arterial blockages prior to surgery. As a part of the study, she designed a procedure to sample video from hundreds of bypass surgeries and store them for future analysis. Once Dr. Lowery initiated the procedure, the Effective Aggregator requested storage space and processing time from the System Broker's Clearinghouse. The Clearinghouse prioritized the request as low-level, which means it will probably be satisfied at off-peak hours. Eventually the low-level request is brought to the attention of the Procurer, which locates many unused desktop PCs for processing the video and multiple networked drives for storing the video samples. The Choreographer coordinates the interaction of the computing grid of PCs to execute the procedure and transfer the output to the procured data grid. The System Broker has quickly produced insightful data for Dr. Lowery's analysis.

Object Directory

A real-time catalog of all of the existing hardware and software objects resident in HealthNet. The Object Directory supports other HealthNet systems in xlocating and validating the identity of these system objects.

Discussion

The Object Directory works with Secure Foundation to ensure all new hardware and software, or system objects, are registered. When new system objects register with the Object Directory, they providing their name, location, purpose, and capabilities. Over time a system object's location or capabilities may change, and such changes should also be noted in the directory. Because these directory entries are made by all new system objects and regularly updated, Object Directory represents a complete catalog of HealthNet capabilities and components.

The Object Directory can support other HealthNet systems in locating other system objects. Other HealthNet systems may be looking for a specific system object by name or by capability. For example, the System Broker may be looking for a specific storage device or a storage device with a large-storage capacity capability. Either way, the Object Directory can support the process of locating the network (and sometimes physical) location of the system object.

The Object Directory validates the identity of system objects. For security purposes, the identity of a system object may need to be validated before data can be sent or received from it or access can be provided to it. In such cases, the Object Directory can serve as a third-party identity verification resource by ensuring the network location, name, and capabilities of a system object matches the directory's records. The Object Directory can employ a range of secure identification technologies to accommodate the varying capabilities of software and hardware objects across HealthNet.

Properties

- Registry for new system objects
- System object locating resource
- Identity validation resource
- Complete catalog of HealthNet capabilities and components

Features

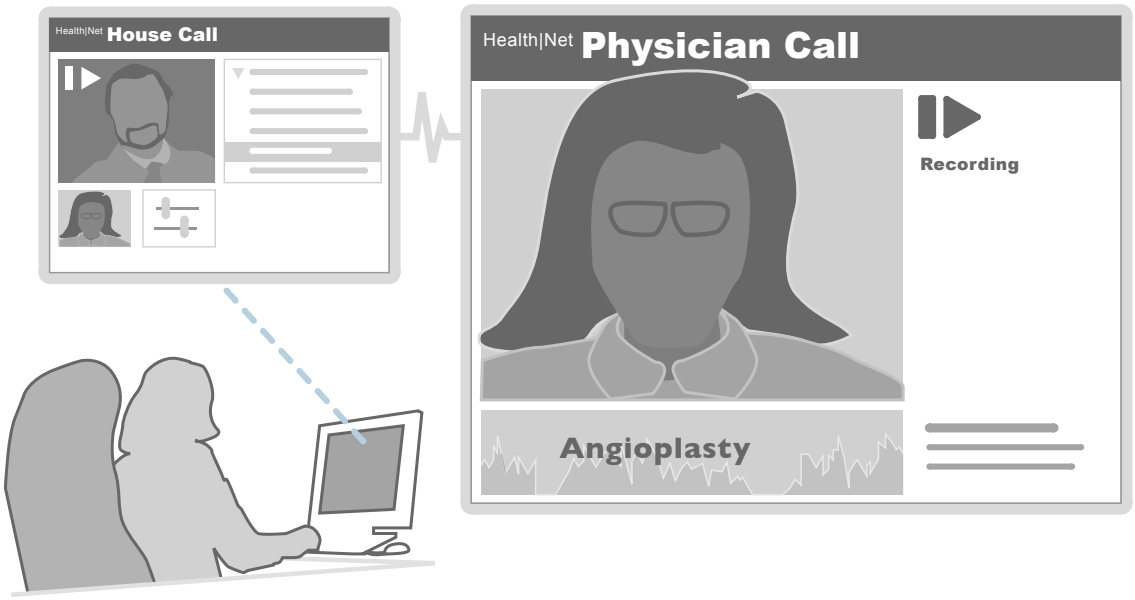
- Registers new system objects
- Locates software and hardware objects
- Validates software and hardware objects' identities

Scenario

Jacob Albertson is a network administrator at HealthNet's Osh Kosh server farm. Today he's just installed a new rack of digital routers. After the installation is complete and they're brought online, Secure Foundation registers the new network additions with the Object Directory. The digital routers are registered as routing hardware objects capable of 320 Gbps switching, peering, and trunking services. The routers' network location is also noted.

Later, Monitier has scheduled an observation of the new digital routers. Monitier looks up the location and specified capabilities of the routers in the Object Directory to support the observation process.

Commsurance



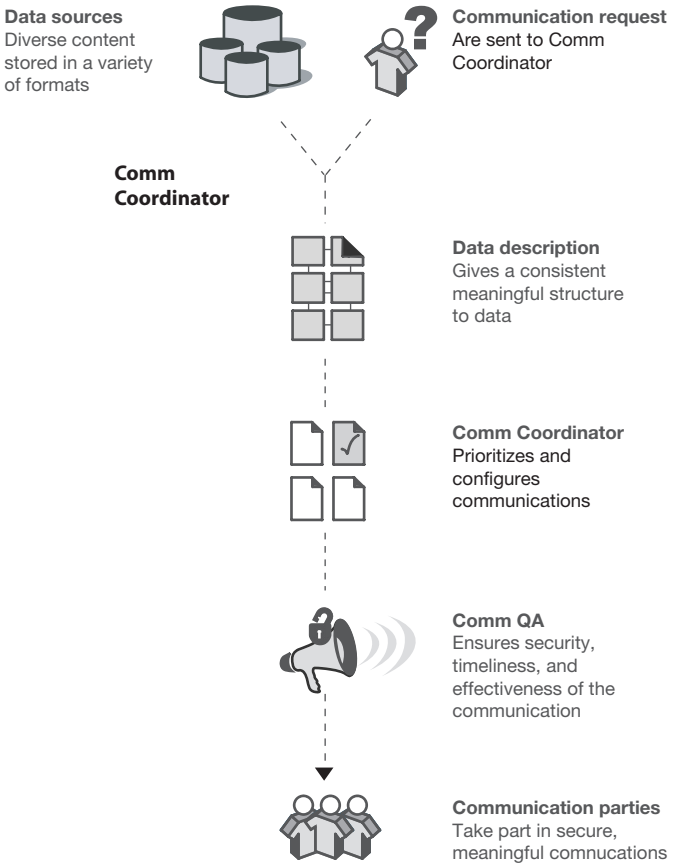
Assures secure and timely communication via multiple media types: text, voice, or video. Commsurance intelligently connects resources via Comm Coordinator and mitigates the risk of corruption or miscommunication via Comm QA.

Discussion

As an information-based infrastructure, HealthNet must connect and support communications between various parties. Data communication resulting in inaccuracies, misunderstandings, or untimely distribution would undermine related HealthNet services that depend on communication. To avoid such problems, Commsurance plans for, moderates, and supervises valuable and accurate communication. At a high level, Commsurance is about connecting people via HealthNet. At a low level, it's about coordinating efficient and effective data transfer.

The foundation of effective communication is a defined language. For information networks, this means a common structuring, or encoding, of the data. Commsurance works with the Effective Aggregator to ensure networked communications share a common structuring to simplify the exchange of "dialog" or data.

Commsurance



The next layer of effective communication is coordination of those parties communicating. In the case of information networks, such parties may be in different time zones with different communication needs using different communication interfaces. And in the case of HealthNet, some communication (such as tele-surgery) may be more critical than other communications. To accommodate these differences, Comm Coordinator receives communication requests, configures the communications based on the capabilities of the parties involved, and prioritizes the communications based on criticality.

The highest layer of effective communication is the assurance of quality, secure, and meaningful communication. Comm QA packages, delivers, and increases the comprehension of the communication. As communication data is created, Comm QA securely packages the information in routing envelopes, specifying the data's destination and priority level to ensure communication is delivered in a secure and timely fashion. In addition, Comm QA works with the communication audience to reinforce the communication by recording the communication and delivering it in additional media types (e.g., sound and text, video and stills, etc.).

Properties

- Communication request clearinghouse
- Comprehension and reinforcement support tools
- Communication configurator and translator
- Secure data envelopes

Features

- Prioritizes communication resource requests
- Assimilates data formats
- Translates communication content for end-users
- Records communication messages
- Brokers mutually beneficial communication formats
- Packs data for secure and timely routing to its destination

Commsurance

Scenario

It's been a week since Dr. Bidlesbee performed Sven's non-invasive bypass surgery. Dr. Bidlesbee said it was a routine procedure, but for Sven it was anything but routine. After a day in the hospital recovering, Sven was sent home. It's been a week since his surgery, and today will be his first post-op checkup from home with Dr. Bidlesbee.

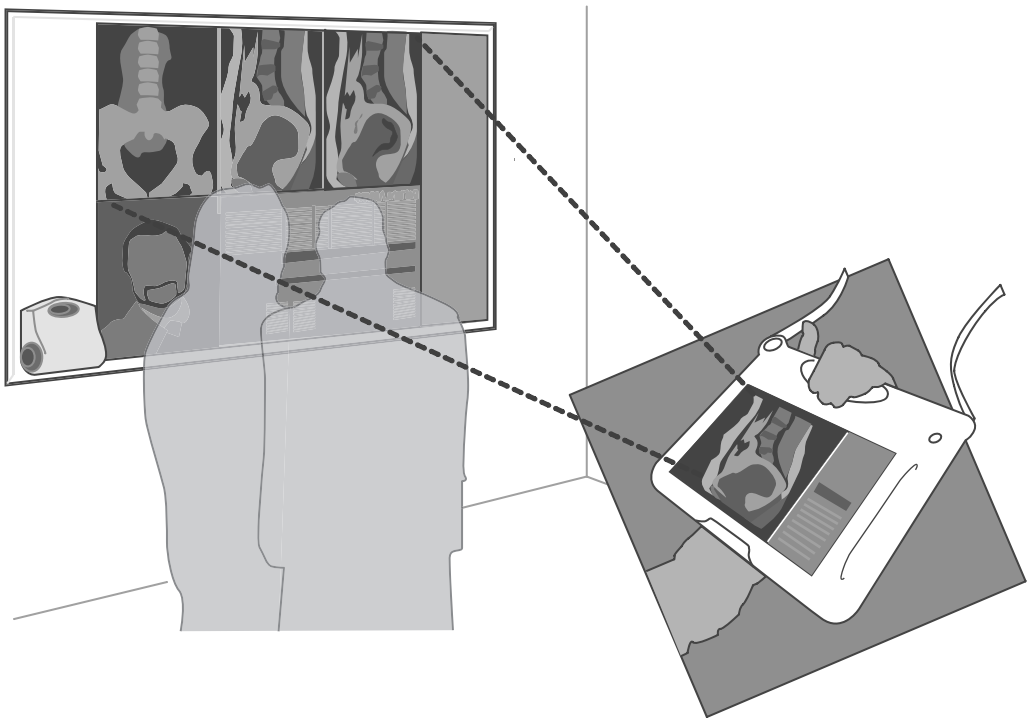
Bidlesbee initiates the tele-checkup with Sven. Bidlesbee is using a camera that captures his face and voice alongside a high-resolution display of Sven's files. Meanwhile, Sven has a low-resolution video-display and camera. The cameras that Dr. Bidlesbee and Sven use create video data based on two different formats. This difference doesn't affect their communications because Commsurance works with the Effective Aggregator to restructure and translate the video formats.

Comm Coordinator negotiates the best configuration between the two parties. Recognizing the limitations on Sven's end, Comm Coordinator gives Dr. Bidlesbee the ability to toggle Sven's video display between the doctor's face and parts of Sven's file that the doctor wants to share.

As the tele-checkup proceeds, Comm QA sends streams of encrypted packeted data between Dr. Bidlesbee and Sven, keeping the communication private. Comm QA recognizes that Sven has experienced some hearing loss, so Dr. Bidlesbee's conversation is transcribed as subtitles over the video.

Dr. Bidlesbee and Sven complete the checkup. Sven was nervous about what the doctor might say about his recovery, and so Sven didn't feel that he had heard all that the doctor had to say about other matters. Luckily, Comm QA asked if Sven would like to replay the check-up. Sven gladly did, feeling better informed and less confused about what Dr. Bidlesbee had to say.

C.A.R.E.



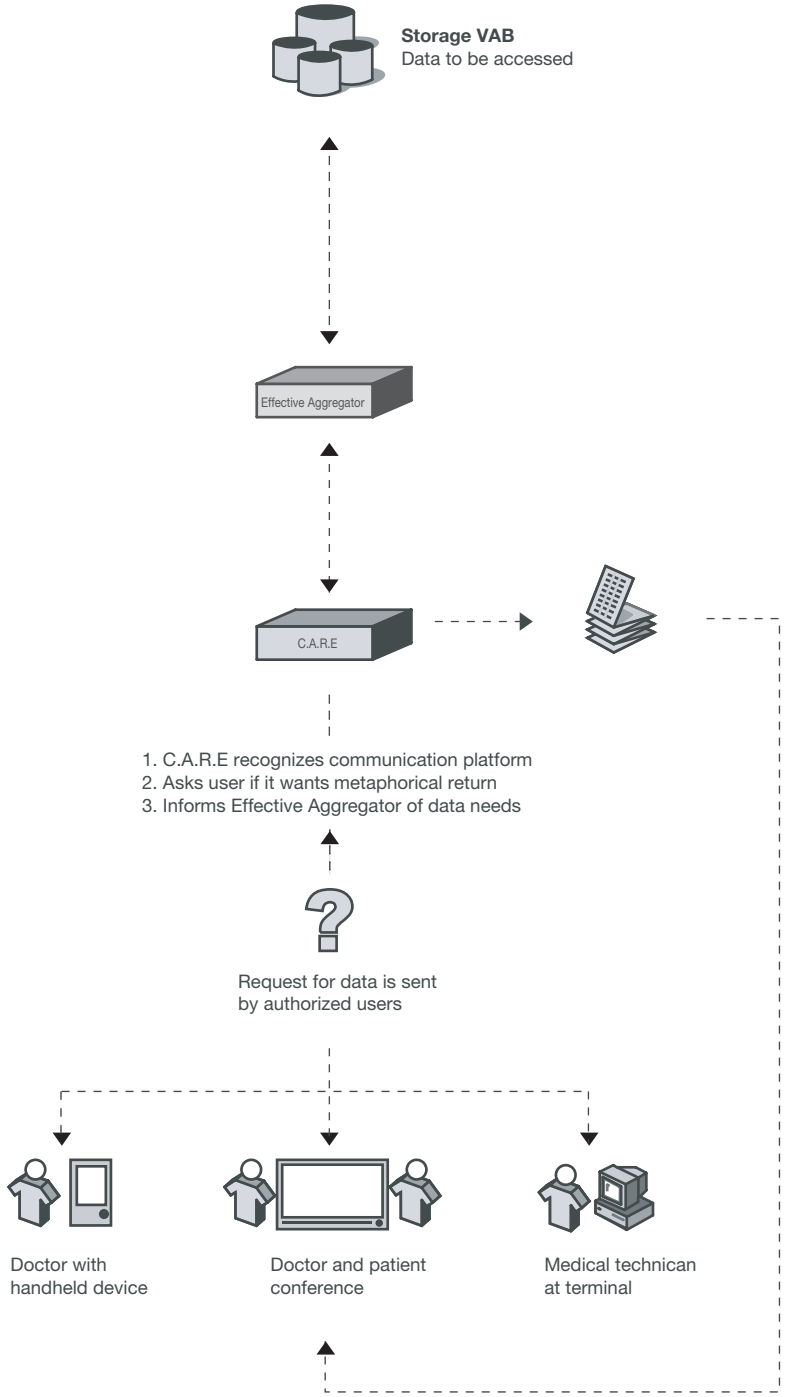
An application serving and rendering platform that facilitates user requests for data. During each data request, C.A.R.E determines the type of data requested, the communication platform, and the rendering requirements for the platform. C.A.R.E is capable of presenting data dynamically, allowing the user to specify data presentation by region of the body, such as head, chest, below knee, etc.

Discussion

C.A.R.E determines how requested data should be assembled, rendered, sent and presented to users. C.A.R.E extends its role in certain situations, namely if the user makes a request for data which needs to be aggregated across a series of storage devices. In this case C.A.R.E is the intermediary between the user and the Effective Aggregator. C.A.R.E further accommodates user's needs by being able to render data in metaphorical ranges. A medical practitioner or patient who is able to download medical data in the range of, for example, upper body, head and neck, left leg, will have a much easier time digesting that data, avoiding information overload.

Information overload isn't the only reason why C.A.R.E is essential for the transmission of medical data over HealthNet. The variety of communication platforms connecting to the system, necessitates a common way to present data across these platforms. For example, medical practitioners who review a patient's personal health record over a handheld device can also share that document with the patient's general practitioner (GP) on the GP's office workstation. The patient himself might

C.A.R.E.



access the same files over his cell phone while at the drugstore just to make sure he is given the right prescription by the pharmacist.

In these situations, C.A.R.E's ability to determine how data should be rendered and presented for a user's communication platform allows portability, reducing the processor burden on the user's device. Because all calculations and rendering determinations are done by HealthNet, the communication platform simply needs to present an image on screen. This function also allows lower income users and healthcare organizations to exploit the benefits of HealthNet, without requiring them to have the latest technology.

Properties

- Analysis of communication platform and data request procedure
- Knowledge base of communication platforms and their rendering requirements
- Capability to amend knowledge base when new platforms are identified
- Knowledge base of medical terms and metaphorical equivalents and procedure to determine what data needs to be collected
- Engine for configuration and presentation of data specific to communication platforms
- Application server that provides session management and access persistence for Effective Aggregator

Features

- Identifies user's communication platform
- Identifies new communication platforms and presentation requirements as they are added to the system through a rendering description specification
- Configures data to efficiently fit the presentation type of the user's communication platform
- Relieves medical data overload presenting data to the user in a variety of different ways
- Allows developers to easily extend application access to multiple devices

C.A.R.E.

Scenario

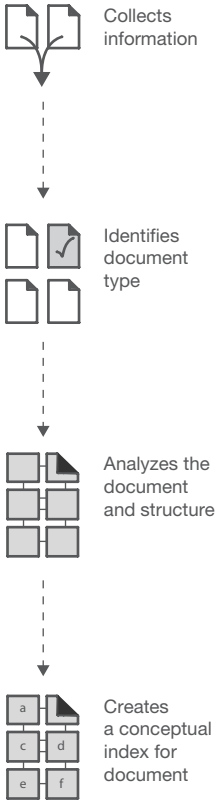
On the fifth floor of Cook County hospital in Chicago, Doctor Bidlesbee is walking down the hallway to his next patient. As he turns a corner, he pulls out his handheld communication platform, necessary for him to view his patient's medical records. In a few moments Dr. Bidlesbee will be checking in on Ms. Michelle Samuleson, admitted yesterday after experiencing a week of scary dizzy spells.

Doctor Bidlesbee that the series of tests he requested Ms. Samuleson to undergo have all been completed and takes a minute outside her room to download the data and analyze the results. The tests done on Ms. Samuleson, include blood work, temperature, blood pressure, chest x-rays and an MRI. Dr. Bidlesbee really doesn't have enough time to analyze this data, and requests that only data pertaining to a particular region of the body, the head in this case, be presented to him.

Just as Dr. Bidlesbee is about to confer with Ms. Samuleson, Ms. Samuleson's general practitioner, Dr. Philip Ruiz checks on what treatments and courses of action Dr. Bidlesbee has been taking for his patient. Dr. Ruiz downloads Ms. Samuleson's personal health records as a way of staying abreast of the treatment Dr. Bidlesbee is prescribing. Dr. Ruiz downloads the same data that Dr. Bidlesbee is accessing in the hallway of Cook County hospital, except Dr. Ruiz is accessing the data on his offices' old Pentium workstation.

Back at Cook County hospital, Dr. Bidlesbee has just sat down next to Ms. Samuleson, apparently he has great bed-side manner, and they begin to discuss what seems to be ailing her and a possible treatment they could undertake. Dr. Bidlesbee shows Ms. Samuleson results of the tests on his communication platform, but this time he asks for the device to display the blood pressure results as compared to those of other members in her family's history. This bit of dynamic comparison allows Ms. Samuleson to see that her family's history of high blood pressure is probably contributing to these series of dizziness episodes.

Effective Aggregator



An integrated set of software tools and procedures that identifies and indexes data stored within the various system connected via HealthNet. Effective Aggregator goes beyond the simple indexing of a web-based search engine, seeking to both understand and classify information based on content and it's structure. In doing so, the system "effectively" integrates disperse systems in HealthNet without going through the laborious, costly efforts of custom integration.

Discussion

Effective Aggregator collates and indexes the millions of documents found in HealthNet so they can be queried and accessed quickly by other applications. To do so, Effective Aggregator must work with documents that are structured and unstructured in a wide range of formats and media types. While various health providers may have unique twists on structured documents like Claim forms and Prescription Requests, application developers will be able to use Effective Aggregator's mapping software to quickly map fields to a standard HealthNet definition. Doing so, enables the system to, in effect, aggregate these files and make comparisons between them even though their structures aren't mirror images of each other.

It's important to note that this method of real-time aggregation provides a far more dynamic model for patient data management than a document-centric notion like a Personal Health Record. With Effective Aggregator, a PHR is nothing more than a query constrained to a specific users unique identity. Resulting data is collated and presented in a single format, but it is not a static, atomic document.

Effective Aggregator also creates relationships between fields and document types across these

Effective Aggregator

structured files. For instance, a patient profile may have the fields SSN, DOB and BLOOD_TYPE. A claim form may have SOCIAL and BIRTH_DATE. Effective Aggregator uses basic lexical analysis and simple rules to create matches across these fields and rank documents on field similarity. This allows care givers to search across and assemble a diverse range of fields from various documents at the patient or population level. It also enables records to be quickly assembled from a wide range of previous documents during text input operations.

This structured information is augmented through the a set of tools that indexes different media types including text, audio, video and still images and where possible attempt to get a basic understanding of their meaning using lexical analysis and ontology-based matching. When document are created or updated, Effective Aggregator looks at the contents of various fields, and index them against the large structured vocabulary found in SNOMED.

By organizing documents and information around concepts, the Effective Aggregator enables much more powerful relationships between different documents that wouldn't be discovered by simply looking at their structure and basic keywords.

Properties

- Relational databases
- Knowledge base of medical terms organized in a taxonomy using SNOMED
- Data definition file creation and storage for major documents: PHRs, Claims, etc
- Mapping software that can automatically map files and database fields to data definition standards
- Indexing algorithms that can summarize a range of unstructured media including text, images and sound
- Algorithms that can create structure from an unstructured document set by examining the documents' content

Features

- Provides a "single view" into the disparate data found in HealthNet
- Supports structured and unstructured documents
- Indexes a range of media: text, images, audio and structured data
- Works with System Broker to identify heavily used data or queries and caches data where necessary
- Enables application developers to create custom "lens" into the data that limit queries to a document sub-set

Effective Aggregator

Scenario

At the successful completion of Sven Koneig's bypass surgery at 9:16 am, Dr. Bidlesbee reviews a few electronic charts and spends a few minutes dictating a review of the surgery itself. In his comments Dr. Bidlesbee notes a few frustrations with his bypass surgery tools and a few minor complications that resulted from their use. After wrapping up his comments and releasing the post-operative summary at 9:21 am, Bidlesbee moves on to see the next patient in his day. The data regarding Koneig's bypass surgery is saved locally at Cook County Hospital in a relational database in their proprietary format.

As a participant in HealthNet, County's local servers are installed with Effective Aggregator. Effective Aggregator has as an XML-enabled interface to County's database, specifically designed to extract and index relevant medical data, particularly that found in personal health records. Effective Aggregator pulls updated patient information from County at regular intervals. At 9:25 am, the effective aggregator makes another call to the County database and finds that amongst others, Sven Koneig's record has been updated and released with a post-operative summary. Effective Aggregator begins the task of extracting this data by converting it from County's proprietary data model to the HealthNet's procedure summary definition standard, utilizing the rapid mapper data model developed by County's application development team. During this conversion, the Aggregator discovers that Koneig's record contains multiple forms of media and documentation including images taken during the surgery, a log of all monitoring data captured during the operation, structured data including the type of procedure and the procedures duration, and Bidlesbee's unstructured oral comments.

Effective Aggregator treats each of these media types differently as it indexes. It tags surgery images with a code denoting the procedure type, then are they analyzed for their histogram, color properties and basic shape contours. The structured data, itself, is analyzed to ensure that it maps to HealthNet data standards. In this case, the duration field used by county is HH:MM:SS, while HealthNet stores all time data in seconds only. This conversion is done on the fly. Effective Aggregator compresses monitoring equipment logs through a series of snapshots and denormalized against a standard for logging data.

Lastly, Bidlesbee's oral comments are indexed by pulling out time-coded keywords using a combination of his personal speech model, a large standard vocabulary and SNOMED's rich ontology of domain-specific terminology. In performing this routine, Effective Aggregator not only identifies keywords like "percutaneous in-situ coronary venous arterialization" the surgery's official name, but then takes the step to index this procedure in a hierarchy under bypass surgeries, under coronary surgeries. Doing so means that the record also gets tagged with synonyms and acronyms for the procedure like PICVA, it's abbreviated name. Effective Aggregator goes one step further, developing an "understanding" of basic concepts mentioned in the oral history, in this case indexing his mentioned frustration about tool use and minor complications that arise from it to concepts including "equipment problems" and "surgical complications."

Health KB

A digital repository of the most recent and factual knowledge generated by medical science and medical services. This compilation of carefully vetted information serves as a reference desk for the Enabling Applications and their end users—the patients and healthcare professionals applying medical knowledge to real world problems.

Discussion

Health KB is a repository for medical and service knowledge needed by the end-users of HealthNet Infrastructure. As users and their applications require these knowledge resources, requests are passed through the Enabling Applications to Effective Aggregator which retrieves applicable information from the Health KB.

By fulfilling requests for medical information, Health KB provides users with the detailed knowledge necessary to make informed decisions. For example, an individual might be accessing an Enabling Application like Med Pathway, to find out what type of medical services are available to her under her health coverage plan. To present options to her, Med Pathway will access the Health KB for her coverage plan rules and different treatment options available to treat her condition.

Health KB is also essential for delivering knowledge to medical practitioners. It allows healthcare professionals to leverage vast amounts of medical information to help guide their decisions. The Health KB removes the need for practitioners to maintain their own repositories of aging information. Instead, the Health KB is continuously renewed with the lasted accepted medical information and has greater depth and breadth than local information sources.

The Health KB is only useful if the knowledge that it contains is current and accurate. As new data is published from reputable sources, it is automatically added into the knowledge base. Data is then channeled through a computer-aided workflow procedure whereby a panel of distributed subject matter experts vets the material. A similar process is used for compulsory reviews of existing knowledge base data to ensure no information persists after it has been disproved or superseded.

Once data is approved, Health KB catalogs and indexes it, making data easily located or cross-referenced when requests are made. Health KB proactively updates its own information by establishing data feeds from healthcare service organizations and medical science publishers. Health KB then requests that their updates, alterations and changes to documentation be synchronized to maintain accuracy.

Properties

- Collection of knowledge detailing different aspects of care giving services and the Healthcare industry
- Automated knowledge collection from reputable sources
- Automated correction and synchronization with knowledge sources
- Computer-aided workflows for knowledge base auditing
- Automated indexing of newly acquired knowledge

Features

- Warehouses the medical related data necessary for end-users to make informed decisions
- Automatically adds and organizes new medical data in knowledge bases
- Coordinates related data across different knowledge bases
- Integrates with all of HealthNet Infrastructure's Enabling Applications
- Integrates with Effective Aggregator
- Continually audits collected knowledge with subject matter experts

Health KB

Scenario

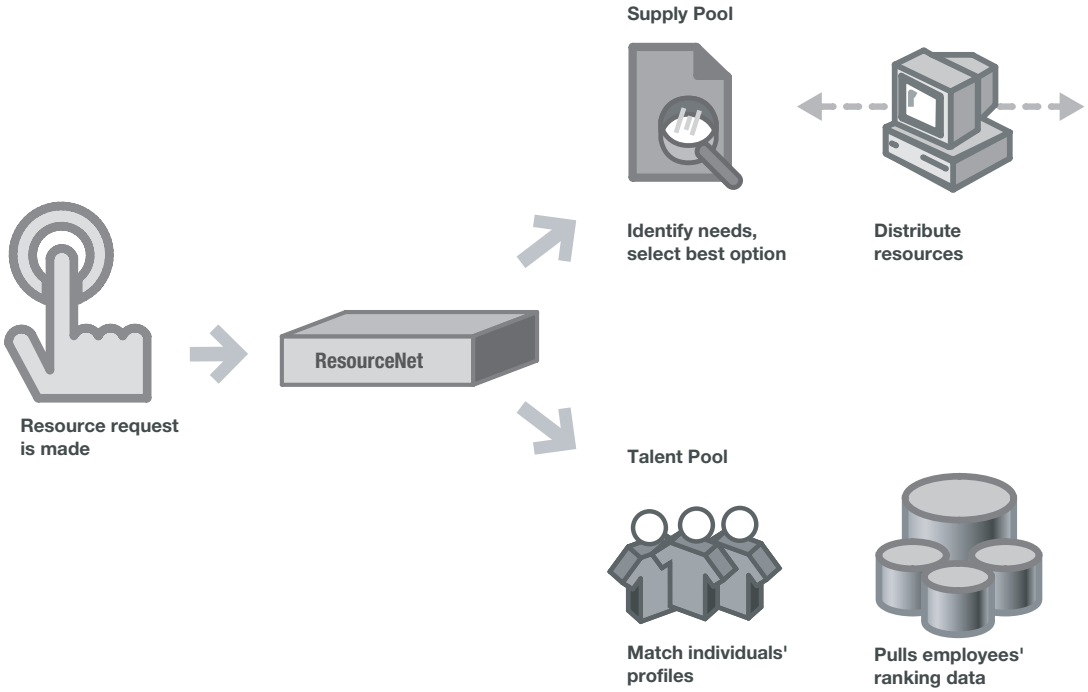
As a GP, Dr. Philip Ruiz has seen hundreds of patients with headaches or dizzy spells. Carefully analyzing these patients' symptoms, Dr. Ruiz can usually trace a case back to an avoidable stimulus or provide a treatment. However, the story was very different when patient Michelle Samuelson came to him. She had been suffering for days with dizzy spells and her symptoms weren't improving in response to the typical course of treatment. Before Ms. Samuelson returned to Dr. Ruiz for a second visit, they both needed some answers.

After requesting a second appointment with Dr. Ruiz, Ms. Samuelson was concerned about whether she would be financially covered for these multiple visits to her GP. Ms. Samuelson called the HealthNet 800 number for some concrete answers. She asked to provide information about the doctor and purpose of her visit. Her data was sent to Med Pathway which queried the Health KB for related coverage details and treatment options. Ms. Samuelson was reassured to hear that not only was the second visit covered with a small co-pay, but that a range of treatment options related to her condition would most likely be covered.

Prior to Ms. Samuelson's second appointment, Dr. Ruiz is reviewing her medical files. The symptoms don't appear all that unusual, so he's surprised that the treatment wasn't effective and that her condition has reportedly worsened. Dr. Ruiz accesses his research application and searches for reference information corresponding to Ms. Samuelson's symptoms and relevant aspects of her medical history. Dr. Ruiz's research application ultimately sends queries to the Health KB which returns multiple relevant matches. A recently released research report catches the doctor's attention—the abstract suggests that women with a medical history like Ms, Samuelson have been shown to be at high risk for a condition causing diminished oxygen supplies and therefore dizzy spells. Dr. Ruiz collected from the reference materials cross-referenced by the Health KB to fully understand diagnosis of the condition and treatment protocols.

When Ms. Samuelson arrived for her appointment, both she and Dr. Ruiz were well prepared by the Health KB to make informed decisions regarding her care. Dr. Ruiz in fact did diagnose Ms. Samuelson as suffering from this condition of diminished oxygen supply and asked that she be admitted to the hospital for further testing. Ms. Samuelson in return could focus on her medical health, knowing that she was financially prepared for this course of treatment.

ResourceNet



An integrated system of tools that provides means to acquire and allocate the broad range of physical and human resources needed by hospitals and healthcare organizations participating in HealthNet. In addition to aggregating suppliers, ResourceNet enables health entities to share and trade resources with each other. ResourceNet also includes capabilities to quickly re-distribute resources in critical situations.

Discussion

ResourceNet is a system designed to provide the right resources at the right place and at the right time. ResourceNet maintains a database of required and available resources that allows it to identify shortages. This knowledge base can be accessed and updated automatically by software routines that establish communication between ResourceNet, Talent Pool and Supply Pool.

ResourceNet can be reactive and proactive. In the first case, it automatically accesses Supply Pool, for physical resources, and Talent Pool, for human resources, once shortages are identified. Through a series of automated selection procedures these two systems provide ResourceNet with the required resources. When this task has been accomplished, ResourceNet uses software routines to identify the exact location where resources have to be delivered. In the other case, ResourceNet proactively prevents resource shortages by accessing Supply Pool and Talent Pool to identify potential needs. Anticipated needs are satisfied by ResourceNet using resources that have not yet been requested but can be proactively allocated.

In addition, ResourceNet is designed to respond to certain critical situations. In these cases, special software routines are activated to quickly

ResourceNet

access its database, to establish communication with Supply Pool and Talent Pool, and to locate, intercept and temporally reallocate resources to critical-need locations. In emergency situations ordinary operations are paralyzed and ResourceNet operates to fulfill emergency needs. Since unpredictable forces like emergency situations can affect funding, ResourceNet includes a financing support system that allows it to generate an emergency financing pool by applying annual micro-fees for the services provided.

Properties

- Database of required and available resources
- Software routines to access Supply Pool and Talent Pool and automatically acquire and allocate resources
- Alternative software routines to access Supply Pool and Talent Pool and automatically locate, intercept and redistribute resources in emergency situations
- Analytical software routines to estimate, apply and collect fees
- Financing pool to maintain the system in critical situations
- Interface to establish communication with Talent Pool and Supply Pool

Features

- Identifies resource shortages in specific locations
- Automates the resource acquisition and allocation process preventing overcoming resource shortage
- Provides emergency provisioning in times of crisis
- Allows the system to generate and apply financing strategies to overcome shortages during critical economic situations
- Optimizes a transaction's cost, timeliness and efficiency by establishing communication with Talent Pool and Supply Pool

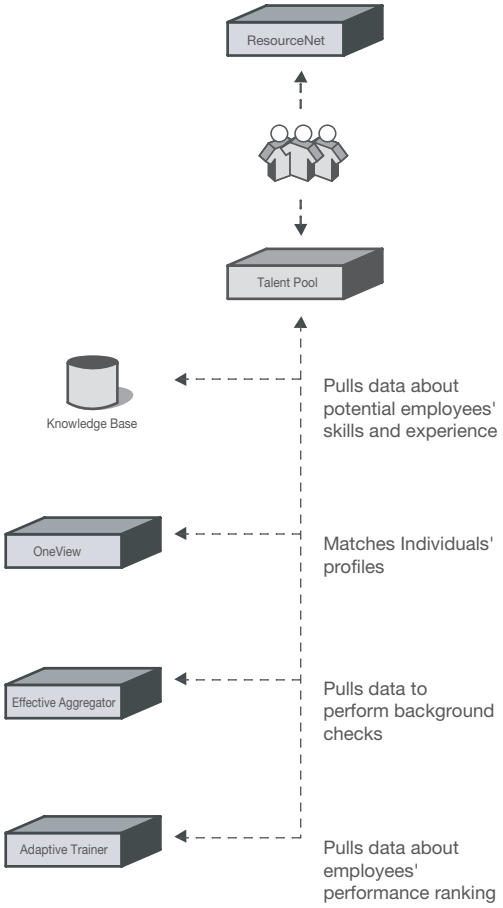
Scenario

It is 8 AM and Bob Robertson, the resource manager of the Chicago Regional Hospital receives a huge set of disposable supplies to perform clinical analysis. Bob accesses the hospital database to register the new acquisition and realizes that they had very low inventory. Luckily these supplies were automatically supplied by the ResourceNet system.

Later in the day, Bob receives a call from one of the hospital technicians who explains to him that two of the ultrasound systems in the maternity department are seriously damaged and he needs to replace them as soon as possible. Bob access ResourceNet and inputs his request. As soon as the request is processed, ResourceNet looks at its knowledge base to identify if there is any extra ultrasound equipment in the system. Since this is specialized equipment, it access Supply Pool to request the acquisition of the specified equipment as soon as possible. Supply Pool assures the delivery of the equipment to the Hospital in the shortest possible time.

At about 5 pm, Bob notices that he is receiving an alert flag from ResourceNet. There has been an earthquake in San Francisco, the hospitals are getting crowded and through Talent Pool, ResourceNet has identified a nurse surplus in the Chicago Regional Hospital. ResourceNet is requesting that fifty of their nurses be temporally reallocated to San Francisco. After receiving the alert Bob contacts the human resource manager to confirm the identity of the fifty nurses to be allocated to San Francisco by the end of the day.

Talent Pool



An integrated set of procedures and tools that lowers the cost of identifying and screening candidates for open job requisitions. Talent Pool automatically matches profiles, checks background history, standardizes interviews and establishes performance ranking among existing and potential employees.

Discussion

Talent Pool overcomes the shortage of qualified professionals by standardizing and improving the efficiency of the recruiting process. It creates a knowledge base of potential employees' skills and experience and acquires data from Adaptive Trainer or its own knowledge. Using software routines to access OneView, Talent Pool matches individuals' profiles with the specified skills and experience required to perform certain tasks.

Once matched profiles have been identified, Talent Pool uses software routines to access Effective Aggregator and perform background checks. It automatically dismisses individuals' with unprofessional performance histories. To assure recruitment of qualified individuals, Talent Pool provides procedures to standardize the interview process and execute the final selection.

Talent Pool is designed to provide Extended Reach with required human resources. In addition, it supports Extended Reach in emergency situations. To perform this task, Talent Pool uses software routines to access Adaptive Trainer and identify data about performance ranking of existence employees and reallocate them to perform temporally tasks.

Finally, Talent Pool provides an Internet Portal in which potential employees can upload their resumes and establish communication via e-mail with advisor teams.

Talent Pool

Properties

- Knowledge base of potential employees' skills and experience
- Integration with OneView to generate and select matching profiles
- Integration with Effective Aggregator to assemble performance criteria
- Procedures to generate interview strategies
- Software routines to pull data from Adaptive Trainer and formulate performance rankings of existence employees
- Internet portal for potential employees

Features

- Organizes potential employees in a database
- Establishes the level of skill and experience required to perform specific activities
- Matches potential employees with required criteria
- Identifies alarming performance of potential employees
- Standardizes the interview process to decrease dependency on the interviewer
- Establishes criteria for interviewing staff members and client
- Reallocates existing staff to fulfill critical needs based on the individual's skills and performance
- Enables communication with potential employees through the Internet portal

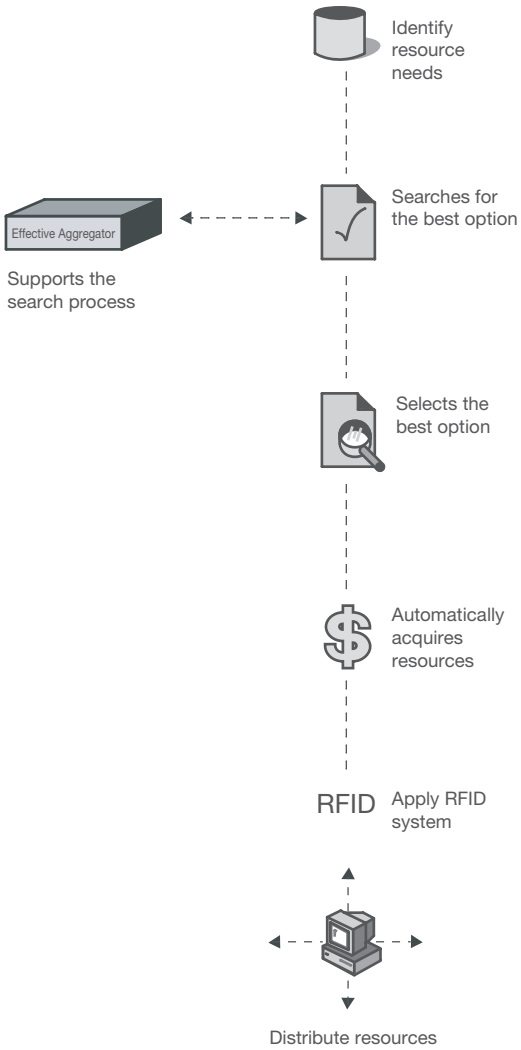
Scenario

It is Monday at 5 pm, there has been an earthquake in San Francisco and the hospitals are getting crowded. Extended Reach has been accessed by the San Francisco hospitals, there is a critical nurse shortage; they need help.

Extended Reach immediately accesses Talent Pool, which suspends its regular operations to cover the emergency situation. Talent Pool uses its knowledge base to look for nurse surpluses at different hospitals across the country. In addition, it accesses Adaptive Trainer to look for ER specialist that can aid the San Francisco medical staff. Talent Pool finds out that there is a nurse surplus in various hospitals across the country; one of them is the Chicago Regional Hospital. Talent Pool requests that fifty nurses from Chicago Regional Hospital to be temporally reallocated in San Francisco. As soon as the hospital accepts the request, the fifty nurses are reallocated to San Francisco along with two ER specialists identified by Talent Pool.

Once the emergency request has been accomplished, Talent Pool returns to its regular operations. Extended Reach requires a new Technical Support Manager for the ER department of the Chicago Regional Hospital. Talent Pool accesses OneView and uses its matching capabilities to find the profiles that match the required skills. Once the profiles have been identified, it accesses Effective Aggregator and checks the candidates' performance history. Two of the six candidates are eliminated after showing problematic performance on their previous employments. Finally, after the three final candidates have been identified, Talent Pool provides the recruiting team with the names and profiles as well as a series of interview protocols that can be used to perform the final selection.

Supply Pool



A physical resource supply system that provides hospitals and healthcare specialized institutions with access to an enormous marketplace of physical resources. Supply Pool reduces transaction costs by automating the resource acquisition and allocation process. In addition, it provides more effective ways to intercept and allocate resources in emergency situations.

Discussion

The process of acquiring and supplying physical resources at the right place and at the right time to perform specific activities within HealthNet plays a fundamental role in determining the efficiency of HealthNet's performance.

Supply Pool is a system that uses advanced technologies to make the supply acquisition and allocation process efficient Supply Pool identifies supply needs across HealthNet through a automatically-updated database of available and required resources. Once resource needs have been identified, it uses the Effective Aggregator to automatically search and find providers, select the best options, acquire resources and distribute them. At the same time, it automatically updates the database with the new acquisitions and estimates their lifetime so it can automatically refresh them and overcome future resource shortages. Supply Pool provides means to access Effective Aggregator as a supporting tool in the searching process.

In addition, Supply Pool uses RFID technology to automatically identify and track resources wherever they are RFID technology allows Supply Pool to quickly identify resources and reallocate them in emergency situations even though they

Supply Pool

have not reached their final destination yet. Since Supply Pool relies on automated procedures, RFID system becomes indispensable for a wide range of automated data collection and identification applications that would not be possible otherwise.

Properties

- Database of available and required resources
- Means to integrate Effective Aggregator with automated selection and acquisition procedures.
- Means to integrate Effective Aggregator with software routines to automatically generate a resource inventory
- Resource Tracking system using RFID (Radio Frequency Identification) technology
- Software routines to integrate RFID resource tracking systems with Semantic Web technology used to allocate, intercept and reallocate resources
- Database of resource providers

Features

- Automates the resource identification, acquisition and allocation process
- Automatically creates resources inventory of available resources
- Provides automated and efficient resource tracking systems
- Provides emergency resource tracking and reallocation system
- Increases HealthNet accessibility

Scenario

It is Monday at 5 pm and there has been an earthquake in San Francisco. The hospitals are getting crowded Extended Reach has been accessed by the San Francisco hospitals. They are afraid that they man run out of ER disposable supplies. Extended Reach immediately accesses Supply Pool which suspends its regular operations to address the emergency situation Using RFID technology it tracks a big order of ER disposable supplies that was in its way to LA. The order is immediately redirected to San Francisco.

Once the emergency request has been accomplished, Supply Pool returns to its regular operations In Chicago, Bob Robertson, the resource manager of the Chicago Regional, receives a call from one of the hospital technicians who explains that two of the ultrasound systems in the maternity department are seriously damaged, so he needs to replace them as soon as possible. Bob accesses ResourceNet and inputs his request As soon as the request is processed, ResourceNet looks at its database to identify if there is any extra ultrasound equipment on the system Since this is specialized equipment, it accesses Supply Pool to request acquisition of the specified equipment as soon as possible Supply Pool uses Semantic Web technology to automatically accomplish the assignment. It searches and finds matching providers. Supply Pool selects the best option from the provider list, acquires the two ultrasound systems, applies RFID tags and sends the systems to the Chicago Regional Hospital. Finally, the Supply Pool automatically updates its database with the new acquisitions.

ResearchNet

Tools that allows health and medical researchers to perform analyses across HealthNet's user populations while protecting the privacy of individuals.

Discussion

ResearchNet gives researchers access to HealthNet's incredibly rich data set while simplifying previously difficult tasks like identifying sample populations and finding patters in returned data Users are able to specify a sample requirements using a research-specific OneView implementation. This search can include basic demographic/geographic information, condition and treatment information, pharmaceutical use, and even DNA/genomic data if available. OneView feeds this request to the Effective Aggregator that then assembles sample populations and returns aggregate statistics to research end users Once researchers tune their population, ResearchNet provides them with tools to contact possible participants via e-mail and the Personal Health Portal Once a sample group has consented to participate in a study, ResearchNet continues to protect individuals by masking their identities through sophisticated data distortion algorithms.

Researchers can set a number of critical markers that they can track or compare across sample groups. Markers can include aspects of recovery like dormancy or the surfacing of different side effects or conditions. These markers can be set historically as well as into the future. As populations reach markers, ResearchNet tracks their progress on behalf of researchers.

ResearchNet charges scientists working for for-profit entities like biotech companies, private hospital systems and pharmaceutical corporations a regular fee for data access and tracking.

Properties

- Integration with the Effective Aggregator
- Integration with Adaptive Trainer to enforce accreditation requirements for researchers
- Software routines that allows users to identify sample populations
- Software routines to track different populations over time
- Software routines that allow users to compare sample populations to each other
- Means of automating sample participation requests
- Software routines that distort identification data to protect individuals' privacy
- Means of tracking and charging certain parties for data access

Features

- Provides access to massive sample populations for analysis
- Enables users to identify and track samples over time
- Automates process of recruiting sample populations and obtaining their consent
- Protects individuals' privacy through distortion techniques
- Provides source of funding for HealthNet

ResearchNet

Scenario

Dr. Denise Lowrey is a leading cardiothoracic surgeon at Mass General. In addition to seeing patients, Lowrey is heavily involved in research particularly in the field of experimental approaches to treating heart disease. Lowrey was in fact one of the first surgeons to experiment with PICVA surgery. She is currently gathering information as part of a major study on PICVA that seeks to analyze post-operative success rates in comparison to traditional bypass surgery as well as any complications or issues that have arisen during the operation. The first part of Lowrey's examination is mostly quantitative and involves identifying a patient population that received both surgeries and tracking key markers of health improvement after the fact.

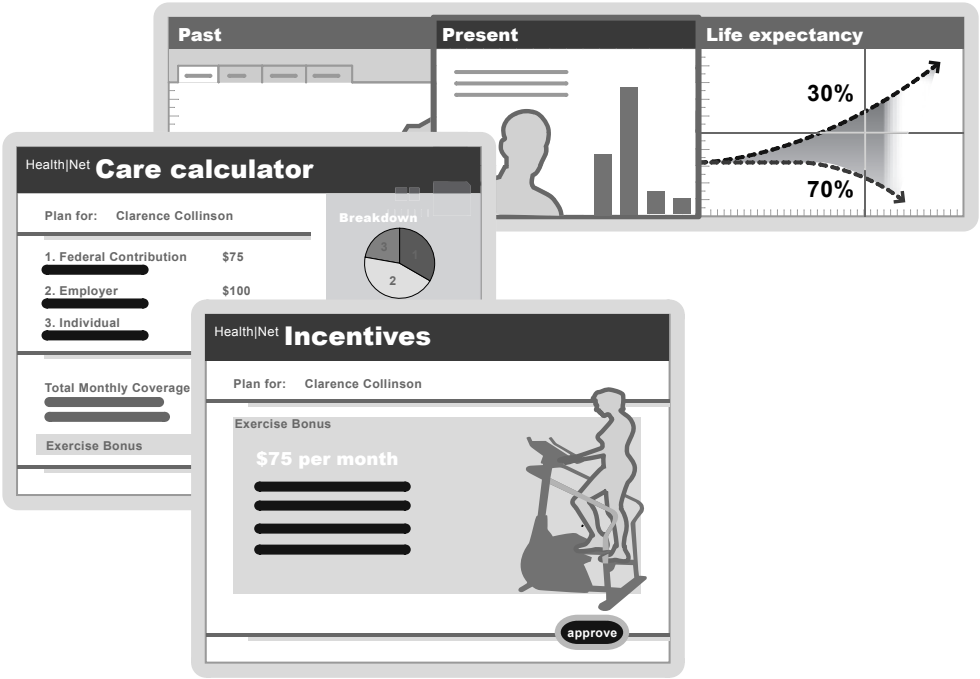
Previous to HealthNet, obtaining such information would be a tedious, pain-staking process. Now Lowrey, like other accredited HealthNet researchers, has access to a massive store of data through ResearchNet. ResearchNet uses a OneView lens specifically designed for aggregate research. This lens allows researchers to identify patient populations and track their progress, while carefully protecting their identities through sophisticated data distortion techniques. Lowrey initiates her research by developing a candidate profile: age, condition, surgical procedures, gender, and ethnicity and asks her ResearchNet search interface to find a pool of candidates that meet her requirements. An initial scan of aggregated data suggests that this will be a processing-intensive search, and OneView works with the System Broker to identify unused processing power on the network. Lowrey receives a time estimate for query completion, and sees that she has time to grab a quick coffee before digging into her research.

When she returns to her monitor, Lowrey receives a summary of her result set. OneView was able to identify 1,317 candidates that met her criteria and are good targets for ongoing study tracking. Before accessing their data, Lowrey alerts these individuals of the study in order to protect their privacy. This task is automated through ResearchNet which creates an alert that appears in each individual's Personal Health Portal as well as sends an e-mail to their registered e-mail account.

Sven Koneig is feeling substantially better these days. He's been back on his feet for three months now and has few signs of the surgery he received three months ago Koneig checks his Yahoo! Mail account and receives Lowrey request via HealthNet. Koneig is obviously thankful that he did not have to have his sternum cracked open for a full bypass surgery and thinks that participating in the study would be fine. After all, it requires no additional effort from him.

Lowrey receives permission from 873 of her initial 1,317 candidates within 48 hours of her initial search and begins the hard work of initial exploration. In addition to getting an overall view of her patient population, she's interested in reviewing any quick indicators of surgical complications. Using her ResearchNet search interface, Lowrey performs a concept search using the keywords "surgical complications." OneView automatically constrains this search to the 873 patients approved for the study and scores each of their records against this concept. After a few seconds of processing, OneView identifies that 150 records have a high correlation to this concept and begins to cluster them around other concepts closely linked to "surgical complications." Koneig's record is one of 20 others sub-clustered around "equipment problems."

SafetyNet



Systems and financial tools designed to drive medical costs down while increasing access to healthcare coverage. SafetyNet has three constituent parts: (1) tools that provide accurate data on the personal and financial costs of not taking preventive measures and treating the uninsured, (2) means to create powerful incentives to increase positive health behaviors and (3) programs to increase health coverage to a larger percentage of the US population. SafetyNet is managed in partnership with HHS and Medicaid/Medicare grants are used to fund many of the programs.

Discussion

SafetyNet is an umbrella program that tackles the rapidly rising costs of healthcare and decreasing access to health services head on. While many HealthNet services indirectly meet these goals, SafetyNet focuses on explicit means to improve the health of Americans first by providing patients and doctors with tools to understand and encourage preventive care and secondly by expanding care coverage through alternative funding strategies.

It's easy to forget that the uninsured in the United States do receive care in emergency rooms and clinics today. Typically, the uninsured use these facilities to treat acute illnesses. As a consequence, the costs of their visits can be quite expensive. SafetyNet provides tools to analyze the cost and quality of care of the uninsured in these situations. This data is accessed through integration with Effective Aggregator. SafetyNet looks at individual cases like that of an undocumented worker with arterial blockage and calculates the

SafetyNet

cost savings that could have resulted from preventive treatment as opposed to acute treatment. Administrators use this data to make improved coverage decisions.

SafetyNet also impacts decisions on the individual level. It provides individuals with tools to forecast their own medical choices and trajectories in dramatic ways. After a review of health data in the Effective Aggregator, SafetyNet projects an individual's life span and likelihood of chronic illness, displaying this information in both pictures and words.

SafetyNet goes beyond providing information as stimuli to change deleterious behavior. The system uses targeted financing in an attempt to alter the behavior of individuals. A number of healthcare providers do have some form of incentives in place today to encourage positive behaviors. Individuals that go to a gym, for instance, may receive free co-payments from Aetna. These programs, however, suffer from two main limitations. The incentives are far too meager to stimulate significant change and monitoring compliance is extremely difficult. In addition to extending the light incentive programs already in place, SafetyNet targets far heavier incentives at at-risk populations. Individuals that quit smoking or lower their cholesterol considerably get large one-time cash. Conversely, SafetyNet uses adverse incentives making the worst offenders of these behaviors pay penalty fees for their lack of compliance.

The ubiquity of HealthNet's network and at-home clinic technology considerably eases the challenges of monitoring compliance. Health club software, for instance, can easily integrated into HealthNet, allowing for people's workout schedules to be checked. While these programs certainly are not a panacea, they can influence the behavior of a small percentage of the total population, leading to an increase in general health and the resulting cost savings.

Obviously prevention activities can only work for so long. Researchers estimate that individuals incur eighteen percent of lifetime costs for medical care, or more than $40,000 per person in the last year of life. Living wills provide a means reducing this cost and are favored by the large majority of Americans who generally do not want invasive procedures or life support in terminal situations. SafetyNet encourages the general population to create living wills without cost and works with insurers and Medicare/Medicaid to provide financial incentives to those that do choose them.

Even with these programs, one cannot forget that millions of Americans have no health insurance. Many of these Americans work for small business. If these businesses were required to pay for care coverage out right, the percentage of uninsured Americans would drop substantially. Yet simply requiring small business to pay the full of insurance has been politically unfeasible because businesses fear that their costs would sky rocket.

Some of these concerns are well founded, small business generally have to pay higher premiums than larger corporations. A number of healthcare policy advocates have proposed that small businesses should ban together and buy insurance as a single entity. Even Congress supports this concept. HealthNet provides the ideal platform to take this idea and turn it into a reality. Small businesses can access a specific website, identify their requirements and then find other businesses that have similar size or geographic constraints. Together, these companies solicit bids from healthcare providers who will compete for their business in an Ebay-like model.

While group purchasing partially reduces the cost of insurance, it still proves cost-prohibitive for many small companies. SafetyNet also includes means to more effectively distribute the cost of care at the individual level. It recognizes, for instance, that all but the absolute poorest Americans are probably willing to pay something for their healthcare each month and that the many uninsured families earning $50,000 a year would probably pay a healthy monthly premium. To put this in perspective, if each, of the forty million uninsured were asked to pay just other $10 a month for coverage

SafetyNet

that would total $4.4 billion a year in additional funding. Likewise, SafetyNet would require small business to also invest additional funding to their needs and abilities for each employee. Again this number might be quite small, say $15 a month for each employee. Federal and state governments would then pay for the additional costs of coverage left over after individual and corporate payment. Doing so, would allow current funds to be spread over a far larger population, truly expanding coverage. SafetyNet includes a specific set of software tools that will allow this fund blending at the individual level. These tools will integrate with IRS records to establish personal and business financial levels and will calculate payment levels. Care would be administered at the employer level and funding would be subtracted from paychecks.

Properties

- Administrative staff under the direction of the Board of Governors
- Funding from the HHS, donations and HealthNet
- Specific incentive programs to get people to quit smoking, exercise and diet
- Means of tracking incentive compliance and rewards through HN applications
- Integration with the Effective Aggregator
- Software routines that calculate the cost of care for these cases
- Software routines that analyze standard of care geographically
- Insurance purchasing portal
- Algorithms to determine individual and business payment levels
- Integration with Coverage KB
- Integration with IRS tax systems

Features

- Provides accurate on the financial costs of not aiding the uninsured
- Provides means to analyze level of care and quality of care across geographic boundaries
- Expands care coverage to larger percentage of Americans
- Allows small businesses to group purchase insurance
- Enables individual, private business and public funding of insurance on the individual level
- Gets individuals to incrementally improve their health through targeted incentives
- Manages awards and penalties on behalf of third party payees
- Expands care coverage to larger percentage of Americans
- Allows small businesses to group purchase insurance
- Enables individual, private business and public funding of insurance on the individual level

SafetyNet

Scenario

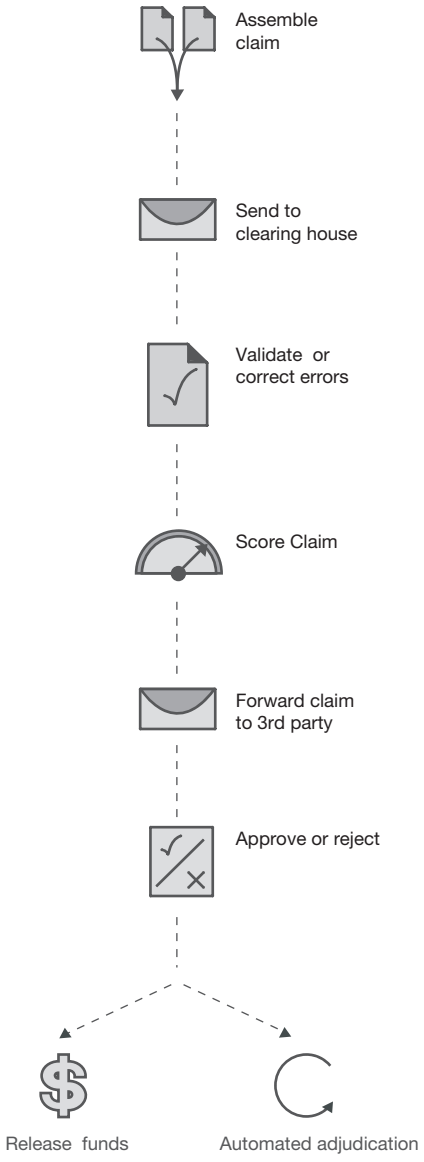
Sven Koneig works for a small publishing company, MK, in Chicago. The company has long had a practice of not providing health benefits to all non-management employees. Sven makes a modest salary, but it had become increasingly difficult for him to pay the monthly insurance premiums for his family. During a particular rough patch five years ago Sven considered giving up his insurance all together. Yet around the same time, Sven was diagnosed with very high cholesterol and his doctor warned him of a heart attack.

Luckily for him, SafetyNet became operational a few months after Sven's diagnosis. He first found out about the program through the publishing company who was now partially required to support Sven's healthcare. When signing up for insurance through the SafetyNet portal, Sven was asked to provide his tax identification number. The system searched income tax returns and calculated Sven's ability to pay for service found that his company was able to pay for 20% of his coverage, he would have to pay 70% and the government would cover 10%. Sven's monthly costs were still high, but they were significantly lower than what he was previously paying. This savings came both from the corporate and government assistance he received as well as the fact that MK had been able to identify and partner with other small printing companies to get discounted premiums in a process facilitated by SafetyNet.

With healthcare in hand Sven returned to his doctor for a more thorough examination. Dr. Bidlesbee informed Sven that his cholesterol was still quite high and that unless he massively changed his diet he was practically guaranteeing a heart attack. To dramatize this Bidlesbee accessed SafetyNet and showed Sven a series of future outcomes based on his current health trajectory, the most dire one being death at a relatively young Sven was pretty startled by Bidlesbee's scenario, and was further surprised when the Doctor mentioned that Sven could receive a substantial tax break ($2000) per year via SafetyNet, if he could lower his cholesterol by 25% and avoid bypass surgery.

This offer was made days before a massive blockage was discovered in one of Sven's arteries and Sven received his PICVA operation. Obviously, he didn't get the tax break, but Sven was quite relieved to have health coverage.

ClaimNet



Provides HealthNet participants with a single gateway for transferring claims and payments. For a small per-transaction fee, participants can send and receive claim information by performing a single integration to the ClaimNet standard. ClaimNet's capabilities extend beyond that of a payment clearinghouse through its use of automated error checking and correction tools, e-payment tracking capabilities and a transparent claim management process.

Discussion

ClaimNet improves and extends the benefits of electronic claim processing to the diverse set of healthcare providers in the HealthNet system. Electronics claim submission is by no means new. HMOs and hospitals have been submitting electronic claims for many years and recent Medicare regulations have required all Medicare payees to submit their claims electronically. Often hospitals, doctors and HMOs will use centralized payment clearing houses to perform these tasks. ClaimNet replicates much of the functionality of these clearinghouses, providing a single point of integration for providers to gain access to the complete HealthNet network. It extends this functionality, however, by establishing a more sophisticated and distributed architecture based on XML and network-based standards as opposed to the closed EDI networks used by most payment processors. This architecture distributes the ClaimNet routing software to a large number of nodes in the network. Billing systems can identify these nodes real-time based on load and availability, quickly routing claims across the network.

ClaimNet

In addition to this distributed architecture, ClaimNet includes robust error handing and auto-correction capabilities. Delays in claim submission hurt the cash flow of claim submitters. ClaimNet uses a series of techniques to reduce the number of pending claims. First, claims are pre-validated for completeness and adherence to HMO rules before they are ever submitted to the HMO's themselves.

Known, minor errors like a misspelled field name or a patient name typo are automatically fixed. Significant errors like a failure to comply with HMO rules are immediately flagged and returned to the sender. ClaimNet calculates rating for all claims by looking at the quality of the claim in light of its completeness and adherence to rules and by comparing the claim to the outcome of similar claims. This latter matching utilizes an integration into OneView. This rating will also be used to alert payer organizations of the strength of a claim prior to them ever examining its content. Particularly strong claims will be able to be automatically paid without any review, greatly speeding the payment process

It is important to note that ClaimNet is not a free service. Payees are charged a small fee for each claim submission ($.05 to $.10) per transaction. These fees are used to improve ClaimNet, and surpluses are put into the HealthNet general fund.

Payers and payees can choose to submit controversial claims to an auto-adjudication system. This set of tools seeks to create a settlement for a claim based on reviewing related cases and propose the settlement to each party. While parties can amend or reject settlements, many may accept an evidence-based verdict and the time savings that comes along with it.

Claim processes are not simply a frustration to HMOs and healthcare providers. Many individuals can point to numerous examples where they had to figure out where a claim was in the process and why it was being held up or rejected. ClaimNet works with the Personal Health Portal to allow all patients to see exactly where a claim is in the payment process and to see any issues that arise for compensation. Doing so provides patients with critical information and a recommended course of action if problems arise. A side benefit of this system is that HMOs will be able to reduce the amount of paper mail they send for claims to patient homes.

Properties

- Distributed claim routing architecture
- HIPAA compliant claim definition file
- Message/Envelope protocol for sending and receiving claims
- Software interface for checking a claims status and documentation associated with it
- Algorithms that can check claims and validate them prior to sending them to various 3rd parties
- Integration with Coverage KB, a centrally managed repository of re-imbursement rules

Features

- Provides a single point of integration to access a large network of payers and payees
- Reduces the cost of submitting and collecting claims
- Provides new means to charge for remote tele-services
- Pro-actively examines message content for obvious errors, avoiding costly time on the pending list
- Helps third parties respond to HIPAA compliance
- Provides all parties with the equivalent of FedEx package tracking for a claim via a web portal
- Prevents risks of a single point of failure, by widely distributing a software-based routing system
- Streamlines administrative work by automating parts of the claim process
- Reduces paperwork and mail sent to patients regarding claim information
- Central code provisioning ensures consistency amongst distributed routers

ClaimNet

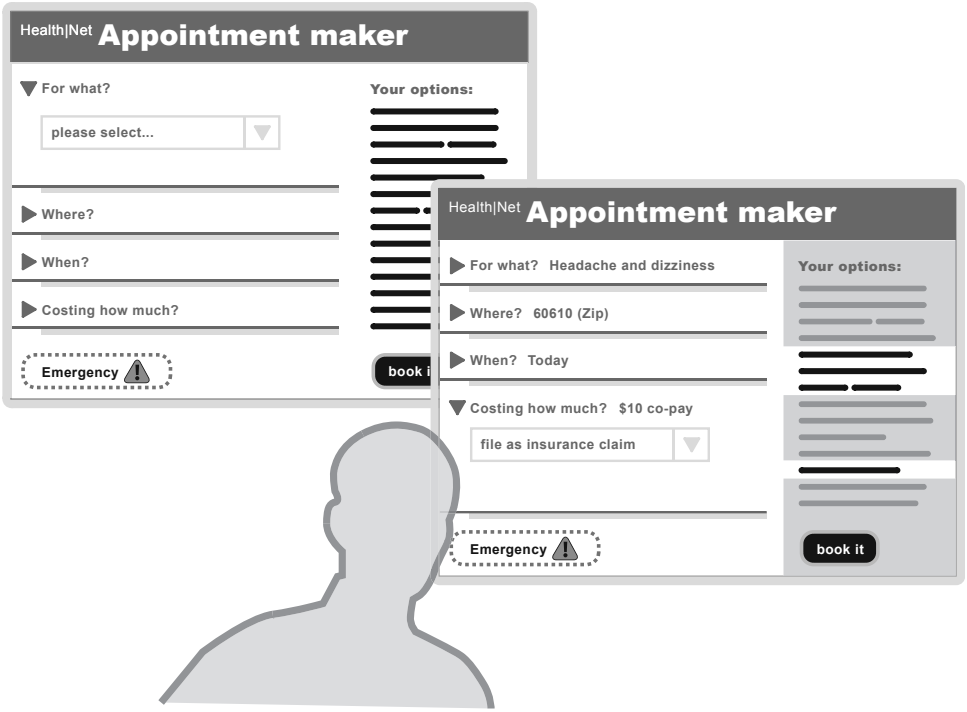
Scenario

Sven Koneig's non-invasive bypass surgery went quite well. Dr. Bidlesbee worked in his usually efficient and exacting manner, and in a little under two hours, three of Koneig's plaque filled arteries were replaced. After two days of rest in the hospital, Koneig was sent home. The next day Cook County hospital's billing system began to automatically assemble the claim for Koneig's procedure and stay The procedure itself, Bidlesbee's time, the hospital stay totalled over $30,000.

Doris Peterson is a billing clerk at County and she generally reviews any claims over $5000 before they are sent to the payer organizations. Koneig's claim appeared Peterson's queue and after a quick glance decided that it was ready to be submitted to Blue Cross Blue Shield, Koneig's HMO After Peterson clicked submit, the claim was sent through the ClaimNet interface. The claim's initially passed through ClaimNet's basic error checking tools that perform simple checks like making sure the patient's name and social security number match or that the procedure code matches the actual procedure. After passing this initial hurdle, Koneig's claim passed through a HIPAA filter, checking to see that any private, sensitive data was not included in the file. Lastly, Koneig's claim went through a specific set of checks for BCBS. Accessing the Coverage KB, ClaimNet's router discovered that Blue Cross Blue Shield requests specific test information and parts of the patient history for such expensive procedures. Without this information, Koneig's claim would be rejected outright. After comparing the claim information to these rules, ClaimNet's router discovered that some of this information had not been included in the initial claim request. Using Effective Aggregator, the ClaimNet router discovered that this information did exist in Koneig's PHR and linked it the claim.

Once the claim passed these initial hurdles, it was scored for its likelihood of payment. This scoring was performed by matching the claim to other similar claims through OneView and reviewing their outcomes. OneView identified 317 recent claims that closely matched Koneig's claim, calculated an overall acceptance rate of 70% at $30,000 and 95% at $27,000. Given that Koneig's claim was slightly above $30,000 it received a score of 70% was passed through to BCBS. BCBS's automated claim management software placed Koneig's claim on hold and sent a notification to Cook County's billing system. This notification detailed the claim's score and status. It also included a note that reducing the fee by $3000, would guarantee immediate payment. Doris received this message, reviewed her own comparative data and responded that $28,000 would be amenable to County. Koneig's claim repeated its journey, and this time BCBS approved it for payment.

Med Pathway



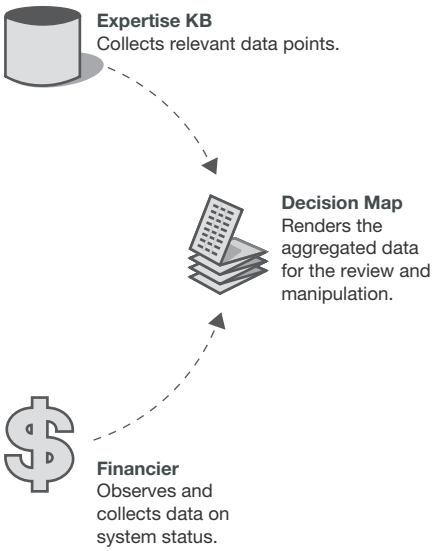
When patients or doctors are faced with medical decisions, Med Pathway coordinates available expertise via an Expertise Knowledge Base to map out alternatives and support informed decision-making using a Decision Map. Med Pathways' Financier function provides users with financial facts to support informed decision-making. Med Pathway increases the level of care while decreases costs through reducing the expenses of delivering expertise.

Discussion

HealthNet empowers healthcare professionals and individuals to make smart, better-informed decisions about healthcare. Whether the decision is about what operational procedure to undertake, what specialist to confer with, or what vitamins to take, an informed decision is a better, more comfortable decision. Using HealthNet's wide access to medical content, professionals and organizations, Medical Pathway can support decision making with the best-available expertise and relevant information. Medical Pathway helps healthcare individuals and professionals map out the viable alternatives so that they can make the best decision for them or their patient.

Medical expertise may come in the form of patient education materials, a diagnosis protocol, a research paper, or a medical specialist. Regardless of the form expertise takes, the Expertise Knowledge Base (or Expertise KB) tracks its availability and allocates it as needs arise. The Expertise KB

Med Pathway



tracks and identifies expertise in the form of documented information available in the Health Knowledge Base. The Expertise KB also tracks expertise in the form of healthcare based on their skills and specialties documented in the Performance Management system. As requests for expertise surface, the Expertise KB determines the most appropriate medical resources available to assist the decision-maker. The appropriate suggestions are returned to the decision-maker, giving her access to multiple formats and perspectives for insight into her situation and alternatives.

Medical decisions are often made in the context of financial considerations. Cost may make some procedures or courses of treatment unattainable. In such situations, coverage and aid may allow the otherwise unfeasible alternative to be a considerable option. As medical decisions are confronted, Financier gathers information about procedure costs and treatment costs from the Health KB and integrates it with information on insurance plans and available aid from ClaimNet. After integrating the gathered data, Financier establishes the true costs of medical alternatives for the consideration of the decision-maker.

Information from the Financier and the Expertise KB is organized and placed in context by the Decision Map. The Decision Map allows the gathered data to be presented either as a library of informative resources, or more powerfully, as different decision options with supporting insight, references, and financial considerations. Regardless of the financial viability, the Decision Map will present all recognized options, giving the decision-maker full control over the process. As the decision-maker considers an alternative, she can review supporting research or other documentation as well as contact any available healthcare professionals deemed an appropriate expert for considering the decision being evaluated.

Med Pathway

Properties

- Knowledge base of insurance plans and government-sponsored coverage
- Knowledge base of medical expertise and educational services
- Expert personnel allocation procedures
- Decision space mapping procedures

Features

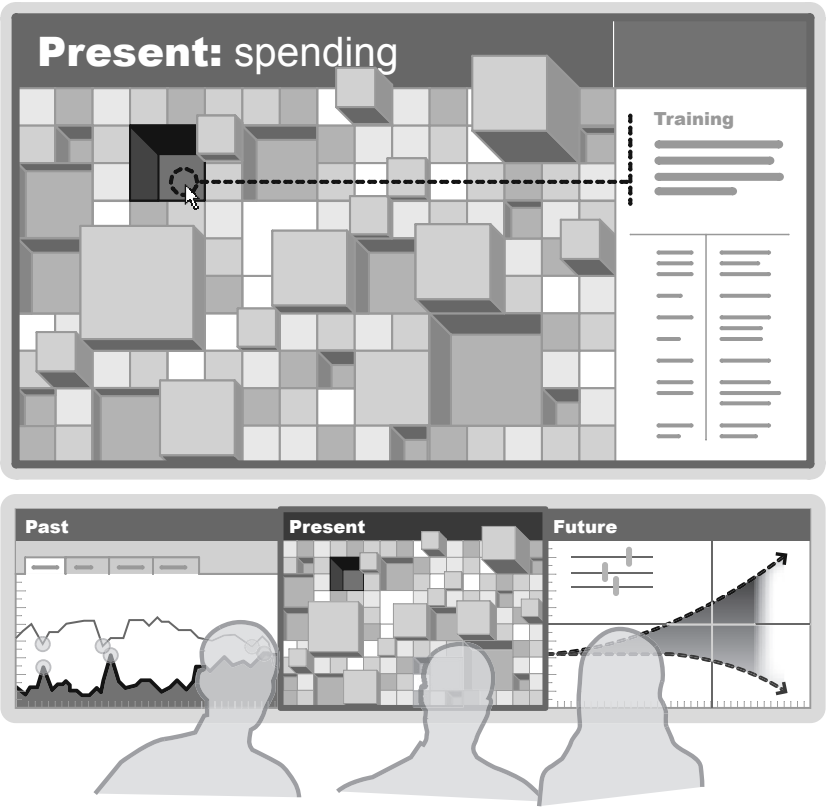
- Responds to requests for expertise
- Presents the universe of medical alternatives
- Gathers potential funding and coverage for alternatives
- Gathers most appropriate educational sources for consultation
- Determines availability of resources for alternatives
- Presents alternatives alongside supporting information
- Integrates with ResourceNet

Scenario

Michelle Samuelson has been experiencing dizzy spells. Unfortunately for her, this is a major problem. She is sensitive to a number of medications, and her job at Wal-Mart doesn't provide medical benefits. She's thinking of going to the ER, but first calls the HealthNet 800 number to check the waiting time. The 800 number is supported by Medical Pathway which queries the Expertise KB for healthcare facilities in Michelle's neighborhood capable of dealing with her case. The Decision Map helps Michelle learn that the ER has over an hour wait for non-critical cases, but there's a clinic on her bus line with no waiting. The Decision Map also integrated information on aid from the Financier, letting Michelle know she has the same coverage at the clinic as she would at the ER. Michelle makes the informed decision to go to the neighborhood clinic.

When Michelle arrives at the clinic, she's assigned to nurse Tito Jasper. Nurse Jasper listens to Michelle about her symptoms and condition, and then performs several routine examinations. Nurse Jasper turns to a HealthNet terminal to request a physician's assistance using Medical Pathway. The Expertise KB gathers a list of available physicians and presents two possibilities that can both address Michelle's special needs and can accommodate her coverage limitations. The Decision Map also shows that the Financier discovered Michelle can be consulted by both physicians, one specializing in headaches and the other being an GP. Nurse Jasper suggests to Michelle that they consult with both physicians, which Michelle agrees with. Both physicians are soon connected by video conference to Michelle and Nurse Jasper.

System Dashboard

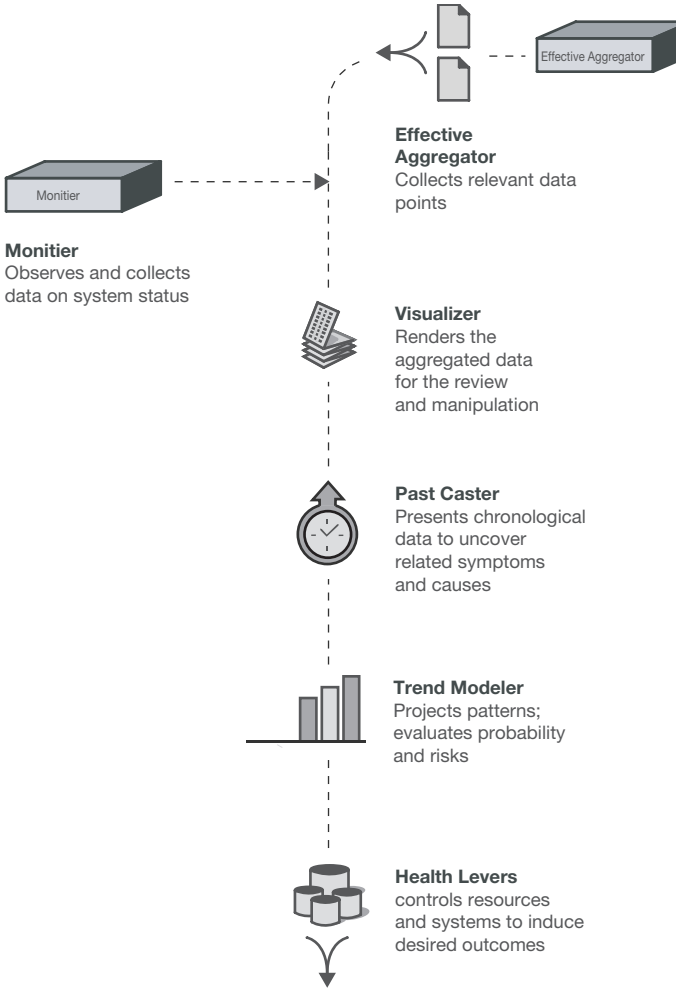


Presents service capabilities, demands, and risks to network and health administrators. Using System Dashboard, administrators can de-risk the nation's health infrastructure in real-time by quickly identifying risks via the Visualizer, diagnosing causal relationships via the PastCaster, and evaluating potential mitigations using the Trend Modeler and Health Levers.

Discussion

Today's national health systems are divergent and reactive in nature. Very few of the health systems are integrated to the degree where any aspect of current conditions can be accurately portrayed. As a result the current systems can only react to changes in the real world far after-the-fact, never anticipating or coordinating to head-off future risks or changes in health needs. As a revolutionary new approach for health management, the System Dashboard is designed to leverage the capabilities of HealthNet to analyze and proactively manage the health needs of the nation in real-time. The System Dashboard presents service capabilities, demands, and risks to network and health administrators. The dashboard then helps the administrators in decreasing future risks by diagnosing causal relationships and evaluating potential mitigations.

System Dashboard



The System Dashboard aggregates real-time metrics using HealthNet's Effective Aggregator to gather information on the current system status from Monitier and current resource allocations from ResourceNet and Performance Manager. Financial information is aggregated from ClaimNet. This aggregate data and additional information from other HealthNet systems is fed to the Dashboard's Visualizer. The Visualizer renders the aggregated data for the review and manipulation by system and health administrators. Given the volume and density of the aggregated data, the Visualizer allows administrators to view more data points across more dimensions and at varying levels of granularity. The visualization of data allows administrators to quickly find patterns, abnormalities, and other indicators or predictors of trouble for the HealthNet system and the nation's healthcare.

When administrators identify points of possible trouble, diagnosis of the problem is essential to resolving it. The PastCaster allows administrators to aggregate and view chronological data relating to the data sources in question. The PastCaster analyzes data patterns and correlates additional relevant data sources to assist administrators in identifying both the problem's symptoms and the root causes.

The risk of identified problems can be understood by using the Trend Modeler to look into the future. The Trend Modeler uses data patterns selected by administrators as being related to the problem to present potential future trending. Related variables are provided to administrators as controls so that the model can be tweaked and refined as assumptions are changed. Critical to the Trend Modeler is its ability to always convey the probability and potential inaccuracy of it's predictions.

Once administrators observe or predict major risks, they use the Health Levers to mitigate these risks in real-time. Health Levers are influencers over HealthNet and healthcare system that administrators have been granted limited control over by the

System Dashboard

HealthNet Directors. Health Levers may control aspects such as spending, training, resource allocation, or system logic to induce desired outcomes. The Trend Modeler helps administrators model and understand the effects brought about by making changes with the Health Levers, fostering proactive management of national healthcare.

Properties

- Metric visualization tools
- Historical analytical tools
- Variable-based projection modeling
- Controllers for leveragable assets

Features

- Aggregates health-related metrics (real-time)
- Analyzes metric patterns
- Visually presents analysis of metrics
- Traces patterns through past historical data
- Models probable futures based on patterns and variables
- Leverages available assets to enact mitigations

Scenario

It's the peak of flu season, so Dr. Greene and his group of administrators at one of Secure Foundation's Network Operations Center remain very cautious. This morning one of the administrations saw an unusual pattern in the System Dashboard's Visualizer—although the reports of flu-related symptoms were as a whole at average for this time of the year, there was a strong correlation between flu symptoms and small, Southeastern communities.

Dr. Greene and the administrator turned to the System Dashboard's PastCaster to analyze related chronological data. The PastCaster shows that there has been a small trend over the past three years of an increase in flu cases in these communities. More importantly, PastCaster also shows a decrease in the number of flu vaccinations over the same time period. Dr. Greene worries that this year could be a tipping point for this trend.

Dr. Greene moves his analysis work to the Trend Modeler, supplying it with the data generated by the PastCaster as well as the latest available data. The Trend Modeler reinforces Dr. Greene's concerns. If the trend continues, small Southeastern communities could experience a flu epidemic that could spill over into larger communities or other regions. Using the Trend Modeler, Dr. Greene changes variables to determine the best possible mitigation plan. As he imagined, flu vaccinations for the general public this late in the season might not have a significant effect on the trend.

Dr. Greene and his administrators continue to work with the modeler to create a more comprehensive plan that reduces the risk of an epidemic. Their final plan includes changing public behavior, faster diagnosis and treatment of the virus, and vaccination of persons at high-risk of transferring the virus. Each aspect of the plan can be enacted using Health Levers. Dr. Greene will approve a budget for educating the community of risky behaviors, the transfer of mobile clinics to the communities at risk, and funds to find and pay high-risk persons to become vaccinated. Thankfully the trend towards a flu epidemic was identified early and most likely will be avoided.

OneView

A matching engine integrated with HealthNet applications to provide them with robust, sophisticated searching functionality. OneView is a web service that works with Effective Aggregator to handle a range of search inputs — text, keywords, images and audio—and knows how to translate that information into a query that delivers quick, high-quality results.

Discussion

OneView is a powerful matching engine thatcan be integrated with HealthNet applications to meet-range of searching and matching needs . The tool itself will not be exposed to end users. Instead, developers will use OneView to quickly integrate robust matching into the wide range of applications available on HealthNet. These tools support image querying techniques like those recently developed at MIT and IBM. They also support searching of voice transcriptions indexed by the Effective Aggregator. Developers can constrain searches to particular domains or broaden them to all of HealthNet by developing "lenses," particular views into the HealthNet database.

OneView's tight integration with SNOMED enables on-the-fly query rightsizing. Users find that over-constrained searches, for instance, are automatically expanded to include synonyms or a broader concept. Likewise, broad searches include quick feedback on ways to narrow the possible results quickly.

Properties

- Web service implementation
- Integrations to SNOMED
- A "lens" architecture allowing developers to retrieve document sub-sets
- Routines that perform query analysis, automatically expanding and contracting result sets
- Content analysis software
- Image analysis software
- Voice/audio analysis tools based on tools developed by IBM
- Query rank analysis: routines that tracks results strengths through analysis of usage patterns

Features

- Allows developers to quickly add matching technology to applications
- Enables application developers to create custom "lens" into the data that limit queries to a document sub-set
- Supports structured, unstructured and combination queries
- Allows search with complex data types including image and audio
- Automatically expands/contracts a query by adding synonyms and moving through a concept hierarchy based on analysis of result set size
- Examines usage patterns of data from search to help understand what information was a good match for a given search

OneView

Scenario

Dr. Denise Lowrey is a leading cardiothoracic surgeon at Mass General. In addition to seeing patients, Lowrey is heavily involved in research particularly in the field of experimental approaches to treating heart disease. Lowrey was in fact one of the first surgeons to experiment with PICVA surgery. She is currently gathering information as part of a major study on PICVA that seeks to analyze post-operative success rates in comparison to traditional bypass surgery as well as any complications or issues that have arisen during the operation. The first part of Lowrey's examination is mostly quantitative and involves identifying a patient population that received both surgeries and tracking key markers of health improvement after the fact.

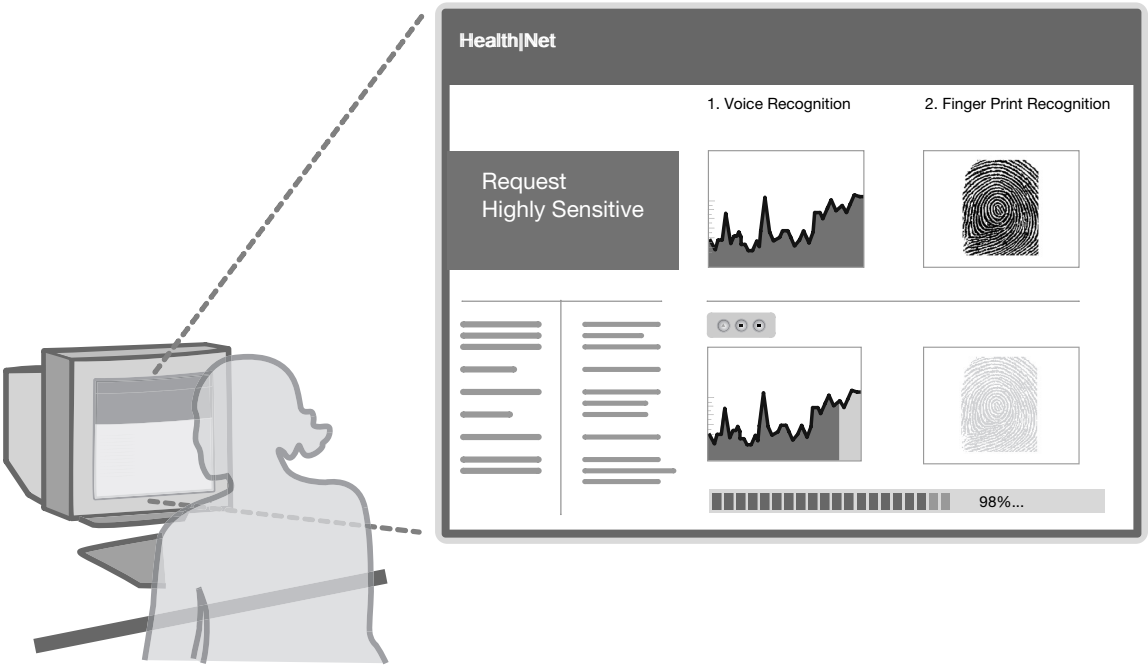
Previous to HealthNet, obtaining such information would be a tedious, pain-staking process. Now Lowrey, like other accredited HealthNet researchers, has access to a massive store of data through ResearchNet. ResearchNet uses a OneView lens specifically designed for aggregate research. This lens allows researchers to identify patient populations and track their progress, while carefully protecting their identities through sophisticated data distortion techniques. Lowrey initiates her research by developing a candidate profile: age, condition, surgical procedures, gender, and ethnicity and asks her ResearchNet search interface to find a pool of candidates that meet her requirements. An initial scan of aggregated data suggests that this will be a processing-intensive search, and OneView works with the System Broker to identify unused processing power on the network. Lowrey receives a time estimate for query completion, and sees that she has time to grab a quick coffee before digging into her research.

When she returns to her monitor, Lowrey receives a summary of her result set. OneView was able to identify 1,317 candidates that met her criteria and are good targets for ongoing study tracking. Before accessing their data, Lowrey alerts these individuals of the study in order to protect their privacy. This task is automated through ResearchNet which creates an alert that appears in each individual's personal health portal as well as sends an e-mail to their registered e-mail account.

Sven Koneig is feeling substantially better these days. He's been back on his feet for three months now and has few signs of the surgery he received three months ago. Koneig checks his Yahoo! Mail account and receives Lowrey request via HealthNet. Koneig is obviously thankful that he did not have to have his sternum cracked open for a full bypass surgery and thinks that participating in the study would be fine. After all, it requires n additional effort from him.

Lowrey receives permission from 873 of her initial 1,317 candidates within 48 hours of her initial search and begins the hard work of initial exploration. In addition to getting an overall view of her patient population, she's interested in reviewing any quick indicators of surgical complications. Using her ResearchNet search interface, Lowrey performs a concept search using the keywords "surgical complications." OneView automatically constrains this search to the 873 patients approved for the study and scores each of their records against this concept. After a few seconds of processing, OneView identifies that 150 records have a high correlation to this concept and begins to cluster them around other concepts closely linked to "surgical complications." Koneig's record is one of 20 others sub-clustered around "equipment problems."

Guard Dog



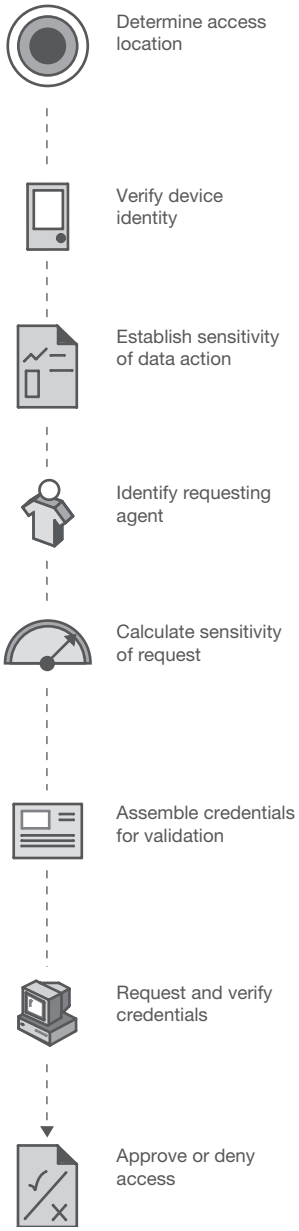
An integrated set of security tools, hardware and protocols designed to protect HealthNet users and data from security breeches and improper use. Unlike general security systems, Guard Dog is specifically tailored to the needs of the healthcare environment, balancing the need for quick information access and security while minimizing the risks of unauthorized access.

Discussion

The sensitive, critical nature of HealthNet necessitates that security measures play a foundational role in the infrastructure's construction. Guard Dog is an umbrella solution of security measures that enables the creation and storage of validation credentials, supports secure access from a range of devices and environments and tracks unusual or suspicious use patterns, altering officials when necessary.

Unlike most security systems, Guard Dog is designed to use multiple credentials to establish an individual's identity. These credentials include basic items like username and password as well as more sophisticated biometric measures like finger scans, retinal scans and voice recognition. These credentials are sorted in a matrix by their relative level of security and accuracy. System users will be able to choose which validation measures they want to have on access at the time of enrollment. To facilitate this process, HealthNet supports the deployment of biometric measurement tools to

Guard Dog



healthcare providers and their staff. Users are able to input their credentials into the system working with certified staff.

HealthNet's security must support a diverse set of healthcare locations (homes, local churches) and devices (PDAs, cell phones, laptops, monitoring equipment). In such a heterogeneous environment, providing a single set of security measures to access the range of data found in HealthNet necessitates a sacrifice of security on the one hand or limit access on the other. Guard Dog provides a nuanced means of securing data and applications that reside within HealthNet. In essence, the system assembles identification requirements based on two sets of concentric circles: the sensitivity of information requested and the security of the physical environment. Highly sensitive data, accessed from insecure environments on unknown devices is simply blocked. Alternatively, accessing highly sensitive information in a known environment like an operating room on a known piece of hardware may require nothing more than an ID scan for quick identification.

Guard Dog seeks to not only prevent system misuse and security breeches, it quickly responds when they do happen. A key tool at the system's disposal is a set of pattern recognition tools that work with date from Monitier and develop a behavioral model for users based on their basic profile and past history. When usage diverges from this profile in a dramatic way, Guard Dog immediately takes steps to avert problems: it flags the pattern and forwards an alert to the Monitier team and it activates Data Quarantine a sub-element of System Broker that immediately protects data from write-access. When Guard Dog successfully alerts Monitier to breeches, the system takes feedback and continues to refine its break-in detection algorithms.

Guard Dog

Properties

- Software routine to identify physical environments and device
- Hardware and processes for assembling biometric data
- Secure, encrypted tunnel for network access
- Matrix of security requirements organized by robustness
- Knowledge base of environments and roles
- Knowledge base of access rules: relationships between roles, environments and content
- Software routine that refreshes Knowledge base by identifying new devices and environments
- Application Programming Interface (API)

Features

- Protects system from unauthorized access and actions
- Balances need for speed and accuracy in validation routines
- Determines environment of use and device seeking access
- Manages and automatically adapts a topology of devices and environments
- Configures access requirements based on security of environment and sensitivity of request
- Seamlessly expands/contracts identification requirements
- Identifies patterns of suspicious use and works with other system elements to minimize potential damage

Scenario

It's 7 AM and Doctor Bidlesbee is eating crumpets again. He enjoys his quiet moments at home, getting prepared for the day, before heading into the rush and hubbub of Cook County Hospital. Bidlesbee boots up his laptop and after waiting for Windows 2010 to load (it still takes forever), he is connected to HealthNet's secure application environment via his fiber optic connection.

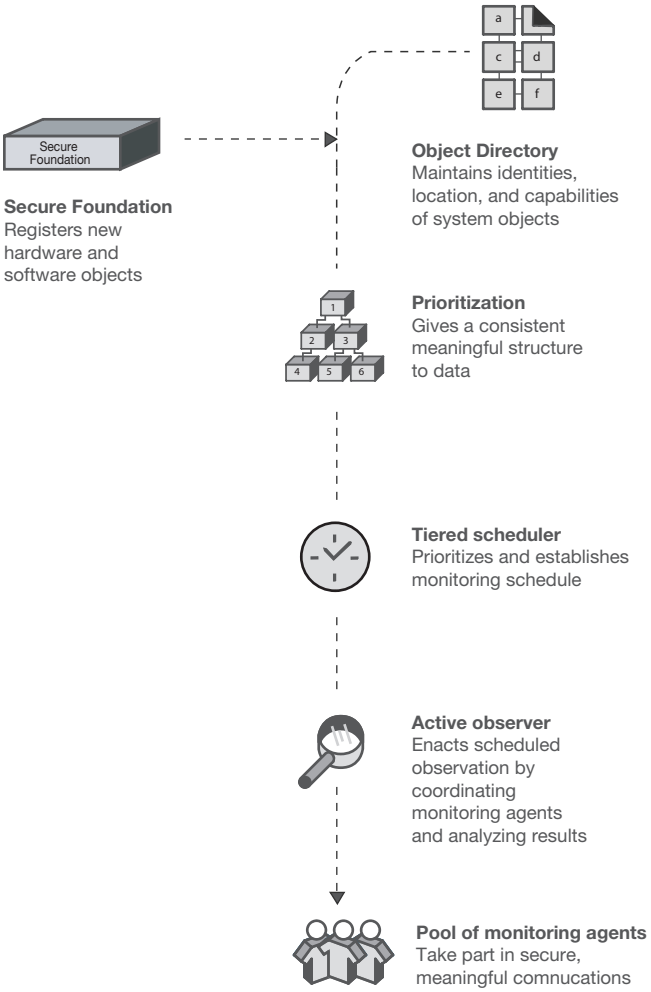
As the application loads, a message is sent to the Guard Dog with the following information: device known (IP address), location unknown, individual: ajbidlesbee, persona: doctor, information requested: cardiac information for patients. Guard Dog examines the content of this information and determines that the request requires moderate to high identification measures. Guard Dog identifies the moderate and high security measures on file for Bidlesbee eye scan, finger print and voice identification and assembles two of these requirements based on Bidlesbee's device profile.

Bidlesbee quickly receives a request to scan his fingerprint on his laptop and to repeat, "The daffodils are lovely in the spring." After reciting the line and scanning his digit, Bidlesbee waits for a few seconds as Guard Dog validates his credentials. Bidlesbee is approved.

It's 11 AM and Bidlesbee is about to begin the second surgery of his day: nothing major, just a standard non-invasive bypass surgery. In the operating room (O.R.), Bidlesbee looks at a large plasma screen and without delay the system provides him with access to the critical data of his next patient, Sven Koneig. The O.R.'s application software automatically identifies patient information for the next surgery and asks Guard Dog for identity requirements. In such a secure environment, on a secure device, no additional identity credentials are needed.

In short the flexibility of Guard Dog allows Dr. Bidlesbee to get quickly obtain the critical information he needs while protecting the highly sensitive nature of the information he access through HealthNet.

Monitier



Ensures a rock-solid HealthNet infrastructure through aggressive monitoring of critical services and systematic monitoring of the entire system. Monitier coordinates the monitoring of all system objects (i.e., hardware and software) preventing the deterioration of optimal service. Monitier prioritizes and coordinates monitoring activities via a Tiered Scheduler. The execution of the monitoring work and the analysis of the resulting data is performed by Monitier's Active Observer functionality.

Discussion

Information networks are natural victims of entropy, meaning that they will inevitably degrade. As a massively-distributed and self-healing system, HealthNet readily overcomes minor obstacles. However, such abilities may actually hide deeper issues that retards overall system performance and ultimately pose a much more significant risk. Monitier is responsible for creating an accurate representation of system performance through systematic monitoring of the entire infrastructure.

Monitier works closely with Secure Foundation to ensure all new hardware and software, or system objects, are registered in the Object Directory. This directory is the basis of Monitier's knowledge of HealthNet, providing the name, location, purpose, and capabilities of every system object on the network. Over time a system object's location or capabilities may change, and such changes should be noted in the directory. The Object Directory can support other HealthNet systems in locating and validating the identity of system objects.

The Object Directory describes the scope of the network that Monitier must monitor. From this information, the Tiered Scheduler procedures create

Monitier

a schedule for the monitoring of system elements based on their significance to critical HealthNet services, their relation to possible network problems, and their past history. These considerations determine the frequency and extent to which a system object should be monitored, essentially tiering the system objects by how much monitoring they require. It should be noted that some system objects will perform some self-monitoring and reporting as a part of Secure Foundation—such behavior should be taken into account when establishing the tiering.

The monitoring plan set forth by Tiered Scheduler is enacted by the Active Observer's pool of monitoring agents that accept and carry out monitoring assignments. The monitoring agents locate system objects using the Object Directory and report back on testing results. The resulting information is collected and immediately evaluated by the Active Observer to determine if there is cause for immediate concern. Such points of concern are escalated to Rapid Response.

Properties

- Registry for system objects
- Criticality-based scheduling automation
- Monitoring agents
- Result analytics reporting

Features

- Registers new system objects
- Coordinates self-reporting system objects
- Prioritizes monitoring based on the criticality of each service
- Coordinates monitoring agents
- Analyzes monitoring results
- Reports findings
- Integrates with Secure Foundation

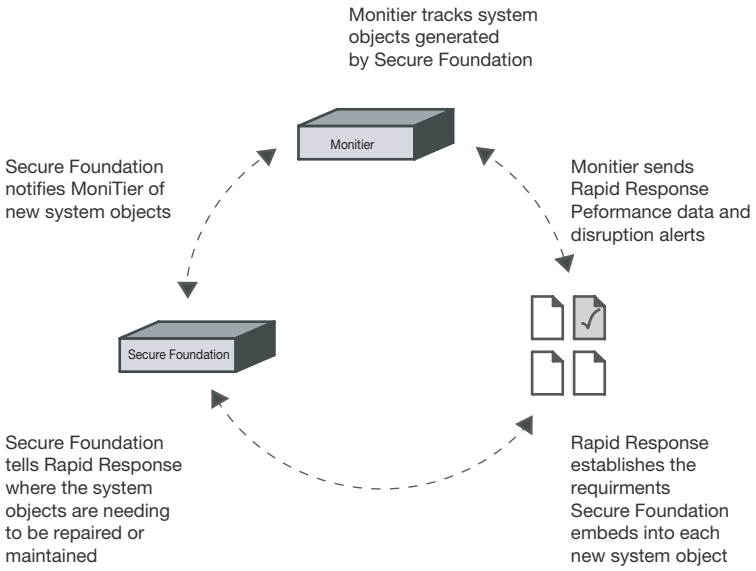
Scenario

Jacob Albertson is a network administrator at HealthNet's Osh Kosh server farm. Today he's just installed a new rack of digital routers. After the installation is complete and they're brought online, Secure Foundation registers the new network additions with the Object Directory. The digital routers are registered as routing hardware objects capable of 320 Gbps switching, peering, and trunking services. The routers' network location is also noted.

As soon as the routers are registered, the Tiered Scheduler is notified of the new hardware. A standard schedule is established for monitoring the new hardware based on their classification as routers. The standard schedule calls for an immediate test followed by semi-monthly testing.

The Active Observer is notified of the immediately scheduled test and assigns it to the next available monitoring agent. The monitoring agent looks up the location and specified capabilities of the routers in the Object Directory and sends several commands through the routers. All the routers check out except one, which is dropping 5% of the packets in testing. Noting the anomaly, the Active Observer flags the troublesome router in the Object Directory and records a description of the testing failure. Active Observer also notifies Jacob of the router and it's testing failure. Jacob removes the bad router from service for troubleshooting.

Rapid Response



A dedicated team of system administrators that takes proactive as well as reactive measures to ensure the sustainability of HealthNet's infrastructure. Working in conjunction with Secure Foundation and Monitier, it takes action once it becomes apparent that a system disruption has the potential for occurring or has already occurred.

Discussion

Rapid Response is a HealthNet department of employees trained in information technology administration. The support department is geographically distributed through out the country, at HealthNet server farms where they protect HealthNet from disruptions.

By leveraging expert knowledge of software development and hardware installation, Rapid Response take proactive as well as reactive measures to ensure the system is always active and healthy. It does this by analyzing and synthesizing performance data sent to it from Monitier. After Rapid Response analyzes and synthesizes such data, they are capable of forecasting where system disruptions are most likely to occur. When a Rapid Response team discovers a problem area, it activates auxiliary system objects in order to maintain service, takes the failing system object(s) offline, diagnoses the problem, designs a solution and then fixes it.

Rapid Response is capable of maintaining a high level of system performance even after it has received a report that a system object has failed. By being strategically dispatched at server sites, Rapid Response teams are able to quickly act upon problems and fix them. While a problem is being fixed, Rapid Response activates procedures to notify the user base about the disruption and informs them when full service will be restored.

Rapid Response

Once activated, HealthNet will be a critical public service, allowing fast access to accurate, life-saving data. The efficiency and dependability of the infrastructure will be based on the tireless vigilance of the Rapid Response team members.

Properties

- HealthNet employees with expert knowledge of Information Technology administration
- Decentralized departments, strategically distributed across the country
- Capability to analyze hardware/software problems and generate solutions
- System disruption forecasting procedure
- Task list assessment procedures
- Software procedure that determines re-routing of system service
- Hardware and software installation procedures

Features

- Ensures that the IT infrastructure of HealthNet is operating efficiently
- Forecasts system disruptions and takes preventative measures
- Analyzes system performance data, and determines how to improve system performance
- Creates work-arounds so that system disruptions go unnoticed by the user base
- Prioritizes maintenance tasks
- Integration with Monitier and Secure Foundation
- Performs necessary hardware and software installations
- Oversees autonomic HealthNet systems
- Notifies other HealthNet departments and users of service disruptions or other maintenance events

Scenario

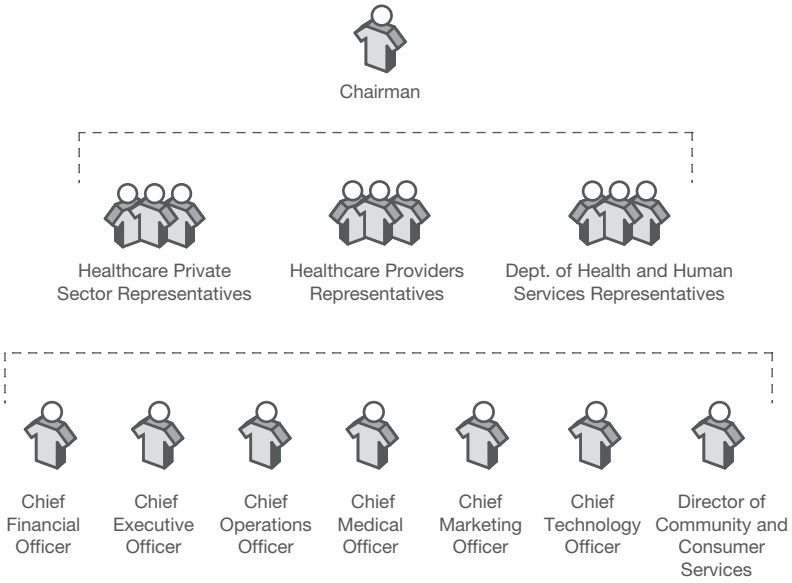
Jacob Albertson works for the Rapid Response HealthNet team near the Osh Kosh, Wisconsin server farm. On most days he is able to take long lunches and watch the dairy cows chew their cud, knowing assuredly that the autonomic, self-healing systems supporting HealthNet's advanced infrastructure are scouring the system looking for aberrations and system objects which might cause a disruption. But today, a cold and wet Monday, we find Jacob reading through pages of performance data sent to him from HealthNet's watchdog, Monitier.

As Jacob and his Rapid Response teammates review the performance data, it becomes apparent that one particular set of storage devices, is under performing, slowing the Effective Aggregator's performance. In particular, the Effective Aggregator has been trying to aggregate headless Personal Health Record data for scientists on the west coast to use in their study on the combined effects of being a smoker, weighing over 200 pounds, having red hair, and a family history of glaucoma in the left eye.

The Osh Kosh Rapid Response team discusses what might be the problem, and requests specific data on these objects from Monitier. The new data from Monitier, leads the team to suggest that a series of heavily fragmented storage devices are the cause of the under performance.

Now with the problem identified the Rapid Response team decides that the first course of action is to conduct a hardware and software diagnostic on these storage devices. Walking over to a HealthNet terminal, they connect to Secure Foundation which is able to tell them where they can find these under-performing storage devices and perform a diagnostic on the hardware components. In a few moments Secure Foundation tells the team that the under performing storage devices are at the Syracuse server farm. Monitier generates a warning notice for the Syracuse Rapid Response team to take some immediate steps towards preventing a system disruption. Just in case the Syracuse storage devices do fail, Jacob Albertson readies a couple of storage devices on site in Osh Kosh to make sure service is never interrupted.

Board of Governors



A heterogeneous unit designed to govern HealthNet, ensure its political independence and maintain its sensitivity to divergent concerns. HealthNet's Board of Governors is led by a chairman and nine members nominated from three different healthcare sectors. The Board of Governors works closely with a Board of Directors representing each of HealthNet's seven divisions.

Discussion

HealthNet's governance is led by a Board of Governors and a Board of Directors representing each one of the infrastructure divisions. Together they base their judgment on HealthNet rules, regulations and enforcement procedures to make better decisions regarding HealthNet performance and projections.

The appointment procedures for the members of the Board of Governance are designed to minimize the influence of politics when making decisions. The Board of Governance chairman is nominated by the United States Department of Health and Human Services for a 14-year term, much longer than the terms of elected office holders. In the same way, the other nine members are nominated to fulfill 14-year terms. Three of the nine members are nominated by the healthcare private sector, three are nominated by healthcare providers organizations and the other three are nominated by the United States Department of Health and Human Services. Moreover, the 14-year terms are staggered. One term expires each January, limiting the ability of an office holder to nominate the majority of the Board in a typical four-year term.

Under the Board of Governors is the Board of Directors. The Board of Governors nominates the six members integrating the Board of Directors by providing a fair representation of the HealthNet

Board of Governors

divisions. Each one of the six members is appointed to hold each one of the following offices; Chief Financial Officer, Chief Executive Officer, Chief Operations Officer, Chief Technology Officer, Chief Medical Officer, Chief Marketing Officer, and Director of Community and Consumer Services. Their primary function is executing the daily activities related with HealthNet six divisions (Data Management, Security, Quality assurance, Operational support, Outreach and Funding). Each member of the board of directors is appointed for a five year-term.

By law, the Board of Governors has to meet at least four times a year. At a high level, it evaluates and overcomes HealthNet general performance. To assure this task, reports about HealthNet's performance are provided by Performance Manager. Some of the meetings require the Board of Directors committee attendance to review HealthNet progress, discuss new directions and provide guidance. The Board of Governors chairman acts as its leader.

The Board of Governors and the Board of Directors work under HealthNet legislations and regulations. Perhaps, a heterogeneous committee formed by HealthNet first Board of Governors and Board of Directors, as well as government and private sector support will create HealthNet legislations, regulations and judicial procedures. In order to establish HealthNet values and maintain them over the time, HealthNet amendments will be also formulated by this heterogeneous group.

Properties

- Board of Governors' chairman nominated by the United States Department of Health and Human Services
- Nine-member Board of Governors
- Healthcare Private Sector representation (three members)
- Healthcare providers representation (three members)
- United States Department of Health and Human Services representation
- Seven-member Board of Directors committee nominated by the Board of Governors providing a fair representation of the HealthNet divisions
- Chief Financial Officer
- Chief Executive Officer
- Chief Operations Officer
- Chief Medical Officer
- Chief Marketing Officer
- Director of community and consumer services
- HealthNet Amendments to establish users rights
- HealthNet Rules and Regulations
- HealthNet Enforcement Procedures
- HealthNet Fund constituted by public and self generated funding

Features

- Provides guidance from the United States Department of Health and Human Services
- Ensures its political independence and its sensitivity to divergent HealthNet concerns
- Provides a diverse Board of Governors including representation from the most significant healthcare sectors
- Directs execution of its seven main divisions
- Establishes users rights through HealthNet Amendments
- Establishes HealthNet legislations and regulations
- Assures funding management

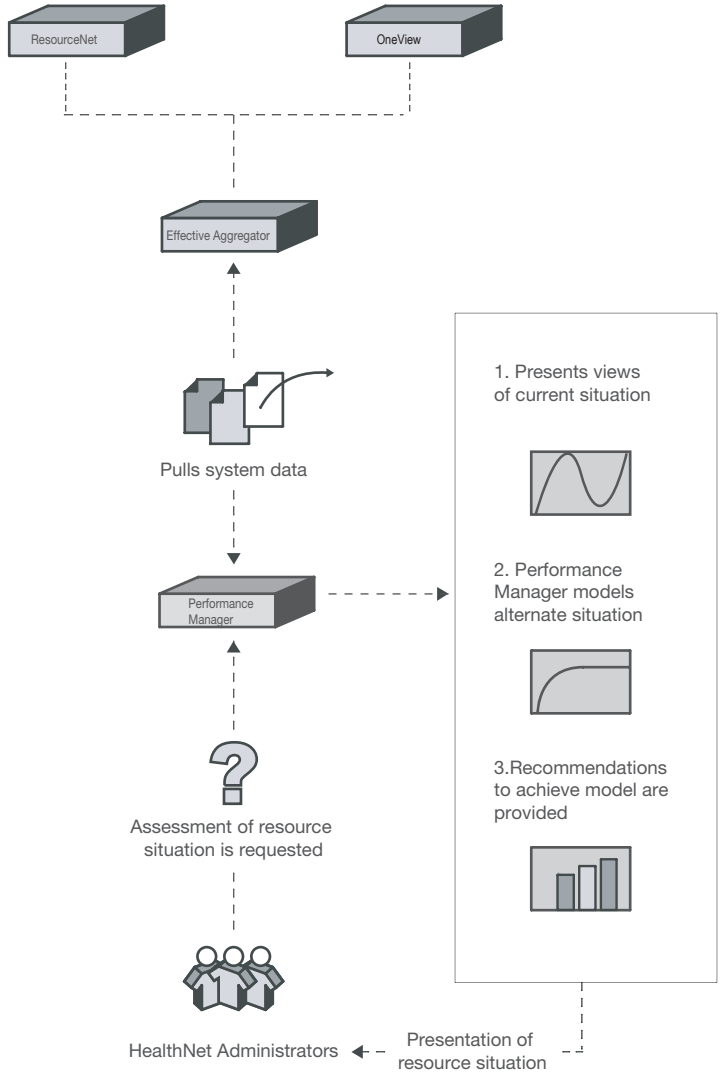
Board of Governors

Scenario

It is Monday at 8 am. The HealthNet Board of Governors meets for an in-progress review as well as to project HealthNet performance for the next period In contrast from the previous meetings there is a new member nominated by the United States Department of Health and Human Services. The chairman and the other eight Board of Governance members are very excited about this new member, like every other year, they need new input in the group.

During the meeting the board of governors discusses some of the problems, vote and makes decisions about new polices that they want to implement. At the end, they come up with some conclusions that will be transmitted to the BOD in the next meeting. Meanwhile, the Board of Directors performs its daily activities to direct each one of the HealthNet divisions and reach out the goals established by the Board of Governors.

Performance Manager



Enables HealthNet administrators to understand current resource allocations and plan for more effective reallocation strategies. Performance Manager collects data about how people, money and system objects are being used, presents that information to administrators, generates models of hypothetical resource allocations, and produces recommendations on how to achieve optimal allocations.

Discussion

Performance Manager is designed to give HealthNet administrators a powerful set of tools to assist them in making resource allocation decisions.

Performance Manager accesses user and resource data about HealthNet, leverages a combination of analysis, synthesis and modeling components to provide administrator's with a comprehensive picture of current resource allocations, generates more effective allocation alternatives, and describes how such alternatives can be realized.

Performance Manager is available for use whenever administrators want to gauge how efficiently the system is using its resources and how effectively those resources are being used towards achieving HealthNet's goals. Administrators also use Performance Manager on a quarterly basis to review wether or not resources are used efficiently and if a allocation of resources is necessary for the next quarter.

In order to promote HealthNet's resource efficiency, Performance Manager collects data on different resource components from ResourceNet and Monitier. Effective Aggregator assists in the process by directing data into Performance Manager's knowledge base. ResourceNet provides Performance Manager with data on the characteristics of the people who use the system as well as

Performance Manager

what services, supplies and financial resources they use. This includes such specifics as age, location, gender, and socio-economic indicators. This data helps to illustrate a picture of who is being served by HealthNet's resources, who is not and what resources they are using. Monitier provides Performance Manager with data on system object and service use.

Once an accurate picture of the existing resource situation has been established, Performance Manager uses algorithms to compare this data against milestones, benchmarks and objectives previously set by administrators. These goals could be reducing resource demand during early evening hours, or ensuring that lower income populations with a family history of high blood pressure get more preventative care so as to reduce industry strain.

Armed with an accurate picture of current resource allocation and information on how HealthNet is proceeding towards its objectives, administrators ask Performance Manager to use its model generation engine to forecast what potential resource situations might look like if specific adjustments to the allocation plan were made. Administrators can also ask for models to be generated representing ideal situations where objectives are met. Either way, once Performance Manager persents administrators with a resource allocation model that suits their needs, they can have Performance Manager generate suggestions on how those situations could be achieved.

Properties

- Interoperability with other system elements
- Synthesis procedure to present data to user
- Assessment and mapping of data against variable benchmark procedure
- Model generation procedure
- Model viewing and manipulation interface
- Storage of views procedure
- Recommendation generating procedure

Features

- Analyzes of data presentation
- Forecasts models of resource situations
- Stores saved models and views for later analysis
- Generates recommendations on how forecasted models could be achieved
- Helps HealthNet administrators to analyze resource performance allocation
- Intergrates with System Dashboard

Performance Manager

Scenario

It is a cold wet Monday morning, and HealthNet Administrator, Michael Waters is preparing his quarterly report to the HealthNet Board on how effective the system has been at applying its resources towards achieving its underlying goals. Chief among those goals is to lower the cost of delivering Healthcare, which will in turn raise the number of people able to participate in the healthcare industry to get care. The backbone of Michael's report to the HealthNet board will be supported by data generated from Performance Manager.

Just before he left the office last week he notified the system that on Monday he would like to conduct a resource assessment and new strategy generation session. The system notified Performance Manager of the request and over the weekend Performance Manager collected the necessary system data to be used in the report.

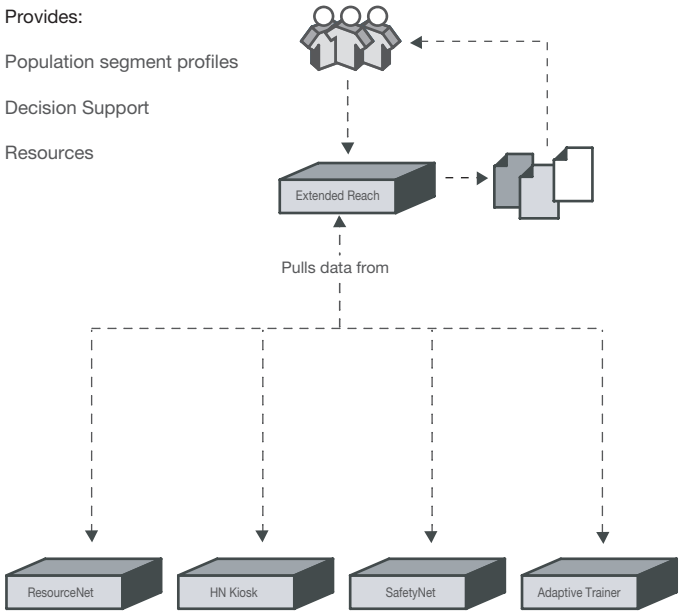
But back at the office on Monday morning, Michael has just put down his cup of coffee and is preparing to view the assessment Performance Manager has made of HeatlhNet's resources. Because Performance Manager collected data on location, gender, and age of the system's users, Michael can see that young men and women on the west coast have been completely ignoring the system and the benefits it has to offer. Intrigued by this he asks performance manger to display the number of medical practitioner employing the system in the same geographic area as these young men and women and notices a correlation between their lack of enthusiasm for the system and the medical practitioner's lack of adoption.

Michael prints out the necessary data for his report to the HealthNet Board, in general everything seems fine, and Michael isn't worried about losing his job, but it is troubling to him why this segment of the population and why in this particular region are they not participating in the system. "Do they think it is all fun and games in the sun out there?" Michael whispers to himself. "The board will want a solution to this problem" Michael asserts and decides to have Performance Manager create some models forecasting what resources would need to be diverted if he were to address this population segment and these medical practitioners with tighter awareness campaigns, additional hardware/software access materials.

In moments Michael is presented with a series of models that are in no way agreeable to him. He knows the board won't be happy with them either, so he adjusts the model generation engine manually, and in a few more moments he is presented with a resource allocation model which should be acceptable to all parties and might go a long way towards enveloping this disconnected population segment into HealthNet.

Michael ends his session with the Performance Manger by having it print its recommendations for how Michael might institute such a resource plan. Armed with these documents he assuredly finishes his report for the board, and leaves for home hoping not to have another dream about relearning Latin again.

Extended Reach



An organization committed to expanding the use of HealthNet by practitioners and underserved populations. Extended Reach uses an integrated system of tools that provides the means to identify populations, to reach out to them via diverse communication channels, and to educate and encourage them to adopt HealthNet.

Description

Healthcare institutions and organizations are constantly faced with the difficult task of assuring broad coverage across the diverse US population. There are sizeable barriers hindering communication between the healthcare system, users and providers including language, ethnic groups, social status, behaviors and geographical locations. In such a diverse environment it is critical for HealthNet to educate and encourage practitioners and users—particularly those in underserved communities—to adopt HealthNet into their lives.

Extended Reach provides a solution to overcome population diversity so as to reach users and providers across the country. In essence, the system gathers statistical data form the US Census Bureau and through a series of software routines it identifies the most significant population segments. In addition, it creates a profile for each identified segment that recognizes patterns regarding education, income, ethnicity, health status, behaviors and geographical location of each segment. Once the profile is generated, the Board of Directors can formulate more effective communication strategies supported by the profiles' projections. The system also provides a tracking database of profiles and strategies previously implemented by HealthNet, allowing the Board of Directors to support its decision-making with previous experiences.

Extended Reach

In addition to identifying and generating profiles of specific population segments, Extended Reach integrates communities by making the information needed to adopt HealthNet accessible for them. It functions as a coordinator of capabilities residing in ResourceNet, Health Kiosk and Adaptive Trainer. For example, educational, training and informative programs are implemented through Health Kiosks, which are previously adapted to fulfill any of the designated activities. The resources required to perform these adaptation are supplied by and ResourceNet. Finally, Extended Reach leverages SafetyNet financial resources to assure broad coverage across the US population.

Properties

- Interface to gather information from the US Census Bureau
- Software routines to identify significant population segments and create supporting profiles
- Knowledge base of previously generated profiles, strategies and results applied by Extended Reach
- Means to reach out to communities through Health Kiosk
- Tracking database of system users
- Means to automatically communicate with system users
- Marketing specialist team

Features

- Collects data to assess breadth of HealthNet coverage
- Identifies population segments that are significant for HealthNet to target
- Provides supporting information and recommendations to aid the Board of Directors in generating strategies
- Optimizes HealthNet resources to reach out communities
- Ensures streamlined enrollment access
- Establishes communication channels between subscribed users, providers and HealthNet
- Assures a wide coverage by utilizing SafetyNet support
- Integrates with Adaptive Trainer
- Integrates with SafetyNet
- Integrates with ResourceNet

Extended Reach

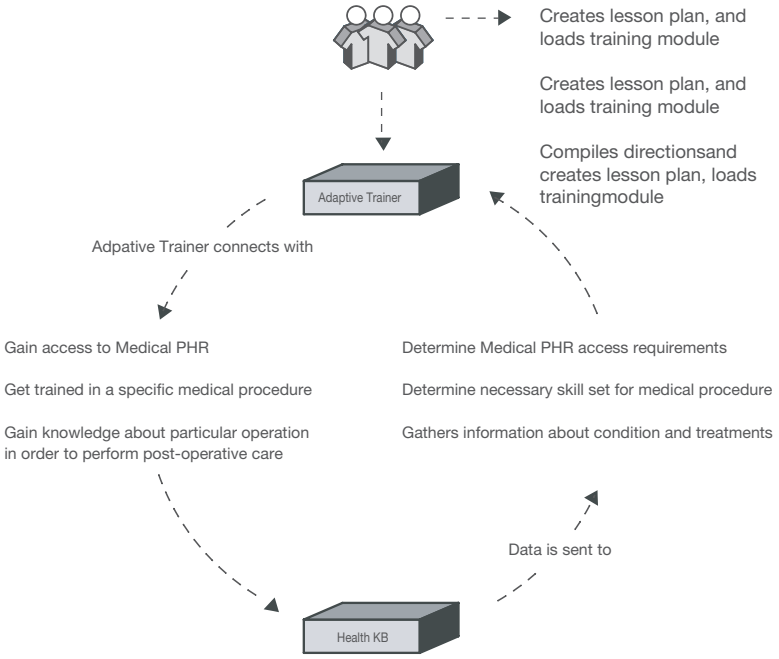
Scenario

It's year 2010, five years since HealthNet was implemented into the US health care system. HealthNet has been successfully adopted at all levels. As a consequence of its successful adoption rate, the HealthNet Board of Directors refocuses on a new phase of innovative applications that would facilitate an even higher level of healthcare delivery.

To accomplish this task, the Board of Directors decides to access Extended Reach and get some information to support decision-making. Once Extended Reach has been accessed, it quickly identifies the most significant population segments and produces their respective profiles. Dr. Greene, one of the Board of Directors' members, examines the profiles generated and notices that there has been a shift in the US population In stark difference from the first time they consulted Extended Reach, this time it has identified a new significant population segment—the percent of students attending collage has tripled its size in the last 5 years As a consequence, the Board of directors decides that it would be critical to establish a new strategy specifically designed to target this group Using the profiles generated, the Board of Directors analyzes particular characteristics defining the needs of this segment, its behaviors and tendencies, and set up a new communication strategy Since there were some minor difficulties with the previous communication strategy, Dr. Plum and his colleagues access Extended Reach and pull out previous profiles to study and learn about their mistakes.

Once the strategy has been formulated, the Board of Directors decides to access Extended Reach once again to implement "outreach" programs Since the needs of this specific group has been already identified, Extended Reach access ResourceNet and obtains the necessary resources to adapt Health Kiosks with clever applications to target collage students and encourage them to adopt new HealthNet applications into their healthcare system. Extended Reach provides kiosks designed to be placed at universities and equipped to provide technology, services and in some cases enticing incentives Once the kiosk model has been generated, Dr. Plum and his colleagues corroborate the decision of implementing the new kiosk across the country.

Adaptive Trainer



Provides users with the training tools and information to develop expertise in a wide-range of health-related subject areas. This includes learning how to use HealthNet's services, acquiring training in medical procedures and learning about preventative care. Upon completion of training, Adaptive Trainer formally accredits users and tracks their expertise for use in 3rd-party or HealthNet-specific applications.

Description

Adaptive Trainer is accessible to the range of user segments connecting to HealthNet, including patients, medical practitioners, home caregivers, pharmacists and healthcare administrators. Adaptive Trainer satisfies three main objectives: it trains and authorizes users on how to handle sensitive data files, certifies professionals in medical procedures so that they can enter the healthcare industry or expand their skill set, and lastly, it provides users with detailed medical knowledge about their conditions and possible treatments. Users wishing to fulfill any of these objectives will be able to take advantage of the Adaptive Trainer from any environment and at any time they wish as long as it is from a secure connection to HealthNet.

By requiring medical practitioners to undergo training on how to handle sensitive data files, it will give patients a sense of assurance that the practitioners handling their data is not simply an employee of a healthcare organization, but an accredited professional. The Adaptive Trainer also makes progress towards driving down the costs associated with delivering healthcare by making it easier for individuals to become medical practitioners. By reducing the costs associated with medical education and training, it is possible for more people to join the healthcare workforce, thus reducing the current shortage in qualified workers.

Adaptive Trainer

The Adaptive Trainer makes it safer and easier for patients to take responsibility for preventative and post-operative healthcare. By having access to training sessions over a secure HealthNet connection from their home, patients learn how to treat themselves safely and cost effectively. Furthermore, their family members can and learn more about the course of action currently being taken.

Adaptive Trainer acts as a framework, offering several powerful training components. One of these is Adaptive Trainers' profile generation component. The user's profile allows him/her to review training sessions, and once a user has completed a module, a note is added to his/her profile which can signal to others the value this user has to an organization. Training modules are accessible from the profile interface and the Adaptive Trainer automatically generates lesson plans by connecting to the HealthKB. During training, Distant Supervision supports users. This component provides users with a connection to remote medical professionals who are available to assist users remotely during their training. Because of the access to users' training profile and because the training programs over HealthNet are standardized, users are not tied to a specific supervisor. Therefore, he/she will be able to get support from anyone available for consultation. Automated support techniques provides via Curriculum Generator. This component recommends what procedures need special attention and what additional materials would be helpful to learning. Once a user has completed a training session or series of training sessions, Adaptive Trainer's Accreditation Generator awards certification. The Accreditation Generator updates the user's profile as well as make their new skill level known to the ResourceNet where they can be matched opportunities that require their new skill set.

Properties

- Graphic user interface with access to trainer componets
- Framework of training and instruction support componets
- Library of training or procedure instruction modules
- Recording of training and development progress
- Accreditation authorization access and certification
- Instruction support component
- Creation of training plan procedure
- Knowledge base of accredited users
- Software intergration with ResourceNet

Features

- Acessible via a network-portal interface
- Supports a variety of users with different skill sets, experiences and objectives
- Works as a framework to provide users access to a range of HealthNet components
- Contains a library of training
- Creates and retains a profile of each user
- Keeps track of each user's training performance
- Awards certification to users upon completion of training program
- Contains a learning support program to ensure user progression during training
- Maintains a knowledge base of accredited users
- Intergrates user's training profile and accreditation certificates with the Talent Pool via ResourceNet

Adaptive Trainer

Scenario

It is a cold wet Monday morning and Samantha Sabine is starting her new job as Manager of MRI technicians at Cook County hospital in Chicago. Over the past three months she has been training for the position using HealthNet's Adaptive Trainer program. She acquired the skills necessary for this new job while working as an MRI technician at St. Vincent's hospital in New York City.

Each training session began with Samantha pulling up her training profile page. On this page Samantha was able to review her last training session's topics, her new training assignments, suggestions from her Distant Supervision agent, and past test scores.

As Samantha walks down the hallway of Cook County, she recalls the rigorous training she had to get through in order to make it to Chicago. One day in particular stands out in memory.

Samantha put down her cup and coffee and turned on here HealthNet terminal. Immediately she was dismayed to see that she had been sent four assignments by the Curriculum Generator all focused on improving her understanding of MRI resolution reports. In the back of her mind she always knew this was her weakest area of study, but this just confirmed it. Therefore, Samantha wanted to get some advice on the best ways to read these reports from a Distant Supervision agent. Samantha pulled up a list of available agents and although it was eight o'clock in the morning, Samantha saw that a former MRI manager, Brandon Bower, was available to give her some advice. Samantha had never contacted Brandon before, but she sent him an e-mail, explaining her situation, and granting him temporary access to her personal training page. Brandon who used to manage the MRI department at Harrison Hospital in Syracuse, was now retired and working from home, assisting other technicians via his broadband connection to HealthNet.

Upon receiving Samantha's e-mail, Brandon put down his cup of coffee and got to work. He first replied to Samantha, saying that he would be happy to help her, but that he would need to take a few moments to review her training history. He suggested that she proceed onto some other areas of study and that he would contact her in a half an hour. During that time, Brandon reviewed her test scores and the assignments the Curriculum Generator had sent her. While this was happening, Samantha was moving on in her training, learning how to resolve disputes between technicians and patients. Just as Samantha had finished the fist lesson in the technician-patient-dispute-resolution module, Brandon contacted Samantha via e-mail and asked if she would be available for conference. Samantha was grateful to get some advice on her problems with MRI resolution reports so early in the morning and so quickly.

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Conclusion

It would be easy to conclude by making a glib statement about how HealthNet infrastructure is the antidote to all of healthcare's woes. Such a statement would belie the obvious reality that the healthcare system is too complex, too screwed up and too mired in its ways for any single solution to solve its many problems. Nonetheless, the solution put forth in this document includes many technologies and policies that if put in place, could put the nation on the road to better, more cost-effective healthcare. Perhaps more important than any single element of the system, however, are the characteristics that they impart on the system as a whole:

The system is systemic and broad
HealthNet provides a platform that allows healthcare services to take place in a wide range of environments, basically any location that has a secure network connection. More than simply providing access, however, HealthNet provides a means of integrating and protecting the data found in these diverse locations. This rich, expansive data set can have massive consequences on identifying trends more quickly, streamlining services and building the healthcare knowledge of individuals and practitioners.

The system is flexible and responsive
A truly connected healthcare ecosystem can operate far differently than the modus operandi common today. HealthNet's powerful pattern recognition tools and data mining software allow trends to be quickly identified. Its real-time resource allocation and information broadcasting capabilities allow these results to be acted not in a matter of weeks, but in hours. This early identification capability also exists at the individual level where powerful tools are marshaled to encourage individuals to seek preventive care and in cases intervene in their own health management.

The system is adaptable
Such flexibility is also a key characteristic of the HealthNet architecture. For infrastructure to be successful, it needs to enable application developers and users to develop their own solutions, using the platform in unexpected ways. HealthNet's core infrastructure and cornerstone applications give application developers a rich set of data management, data access and communication management tools that can be harnessed in diverse applications like software billing systems, diagnostic tools and public educational tools.

The system is supported
It is easy to get lost in the details of building a technical infrastructure and lose sight of the fact that it needs people and resources to guide its growth and operations. HealthNet recognizes this need and provides a blueprint for the ongoing governance of such a critical system. In addition to identifying how the system should be managed, it also provides an insight on how such a system can maintain a funding base by charging small access fees for use quite similar to models found in other public infrastructure projects.

Appendix A

Charter

Defining Statements

Institute of Design
Illinois Institute
of Technology

***HealthNet** Infrastructure*

A 21st Century Approach to Healthcare

Charter

Background

Healthcare professionals today are deluged with information on research findings, new drugs and innovative treatment options. Able to assimilate only part of this wealth of information, the may easily miss new and more efficacious ways to treat ailments. Meanwhile, important information about their patients may be lost because there is no effective way to capture it during the hectic activities of patient care. Documentation, including patient records, prescriptions and medication charts, largely remains paper-based and difficult to access, update and share.

As pressures to reduce medical costs increase and shortages of nurses and other medical staff continue, there is a growing effort by health organizations to reduce the need for professional medical care by educating those at risk. Following the cost containment movement, more responsibility for their own care after treatment is also being placed on patients. Education for patients now stresses goals of understanding their health condition more fully, participating actively in regaining their life activities, and making the transition quickly and successfully from hospital care to self care at home.

Hospitals and associated health-care institutions are complex systems, frequently operation in an environment where immediate access to information and timely communication among doctors, care givers, technical support staff, administrators, patients, and families are critical. Recent developments in computing, networking, diagnostic and monitoring technologies, combined with continuing innovations in treatment procedures and protocols have created exciting new ways for these institutions to meet these challenges. Yet, in many ways, they remain woefully slow to respond to change. The time is right to describe—and force to professional attention—how information, communication, and product systems developed to take advantage of new technologies can support the health-care and the care-giving community in their critical mission of serving patients.

Over the past decade, the Institute of Design has undertaken a number of student projects on health-care topics with the support and expert guidance of Rush-Presbyterian St. Luke's Medical Center, the University of Illinois Chicago Medical Center, Northwestern Memorial Hospital, Children's Memorial Hospital, the Rehabilitation Institute of Chicago, and Planned Parenthood. The school is now developing a project/research initiative that will focus on how design can add value to the work going on to improve health care.

From these system-level planning projects (***HealthNet** Infrastructure* and ***HealthNet** Applications*), detailed design projects will be initiated to examine opportunities revealed to improve information, communications and products in an integrated way throughout the phases of health care: prevention, diagnosis, treatment, recovery, and maintenance. From the planning level down, better information management systems will be sought to connect medical and care-giving professionals on the job, and to increase their ability to interact with the patients and families they serve. Ways will be developed fore care-givers to share information more easily while gaining deeper understanding of patient conditions and, consequently, improving treatment outcomes. Systems will be explored to support the ongoing while gaining deeper understating of patient conditions and, consequently, improving treatment outcomes. Systems will be explored to support

the ongoing learning necessary for all to stay knowledgeable about best practices. And, extending the health-care network, ways will be sought to provide patients with alternatives to office visits—ways to give them reliable, operative services, in forms that they can understand and process that they can use to take greater charge of their own health and lives

Relevant Trends

Trends initiated by emerging technologies and evolving social needs, interests and conditions will have direct impact on the state of medical practice, medical research and the technologies associated with health care. Among such trends are:

Increasing expectations
The ubiquitous media with their growing interest in reporting the advances of medical science are finding a plentiful supply of new developments from medical research. The resulting barrage of media stories is creating expectations among the public that are difficult to meet in practice and, at worst, are generating growing dissatisfaction with the health-care system.

Internet Penetration
Computer use and Internet access grow exponentially every year. Information of encyclopedic detail can now be obtained easily, and complex, sophisticated processes can be used remotely. Opportunities for high-quality communications are increasingly available to individuals and groups anywhere.

Emerging Technologies
The pace of technological change now places constant pressure on all organizations to update their core technologies as well as their information and communication technologies frequently. Constantly improving hardware and software are pushing a continuous process of functional improvement and enhancement.

Expanding Relationships
Greater public mobility and access to information is changing the nature of association for many organizations and institutions. Organizations that once operated independently or even in isolation are now finding themselves players in a common environment, sometimes competitive, sometimes cooperative.

Changing Demographics
Peaks in the age profile of the American public continue to move toward the older sector of society. Babyboomers will reach retirement age in the next decade, and a major voting segment of American society will be one highly aware of health problems and government programs to solve them.

Return to the Cities
Reversing a long-term trend, suburbanites are moving to the central city in growing numbers. The renewal of city centers in most of America's medium to large cities has sparked a renaissance in urban vitality and, perhaps, an economic/social reversal in land use around the cities with a concomitant mismatch of institutional capabilities in brick-and-mortar centers unable to move.

Cost of Care
The success of high technology in both diagnostic and meditative interventions has virtually mandated the use of high cost equipment and pharmaceuticals for growing numbers of ailments, some formerly not treatable. The cost of health care continues to rise and can only be expected to accelerate with the need for and availability of high-tech care. Meanwhile, social security, the safety net for the neediest, will bear a heavier and heavier load with fewer and fewer paying.

Project Statement

Using a Structured Planning methodology, conduct an advanced planning project to develop a networked approach to health care, concentrating on the infrastructure necessary to make it work. The infrastructure must be able to:

1. support individuals, families, the medical community, and associated professionals in maintaining health, preventing disease and solving medical problems.
2. provide a framework for a virtual health care environment allowing patients, doctors, and health-care specialists to work together at a distance,
3. create a human-centered process of operations and communications that builds confidence, improves effectiveness and allays fears, and
4. provide, as System Elements, comprehensive briefs for follow-on demonstration projects that can be undertaken by students at the Institute of Design.

Goals

As general guidelines, the proposed health-care system should:

- Explore the full range of possibilities, paying especial attention to appropriate technologies and user needs and interests.
- Consider both high- and low-tech proposals as they are appropriate.
- Include ideas for services, communications, products and systems including processes, procedures, activities, organizational concepts, policies and any relevant relationships among them.
- Explore revolutionary as well as evolutionary ideas.
- Consider the educational process through which patients as well as health-care professionals can learn to work with and within the system.
- Accommodate all users of the system and provide for them in the design. Thoroughness is a step toward system integrity.
- Consider potential costs thoughtfully; the proposal should not advocate unnecessary detail, but it should not sacrifice thoroughness for low cost.
- Provide for adaptivity; adaptive at installation for users; adaptive by users to changing needs.
- Treat the design problem as design from the inside out; user needs come first, with priorities among users influencing decisions when necessary. The process should exist for its users.
- Conceive the properties and features of the system as means toward furthering trust and empowering patients, medical professionals and care givers.

Overall, the system should:

- Assume that the proposal can be acted upon as it is conceived. Do not under-propose on the assumption that a concept might be politically opposed.
- Demonstrate what might be achieved. The value of the proposal is in its ideas, not its direct attainability. Ideas that might not be fully attainable under today's conditions may be incrementally achieved tomorrow—if they are known.

Resources

Resources for the project will be:

Physical:

- The facilities of the Institute of Design, including Room 514 as general meeting space and the 6th floor Crate & Barrel Room for team activities.
- Computing support from the fifth floor computer facilities.
- Equipment as necessary from ID resources.

Financial:

- None

Human:

- Planning team:
  - **Matt Hamlin**
  - **Samantha Ruiz**
  - **Brandon Schauer**
  - **Michael Winnick**
- Project advisor:
  - **Charles L. Owen**, Distinguished Professor Emeritus
- Advisory Board:
  - **Patrick Whitney**, Director & Steelcase/Robert C. Pew Professor of Design, Institute of Design
  - **Dale Fahnstrom**, Professor, Institute of Design
  - **Greg Prygrocki**, Associate Professor, Institute of Design
  - **Don Hollis**, Member, IIT Board of Trustees

Schedule

The project will be conducted from January 21 to May 9, 2003:

Week		Phase	Activity	Product
1	Aug 26	Introduction	Introduce project	
	Aug 29	Project Definition	Develop Issues and Defining Statements	
2	Sep 2			
	Sep 5		**In-Progress Review**	Issues DefStates 1
3	Sep 9	Function Structure	Develop Modes and Activities of Function Structure	
	Sep 12		**In-Progress Review**	DefStates 2 Fn Struc 1
4	Sep 16	Information Development *Action Analysis*	Generate Functions, Design Factors, and Solution Elements	
	Sep 19			
5	Sep 23			
	Sep 26			
6	Sep 30		**In-Progress Review**	DfStats complete Fn Struc 2 DesFacs 1 SolnEls 1
	Oct 3	Information Development *Action Analysis 2*	Complete Functions, Design Factors and Solution Elements	
7	Oct 7			
	Oct 10			FnStruc complete DesFacs complete SolnEls complete

8	Oct 14	Information Structuring	Score Soln Elements vs Functions	
		Interaction		
	Oct 17	*Structuring*		RELATN input; Information structure
9	Oct 21	Concept Development	Means/Ends Analysis	
	Oct 24			
10	Oct 28		Ends/Means Synthesis	
	Oct 31			
11	Nov 4			
	Nov 7		**In-Progress Review**	Initial System Elements
12	Nov 11			
	Nov 14		**Presentation**	Final SysEls
13	Nov 18	Communication	Refine final SysEls; write report; complete illustrations	
	Nov 21			
14	Nov 25			
	Nov 28	***Thanksgiving***		
15	Dec 2			
	Dec 5		**Final Presentation**	Illustrated Report

Methodology

This project will be conducted using Structured Planning.

For the solution, develop an integrated set of concepts that focus on gathering, handling, and using information in the full range of environments expected for health care systems of the next decades. Consider all forms of solution, including procedural, organizational and environmental options, but concentrate on solutions that can be further developed at the design level in demonstration projects at the Institute of Design.

Issues

Consider the following topics as initial issues to be investigated. Supplement them with additional issues as information is developed during the first phase of the project.

Location. Healthcare services are performed in a variety of locations including doctor's offices, hospitals, homes and pharmacies, etc. Which of these locations should HealthNet serve?

Ownership. Who owns and controls the data accessed by and stored in HealthNet?

Malpractice. Should HealthNet provide means to curb rapidly increasing malpractice insurance premiums and the resulting rise in healthcare costs?

Incentives. Why should the various parties contribute time, effort, or money to the HealthNet system?

Ethics. What steps should the HealthNet infrastructure take to enforce ethical guidelines in the usage and dissemination of information available to HealthNet?

Incentives. How should the HealthNet system seek to align the various interests of parties in the healthcare system?

Location. Should HealthNet's infrastructure be deployed on a local, regional or national level?

Administration. How should administrative responsibility for HealthNet be assigned?

Awareness. How should the public be made aware of HealthNet?

Implementation. What are key considerations for how HealthNet should be implemented?

Introduction. When should the system become operational?

Privacy. What provisions should HealthNet make to address the privacy of patient medical records?

Regulation. How should HealthNet be regulated to assure that objectives are being met?

Technology. What levels of technology should HealthNet expect to employ?

Funding. Who will pay to develop and maintain HealthNet's infrastructure?

Corporate Participation. What levels of participation should private corporations have in creating HealthNet?

Government Participation. What role should government play in developing HealthNet's infrastructure?

Individuals' responsibility. How should HealthNet encourage individuals to become more responsible for maintaining their well-being?

Data. What data standards should be established for HealthNet?

Education. What education needs to be provided to bring participants in the healthcare industry on board?

Adaptability. How will the HealthNet Infrastructure need to be built in order to adapt?

Security. What principals should shape the security of HealthNet?

Access. What approach should be taken for granting access to data?

Maintenance. Who should be responsible for maintaining HealthNet?

Defining Statements

Issue Topic: Location

1

Project: **HealthNet Infrastructure**

Originator: Michael Winnick

Question at Issue

Healthcare services are performed in a variety of locations including doctor's offices, hospitals, homes and pharmacies, etc. Which of these locations should HealthNet serve?

Contributors

M. Hamlin
B. Schauer

Position

Constraint

HealthNet **must** be built to support applications deployed in a wide variety of environments, specifically including non-traditional environments like a patient's home.

Sources

Blue Cross Blue Shield Association. **What's Behind The Rise: A Comprehensive Analysis of Health Care Costs**. Chicago: Blue Cross Blue Shield, 2002.

President's Information Technology Advisory Committee: Panel on Transforming Health Care. **Transforming Health Care Through Information Technology**. Arlington, VA: National Coordination Office for Information Technology Research & Development, 2001.

Alternate Positions

Objective

HealthNet **should** primarily support applications at key points of care giving like hospitals and doctor's offices, placing secondary emphasis on less critical locations.

Background and Arguments

While one traditionally thinks of healthcare as something performed in a doctor's office or hospital, we often take care of our own health in a broad range of contexts and situations. HealthNet must strive to greatly enhance these efforts by providing access to the right tools and information to users in these non-traditional contexts. Doing so, could not only provide better care for patients, but may also lessen their need to seek professional care and, thus reduce overall healthcare costs.

The rising use of home care provides a great example of how non-traditional care environments that can benefit from access to HealthNet. Home care and nursing homes represented 9% of total health care expenditures in 2002 (BCBS, 2002, 6). Networked technology could vastly increase that percentage while reducing impatient hospital visits, nursing home stays and service delivery costs. As noted in a report by the President's Advisory Board on Information Technology, "A significant number of people who reside in nursing homes are there more for health 'security' reasons than for heathcare 'needs.' Many residents in extended-care facilities could be cared for at home at significantly reduced costs if the appropriate telemedicine tools were available to enable remote monitoring" (President's Advisory Board 2001,11).

As the above quotation suggests, if HealthNet initially focused on "standard" healthcare environments, it would not be able to support the range of applications need to truly affect systemic changes in the way we administer healthcare.

Defining Statements

Issue Topic: Ownership

2

Project **HealthNet Infrastructure**

Originator Michael Winnick

Question at Issue

Who owns and controls the data accessed by and stored in HealthNet?

Contributors

M. Hamlin
B. Schauer

Position

Constraint
HealthNet **must** support and enforce multiple levels of ownership over different types of data that can be accessed through the system.

Sources

President's Information Technology Advisory Committee: Panel on Transforming Health Care. **Transforming Health Care Through Information Technology**. Arlington, VA: National Coordination Office for Information Technology Research & Development, 2001.

Group deliberations

Alternate Positions

Constraint
The creators of data **must** own the data available on HeathNet while providing some protection for individual use.

Constraint
Individuals **must** own their personal data available on HealthNet.

Background and Arguments

Without establishing clear ownership and use rights to data, HealthNet would face great difficulties in gaining wide spread participation and public trust. Providing a means to protect data ownership, however, must take into account the many kinds of data that can be accessed through and will reside within HealthNet including individual medical records, knowledge bases and meta-data.

In today's legal and regulatory environment, record takers officially own patient data though patient's maintain a right over the dissemination of that data. HealthNet must maintain this arrangement while strengthening an individual's right to control access to their files (President's Advisory Committee 2001, 12). Without this assurance, HealthNet could engender a public backlash, that could in turn undermine the system's effectiveness.

Knowledge bases that store structured, rich information about treatments, drugs, drug interactions, and conditions could be a key piece of the HealthNet infrastructure. The data resident in these knowledge bases should be publicly available for read access under the equivalent of an open source agreement for HealthNet application developers.

Meta-data–data about the data–represents an area of huge opportunity for HealthNet. An example of metadata would be: aggregate statistics on people in New York City under the age of 25 with B Hodgkins Lymphoma that have responded positively to Chemotherapy and an experimental drug treatment. This data would differ from individual records – it would be "headless" – and of great interest to public health officials, HMOs, biotech and pharmaceutical companies. This data must be owned by HealthNet with access rights granted to public or private parties.

Defining Statements

Issue Topic: Malpractice | **3**

Project: **HealthNet Infrastructure**

Originator: Michael Winnick

Question at Issue

Should HealthNet provide means to curb rapidly increasing malpractice insurance premiums and the resulting rise in healthcare costs?

Contributors

M. Hamlin
B. Schauer

Position

Directive

HealthNet **ought** to take steps to provide application medical professionals with information that can help to reduce incidences of malpractice.

Sources

Miller, Allen. *Why we need malpractice reform*. **CBS Marketwatch**, May 30, 2003.

Kane, N and Siegrist, R. **Understanding Rising Hospital Inpatient Costs: Key Components of Cost and The Impact of Poor Quality.** Chicago: Blue Cross Blue Shield, 2002.

Alternate Positions

Constraint

HealthNet **must** take steps to limit malpractice premiums.

Background and Arguments

According to Alan Miller, CEO of United Heathcare, "Malpractice insurance rates are increasing at 25% annually and quadrupling in states with particularly high damage awards" (Miller, 2003, 1). These costs, in turn, are being passed on to patients in the form of higher premiums and service costs. Much of the debate on how to reduce these costs has centered on capping monetary damages and developing alternative bodies to judge a doctor's culpability. These policy-level issues are simply too political and far beyond HealthNet's mandate.

HealthNet will not be able to play a role that leads to capping rewards or developing new bodies for medical review, but can play a role in reducing medical errors in the first place. According to a study conducted by Blue Cross Blue Shield, the gross direct cost of poor outcomes for six quality indicators in hospitals is $6.4 billion annually or 2.3% of inpatient costs (Kane and Siegrist 2002, 34). If hospitals were able to reduce their incidence rate to the lowest quartile that would result in $2.9 billion saved each year (Kane and Siegrist 2002, 34).

HealthNet ought to investigate means to advise care-givers when they are taking risky or non-standard courses of action as well as providing support means to identify health providers (hospitals and doctors) who are high risk for a given situation or condition.

Defining Statements

Issue Topic: Incentives

4

Project: **HealthNet Infrastructure**

Originator: Michael Winnick

Question at Issue

Why should the various parties contribute time, effort, or money to the HealthNet system?

Contributors

M. Hamlin
B. Schauer

Position

Constraint
HealthNet **must** provide clear and compelling benefits to the various parties whose level participation will determine its success.

Sources

Shim, R. *Wal-Mart to throw its weight behind RFID*. **News.com**. < http://news.com.com/2100-1022-1013767.html?tag=n> June 05, 2003.

Alternate Positions

Constraint
The government **must** require hospitals and HMOs to participate in HealthNet by passing federal regulation.

Background and Arguments

Establishing the right incentives for individuals and organizational participation represents one of the greatest challenges in developing HealthNet. HMOs, hospitals and individuals may zealously guard the medical record data that they currently have. Likewise, many organizations have invested heavily in their own technological systems and infrastructure. They will be wary of another approach to managing health information. Careful consideration needs to be given to the mix of incentives that will encourage wide spread adoption and use of HealthNet.

The adoption of RFID technology in the retail arena is a good example of why incentives are needed for new technologies to take hold. RF chips have been around for a long time, but have generally been cost prohibitive because they cannot be made in large enough volumes to result in price reductions (Shim 2003). As a consequence, manufacturers of retail goods have shied away from RF implementations even though they know that RF technology could result in great cost savings down the road. Recently Wal-Mart announced that they would require their top vendors to be RF compliant by 2005 (Shim 2003). This has become a huge incentive to manufacturers and will result in wide scale use and lowered implementation costs.

HealthNet's governing body must think in similar ways about getting organizations to participate. Possible incentives include requiring all Medicare claims to be made via HealthNet or providing participating organizations with substantial tax breaks. While strong federal regulation is an option, without strong incentives, one could foresee significant resistance among healthcare organizations.

Defining Statements

Issue Topic: Ethics

5

Project: **HealthNet Infrastructure**

Originator: Michael Winnick

Question at Issue

What steps should the HealthNet infrastructure take to enforce ethical guidelines in the usage and dissemination of information available to HealthNet?

Contributors

M. Hamlin
B. Schauer

Position

Directive

HealthNet **ought** to provide safeguards that prevent the abuse and misuse of information made available to its users and ought to, when possible, ensure the ethical conduct of its users.

Sources

American Medical Association. **AMA's Principles of Medical Ethics**. <http://www.ama-assn.org/ama/pub/category/2512.html>. June, 17, 2001.

Alternate Positions

Constraint

The HealthNet infrastructure **must** require users to be bound to a strict code of ethics.

Objective

Ethics are personal codes of conduct that a system **should** play little role in attempting to enforce.

Background and Arguments

Since the time of Hippocrates, medical professionals have been committed to upholding a strong ethical code focused on treating patients to the best of their abilities and respecting their needs for confidentiality. The AMA's "Principles of Medical Ethics," a good overview of more recent Ethical guidelines, highlights the challenges in enforcing medical ethics within a network system (AMA 2001). Take, for instance, the AMA's first principle: "A physician shall be dedicated to providing competent medical care, with compassion and respect for human dignity and rights." Many of the ethical guidelines put forward by the AMA relate to personal interactions and decisions, making infractions very difficult to identify and enforce via HealthNet.

Nonetheless, the system ought to strive to provide application developers with ways to prevent and identify unethical misuses of patient data as well as dubious standards of care. These safeguards will raise both professional and individual confidence in the belief that HealthNet will serve them and protect their privacy and, without them, widespread adoption of HealthNet could be severely hampered.

Defining Statements

Issue Topic: Incentives

6

Project: **HealthNet Infrastructure**

Originator: Michael Winnick

Question at Issue

How should the HealthNet system seek to align the various interests of parties in the healthcare system?

Contributors

S. Ruiz

Position

Directive

HealthNet **ought** to enable tools and applications that better align the diverse interests of the many parties that currently participate in the healthcare economy.

Sources

Stewart, K. *Seven Ways to Help Your Hospital Stay in Business*. **Family Practice Management**. American Academy of Family Physicians 10, No. 5 (May 2003): 27-31.

Alternate Positions

Objective

Creating better alignment between the many parties that currently participate in the healthcare economy **should** be beyond scope of HealthNet's mandate.

Background and Arguments

Many of the incentives that motivate parties in the current health care system are set against one another, slowing systemic problem solving, increasing litigiousness, and preventing the realization of cost efficiencies. As Dr. Katherine Stewart notes in an article on how doctor's can help hospitals stay in business, "Under current reimbursement systems, the physician's incentive is to take 'as long as it takes' to get the patient well, while the hospital's incentive is to take care of the patient's acute problem only and get the patient out of the facility as quickly as possible" (Stewart 2003, 07).

This situation is further exacerbated by patients, HMOs and pharmaceutical companies. Patients want effective treatment at a low cost, though their willingness to pay will differ radically with their economic situation. HMOs want patients to pay as much as possible, yet have doctors treat them as cost-effectively as possible. Pharmaceutical companies want to get rewarded for developing new drugs and charge premiums prices for medical advances.

This over-simplified view of today's system shows that many participants have different, contrary objectives particularly regarding costs and financial rewards. These differences are exacerbated by a system that has very high transaction costs. Ignoring these transaction costs would limit one of the key ways that a networked infrastructure can be employed. For instance, HealthNet could play an active role in creating buying cartels or re-allocating tight staff resources across local areas, reducing inefficiencies and bureaucratic costs. Likewise, the system could positively incent healthcare providers that meet high quality standards through either direct cash payments, tax breaks or increased referrals.

Defining Statements

Issue Topic: Location

7

Project: **HealthNet Infrastructure**

Originator: Michael Winnick

Question at Issue

Should HealthNet's infrastructure be deployed on a local, regional or national level?

Contributors

Position

Constraint

HealthNet's infrastructure **must** be deployed on a national basis.

Sources

United Healthcare History. <http://www.unitedhealthcare.com/WhatWorksForYou/>. August,31,2003.

Government Acoounting Office. **Bioterrorism: Information Technology Strategy Could Strengthen Federal Agencies ' Abilities to Respond to Public Health Emergencies**. GAO-03-139,Washington DC: Government Accounting Office, 2003.

Alternate Positions

Objective

HealthNet's infrastructure **should** be nationwide, but **should** be planned and developed with a strong regional emphasis.

Background and Arguments

A good deal of digital infrastructure is national by definition. Much of HealthNet 's digital infrastructure can be immediately available to a wide geographic area through use of the Internet and Internet-based protocols. These technologies ensure that the cost of deploying the system nationally are minimally higher than those of deploying it regionally.

Many HMOs, hospital groups and health-focused corporations span national and even international boundaries. United Healthcare is a great example: "We offer a variety of health care plans and services that reach over 16 million people, from groups ranging in size from 2 to over 5,000 with one and multiple locations. We also serve individuals from the Medicare and Medicaid populations. On behalf of these customers, we arrange access to care with more than 400,000 physicians and 3,300 hospitals. Over 50% of all U.S. hospitals are apart of our networks " (United Healthcare 2003). A national deployment of HealthNet will make the system far more valuable to corporations like United Healthcare and will increase the likelihood of their participation.

The threat of bio-terrorism makes national coordination of emergency response a critical issue. The GAO recently reported that, "In order to enhance American preparedness for public health emergencies —especially those involving bioterrorism ...key stakeholders should develop a strategy that includes setting priorities for IT initiatives and coordinating the development of IT standards for the health care industry " (GAO 2003,2). A nationwide deployment of HealthNet could support improved coordination amongst stakeholder organizations, greatly improving emergency response.

Defining Statements

Issue Topic: Administration

8

Project **HealthNet Infrastructure**

Originator B. Schauer

Question at Issue

How should administrative responsibility for HealthNet be assigned?

Contributors

M. Hamlin
M. Winnick

Position

Objective
Administrative responsibility **should** belong to an appointed group representing a balance of public and private interests.

Sources

Olsson, Anders, et al. **Understanding Telecommunications**. Lund, Sweden: Studentlitteratur AB. 1997

Team deliberation

Alternate Positions

Objective
Administrative responsibility **should** be assigned to an existing governmental agency capable of extending its current administrative framework.

Objective
Administrative responsibility **should** belong to a membership-based consortium, independent of the government.

Background and Arguments

Administration is responsible for carrying out the objectives of HealthNet. Duties for the administration may include enforcement of policy, management of funds, investigation and resolution of issues, and representation of the HealthNet to the public.

Based on these responsibilities, the federal government is one candidate for taking on the administrative responsibilities of HealthNet. For example, The United States Department of Health & Human Services (HHS) has been assigned administrative responsibility for the Health Insurance Portability and Accountability Act (HIPAA). This assignment reflects the origin and benefactors of the initiative—the Federal Government protecting the general public. HealthNet shares a similar relationship between the government and the public. However, for HealthNet the benefactors are more numerous, including patients, healthcare organizations (HCOs), payers, and more. Therefore, a purely governmental administrative body, as a voice of the general public, is only part of the solution.

HealthNet benefits all the participants in the network and depends on their cooperation. This situation is similar to that of the Internet, where a member-driven independent administrative body called the Internet Society (ISOC) is responsible for maintaining standards, expanding architecture, developing operational processes, and promoting accessibility (Olsson 1997, H.2.1). While these are all admirable objectives, none of these require the might of a government to force compliance, something that is requisite for the HealthNet infrastructure.

An ideal administrative body for HealthNet would be a mixed representation of public and private interests to reflect the origin of the initiative and the benefactors as well as providing some authority for enforcing compliance. Because such a mixed administration can become complex and slow, task force teams made up of subject matter experts should be considered for day-to-day administration.

Defining Statements

Issue Topic: Awareness

Project **HealthNet Infrastructure**

Originator B. Schauer

Question at Issue

How should the public be made aware of HealthNet?

Contributors

M. Hamlin
M. Winnick

Position

Objective

Information regarding the rollout and use of HealthNet **should** be both "pushed" to the public via broadcast channels and available to be "pulled" by individuals as needed.

Sources

Team deliberation

Alternate Positions

Objective

Information regarding the rollout and use of HealthNet **should** be delivered to the general public through all available broadcast media, building awareness through repetition and saturation.

Background and Arguments

The majority of the general public should be made aware of HealthNet prior to its use to avoid fear, confusion, or disuse. A level of awareness should be attained where the majority of the general public feels comfortable with the existence of the system, are likely to participate, and recognize key facts regarding the system.

To reach such a massive and diverse population, one might develop a comprehensive broadcast campaign covering a variety of broadcast media targeting various language groups and other demographics. Because the information is relatively complex, many associated informational messages could be delivered to reach the awareness objectives. As the campaign continued, messaging could even adapt to address issues that are less prevalent in the public's awareness. While this approach seems comprehensive, it assumes that awareness and learning can occur whenever and wherever a broadcast message is seen, heard, or read. It ignores the human capacity to ignore, forget, and postpone.

Instead, a broadcast "push" awareness campaign should be balanced with other "pull" channels to allow the general public to build awareness where and when there needs dictate. The broadcast campaign should focus upon messaging what the system is, why it's critical to know about it, and how to find out more. Such messaging moves the burden of more customized and detailed messaging to channels where the public is in control of the timing and quantity of the information. The Web, paper collateral, 1-800 numbers, and "local experts" would all be able to present individuals the critical information about HealthNet when asked. In addition, each of these "pull" channels segue nicely into channels for education, support, and complaints.

Defining Statements

Issue Topic: Implementation

10

Project **HealthNet Infrastructure**

Originator B. Schauer

Question at Issue

What are key considerations for how HealthNet should be implemented?

Contributors

M. Hamlin
M. Winnick

Position

Objective
HealthNet **should** be developed and made available from a central team, with some software components allowing for modification by participants for customized implementation.

Sources

Team deliberation

Alternate Positions

Objective
HealthNet **should** be developed and controlled by a central team.

Objective
HealthNet development **should** be distributed across local resources.

Background and Arguments

Reliability and security are critical to the HealthNet system's implementation. Because the system can determine the difference of life and death for so many people, HealthNet can't be rolled out with critical "bugs" or the security holes found in current Internet and desktop software.

Distributed development is the current implementation model for the internet. On the internet, software can be developed by any person and released. If the software is useful, others will adopt it, thereby benefiting the network of users. This distributed model leads to innovation and rapid advancement; however, it also lacks the control necessary to create a very secure and reliable network.

One approach to ensure a reliable, secure implementation is a centrally coordinated team. In contrast to the Internet, where anyone can create an application or Web service, a central implementation team for HealthNet could assure the quality of the system by maintaining tighter control. This approach appears very solid, but unfortunately, it is also very slow to implement and very slow to innovate. It also offers less flexibility in how the network can be used.

A better alternative would be a central implementation team that implemented high-quality, secure system elements that could be modified by licensed developers. This approach would allow modifications to be made by participants such as healthcare organizations that felt a particular element of the system could be better tailored to their needs. Such an approach to the implementation would create a secure, reliable foundation that still supports widespread innovation and customization.

Defining Statements

Issue Topic: Introduction

Project **HealthNet Infrastructure**

Originator B. Schauer

Question at Issue

When should the system become operational?

Contributors

M. Hamlin
M. Winnick

Position

Directive

The network **ought** to become operational as soon as possible to support healthcare organizations, phasing in other groups of participants as conditions allow.

Sources

Segaller, Stephen. **Nerds 2.0.1: A Brief History of the Internet**. New York: TV Books L.L.C. 1998

Gladwell, Malcolm. **The Tipping Point: How Little Things Can Make a Big Difference**. Boston: Little, Brown, and Company. 2000

Alternate Positions

Objective

The system **should** only become operational after a meaningful sub-set of the targeted groups of participants are prepared to use a robust set of functionality (assumed possible within approximately five years).

Background and Arguments

Successful timing of a network introduction depends on many factors. Sufficiently affordable technology must be available for the creation of reliable infrastructure, standards must be agreed upon, and adequate funding must exist. The participants, or "nodes" of the network, must also be ready. Metcalfe's Law states that the more nodes a network has, the more valuable the network becomes (Segaller 1998, 283). For example, the first fax was useless, but the second fax made it valuable. The third fax doubled the value of the network (Gladwell 2000, 272). A network for healthcare is no different. The aggregation, dissemination, and communication of healthcare data isn't valuable if it only covers one node of a patient's world.

The purpose of HealthNet is life-critical, and the data it carries must be secure. It has a wide range of participants, including health care organizations (HCOs), patients, practicing clinicians, public health agencies, and many others. It could be argued that these factors call for a careful, methodical, and comprehensive approach to the development of a robust network accessible by the many participants. Such a holistic project could take five years or more to become operational.

A suitably valuable network could be available much earlier by focusing on the HCOs. HCOs are starting to embrace the use IT networks to reduce accidents, lower the overhead of paperwork, and become HIPAA complaint. However, many HCOs can't afford these networks, as their IT spending trails far behind other industries. If HealthNet becomes operational as soon as possible, HCOs may realize considerable savings, possibly receive government funding, and become willing participants. The opportunity exists to benefit from greater standardization and less resistance before the HCOs have invested in their own proprietary and incompatible standards. While a network of HCOs may not encompass the world of patient healthcare, it's a critical backbone where the majority of paper-based medical records currently exist. Sharing medical information between just the HCOs will raise the quality of healthcare and lower the cost. The networking of the HCOs will create a foundation for future network expansion, just as the government and universities established the foundation of the Internet.

Defining Statements

Issue Topic: Privacy

Project **HealthNet Infrastructure**

Originator B. Schauer

Question at Issue

What provisions should HealthNet make to address the privacy of patient medical records?

Contributors

M. Hamlin
M. Winnick

Position

Directive

A new level of medical privacy standards **ought** to be inherent in the infrastructure itself, using technologies that protect sensitive information during and even after transmission via HealthNet.

Sources

United States Dept. of Health and Human Services. **Fact Sheet: Protecting the Privacy of Patients' Health Information**. Washington: 2003

Minnesota Hospital Association. **HIPAA Medical Privacy Standards**. St. Paul: 2003.

Team deliberation

Alternate Positions

Constraint

The privacy standards for storage and delivery of information on the infrastructure **must** meet or exceed the standards of comparable industries (e.g., banking). Use of information taken from the infrastructure must conform to the privacy policies and practices of the national and state governments.

Background and Arguments

Information on the healthcare of an individual is both personal and valuable. By introducing an electronic network for transmitting or storing this sensitive information, it is made more secure than paper-based archives handled by hand. However, the privacy risks still increase because of the quantity of information accessible and the challenge of maintaining privacy on any electronic network. The level of privacy that any electronic network affords is determined by the privacy polices and practices applied. Security does not equal privacy.

Today, standards for the privacy of medical records are established by both the federal and state governments to protect information whether it is transferred by electronic, paper, or oral means. These standards support patients with access to their records, limit the usage of the records, prohibit marketing, insist on confidential communications, and make provisions for the handling of complaints (Dept. of Health and Human Services 2003, 1).

Policies and practices for HealthNet could be created so that they adhere to these existing electronic privacy standards as well as incorporating additional successful privacy standards found in comparable industries. While this approach appears robust, the HealthNet will suffer significant privacy risks as long as the standards are external to, or separate from, the infrastructure itself. In addition to risking privacy, it has been shown that separating the privacy procedures from the functions of the infrastructure lead to additional overhead, such as paperwork (Minnesota Hospital Association 2003, 2).

A network ought to integrate privacy standards so that they becomes a part of the structure and functionality. Such a network will enforce the standards by directly applying the procedures and policies where and when the patient medical records are acted upon. In doing this, HealthNet will remove much of the additional overhead introduced by privacy standards, but instead it must make these procedures of privacy evident to the patients and end-users to instill trust in the system.

Defining Statements

Issue Topic: Regulation

Project **HealthNet Infrastructure**

Originator B. Schauer

Question at Issue

How should HealthNet be regulated to assure that objectives are being met?

Contributors

M. Hamlin
M. Winnick

Position

Constraint

A small independent body of regulators **must** be formed to measure HealthNet, enforce its rules, and administer its budget and directives.

Sources

Money to Burn. **The Economist**. <http://economist.com/displaystory.cfm?story_id=S%26%29H%2C%24P%213%25%0A&ppv=1>. December 4, 1997.

Alternate Positions

Objective

Independent regulators **should** evaluate and redirect the processes and practices of the administration.

Background and Arguments

Regulation is necessary to ensure that HealthNet continues to reach its objectives safely, ethically, and effectively. Regulation will require a base set of rules and guidelines and a means to monitor and enforce adherence. Many existing healthcare regulations (e.g., HIPAA) will be inherited by the system, while many new regulatory rules will need to be established. Regulations that focus on the means by which systems and organizations reach their objectives are more proactive. By evaluating the processes and practices, this approach may identify problems before they occur, which is especially important for critical systems. However, this approach also implies tremendous overhead, especially for monitoring such a large and distributed system. Enormous human effort would be required to monitor the people processes and other activities not measurable by automated methods. In addition, regulation of activities can stifle human productivity.

Instead, a smaller body of regulators could use the network itself to aid in measuring how well HealthNet is meeting its objectives. Both quantitative and qualitative measurements could be captured by the system and reviewed by the regulators. Regulators in turn should have the authority to redirect the immediate objectives and budget of administrators or other HealthNet participants who are falling short of the overall objectives. This method focuses on the ends, rather than the means of meeting objectives.

Take for example the emission credits regulations that allows for creative approaches to reaching an overall lower total emission rate (Money to Burn 1997). In the environment as well as healthcare, focusing on the results allows for innovation in the processes and practices, creating greater efficiencies and savings.

Defining Statements

Issue Topic: Technology

Project **HealthNet Infrastructure**

Originator B. Schauer

Question at Issue

What levels of technology should HealthNet expect to employ?

Contributors

M. Hamlin
M. Winnick

Position

Constraint
HealthNet **must** employ adaptable, high- and low-tech approaches for accessing, contributing to, monitoring, and benefiting from the network.

Sources

Blue Cross Blue Shield Association. **What's Behind The Rise: A Comprehensive Analysis of Health Care Costs**. Chicago: Blue Cross Blue Shield, 2002.

Jonietz, Erika. *Medicine*. **Technology Review**. April, 2003: 59-64.

Team deliberation

Alternate Positions

Constraint
A minimal technology benchmark **must** be established for participants in HealthNet to ensure that the benefits of a technological infrastructure are reached in a financially conservative manner.

Background and Arguments

Investment in technology improves the quality, safety, and efficiency of healthcare. "One basic change—using computers to order prescriptions—has reduced medication errors by as much as 80 percent in some hospitals" (Jonietz 2003, 60). However, investing in IT can also have a downside, creating what the BlueCross BlueShield Association (BCBS) calls, "duplicate technology that adds cost without improving the quality of patient care" (BCBS 2002, 1). Clearly, investment in IT is important, but investment in the right IT technologies is even more critical.

One approach to avoiding investment in duplicative or "throw-away" technology is to create a minimal requirements benchmark for network technology to avoid issues that come with the aging equipment and software systems. This approach avoids costly gaps in a network that must be patched by human effort. However, not all of HealthNet's participants will be able to meet such standards and benchmarks, especially the general public.

To address the full range of participants and still receive the benefits of technology, HealthNet should employ a range of high- and low-tech approaches. (High-tech is intended to mean more cutting edge and probably more costly technologies such as broadband communications or data mining; Low-tech implies use of technologies like phone or mail to extend the network to a wider audience.) Standards should be established where necessary, but always sensitive to the means of each participating group.

Defining Statements

Issue Topic: Funding

Project **HealthNet Infrastructure**

Originator Samantha Ruiz

Question at Issue

Who will pay to develop and maintain HealthNet's infrastructure?

Contributors

Michael Winnick

Position

Objective

HealthNet's initial development **should** be underwritten by the federal government. The Infrastructure's overseers should strive to build their own revenue streams so that ongoing development and maintenance can be self-funded.

Sources

Team deliberations

Alternate Positions

Objective

The US government **should** be the primary funder of the HealthNet infrastructure in order to initiate its development and further maintenance.

Objective

Private funds **should** be used source for the development and maintenance of the HealthNet infrastructure to accelerate the development process.

Background and Arguments

HealthNet shares much in common with other infrastructure projects like building roads, power grids and damns. Typically these sorts of projects require government funding because individual participants lack the incentives, resources and means of enforcement to recoup investments in such large projects. Government funding of these projects, thus, becomes a huge benefit and catalyst to those that can benefit from their existence.

HealthNet's initial development should be viewed the same way. By developing the infrastructure for a networked health system, the government can pave the way for private parties and other public institutions to gain great efficiencies and chart new uses. It should be noted that the government has much to directly gain from funding HealthNet. After all, through Medicare, Medicaid and countless other programs the federal government is already funding the current healthcare system.

Once the system is established, it can be designed to build its own revenue streams so that ongoing development and maintenance can be self-funded. Similar to toll roads, HealthNet could automatically charge small transaction fees to participants, using the funds to keep the system itself in healthy, working order.

Defining Statements

Issue Topic: Corporate Participation

Project **HealthNet Infrastructure**

Originator Samantha Ruiz

Question at Issue

What levels of participation should private corporations have in creating HealthNet?

Contributors

Brandon Schauer

Position

Constraint

Private corporations **must** play a prominent role, in collaboration with the public sector, in developing and implementing HealthNet.

Sources

HIMMS Board of Directors. *Position Statement. National Health Information Infrastructure (NHII).* <http://www.himss.org/ASP/indexASP>. 2003.

Morrisey, Jhon. *Across the board.* **Modern Healthcare** v 33, No 13 (March 2003): 10-11.

Alternate Positions

Objective

Private corporations **should** play a supporting, but very limited role in the direction of the HealthNet Infrastructure.

Objective

Private corporations **should** not participate at all in the development of the HealthNet Infrastructure.

Background and Arguments

The current US healthcare system is a mix of government (e.g., Medicare) and private corporations (e.g., HMOs). The proposal of a healthcare information network is not a new one, and private corporations have already begun to vie for a role. For example, organizations like the HIMSS (Healthcare Information Management Systems Society) want to play leadership roles in the effort to create a national health information infrastructure with the goal of connecting health delivery organizations, clinicians, public health professionals and patients. As a consequence of the rapid deployment of technologies, standards, practices, process, laws and regulations necessaries to implement the system, private groups like the HIMSS are proposing collaboration of government and private organizations to carry out the objectives. (HIMMS Board of Directors 2003).

It could be suggested that private corporations do not operate with the general public's best interest at heart and therefore should play a limited, subdominant role to the public sector. However, the success of HealthNet might be seriously challenged if public corporations did not willing contribute. Public organizations like the HHS (U.S. Department of Health and Human Services) and the Department of Defense consider crucial the participation of the private sector in the development of HealthNet (Morrissey 2003, 10). As one example, the leading organizations in this project are promoting corporate participation to solve issues similar to those faced by HealthNet. In this case, like in many others, the input of expert and specialized companies would accelerate the process of development and would make the system more effective.

The complexity and breadth of HealthNet's goals requires that the US government be willing to provide the industry with the opportunity to be part of a consortium or collaboration team in the overall project development. Together public and private sector organizations can move towards the desired goal of increasing the efficiency and improving care.

Project **HealthNet Infrastructure**

Originator Samantha Ruiz

Question at Issue

What role should government play in developing HealthNet's Infrastructure?

Contributors

Brandon Schauer

Position

Constraint

The US government, **must** play a leadership role in the initial development of HealthNet. Once operational, the government's role must diminish, sharing the administrative and regulatory responsibilities with private organizations.

Sources

HIMMS Board of Directors. *Position Statement. National Health Information Infrastructure (NHII)*. <http://www.himss.org/ASP/indexASP>. 2003.

Morrisey, Jhon. *Across the board*. **Modern Healthcare** v 33, No 13 (March 2003): 10-11.

Alternate Positions

Objective

The US government **should** be solely responsible for the development, operation, and oversight of HealthNet.

Objective

The US government **should** have neither a financial, operational, or regulatory role in the HealthNet Infrastructure.

Background and Arguments

US government participation is essential to represent the interest of the general public in the development, operation, and regulation of HealthNet (Morrisey 2003,10). As the main responsible for public health, government would regulate, mandate, and standardize HealthNet infrastructure, as well as persuade the private sector to participate.

The US public will receive great benefit from HealthNet. With the goal of connecting health delivery organizations, clinicians, public health professionals and patients using a network Infrastructure, HealthNet can improve patients' safety and access to health care, reduce medication errors, upgrade existing clinical information, as well as provide quickly access to information in case of a national threat to public health (HIMMS Board of Directors 2003). The US government also stands to gain from HealthNet, as the infrastructure could play a role in lowering the rapidly escalating costs of Medicare and Medicaid programs.

Although government participation would be essential for the project success, it would bring with it a number of challenges. Bureaucratic hurdles and political obstacles could greatly slow the system's adoption, and the infrastructure could be forced to change with political whims. Since one of the goals of HealthNet infrastructure is to make the healthcare system more efficient, it is not recommended for government to take complete control over the whole project.

Although private sector involvement could stop bureaucratic hurdles and political obstacles, the lack of government support to HealthNet infrastructure can turn the system to be an excludable resource, thereby thwarting the goals of improving equitable health care delivery to the nation.

The government must play an active role in initiating HealthNet and establishing momentum to ensure a successful beginning. Creating the right set of regulatory and legal safety nets for the infrastructure. To prevent the bureaucratic and political hurdles that will appear as the system becomes operational, HealthNet must develop an organizational structure that combines government involvement in collaboration with private.

Defining Statements

Issue Topic: Individuals' responsibility

18

Project **HealthNet Infrastructure**

Originator Samantha Ruiz

Question at Issue

How should HealthNet encourage individuals to become more responsible for maintaining their well-being?

Contributors

Matt Hamlin

Position

Constraint

HealthNet **must** supply individuals with the necessary information to encourage them to better educate themselves and become more responsible about their well being.

Sources

Crigger, Bette-Jane. *Foundations of the Code of Ethics*. The Hastings Center. November 2001.

Alternate Positions

Objective

HealthNet **should** supply individuals with the necessary information to improve their well-being but responsibility should lay with individuals to use it.

Background and Arguments

HealthNet must provide patients with information and the ability to make more educated decisions about their health. Although HealthNet will provide patients with information, products and services, that does not mean they will use these tools to improve their health. The lack of education, experience and common sense in some individuals can make it easy for them to misunderstand medical information given, and prevent them from making the best possible decisions. Even though information is available for patients, the lack of more personalized advice regarding HIV/AIDS issues has been the cause of misunderstanding of the disease's transmission risks.

HealthNet must make reasonable efforts to monitor the accuracy of medical information accessed over the network. It is essential for HealthNet to create conditions of trust in order to reach its goal of improving people's health and not doing harm. Readily available information and advice about healthcare related topics would facilitate individual's understanding about their well being and encourage them to take steps towards improvement. HealthNet will make a big improvement in individuals' lives and it will respect the individuality of each patient. As the principle of respect states, "Individuals must be treated as independent decision makers able to make choices about what is most important in living a good life based on their own values" (Crigger 2001).

Defining Statements

Issue Topic: Data

Project **HealthNet Infrastructure**

Originator Matt Hamlin

Question at Issue

What data standards should be established for HealthNet?

Contributors

Charles Owen

Position

Constraint

Standardized formats for key data elements **must** be established and required for all data immediately; less critical data may converted to standard format over time.

Sources

Markle Foundation, <http://www.connectingforhealth.org/news/pressrelease_060503.html> June, 2003

Alternate Positions

Constraint

Standardized formats for all data **must** be established so that all HealthNet users can have reliable, efficient access to information without ambiguity.

Objective

Applications that can search for and retrieve data from a variety of healthcare organizations **should** be incorporated into HealthNet.

Background and Arguments

Unlike the electronically integrated financial services industry, which allows customers to withdraw their money from an ATM machine anywhere in the world, American healthcare organizations still store most of their data on paper. This creates dangerous situations for doctors who need access to important information, and it makes it difficult for patients to move from doctor to doctor. It also puts undue stress on emergency room attendants who need to know quickly the detailed medical histories of their patients (who may be unconscious). A clear improvement would be to move this and other critical information to network-accessible databases. Standardized electronic health records alone would dramatically reduce the almost 100,000 American deaths each year resulting from errors committed in hospitals and medicines mis-prescribed by pharmacists misreading illegible doctors' handwriting.

The value of electronic records is incontrovertible; the question is: how much standardization is required (Markle Foundation 2003)? Standardized data formats would allow healthcare organizations to work together smoothly and rapidly to serve patients' needs and track and combat public health crises. On the other hand, standardized formats require the conversion of data beyond what is simply necessary to move create an information network. They also restrict innovation (intentionally) in the improvment of the overall efficiency of communication. An alternative approach would be to allow open electronic formatting for information, with translation engines to enable different applications to communicate with one another. With this approach, healthcare institutions would be spared the inconvenience of converting to common formats (but with the cost of developing translation processes and some risks inherent in translation errors). Large-scale reformatting of information would be avoided.

A compromise that preserves the best advantages of both approaches is to require for any institution that critical data elements be standardized to format immediately upon joining the net. Non-critical data can be relegated to associated data blocks not standardized for content. These can be converted to standard formats over time as resources permit or left as special data elements if their use is likely to be restricted to the institution itself

Defining Statements

Issue Topic: Education

20

Project: **HealthNet Infrastructure**

Originator: Matt Hamlin

Question at Issue

What education needs to be provided to bring participants in the healthcare industry on board?

Contributors

Position

Constraint

HealthNet **must** anticipate a variety of reactions make sufficient effort to educate the industry so as to suppress any misconceived notions and promote universal acceptance.

Sources

Hay, Joel and Sharon Forrest, Executive Summary of Hospital Costs in the US, 2002, 21-27.

Alternate Positions

Objective

HealthNet **should** initiate a series of dialogues about what HealthNet will mean to industry and how they can prepare to integrate themselves into the network. HealthNet should be responsive to industry concerns but should not compromise the guiding principals as outlined by a charter.

Background and Arguments

At the infrastructure level, HealthNet needs to be concerned with the major business players of the healthcare industry. These organizations have a lot of money, subscribers and political clout. HealthNet will look to them for support once the system is operational and therefore needs to be responsive to their concerns as well as promote universal acceptance amongst their members.

Although electronic connectivity to healthcare has the potential to end the nearly two million mis-prescribed drug events which occur each year in the United States, one might pose the question why hasn't the healthcare industry already taken it upon themselves to build an electronic infrastructure? Much of the reason lies in the industry's demand to see results on their investments in technology. Unfortunately in recent years many hospitals have made costly investments in the wrong technology. An industry-led report from the BlueCross BlueShield Association stated that the most costly drivers of healthcare were due to the adoption of new technology, which weren't necessarily needed, but "consumer demand for the best and latest [encouraged] hospital over-investment in cost-enhancing new technology" (Hay et al. 2002).

If the purpose of HealthNet is to facilitate the exchange of accurate medical data, then the HealthNet administrators will need to educate the healthcare industry about the potential benefits electronic connectivity of healthcare will bring to them. Through greater efficiency, the HealthNet could potentially save healthcare organizations up to $44 billion in reduced medication, radiology, laboratory, and hospitalization expenditures (Hay et al. 2002).

Defining Statements

Issue Topic: Adaptability

Project **HealthNet Infrastructure**

Originator Matt Hamlin

Question at Issue

How will the HealthNet Infrastructure need to be built in order to adapt?

Contributors

Position

Constraint

HealthNet administrators **must** select experts in Open Systems Architecture to develop and build the system.

Sources

Bauer, Jeffery. *Technology and the future of healthcare* <www.superiorconsultant.com/Pressroom/Article> March, 2003

Severns, Michael. *Technology infrastructure: Tomorrow's healthcare delivery* <www.expresshealthcaremgmt.com/20020715/edit3.shtm> June, 2001

Open System Architecture, **Institute for Telecomunnication Sciences** <http://www.its.bldrdoc.gov/fs-1037/dir-025/_3679.htm> October, 2001

Alternate Positions

Directive

HealthNet administrators **ought to** use existing concepts in networking infrastructure to build a system which will be adaptable for future technologies and users.

Background and Arguments

HealthNet must be as adaptable as possible for the technological innovations of the future as well as for the inclusion of more players from the healthcare ecology (e.g., pharmaceutical companies and biotech companies). To reach this goal HealthNet must be built employing technology that affords it the greatest flexibility and makes it easy for developers to have their applications communicate effortlessly and securely across the system. By definition, Open Systems Architecture is any system which has "characteristics that comply with specified, publicly maintained, readily available standards and that therefore can be connected to other systems that comply with these same standards." On an infrastructure level, Open Systems Architecture has added value because developers are able to make improvements or perform maintenance on one layer of a system without impairing the functions of another. For example, a developer could convert "from wire to optical fibers at a physical layer without affecting the data-link layer" (ITS 2001).

Advances in networking technologies will tear down the distance barriers, reducing costs and allowing more patients to be treated by the same amounts of experts. Telemedicine and Telehealth will allow healthcare professionals to conduct long distance medical procedures. E-medicine will provide instant diagnosis. Advances in semantic web networking will yield web searches that produce more accurate information with richer content (Severns 2001).

Although we cannot say for certain which types of technologies will permeate the healthcare organizations of the future or even when they will arrive, we can say for certain that they will be developed and that healthcare will become increasingly dependent on them.

Defining Statements

Issue Topic: Security

22

Project **HealthNet Infrastructure**

Originator Matt Hamlin

Question at Issue

What principals **should** shape the security of HealthNet?

Contributors

Position

Constraint

HealthNet **must** have the utmost protection from physical and electronic disturbances. Sufficient funding must be directed towards building HealthNet's infrastructure as self-dependent and autonomous as possible.

Sources

Salus, Peter H. and John Quarterman. *Disruptions and Emergencies on the Internet* <http://www.sat.quarterman.com/jsq/talks/tprc2002.htm>. September, 2002

Anaova.com *Big increase in e-mail viruses* <http://www.ananova.com/news/story/sm_728153.html> December, 2002

Alternate Positions

Objective

HealthNet **should** appropriate and amplify existing security measures to protect data against electronic and physical disturbances.

Background and Arguments

As each day passes, the Internet is becoming more prevalent in our personal and professional lives. This prevalence has led to a large amount of media coverage documenting and sensationalizing disruptions in Internet service. In recent years service has been disrupted by natural phenomenon such as earthquakes and hurricanes (Northridge, CA and Hurricane Floyd), as well as the cutting of terrestrial and marine cables in Ohio and the China Sea. The Internet is also under constant assault from virus creators exploiting security holes in popular software platforms (Salus, Peter H. and John Quarterman 2002). Continued disruptions to networking traffic is expected to increase. It was recorded that in the year 2000, one in every 790 e-mails sent around the world contained a virus. That ratio jumped to one in every 380 e-mails a year later (Anaova.com 2002). When considering how to protect the HealthNet, these statistics must be thought of in conjunction with what role HealthNet will play in society and how important it will be to its users.

HealthNet will be a critical public service, giving Americans access and control over their Personal Health Records (PHRs). For example, HealthNet will make it easier for emergency room physicians to treat patients in crisis situations, which will in turn save more lives. Once the system becomes active and PHRs are stored electronically to support these crisis situations, disturbances in the system must not be allowed. Backup PHRs will have to be made and alternative methods of getting at the data must be fleshed out, but the HealthNet can not fail once it has become active. For that reason, HealthNet must receive the utmost protection from physical and electronic disturbances.

Defining Statements

Issue Topic: Access

Project **HealthNet Infrastructure**

Originator Matt Hamlin

Question at Issue

What approach should be taken for granting access to data?

Contributors

Brandon Schauer

Position

Constraint
HealthNet **must** grant individuals control over who has access to view and edit their Personal Health Records. However, common sense and medical ethics **must** dictate when healthcare practitioners and organizations can gain access to this data without a patient's consent.

Sources

Markle Foundation, <http://www.connectingforhealth.org/news/pressrelease_060503.html> June, 2003

Alternate Positions

Constraint
A multi-tiered approach **must** be adopted in which individuals have the power to grant limited access to their Personal Health Records beginning with their most direct healthcare provider and subsequently rewarding requests when needed.

Constraint
Individuals **must** have control over who has access to their Personal Health Records. But on a case by case basis, such as an emergency, healthcare practitioners and organizations **must** also be granted the same control. Anonymous data must be made accessible to health care practitioners and organizations.

Background and Arguments

Access to data is one of the most critical issues involved in HealthNet's development. Empowering individuals with control over their health data is both possible and desireable:

> "A survey of Internet users shows that a significant majority of them want the ability to access their medical information on-line, in a private and secure environment. The consumer survey conducted by the Foundation for Accountability (FACCT) showed 70 percent of on-line Americans are interested in the benefits of using one or more aspects of an electronic personal medical record" (Markle Foundation 2003).

HealthNet will give healthcare practitioners and administrators greater speed, flexibility and accuracy in how they communicate with their patients and colleagues. However, along with these advances are privacy concerns to be addressed. If the public does believe that their Personal Health Records are out of reach from unauthorized users they will not adopt and support HealthNet. At the same time common sense must dictate in these matters. In crisis situations, healthcare practitioners must still be granted the same access to healthcare records that they have had in the past. However the efficiency of this new technology should not allow them to forget the ethical rules that they have had to abide by since the days of Hippocrates.

Defining Statements

Issue Topic: Maintenance

24

Project **HealthNet Infrastructure**

Originator Matt Hamlin

Question at Issue

Who should be responsible for maintaining HealthNet?

Contributors

Position

Objective

The core software components of HealthNet **should** be maintained by a centralized team. Maintaince of the nodes linking to this core should be provided by local, private resources.

Sources

Team deliberation

Alternate Positions

Objective

A maintenance plan for HealthNet **should** resemble the same self-supporting plan that has evolved for the Internet.

Background and Arguments

The successful maintenance of HealthNet's software and hardware will be critical to allowing users to effectively use the Network. Because HealthNet will be facilitating the exchange of medical data, which in some cases will determine the difference between life and death, the system cannot be allowed to have its data corrupted or nodes and links disconnected.

A self-supporting distributed maintenance plan is the current implementation model for the Internet. Individuals pay Internet Service Providers (ISPs) for reliable connections to data, ISPs in turn maintain their software and hardware in order to keep their subscribers (individuals) happy. ISPs then must pay Network Providers for the bandwidth their subscribers need in order to access data. And in turn, Network Providers maintain their software and hardware to keep ISPs happy.

Most individuals and organizations will connect to HealthNet via a similar method to how they connect to the Internet. Therefore, one might consider using this same method of maintenance for HealthNet. However, given the critical nature of the data running over HealthNet, a better option is to have the core components of HealthNet—the programming, security keys, privacy guards, trackingsoftware—maintained by a centralized group. By using this approach, users will still be allowed to pick and choose their service providers, promoting competition and innovation while at the same time ensuring that however the nodes and links connect, the data will still be there.

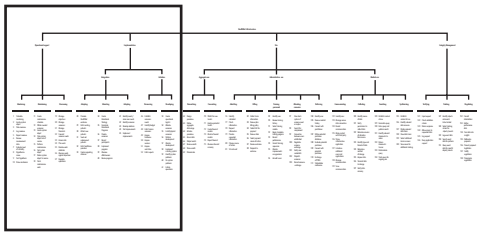
Appendix B

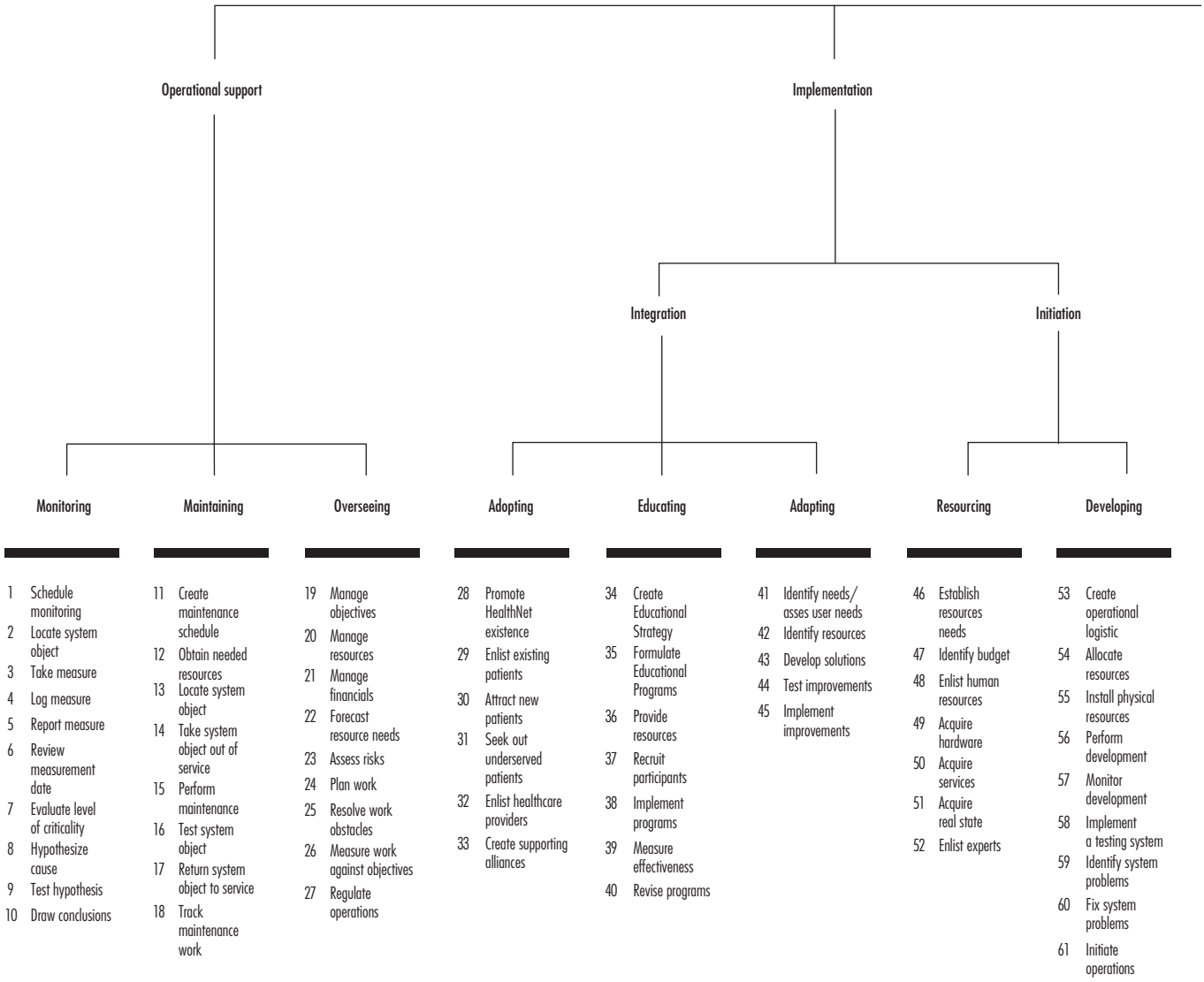
Function Structure

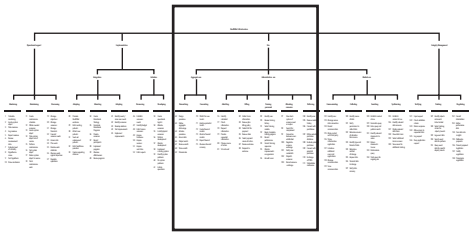
Activity Analysis

Design Factors

Solution Elements




Operational support
Implementation
Integration
Initiation
Monitoring
1 Schedule monitoring
2 Locate system object
3 Take measure
4 Log measure
5 Report measure
6 Review measurement date
7 Evaluate level of criticality
8 Hypothesize cause
9 Test hypothesis
10 Draw conclusions
Maintaining
11 Create maintenance schedule
12 Obtain needed resources
13 Locate system object
14 Take system object out of service
15 Perform maintenance
16 Test system object
17 Return system object to service
18 Track maintenance work
Overseeing
19 Manage objectives
20 Manage resources
21 Manage financials
22 Forecast resource needs
23 Assess risks
24 Plan work
25 Resolve work obstacles
26 Measure work against objectives
27 Regulate operations
Adopting
28 Promote HealthNet existence
29 Enlist existing patients
30 Attract new patients
31 Seek out underserved patients
32 Enlist healthcare providers
33 Create supporting alliances
Educating
34 Create Educational Strategy
35 Formulate Educational Programs
36 Provide resources
37 Recruit participants
38 Implement programs
39 Measure effectiveness
40 Revise programs
Adapting
41 Identify needs/ asses user needs
42 Identify resources
43 Develop solutions
44 Test improvements
45 Implement improvements
Resourcing
46 Establish resources needs
47 Identify budget
48 Enlist human resources
49 Acquire hardware
50 Acquire services
51 Acquire real state
52 Enlist experts
Developing
53 Create operational logistic
54 Allocate resources
55 Install physical resources
56 Perform development
57 Monitor development
58 Implement a testing system
59 Identify system problems
60 Fix system problems
61 Initiate operations



HealthNet

Use

Aggregate use

Administrative use

Researching

62 Design procedure
63 Define aggregate data usage
64 Activate procedure
65 Access data
66 Output results
67 Review results
68 Share results
69 Disseminate

Forecasting

70 Watch for new trends
71 Analyze potential trends
72 Create forecast models
73 Monitor forecast models
74 Report forecast
75 Measure forecast accuracy

Admitting

76 Identify individual
77 Check information
78 Request information
79 Provide requested information
80 Choose course of action
81 Sit and wait

Billing

82 Collect claim information
83 Review plan billing policy
84 Submit bill for payment
85 Review claim
86 Select payment course of action
87 Receive outcome
88 Respond to outcome

Training personnel

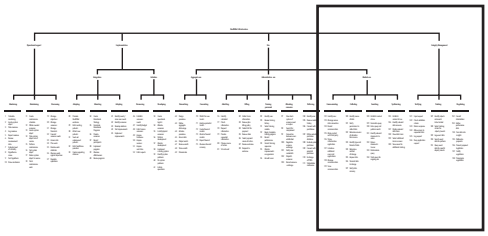
89 Identify user
90 Review training history
91 Select training module
92 Begin/complete training program
93 Record performance
94 Consult training supervisor
95 Monitor improvements or regressions
96 Accredit users

Allocating resources

97 User alerts system of resource need or surplus
98 Search for complement
99 Connection between users established
100 Negotiate resource exchange
101 Verify user credentials
102 Dispatch resources
103 Record resource exchange

Referring

104 Identify user
105 Review medical history
106 Connect with practitioner
107 Utilize potential practioner database
108 Evaluate potential practioner
109 Connect with potential practioner
110 Exchange of PHRs
111 Stakeholder conference



Integrity Management

Medical use

Communicating

- 112 Identify user
- 113 Manage secure data connection
- 114 Record communication
- 115 Make contact with third party
- 116 Share infrastructure application
- 117 Introduce additional users and applications
- 118 Manage communication
- 119 Save communication

Collecting

- 120 Identify source of data
- 121 Verify permissions to collect data
- 122 Determine means of collection from source
- 123 Identify type and format of data
- 124 Determine method of storage
- 125 Acquire data
- 126 Transmit data to storage
- 127 Verify data accuracy

Searching

- 128 Establish context of use
- 129 Formulate query
- 130 Enter query and perform search
- 131 Identify relevant documents to return
- 132 Return documents to user
- 133 Re-formulate query
- 134 Track query for ongoing use

Synthesizing

- 135 Establish context of use
- 136 Identify relevant data universe
- 137 Display relevant data items
- 138 View data items
- 139 Select additional items or views
- 140 Save views for additional tracking

Verifying

- 141 Input request
- 142 Check validation criteria
- 143 Return response
- 144 Allow access to requested data
- 145 Log request
- 146 Deny application request

Tracking

- 147 Identify objects and events to be tracked
- 148 Select tracking criteria for objects/events
- 149 Log event data
- 150 Search event data for patterns
- 151 Query event data for specific objects/events

Regulating

- 152 Consult stakeholders
- 153 Gather performance data
- 154 Turn data into insights
- 155 Deliberate proposals
- 156 Present proposed legislation
- 157 Codify regulations
- 158 Promulgate regulations

Activity Analysis

Activity: Admitting

A11

Project	HealthNet Infrastructure
Mode	Administrative Use
Originator	Michael Winnick
Contributors	Team

Scenario

Patient enters care giving facility and identifies herself for an appointment or to receive service.

Users

Administrative staff
Paramedics
Patients

System Components

Keyboard
Computer application
Forms
Insurance card
Diagnostic tools
Pen

Environmental Components

Workspace
Waiting area
Lighting
Space configuration

Functions

F076 Identify individual
F077 Check information
F078 Request information
F079 Provide requested information
F080 Choose course of action
F081 Sit and wait

Associated Design Factors

Person is unidentifiable
Errors in transcription
Long waits
Patient/Facility mismatch

Version 3 Date: 22-Oct-03	Date of first version: 8-Sep-03

Activity Analysis

Activity: Collecting | **A17**

Project	HealthNet Infrastructure
Mode	Medical use
Originator	Brandon Schauer
Contributors	Team

Scenario
Data from a source is transmitted and stored via the HealthNet infrastructure.

Users
Healthcare professionals
Patients
Healthcare organizations
Administrators
Scientists

System Components
Personal Health Records (PHRs)
Software objects
Communication infrastructure
Storage devices

Environmental Components
Data generation subject
Data generation tool

Functions
F120 Identify source of data
F121 Verify permissions to collect data
F122 Determine means of collection from source
F123 Identify type and format of data
F124 Determine method of storage
F125 Acquire data
F126 Transmit data to storage
F127 Verify data accuracy

Associated Design Factors
Inability to identify source
Inability to gain permissions to collect
Unknown data types
Availability of storage
Long session times
Failure to collect accurate data

Design Factor	**Title: Can't monitor everything**	**D01**

Project	HealthNet Infrastructure	Sources Personal observation	Associated functions F001. Schedule monitoring F002. Locate system object F003. Take measure F004. Log measure F005. Report measure
Mode	System support		
Activity	Monitoring		
Originator	Brandon Schauer		
Contributors			

Observation
Because of the volume of hardware and software that makes up HealthNet, not every object in the system can be monitored.

Extension
A network and its nodes are a compilation of a humungous quantity of hardware and software objects. Each of these system objects could potentially fail, creating a mere nuisance or a major service outage. However, monitoring such a large quantity of system objects is impossible. First, the number of sensors and quantity of data that would have to be collected would be prohibitively large. Second, the observation and analysis of such a huge quantity of monitoring data would be prohibitively costly, if not impossible.

Design Strategies
Selectively monitor system objects

Solution Elements
Speculative S122 MoniTier

Version 1 Date: 12-Oct-03	Date of first version: 12-Oct-03

Design Factor

Title: Quantity and complexity of data | **D02**

Project	HealthNet Infrastructure
Mode	System support
Activity	Monitoring
Originator	Brandon Schauer
Contributors	Michael Winnick Matt Hamlin

Sources
Personal observation

Associated functions
F006. Review measurement data

Observation
Because so much measurement data will exist, monitoring of measurement data will require tremendous effort.

Extension
The typical approach to monitoring networks is to wait for failure. While this approach may be fine for non-critical systems, a life-and-death infrastructure like HealthNet should be constantly monitored to avoid service outages.

Constant monitoring presents many problems. A single measurement may be simple to review, but when multiplied by the number of system objects to be monitored on HealthNet, the quantity of data to be reviewed could be staggering. Many human observers would be required to review the measurement data, creating a significant cost of time and money. In addition, human observation of the qualitative data is bound to lead to mis-readings and oversights.

Design Strategies
Summarize measurement data
Replace human observation

Solution Elements

Modified	S119	Multi-Measure Visualizer
Speculative	S120	Effecting Data Analyzer
Modified	S121	HealthNOC

Version 2 Date: 12-Oct-03 | Date of first version: 15-Sep-03

Design Factor

Title: Quantity of maintenance tasks | **D03**

Project	HealthNet Infrastructure
Mode	System support
Activity	Maintaining
Originator	Brandon Schauer
Contributors	Michael Winnick Matt Hamlin

Sources

Kephart, Jeffery and David Chess. *The Vision of Autonomic Computing*. **Computer**, 2003: 41-50

Horn, Paul. *Autonomic Computing: IBM's Perspective on the State of Information Technology*. **IBM**. October, 2001

Associated functions

F011. Review maintenance schedule
F015. Perform maintenance

Observation

A network has many complex parts and therefore is bound to have numerous maintenance tasks, creating a backlog of work for a limited supply of human technicians.

Extension

Computer systems continue to grow and increase in complexity. HealthNet is no different. It will be larger than a single computer environment, crossing across many different corporations, organizations, and end user systems. Along with this breadth of coverage comes complexity. For example, with the comparatively similar Internet network, there "has come increasingly sophisticated architectures governed by software whose complexity now routinely demands tens of millions of lines of code" (Horn 2001, 2). Complexity continues to grow with innovation and maturity of such networks.

Given the size and complexity of the system, developers will not be able to anticipate use and interaction between all components, "leaving such issues to be dealt with at run time" (Kephart 2003, 41). Normal wear and tear of hardware objects and the runtime issues will create an enormous quantity of maintenance task requiring significant financial resources to keep the system running.

Design Strategies

Avoid or reduce frequency of maintenance

Automate maintenance tasks

Solution Elements

Speculative	S128	Auto-Updater
Speculative	S127	Predictive Hardware Mortician
Speculative	S126	Self-Diagnosing Systems

Version 4 Date: 12-Oct-03 | Date of first version: 15-Sep-03

Design Factor

Title: Locating object in need of repair

D04

Project	HealthNet Infrastructure
Mode	System support
Activity	Maintaining
Originator	Brandon Schauer
Contributors	Michael Winnick Matt Hamlin

Sources
Personal observation

Associated functions
F013. Locate system object

Observation
Locating a system object in disrepair within a large, distributed network presents significant and costly challenges.

Extension
For a human to repair a system object, the object must first be identified and located. Locating system objects can be very difficult because of their similarity to many other similar objects (i.e., software objects) or because of the geographical range in which they could reside (i.e., hardware objects). This problem increases in complexity if the system object is in need of repair, because the object my be non-functioning and cannot aid in identifying and locating itself. Distributed systems also add to the challenge because they are designed to re-route around existing problems, thereby hiding the problems from administrators.

Design Strategies	Solution Elements		
Look for the system object's "shadow"	Speculative	S130	Hardware SOS
Track system object locations	Speculative	S129	Object Directory
Roam the network to locate system objects in need of repair	Speculative	S131	Repair Detective

Version 4 Date: 12-Oct-03

Date of first version: 15-Sep-03

Design Factor

Title: Downtime for maintenance | **D05**

Project	HealthNet Infrastructure
Mode	System support
Activity	Maintaining
Originator	Brandon Schauer
Contributors	Michael Winnick Matt Hamlin

Sources
Fox, Armando and David Patterson. *Self-Repairing Computers*. **Scientific American**. May 12, 2003

Associated functions
F014. Take system object out of service

Observation
Removing a system object from service to perform maintenance may result in downtime of some system operations.

Extension
Performing maintenance on a system object may require maintenance technicians to remove it from service, resulting in downtime of one or more system services. Hardware objects must be removed from service to replace components (e.g., a failed storage drive) or repair components. Repair of software objects often requires a reboot of the related system to wipe the slate clean and properly initiate the repaired software.

In most cases, the maintenance of hardware objects or the reboot of a system can cause significant downtime for services. One advantage in maintenance downtime versus repair downtime is that maintenance downtime can often be schedule for the least disruptive time and be announced to those affected prior to the scheduled maintenance.

Design Strategies
Prevent reliance on a single system object
Perform maintenance when system object isn't needed

Solution Elements

Existing	S124	HotSpares
Speculative	S125	Maintenance Recorder
Speculative	S123	Compartmentalized Reboots

Version 4 Date: 12-Oct-03 | Date of first version: 15-Sep-03

Design Factor

Title: Reactive management practices

D06

Project	HealthNet Infrastructure
Mode	System support
Activity	Overseeing
Originator	Brandon Schauer
Contributors	Michael Winnick Matt Hamlin

Sources

Eisenhardt, Kathleen M. *Speed and Strategic Choice: How Managers Accelerate Decision Making*. **California Management Review**. Spring 1990

Associated functions

F019. Manage objectives
F020. Manage resources
F021. Manage financials

Observation

Management activities may lag behind actual conditions because the applied management techniques are reactive to the current state rather than predictive of future states.

Extension

The practice of healthcare has always kept a focus on the current state. It's a natural outgrowth of the caretaker's role—assessing the patient's current situation and adapting the treatment to address it. However, such a practice is not appropriate for the oversight of HealthNet.

HealthNet oversight requires anticipation of problems. Luckily, the habit of assessing the current situation is a good starting point for doing so. Managers that track real time information are better able to spot potential problems or opportunities for improvement. "Real time information acts as an early warning system so that managers can respond before situations become too problematic."(Eisenhardt 1990) This challenge lies in helping managers use the real time information to anticipate future issues.

Design Strategies

Displace need to focus on current state

Enhance predictive skills

Solution Elements

Speculative	S134	Anticipation Scorecard
Speculative	S135	What-if Modeler
Speculative	S136	Rational Decision Supporter

Version 3 Date: 12-Oct-03

Date of first version: 15-Sep-03

Design Factor

Title: Lack of visibility into work

D07

Project	HealthNet Infrastructure
Mode	System support
Activity	Overseeing
Originator	Brandon Schauer
Contributors	Michael Winnick Matt Hamlin

Sources
Personal observation

Associated functions
F022. Forecast resource needs
F023. Assess risks
F025. Resolve work obstacles

Observation
Management is unable to easily monitor work, resulting in an inability to foresee obstacles or cultivate innovative ideas.

Extension
A national network requires managers to oversee staff spread across a wide geographic range. Obviously, management will not be able to be present at all places at once, therefore their visibility into the staff's work is greatly compromised. Without visibility, it is both difficult for management to recognize reoccurring issues or foresee approaching obstacles. The management simply lacks the "ground-level" experiences to have this depth of understand. In addition, management is unable to recognize innovations and ideas developed by one staff member so that they can be shared with other staff members, thereby raising the productivity of the entire staff.

Design Strategies	Solution Elements		
Increase visibility into work	Speculative	S132	Blackstar/Goldstar
Improve communication practices of managers and staff	Speculative	S133	Productivity Tracker

Version 3 Date: 12-Oct-03

Date of first version: 15-Sep-03

Design Factor

Title: Difficulty in measuring objectives

D08

Project	HealthNet Infrastructure
Mode	System support
Activity	Overseeing
Originator	Brandon Schauer
Contributors	Michael Winnick

Sources

Hotler, Dave. *21st Century Management And The Quest For Excellence: Is There Anything New Under The Sun?* **Supervision**. Burlington: Oct 2002. p. 3-7

Associated functions

F026. Measure work against objectives

Observation

Management will have difficulties achieving objectives that are vague and not measurable.

Extension

To have meaningful impact, objectives must be measurable, meaningful, and achievable. "There must be a way to reflect progress. The old adage is true. 'You can only manage what you measure'" (Hotler 2002). Measurable objectives provide managers with a means by which to judiciously adapt the application of resources and knowledge.

Design Strategies

Define measurable objectives

Devise means of measurement

Solution Elements

Speculative	S137	Objective Ledger
Speculative	S138	Quantitator

Version 3 Date: 12-Oct-03

Date of first version: 15-Sep-03

Design Factor

Title: Providers are not attracted to join HealthNet

D09

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Adopting
Originator	Samantha Ruiz
Contributors	Matt Hamlin Brandon Schauer

Sources
Personal observation

Associated functions
031 Promote HealthNet existence
035 Enlist healthcare providers
036 Create supporting alliances

Observation
Because adopting HealthNet will require an initial capital investment, healthcare providers might not be attracted to its long-term benefits.

Extension
Healthcare providers will be required to make large initial investments in capital and human resources in order to make their systems compatible with HealthNet. Such investments, may be adverse to certain providers, who have in the past, invested in technology only to see worthless return on investment. In addition to the financial capital necessary to make their IT departments compatible, healthcare providers will also have to spend capital on training, organizing and coordinating staff during the adoption process. These activities will not allow them to complete their regular duties, thus reducing the organization's productivity. For a successful completion of the implementation phase, HealthNet must provide attractive alternatives to get healthcare providers to "buy into" the network.

Design Strategies
Attract providers
Reduce misperceptions
Increase stakeholder base

Solution Elements

Modified	S083	Financial Incentives
Speculative	S082	HealthNet Demo Tours
Speculative	S084	Collaborative Planning

Version 2 Date: 12-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Unable to reach some population segments | **D10**

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Adopting
Originator	Samantha Ruiz
Contributors	Matt Hamlin Brandon Schauer

Sources

Media Campaigns. **Divisions of HIV/AIDS Prevention**. <http://www.cdc.gov/hiv/media.htm> 2003

Associated functions

031 Promote HealthNet existence
032 Enlist existing patients
033 Attract new patients
034 Seek out underserved patients

Observation

Because HealthNet users are spread widely across the socio-economic scale, It may be difficult to notify key population segments - such as those in poverty or non-english speakers- about HealthNet's existence or benefits.

Extension

Being culturally sensitive to the target audience is a critical component in the production a successful communication campaign. If the target audience's language, behaviors and perceptions are not thought of during the development of such a campaign, the communication materials will not resonate and become lost amongst the noise. As an example, underserved population or non-english speakers do not respond to the same communication strategies as high-educated professionals.

The HIV/AIDS Directorate has faced this problem running a number of national communication campaigns. To overcome this problem, specific targets are identified and information about HIV/AIDS is communicated through different campaigns. These campaigns targeted"Woman and HIV/AIDS", "HIV/AIDS at work"," Family and HIV/AIDS" and youth oriented campaigns (Media Campaigns. Divisions of HIV/AIDS Prevention, 2003).

Design Strategies

Provide a wealth of information

Represent a variety of cultures

Solution Elements

Modified	S090	Target specific campaigns
Speculative	S088	In-your Community Modules
Modified	S089	Community Leaders

Version 2 Date: 12-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Community's lack of concern | **D11**

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Adopting
Originator	Samantha Ruiz
Contributors	Matt Hamlin Brandon Schauer

Sources

Gavin, Kara. *U-M study finds patients and physicians encourage e-mail use*. **The University Record**, October 25, 1999

Associated functions

031 Promote HealthNet existence
032 Enlist existing patients
033 Attract new patients
034 Seek out underserved patients
035 Enlist healthcare providers
036 Create supporting alliances

Observation

Individual adoption of HealthNet could be slowed by people's adherence to old habits and routines.

Extension

People's daily routines, combined with their background and level of education may make them incapable or uninterested in using HealthNet to manage their wellbeing and track their personal health records. If these individuals are not encouraged to adopt the system, they will continue to manage their health the way they always have, wasting the potential of how HealthNet can change their lives.

E-mail is one example of a community's resistance to change for the better. A recent survey by researchers at the Health System organization has found that although 40 percent of general medicine clinic patients regularly use e-mail, only 14 percent of them have used it to communicate with their doctors. About 70 percent of those surveyed (both e-mail users and non-users) said they would like to communicate with their health care provider via e-mail. In fact, individuals are willing to apply technology to their healthcare, but the ways are not still standardized. (Gavin, 1999).

Design Strategies

Provide incentives

Direct patient outreach

Solution Elements

Modified	S087	Check up! Mobile unit
Speculative	S085	Prescription discount card
Speculative	S086	Wellness center enabler

Version 2 Date: 12-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Unable to contact certain healthcare providers | **D12**

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Educating
Originator	Samantha Ruiz
Contributors	Matt Hamlin Brandon Schauer

Sources
Personal observation

Associated functions
037 Create educational strategy
039 Provide resources
040 Recruit participants

Observation
Because there are so many participants and they are so spread out geographically, contacting them all will be a challenging process.

Extension
Contacting, recruiting, and coordinating potential participants can be a time-consuming, expensive and difficult task to accomplish. Because this process deals with large amounts of information, it can be prone to human errors and inefficiency if there is a lack of technology applied to it.

Because there are so many participants and they are so spread out geographically, contacting them all will be a challenging process. Special strategies will have to be implemented to contact those that are not registered in the system.

Design Strategies
Provide contacting technologies
Outreach to new participants

Solution Elements

Speculative	S091	Quick-Contact System
Speculative	S093	Certification Net
Speculative	S092	Providers' Kiosk

Version 2 Date: 12-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Failure to measure effectiveness in educational programs | **D13**

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Educating
Originator	Samantha Ruiz
Contributors	Matt Hamlin Brandon Schauer

Sources

Gielecki, Mark; Mayes, Fred and Prete Lawrence. *Incentives, Mandates, and Government Programs for Promoting Renewables*. <http://www.eia.doe.gov/cneaf/solar.renewables/rea_issues/incent.html> February, 2001

Associated functions

037 Create educational strategy
038 Formulate educational programs
039 Provide resources
041 Implement programs
042 Measure effectiveness
043 Revise programs

Observation

Because the process of measuring educational programs can be subjective, determining effectiveness may be difficult.

Extension

The process of measuring educational programs for effectiveness can be hindered by a lack of time, effort and experience by the team in charge. If a good approach is not used, the analysis and interpretation of the results becomes a task difficult to accomplish. In addition, the lack of standardized protocols to collect data may lead to uncertain results.

To assess program performance, it is essential to track, measure and explain the determinants of key performance indicators. Consequently, the Government Performance and Results Act of 1993 requires federal agencies to measure the effectiveness of their programs (Gielecki, Mayes and Lawrence, 2001).

Design Strategies

Incorporate more efficient measuring tools

Solution Elements

Speculative	S094	EdUsage Benchmarker
Modified	S095	Providers Staisfaction Survey

Version 2 Date: 12-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Insufficient Participant Response

D14

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Educating
Originator	Samantha Ruiz
Contributors	Matt Hamlin Brandon Schauer

Sources
Personal observation

Associated functions
037 Create educational strategy
038 Formulate educational programs
039 Provide resources
041 Recruit participants

Observation
There will be an unenthusiastic response to HealthNet's educational programs if they are not convenient for staff to access.

Extension
Convenience is a big issue for healthcare providers. Accessibility becomes important when the intensity in which these institutions or organizations operate prevents them from sacrificing their time and effort on what may be perceived as unnecessary activities. Sometimes, the lack of accessible locations or alternative ways to participate in educational sessions may be crucial in determining their interest and response toward educational programs. In the same way, high costs and poor content in the programs offered would lead to low participation.
Location, alternative educational methods, resources and qualified material are some of the key factors determining the successful response of healthcare providers to educational programs.

Design Strategies
Provide alternative educational methods
Provide educational resources

Solution Elements

Speculative	S097	HealthNet Integrated Learning Portal
Speculative	S096	Onsite Smart Classrooms
Modified	S098	Learning Center

Version 2 Date: 12-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Poor technology incorporation

D15

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Adapting
Originator	Samantha Ruiz
Contributors	

Sources
Center of Excellence for Information Technology at NASA-Ames. <http://www.arc.nasa.gov/coe/index.html>

Associated functions
044 Identify needs
045 Identify resources
046 Develop solutions
048 Implement improvments

Observation
HealthNet developers may fail to incorporate the most appropiate technology into the system.

Extension
In order to better adapt HealthNet to specific needs, it is necessary to find the best way to incorporate technology to possible solutions. Failure to accomplish this task may lead to malfunctioning and inefficiency in the system. Inefficient methods to find and maintain relationships with technology may lead to technological isolation. That is, HealthNet may not explore new ways to approach problems.

If inappropiate technology resources are employed, the resulting adaptation may be inaccurate, wasting time and funds. As an example, coordination in the identification and selection of appropiate technology has been successfully achieved by institutions like NASA, avoiding technological isolation (Center of Excellence for Information Technology).

Design Strategies
Provide specialized technology information
Replace obsolete components

Solution Elements

Modified	S106	T&R Smart Database
Modified	S105	Center for Excellence
Speculative	S104	Planned Obsolescence

Version 2 Date: 12-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Proposed solutions may fail | **D16**

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Adapting
Originator	Samantha Ruiz
Contributors	

Sources
Personal observation

Associated functions
046 Develop solutions
047 Test improvements
048 Implement improvements

Observation
Developed solution approaches may not fullfill requirements.

Extension
Failure to develop effective solution approaches may rise from the methods used during the development process. If ideas about possible solutions are developed without clearly identifying the needs, the problem may be misunderstood and as a consequence, the solutions may not be the most appropriate. In addition, many innovative approaches fail due to hurdles created by interdisciplinary teams and the related communication difficulties. Strong problem-solving skills are essential to the successful development of solutions approaches. Without these skills solution approaches are handicaped by unpredictable results.

Design Strategies
Develop testing technology
Request advice

Solution Elements

Speculative	S101	Viability Determination Computer Aid System
Modified	S100	Realty Simulator
Modified	S099	Round Table Review

Version 2 Date: 13-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Lack of regulation and standardization | **D17**

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Adapting
Originator	Samantha Ruiz
Contributors	

Sources
Personal observation

Associated functions
046 Develop solutions
047 Test improvements
048 Implement improvements

Observation
A lack of regularization and standardization of HealthNet components will increase the likeliness of errors in the system.

Extension
When developing solutions that incorporate multiple technologies, errors may be produced as a consequence of the lack of compatibility. of the technologies or products. When detected, compatibility errors delay the development process wasting funds, time and effort. As an example, the lack of standardized procedures has been a major issue in some technology research centers where simple differences in measuring systems produced huge errors.

Failure to meet regulation and stadardization requirements may cause projects to be rejected by private and government institutions that are required to regulate their products and services according to established rules, laws, principles or systems.

Design Strategies
Apply standards and regulations

Solution Elements

Speculative	S102	Instant Foundation
Speculative	S103	Re-use Library

Version 2 Date: 13-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Human resources do not satisfy needs | **D18**

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Resourcing
Originator	Samantha Ruiz
Contributors	Brandon Schauer

Sources
Personal observation

Associated functions
049 Establish resource needs
051 Enlist human resources
055 Enlist experts

Observation
Human resources may not be qualified to perform the tasks required of them.

Extension
Projects are assigned to individuals with the expectations of valuable and efficient results. Sometimes, individuals may fail to perform tasks assigned to them. They may lack the capability and qualifications to perform or solve complicated issues. Individuals' lack of experience or knowledge may lead to misse deadlines and incomplete projects.

The process of finding individuals with requisite skills from a mass of applicants can be tedious and fraught with mistakes. If resumes are not well analyzed, the possibility of hiring individuals that are not capable to perform specific tasks will increase.

Design Strategies
Recruting process support

Solution Elements
Modified S107 Applicant Tracking System

Version 2 Date: 12-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Lack of resources in isolated communities | **D19**

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Resourcing
Originator	Samantha Ruiz
Contributors	Brandon Schauer

Sources
Emily Rosenoff. Center for California Health Workforce Studies, UCSF Center for the Health Professions. <http://www.futurehealth.ucsf.edu/from_the_director_0501.html>

Associated functions
049 Establish resource needs
051 Enlist human resources
052 Acquire hardware
053 Acquire services
054 Acquire real estate
055 Enlist experts

Observation
Because of geographical barriers, some communities are not provided with the same facilities and resources as urban centers.

Extension
The process of acquiring the necessary resources for HealthNet implementation may be hindered when dealing with isolated and rural communities. These communities are not provided with the same facilities and resources as urban centers. Sometimes they are restrained by their low economic income, lack of communication systems and inaccessibility to urban centers. As an example, research by the Center for Health Professionals at the University of California in San Francisco has shown that the general health of rural residents is significantly lower than that of the urban population. This is due to the fact that healthcare services lack the building management facilities, management systems and information systems. As a consequence of a similar lack of supporting resources, Healthnet may fail to perform effectively in isolated areas (Rosenoff).

Design Strategies
Identify resource shortages
Provide community facilities
Provide community incentives

Solution Elements

Speculative	S108	Smart Inventory
Modified	S109	Tech Resource Finder
Modified	S110	Northern Exposure

Version 2 Date: 12-Oct-03 | Date of first version: 16-Sep-03

Design Factor

Title: Technical problems will arise | **D20**

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Developing
Originator	Samantha Ruiz
Contributors	Brandon Schauer

Sources
Personal observation

Associated functions
059 Perform development
060 Monitor development
062 Identify system problems
063 Fix system problems
064 Initiate operations

Observation
Because HealthNet implementation involves the development of new information technologies, technical challenges will arise during the process.

Extension
The implementation of a new system that involves the launching of new technologies always brings with it technical problems. When launching HealthNet, technical problems regarding software, hardware and engineering may create barriers to completition or short-comings in system functionality. If all these problems are not correctly resolved, HeathNet performance may not meet requirments.

Design Strategies
Provide technological support
Request technological advice

Solution Elements

Modified	S118	Tech-Helper
Modified	S117	ITS Network
Speculative	S116	Beyond HealthNet

Version 2 Date: 13-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Unable to meet deadlines

D21

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Developing
Originator	Samantha Ruiz
Contributors	Brandon Schauer

Sources
Personal observation

Associated functions
064 Initiate operations

Observation
When dealing with a complex project that involve the participation and coordination of many people for its development, making a deadline becomes challenging.

Extension
HealthNet's development process may be hindered if the working teams involved are not able to make the established deadlines. When dealing with a multi disciplinary team, the process of coordinating team members becomes a difficult task. Sometimes teams members do not coordinate with each other and do not respect the established deadlines. As a consequence of this, they may delay other teams' work and impact motivation. If they are not encouraged to work efficiently, the progress of HealthNet's development process may become complex and difficult to accomplish.

Design Strategies
Organize the process
Provide deadline incentives

Solution Elements

Speculative	S113	Daily Monitory System
Speculative	S114	Smart Agenda
Speculative	S115	Objective Incentivizer

Version 2 Date: 12-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Lack of Funds

D22

Project	HealthNet Infrastructure
Mode	Implementation
Activity	Developing
Originator	Samantha Ruiz
Contributors	Brandon Schauer

Sources
Personal observation

Associated functions
049 Establish resource needs
051 Enlist human resources
052 Acquire hardware
053 Acquire services
054 Acquire real estate
055 Enlist experts

Observation
Because external factors effect HealthNet's development, the initial HealthNet budget may be insufficient to complete development.

Extension
HealthNet's development process may be hindered by the lack of funds available to support it. Funds often become insufficient when dealing with complex projects in which funding depends on different sources. An increase in the original projected costs, the prioritization of other projects and changes in policies are some of the key indicators of insufficient funds. In addition, when dealing with government, funding can become unpredictable since it depends on governmental policies.

Design Strategies
Generate funds

Solution Elements

Modified	S112	MicroTransaction Fees
Modified	S111	Aggregate Data Access Fees

Version 2 Date: 13-Oct-03

Date of first version: 16-Sep-03

Design Factor

Title: Data privacy

D23

Project	HealthNet Infrastructure
Mode	Aggregate use
Activity	Researching
Originator	Brandon Schauer
Contributors	Michael Winnick

Sources

Agrawal, Rakesh and Ramakrishnan Srikant. *Privacy-Preserving Data Mining*. <http://www.almaden.ibm.com/software/quest/Publications/papers/sigmod00_privacy.pdf> May 9, 2000

Associated functions

F074. Access data

Observation

It may be difficult to protect the privacy of individuals while sharing their data.

Extension

The purpose of accessing aggregate data is to create representations of the distribution of broad population. While this end result is for the public good and does not threaten individual privacy, the method of sampling individual data records to reach this end does threaten privacy. HealthNet must protect the privacy of individual data records while not hampering the benefits of researching the aggregated data.

Design Strategies	Solution Elements		
Separate identity from data	Speculative	S072	Headless PHRs
Mask private or identity-related data	Speculative	S073	Value Distortion
Give control to data owner	Speculative	S074	Aggcess

Version 3 Date: 12-Oct-03

Date of first version: 15-Sep-03

Design Factor

Title: Too much aggregate data

D24

Project	HealthNet Infrastructure
Mode	Aggregate use
Activity	Researching
Originator	Brandon Schauer
Contributors	Michael Winnick

Sources
Personal observation

Associated functions
F074. Access data
F075. Output results

Observation
Aggregating data for research will result in significant data storage challenges.

Extension
To perform research using the wide range of data available via HealthNet, the applicable data must be gathered so that it can be compiled for analysis. Gathering and storing such a potentially large amount of data would require significant time and resources, reducing the scope of research or the number of research projects that could be performed.

Design Strategies
Distribute the data storage and calculation

Solution Elements

Modified	S075	MedGrid
Speculative	S076	LoCalc

Version 3 Date: 12-Oct-03

Date of first version: 10-Oct-03

Design Factor

Title: Quantity of trends identified | **D25**

Project	HealthNet Infrastructure
Mode	Aggregate use
Activity	Forecasting
Originator	Brandon Schauer
Contributors	Michael Winnick

Sources
Personal observation

Associated functions
F080. Analyze potential new trends

Observation
System-performed analysis of data may generate an enormous set of potential trends that will require costly and time-consuming analysis.

Extension
A number of potential trends can be generated through data mining and other computer-based methods. Trends are sought by looking for related data that show some resemblance of a pattern. Such a technique of "sifting" for trends could uncover critical trends before they are otherwise noted (e.g., the relationship between a particular course of drugs, a prior patient condition, and a patient outcome). While the potential value of finding such trends could be very high, the cost of reviewing and analyzing each potential trend found by a computer-based method could be enormous.

Design Strategies	Solution Elements		
Prioritize most sever trends	Speculative	S079	SeveritySifter
Prioritize unusual cases	Speculative	S080	Cross-Trend Correlator
	Speculative	S081	TrendBreaker

Version 3 Date: 12-Oct-03 | Date of first version: 15-Sep-03

Design Factor

Title: Difficult to present trend data

D26

Project	HealthNet Infrastructure
Mode	Aggregate use
Activity	Forecasting
Originator	Brandon Schauer
Contributors	

Sources
Tufte, Edward R. **The Visual Display of Quantitative Information**. Cheshire, CT: Graphics Press 1983

Associated functions
F080. Analyze potential new trends
F081. Create forecast models
F082. Monitor forecast models
F083. Report forecast

Observation
Presentation of trend data is difficult due to the complexities of representing the variable of time.

Extension
Trends are constructed by connecting multiple data points that imply a pattern. In the case of forecasts, the data points are mapped across time to forecast the future by extrapolating the pattern. "The problem with time-series is that the simple passage of time is note a good explanatory variable: descriptive chronology is not causal explanation" (Tufte 1983, p. 37). In other words, the presentation of trend data may present future patterns, but they do little to help the viewer understand the causes.

Design Strategies	Solution Elements		
Backtrack the causes of patterns	Speculative	S077	Forecast Portfolio
Present forecasts as opportunities to improve	Speculative	S078	PastCast

Version 3 Date: 12-Oct-03

Date of first version: 7-Oct-03

Design Factor

Title: Errors in transcription

D27

Project	HealthNet Infrastructure
Mode	Administrative Use
Activity	Admitting
Originator	Michael Winnick
Contributors	

Sources
Personal observation

Associated functions
077. Check information
078. Request information
079. Provide requested information

Observation
Transcription, the process of copying data from written forms to computerized forms, often leads to high error rates.

Extension
Transcription, the process of copying data from written forms to computerized forms, often leads to high error rates. These inaccuracies can become part of a patients medical record and can be utilized at some later date to make an inaccurate diagnosis. The incidence of error is compounded by the fact that individuals repeatedly fill out new information on paper forms whenever they see a new doctor or go to a new hospital.

Design Strategies
Automatic error detection and repair
Double-verification of odd entries
Reduce data entry

Solution Elements

Speculative	S047	Elegant Error
Speculative	S045	Validata
Speculative	S046	Double Check
Speculative	S039	Smart ID

Version 3 Date: 24-Sep-03

Date of first version: 10-Sep-03

Design Factor

Title: Long waits

D28

Project	HealthNet Infrastructure
Mode	Administrative Use
Activity	Admitting
Originator	Michael Winnick
Contributors	

Sources

Preserving America's Health Care safety Net: An Imperative for us all. **American College for Emergency Physicians**. Washington DC, 2000

ERs advertising for patients. **Cnn.com**. <http://www.cnn.com/2002/HEALTH/08/09/gupta.er.ads.otsc/> August, 2002

Associated functions

081. Sit and wait

Observation

Wait times at doctor's offices and hospitals can be extremely long, and overcrowding can lead to lower quality care.

Extension

The average wait time in ERs across the country is about 60 minutes; 103 million people visit emergency rooms every year, and most of the people are between 4:00 p.m. and 8:00 p.m. (CNN, 2002). Wait times can be much wore at busy ERs during peak hours. At Cook County hospital in Chicago, for instance, average wait times are in the neighborhood of 3 to 4 hours. As the American Council of Emergency Medicine reports, "Although the number of hospitals with emergency departments declined from 5,210 to 4,740 between 1988 and 1996, over the same period the number of emergency visits grew 14 percent, from 81.3 million to 93.1 million, with the average annual emergency department volume climbing 25.6 percent" (ACEM 2000, 11). Long waits are not just an annoyance for patients, they can result in lower standards of care. Staff visits with patients are often shortened, and the care givers themselves tend to carry higher stress levels.

Design Strategies	Solution Elements		
Provide accurate wait information	Speculative	S041	Patient Dispatch
Discourage people from going to overcrowded facilities	Speculative	S044	Outsourcer
Reduce paperwork and administrative requirements	Speculative	S040	Precheck
	Speculative	S039	Smart ID

Version 3 Date: 25-Sep-03

Date of first version: 10-Sep-03

Design Factor	Title: Person is unidentifiable	D29

Project	HealthNet Infrastructure	Sources Personal observation	Associated functions 076. Identify Individual
Mode	Administrative Use		
Activity	Admitting		
Originator	Michael Winnick		
Contributors			

Observation

Personal Health Records (PHRs) are of limited use if the person that they are associated with cannot be identified.

Extension

In building most network systems, one can assume the availability of standard identification cues that exist for conscious, whole-bodied individuals. In healthcare, that assumption become more challenging. While the cases are extreme, HealthNet must be able to recognize people that are severely injured, disfigured, lack consciousness, have no ID cards, and in some case are literally unrecognizable.

Design Strategies

Use range of biometrics

Solution Elements

Speculative S003 Identity Matrix

Version 3	Date: 27-Sep-03	Date of first version: 10-Sep-03

Design Factor

Title: Facility/Patient mismatch

D30

Project	HealthNet Infrastructure
Mode	Administrative Use
Activity	Admitting
Originator	Michael Winnick
Contributors	

Sources

Preserving America's Health Care safety Net: An Imperative for us all. **American College for Emergency Physicians**. Washington DC, 2000

Associated functions

080. Choose course of action
081. Sit and wait

Observation

Many uninsured patients use emergency rooms for primary care because they have no alternatives.

Extension

Under the 1985 federal Emergency Medical Treatment and Active Labor Act (EMTALA), all persons who visit a hospital emergency department have a right to a medical evaluation and stabilizing treatment. Consequently, Emergency rooms serve as the primary conduit for uninsured Americans to receive their healthcare. According to a report by the American College for Emergency Physicians, "The nation's more than 4,000 hospital emergency departments are a portal for as many as three out of four uninsured patients admitted to U.S. hospitals" (ACEM 2000, 1). As the ranks of uninsured Americans rise, emergency care facilities will continue to face severe shortages and over-crowding. They will also face a budget crunch since they often have to absorb the costs of serving uninsured patients, estimated at $209.42 per patient (ACEM 2000, 11).

Design Strategies

Re-direct to different location

Solution Elements

Speculative	S044	Outsourcer
Speculative	S043	Consisent Mismatch
Speculative	S042	Telemedicine

Version 3 Date: 28-Sep-03

Date of first version: 25-Sep-03

Design Factor

Title: Patient lacks insurance and means to pay | **D31**

Project	HealthNet Infrastructure
Mode	Administrative Use
Activity	Billing
Originator	Michael Winnick
Contributors	

Sources

Preserving America's Health Care safety Net: An Imperative for us all. **American College for Emergency Physicians**. Washington DC, 2000

Department of Health and Human Services. **2003 CMS Statistics.** Washington, DC: June 2003

Associated functions

084. Submit bill for payment
077. Check information

Observation

Uninsured patients get poor care and are very costly to support.

Extension

Uninsured Americans receive a very low standard of care and tend to only use health facilities for acute emergencies. This not only bodes poorly for their own health and prognosis, but impacts the nations overall health infrastructure and fiscal health. "This lack of serious and effective attention to achieving health care coverage for all Americans cannot continue without affecting us all," warned Michael T. Rapp, MD, FACEP, president of the American College of Emergency Physicians (ACEP 2000, 5). "Emergency physicians serve the insured and the uninsured. If you overburden the system, it can impair access for everybody" (ACEP 2000, 5). Likewise, the financial costs of public support for the poor and elderly are staggering. Medicare and Medicaid spending alone last year topped $375 billion, 18% of total federal government spending (HHS 2003, 3).

Design Strategies

Increase system efficiencies

Encourage prevention amongst uninsured

Solution Elements

Speculative	S055	Insurance configurator
Speculative	S053	Prevention Credit Bank
Modified	S054	Prevention Grants

Version 3 Date: 29-Sep-03

Date of first version: 25-Sep-03

Design Factor

Title: Vendor rejects claim

D32

Project	HealthNet Infrastructure
Mode	Medical Use
Activity	Billing
Originator	Michael Winnick
Contributors	

Sources

Tabar, Pamela. *Electronic claims: Now what?* **Healthcare Informatics.** July, 2001, 19

Hagland, Mark. *Referrals and claims go electronic*. **Healthcare Informatics.** April, 2002, 18

Associated functions

087. Receive outcome
088. Respond to outcome

Observation

A high percentage of claim submissions are delayed or rejected.

Extension

Even with electronic claims processing, 30 to 50% of all claims spend some time in a pending state (Tabar 2001, 19). Claims processing systems generally have two choices when data on a claim is missing or incorrect: deny the claim or put it on a waiting list and let a human review it. In addition, manual appeals and processing of rejected claims are relatively expensive costing $12 to $14 apiece (Hagland 2002, 18). Error rates can be caused by a variety of issues: errors in human transcription, blanks or improperly filled forms and submissions to cover treatments that do not correspond to an HMO's accepted procedure manual.

Design Strategies	Solution Elements		
Pre-validate form entry	Speculative	S048	Claim Validator
Pre-verify treatment matches payer's requirements	Speculative	S051	Claim Chain
Provide transparency into claim process	Modified	S052	Auto Adjudicator
Streamline adjudication process	Speculative	S049	claimRouter
Centralized gateway			

Version 2 Date: 3-Oct-03

Date of first version: 28-Sep-03

Design Factor

Title: Complex rules for reimbursement

D33

Project	HealthNet Infrastructure
Mode	Medical Use
Activity	Billing
Originator	Michael Winnick
Contributors	

Sources

Tabar, Pamela. *Electronic claims: Now what?* **Healthcare Informatics.** July, 2001, 19

Hagland, Mark. *Referrals and claims go electronic*. **Healthcare Informatics.** April, 2002, 18

McGinley, Laurie. *Health Club: Behind Medicare's Decisions, An Invisible Web of Gatekeepers; Shot in the Spine, Mr. Erringer Suddenly Lost Coverage For Some Pain Medicine; A Fateful Letter From Fargo*. **Wall Street Journal**. New York, N.Y.: September, 2003, A1

Associated functions

082. Collect claim information
083. Review plan billing policy
085. Review claim
086. Select payment course of action

Observation

Healthcare providers must navigate a confused and complex web of rules to get reimbursed for procedures.

Extension

Even with electronic claims processing, 30 to 50% of all claims spend some time in a pending state (Tabar 2001, 19). Claims processing systems generally have two choices when data on a claim is missing or incorrect: deny the claim or put it on a waiting list and let a human review it. In addition, manual appeals and processing of rejected claims are relatively expensive costing $12 to $14 apiece (Hagland 2002, 18). The complexity of reimbursement rules is a key factor in such high error rates. According to a recent article in the Wall Street Journal, Medicare has over 9,000 rules to determine what treatments get re-imbursed for what conditions. It is customary for each HMO to establish their own guidelines for what drugs can be administered and what treatments can be performed on their plan (McGinley 2003, A1). The sheer number of guidelines leads to errors in claim submissions, but even worse, can lead to care being denied for the wrong reasons.

Design Strategies

Centrally managed rules repository

Simplify rule set

Solution Elements

Speculative S050 Rule KB

Version 2 Date: 4-Oct-03

Date of first version: 2-Oct-03

Design Factor	**Title: Visual or aural content is difficult to search**	**D34**

Project	HealthNet Infrastructure	Sources Personal observation	Associated functions 129. Formulate query 131. Identify relevant documents to return
Mode	Medical Use		
Activity	Searching		
Originator	Michael Winnick		
Contributors			

Observation

Search technologies tend to specialize in text-based querying and generally do a poor job of multimedia searching.

Extension

A good portion of the information found in a Personal Health Record (PHR) is visual including X-rays, CT scans, MRIs and ultrasounds. Likewise, patient histories which today are laboriously transcribed by doctors, are nothing more than a conversation between doctor and patient. Keyword search technologies like Google are not designed to handle searches of non-text based information. Imagine the difficulty of the query,"Find me an MRI that looks like this one," using a text-based query engine. However, the benefits of performing such a search could be tremedously helpful in speeding accurate diagnosis in a wide range of medical contexts.

Design Strategies	Solution Elements		
Transform non-textual data into text-based indecies	Modified	S029	Image Query
Use image indexing and searching algorithms	Speculative	S028	VOXTranslator

Version 2 Date: 5-Oct-03	Date of first version: 3-Oct-03

Design Factor	Title: Practitioner maintains limited conferee list	D35

Project	HealthNet Infrastructure	Sources Personal observation	Associated functions F 160. Utilize practitioner database F 161. Evaluate potential practitioner F 162. Connect with potential practitioner
Mode	Administrative use		
Activity	Referring		
Originator	Matt Hamlin		
Contributors			

Observation

Because practitionars can be wary of trusting and working with new people, they can penalize themselves and they patients by maintaining a select list with whom they confer.

Extension

On a daily basis healthcare practitioners are asked to contend with a multitude of competing interests including reviewing new medical findings, performing administrative tasks, and maintaining existing patient care. Doctors do not have the time to search out new conferees. They also don't have the time to develop relationships with new colleagues. It is easy to understand why practitioners could continually refer their clients to the same list of "tried and true" specialists.

It is essential to relieve practitioners of the burden of finding new conferees. Technology should be employed to retrieve detailed data that these practitioners need. At the same time, the patient's role should be expanded so that they become more active participants and can assist in the process of finding new conferees. Finally, all referrals should be tracked and patients should be asked to contribute an evaluation of their referral experience.

Design Strategies	Solution Elements		
Push conferees to practitioner' atttention.	Modified	S060	Connection Agents
Empower patients to suggest their own referrals	Modified	S059	AmplifiedAdvice
Track and log referrals from practitioners to specialists			

Version 2	Date: 15-Oct-03	Date of first version: 1-Oct-03

Design Factor

Title: Referred to unqualified practitioner

D36

Project	HealthNet Infrastructure
Mode	Administrative use
Activity	Referring
Originator	Matt Hamlin
Contributors	

Sources

Robertson, William O. *National Practitioner data bank—still not effective after all these years?* **Western Journal of Medicine** vol. 174 (Febuary 2001): 148-149

Associated functions

F 159. Communicate with practitioner
F 160. Utilize practitioner database
F 161. Evaluate potential practitioner
F 162. Connect with potential practitioner

Observation

Sometimes patients are referred to an unqualified practitioner.

Extension

Referrals between doctor's are guided and constrained by three factors. First, practitioners, and sometimes patients, know specialists that are available. Secondly, a health insurnace plan may only cover a limited set of practitioners and the patient may not want to pay full fee for service. Finally, referrals are determined by a practitioner's existing relationship with particular specialists and the convenience with which a patient can get to or see a particular specialist. Unfortunately, none of these factors have anything to do with a doctor's competency or compatibility to the patient. Furthermore, it is very easy for "bad doctors to skip around the country after they have been disciplined" (Robertson 2001), increasing the chances that a patient may visit an unqualified practitioner without even getting a referral.

Design Strategies

Publish patient-practitioner grading database

Provide greater access to Evidence-Based Refferal documents

Solution Elements

Modified S059 AmplifiedAdvice

Version 2 Date: 15-Oct-03

Date of first version: 1-Oct-03

Design Factor	Title: Practitioner cannot get access to PHR	D37

Project	HealthNet Infrastructure	Sources Personal observation	Associated functions F 158. Review medical history F 163. Exchange PHRs F 164. Confer with stakeholders
Mode	Administrative use		
Activity	Referring		
Originator	Matt Hamlin		
Contributors			

Observation

Because robust measures will be employed to ensure that a user's medical records remain private and secure, there may be times when a healthcare practitioner is unable to gain access to them.

Extension

Protecting a patient's privacy and preventing unauthorized access to their Personal Health Records (PHRs) will be critical toHealthNet's operations. Because the experience of retrieving and storing medical records on HealthNet will be new to patients, many will possess a great deal of fear about how secure these documents really are.

If PHRs are too tightly protected, these security measures will be counter prdocutive. For example, fast access to electronic PHRs can immediately give acute care givers the detailed medical information necessary to treat a patient safely and effectively. If an acute caregiver is locked out of this information because of security measures, than that information is wasted and a patient's life could be put in jeopardy. Rigorous measures could prevent a patient from receiving the best possible care.

Design Strategies

Maintain passkeys

Solution Elements

Modified	S057	Acute Access
Modified		Doctor Overrides

Version 2 Date: 15-Oct-03	Date of first version: 1-Oct-03

Design Factor

Title: Insufficent resources for demand

D38

Project	HealthNet Infrastructure
Mode	Administrative use
Activity	Allocating resources
Originator	Matt Hamlin
Contributors	

Sources
Personal observation

Associated functions
F 106. User alerts system of resource need or surplus
F 107. Search for complement

Observation
The short supply of resources throughout the healthcare industry makes it challenging to judiciously allocate the right resources to the right situation.

Extension
Healthcare organizations are regularly flooded with patients looking to receive the best possible care. This deluge of demand has not been met with an adequate response of supply. Healthcare practitioners are continually asked to provide more services with fewer resources. This includes staff, equipment, treatments, infrastructure and organic material. Since there are not enough resources to meet demand patients encounter long wait times, disorganized practices, frustrated staff, and sometimes adverse results.

Healthcare organizations can improve their operations by acquiring the resources they need through better communications between organizations within the industry. In addition to improving communications within the industry, outside forces or third-parties need to be attracted to help meet demand. This will allow practitioners to spend their time administering health, not administering the supply cabinet.

Design Strategies	Solution Elements		
Create a centralized resource processing unit	Modified	S061	NeedFunnel
Automate processes	Modified	S062	Quatermaster
Leverage the connectivity of the network	Modified	S063	EntreHealthNet

Version 2 Date: 15-Oct-03

Date of first version: 1-Oct-03

Design Factor

Title: Replenishing human resources is hard | **D39**

Project	HealthNet Infrastructure
Mode	Administrative use
Activity	Allocating resources
Originator	Matt Hamlin
Contributors	Brandon Schauer

Sources
Personal observation

Associated functions
F 107. Search for complement

Observation
Because it is not possible to produce more human resources on demand, fulfilling human resource needs is hard.

Extension
The current demand for trained medical practitioners is very strong and is demonstrated by the long waits at healthcare organizations and the high price for services rendered. Fulfilling the human resource needs of the healthcare industry is particularly challenging since potential practitioners need to be properly trained and proper training is time consuming and expensive.

Staff shortages in the healthcare industry are particularly adverse since they initiate a domino effect. By not having enough practitioners to administer health, delays occur, which leads to dissatisfaction among patients, and frustration on part of the staff. This is followed by an overall decrease in the quality of care given and an exacerbated sense of resentment by the staff towards the patients. Temporary staffers can help to meet demand, but employing these workers can be very costly since one must pay a premium for their services.

Design Strategies	Solution Elements		
Increase resource pool	Modified	S065	HealthNet Accreditation
Classifiy job requirments	Modified	S064	Badge system

Version 2 Date: 15-Oct-03 | Date of first version: 1-Oct-03

Design Factor

Title: Unplanned resource need

D40

Project	HealthNet Infrastructure
Mode	Administrative use
Activity	Allocating resources
Originator	Matt Hamlin
Contributors	

Sources
Personal observation

Associated functions
F 106. User alerts system of resource need or surplus

Observation
Because sufficient resource for demand cannot always be forcasted, there may be times when there are not enough available resources.

Extension
Because it is impossible to predict when natural disasters, environmental tragedies, and malicious acts by mankind will occur, these tragic events can be poorly prepared for, and poor planning can result in excessive emergency costs and loss of life. But a comprehensive, risk-based emergency management program of preparedness and response will reduce the loss of life and strain on resources. Furthermore, developing an emergency management program during non-emergency periods will be the most cost-effective strategy in preparing for a disaster.

Once an emergency management program has been activated, the next requirmentsa are an accurate understanding of the resources needed and the location of where they must go. As critical as the resources will be to saving lives, the emergency support staff to administer them will be just as critical. Networking technologies will be able to assemble and dispatch these resources quite effectively.

Design Strategies	Solution Elements		
Prioritize available resources for distribution	Modified	S066	Fast Track
Secure resources for need	Modified	S068	Prioritized Messenger
Facilitate assemblage of resources	Modified	S067	S.M.A.T

Version 2 Date: 15-Oct-03

Date of first version: 1-Oct-03

Design Factor

Title: Person-to-person supervision is slow and costly | **D41**

Project	HealthNet Infrastructure
Mode	Administrative use
Activity	Training personnel
Originator	Matt Hamlin
Contributors	Brandon Schauer

Sources
Personal observation

Associated functions
F 99. Review training history
F 103. Consult training supervisor
F 104. Monitor improvements or regressions

Observation
Because of the rising costs associated with education and a shortage of human resources to meet demand, it will take too long and be too costly to have training personally supervised.

Extension
There are several factors which contribute to a student's educational development, but two of the major components are self-discipline and structured supervision. Unfortunately, personal supervision for trainees can be very expensive. Furthermore, to help lower the costs associated with delivering healthcare services, patients are being asked to take on more of the post-operation treatment procedures themselves.

Trditional education methods lack the standardized review methods and protocols that would allow any certified supervisor to assist an individual in the training program.

Design Strategies
Utilize standardized review methods
Encourage self-supervision

Solution Elements

Modified	S070	Distance supervision
Modified	S069	Curriculum advisor

Version 2 Date: 15-Oct-03

Date of first version: 1-Oct-03

Design Factor	Title: Lack of practical experience	D42

Project	HealthNet Infrastructure	Sources Personal observation	Associated functions F 103. Consult training supervisor F 104. Monitor improvements or regressions
Mode	Administrative use		
Activity	Training personnel		
Originator	Matt Hamlin		
Contributors			

Observation

Because learning how to administer healthcare services requires hands-on experience, users of use distance learning techniques will fail to gain full certification.

Extension

There is great demand for more healthcare practitioners, and distance learning techniques have a great deal of potential to help bridge the demand. But in order for distance learning techniques to produce properly trained healthcare practitioners, they need to be used in conjunction with traditional training techniques, in particular, ensuring that potential practitioners enter the workforce with some practical, hands-on experience. Although distance training programs are capable of certifying users for certain industries without any hands-on experience, the healthcare industry is not one of them. Practical, hands-on experience, is essential for the healthcare industry, because there is a huge difference between learning how components of the body work in a two-dimensional diagram and actually handling a patient.

A centralized access point where potential practitioners can be connected with healthcare organizations for internship placement will facilitate the delivery of more certified healthcare practitioners into the industry. Furthermore, a centralized access point where individuals who wish to volunteer could be easily folded into this program.

Design Strategies

Incorporate tangible experiences

Solution Elements

Modified S071 HealthED Connector

Version 2 Date: 15-Oct-03	Date of first version: 1-Oct-03

Design Factor	Title: Skills are rejected by healthcare organization	D43

Project	HealthNet Infrastructure	Sources Personal observation	Associated functions F 105. Accredit users
Mode	Administrative use		
Activity	Training personnel		
Originator	Matt Hamlin		
Contributors			

Observation
Because it is cost prohibitive for many individuals to obtain a professional degree certifying them to administer healthcare services, the healthcare industry has locked out many potential practitioners.

Extension
As costs associated with medical education continue to rise, the scholarships available to students continue to contract. Patients are being forced to suffer through a great shortage of medical practitioners. Despite the fact that a rise in the number of practitioners would drop the costs associated with providing healthcare, the industry does not seem poised to provided alternatives to the expensive certifications required.

By decreasing the costs associated with getting certified, HealthNet can increase the number of practitioners in the industry, opening up new markets for medical practitioners, particularly in the fast growing home-healthcare market. If a training program conducted over HealthNet could be accredited, then a sufficient number of users could gain certification necessary to meet the demand of the industry.

Design Strategies
Facilitate entry into industry

Solution Elements
Modified S065 HealthNet Accreditation

Version 2 Date: 15-Oct-03	Date of first version: 1-Oct-03

Design Factor

Title: Contact not responding

D44

Project	HealthNet Infrastructure
Mode	Medical use
Activity	Communicating
Originator	Matt Hamlin
Contributors	Charles Owen

Sources

Hawaleshka, Danylo and Luke Fisher. *Healthy Communication*. **Maclean's**, August 27, 2001: 42

Associated functions

F 122. Make contact with third party

F 127. Introduce additional users and applications

Observation

While in some instances it may be inconvenient not to be able to reach a healthcare practitioner or patient, in other instances it can be life threatening.

Extension

Most people have experienced the frustration of wasting time and energy trying to get in touch with a physician about something. Generally, healthcare practitioners are as responsive as possible, but for a sick or elderly patient living at home alone or with minimal nursing aide, "as responsive as possible" may not be enough. The need to be able to contact a physician may be critical; failure may not be simply an inconvenience.

For example, when a patient is being prepared for surgery, a conference between the specialist, the patient's physician and the patient is highly recommended to mitigate complications. It would be foolish to go ahead with the operation without the conference, but that may just happen when communication connections cannot be made in a timely manner. A number of studies worldwide has shown that communication breakdowns between medical staff are the most common cause of preventable deaths (Hawaleshka 2001, 42).

Design Strategies	Solution Elements		
Provide some information rather than none	Modified	S018	DescriptiveAbsence
Continue trying until succesful	Modified	S017	Automated Reconnect
Provide alternative contact	Modified	S019	Referral Connex

Version 2 Date: 3-Oct-03

Date of first version: 1-Oct-03

Design Factor	Title: Miscommunication between users	D45

Project	HealthNet Infrastructure	Sources Personal observation	Associated functions F 124. Communicate
Mode	Medical use		
Activity	Communicating		
Originator	Matt Hamlin		
Contributors			

Observation

Once patients, practitioners and administrators begin communicating with one another over HealthNet, instances of miscommunication will occur.

Extension

Miscommunication is an inherent component of communication. They have opposite outcomes, but are mutually dependent. But that doesn't mean miscommunication has to be commonplace. Various factors contribute to the chances of miscommunication occurring: the use of jargon and technical information, an individual's cultural expressions, and the individual's ability to articulate himself.

As the insurance and liability costs continue to rise because of miscommunication instances in the workplace, it becomes more important for professionals to mitigate their exposure to miscommunication. To do so, they should embrace three concepts. One, ensure that when data is exchanged, simply transposition of number or other clerical mistakes don't happen. Two, reduce the reliance individuals put on remembering key concepts and instructions. Third, validate whether or not the individuals communicating with one another truly understand the information being exchanged.

Design Strategies	Solution Elements		
Protect against miscommunication	Modified	S016	Common Guidance
Reduce the reliance on memory	Modified	S014	Communication Recorders
Determine if communication is understood	Modified	S015	Authentic Understanding

Version 2 Date: 15-Oct-03	Date of first version: 1-Oct-03

Design Factor	Title: Hardware or software is incompatible	D46

Project	HealthNet Infrastructure	Sources Personal observation	Associated functions F 123. Manage secure data connection
Mode	Medical use		
Activity	Communicating		
Originator	Matt Hamlin		
Contributors			

Observation

As the number of devices attempting to communicate and exchange data with one another rises, so to will the chances that these devices will encounter instances of incompatibility.

Extension

Emerging technologies will present users with an array of new devices that are no longer stand alone pieces of hardware or software, but are dynamic, and capable of talking with one another. However, as innovation spurs these devices to market quickly, they might reach the end user before compatibility issues between software and hardware devices are fully tested. If this happens, instances of incompatibility will arise, and effective communication will be disrupted.

In order to ensure that communication between devices operates on a consistently effective level, operational checks must be made while the devices are in use to see if the devices are operating correctly. Furthermore, sensory technologies can be used to validate that the data transmissions between devices is authentic and not corrupted.

Design Strategies	Solution Elements		
Perpetuate operational check between devices	Modified	S021	Operating Handshakes
Request operational check by third-party	Speculative	S020	Dr. Mote

Version 2 Date: 15-Oct-03	Date of first version: 1-Oct-03

Design Factor

Title: Can't gain permissions to collect

D47

Project	HealthNet Infrastructure
Mode	Medical use
Activity	Collecting
Originator	Brandon Schauer
Contributors	Michael Winnick

Sources
Personal observation

Associated functions
F130. Verify permissions to collect data

Observation
When the network collects data to add to or alter existing health records, it may be difficult to gain permission to do so.

Extension
Much of the data collected by the HealthNet will be appended to or added to a patient's Personal Health Record (PHR). Due to the sensitivity of the PHR, permission might be sought prior to altering it, thereby avoiding tampering, erroneous data, or cases of data collection without the owner's knowledge.

However, the owner of the PHR may or may not be accessible to be asked for permission. For example, the PHR owner might be a guardian at a separate location or be an unconscious patient. In such cases, how can permission be gained so that the valuable data can be collected?

Design Strategies	Solution Elements		
Owners create "standing" permissions	Speculative	S006	Permission Profiles
Data is retained without being applied	Speculative	S027	Data Quarantine

Version 3 Date: 12-Oct-03

Date of first version: 23-Sep-03

Design Factor

Title: Unknown data types

D48

Project	HealthNet Infrastructure
Mode	Medical use
Activity	Collecting
Originator	Brandon Schauer
Contributors	Michael Winnick

Sources
Berners-Lee, T. , Hendler, J. and Lassila, O. *The Semantic Web*. **Scientific American**. May 1, 2001

Associated functions
F132. Identify type and format of data

Observation
The wide range of data types in HealthNet may burden and slow the collection process.

Extension
The realm of "medical data" covers a huge range of data types and formats. Consider these different types of medical data: X-ray images, EKG readings, spoken notes from a doctor, a notated patient history. Each is a different media type and contains very different structuring of the information. An appropriate analogy might be a truck driver who must show up to a dock not knowing if the cargo will be hazardous materials, livestock, or frozen foods. As with this example, the variety of medical data "cargo" will have different transfer and storage requirements. Despite this variety, HealthNet must successfully collect and store the data to make the data useful.

Design Strategies
Self-identifying data formats

Solution Elements

Modified	S024	Structured Data Generator
Modified	S023	Data Description File
Speculative	S022	Unidentified Data Promoter

Version 3 Date: 12-Oct-03

Date of first version: 23-Sep-03

Design Factor

Title: Availability of storage

D49

Project	HealthNet Infrastructure
Mode	Medical use
Activity	Collecting
Originator	Brandon Schauer
Contributors	Michael Winnick

Sources

Toigo, Jon William. *Avoiding a Data Crunch*. **Scientific American**. May 21, 2000

Associated functions

F133. Determine method of storage
F134. Acquire data
F135. Transmit data to storage

Observation

Due to the sheer quantity of data that could be collected to support the healthcare system, the availability of data storage presents a challenge.

Extension

Recent years has seen a plummeting of the price of data storage and increases in data storage capabilities. However, existing data storage technologies are reaching physical barriers to further advancement. Meanwhile, the HealthNet network will create a new demand for enormous data storage capabilities. The collection and storage of data on every patient, every physician, every clinic, etc. implies a humongous and nearly un-paralleled data store. To further complicate the problem, the storage of this data will have to conform to tight security, privacy, and portability regulations.

Design Strategies	Solution Elements		
Distributed data storage	Speculative	S026	Storage Broker
Smart allocation of storage	Speculative	S025	Data Terminator

Version 3 Date: 12-Oct-03

Date of first version: 23-Sep-03

Design Factor

Title: Vocabulary inconsistencies

D50

Project	HealthNet Infrastructure
Mode	Medical Use
Activity	Searching
Originator	Michael Winnick
Contributors	Brandon Schauer

Sources

Berners-Lee, T. , Hendler, J. and Lassila, O. *The Semantic Web*. **Scientific American**. May 1, 2001

Associated functions

131. Identify relevant documents to return

Observation

Inconsistencies in terminology and vocabulary can result in queries that return either incomplete or over abundant document sets.

Extension

Standard, keyword-based search systems have serious limitations because they assume that users are utilizing the correct words when conducting searches (Berners-Lee 2001). In the context of HealthNet such inconsistencies could have serious consequences. Take a healthcare practitioner who is searching a patient's record for relevant historical information on heart trouble. She types a query that scans her patient's history for the words heart attack, angina and EKG. Meanwhile, the record references an electrocardiogram, but doesn't make note of the acronym. The doctor never sees that patients test results and chooses an alternative, uninformed course of action.

Design Strategies

- Add information to search queries
- Standardize document nomenclature
- Control the vocabulary that professionals use
- Use an ontology of medical terms and relationships

Solution Elements

Speculative	S031	synonymousSearch
Speculative	S032	docIndexer
Modified	S033	ShortSpeak
Existing	S034	SNOMED

Version 3 Date: 9/30/00

Date of first version: 9/25/03

Design Factor

Title: Query is too broad/too narrow

D51

Project	HealthNet Infrastructure
Mode	Medical Use
Activity	Searching
Originator	Michael Winnick
Contributors	Brandon Schauer

Sources

Nielsen, Jakob. *Information Foraging: Why Google Makes People Leave Your Site Faster*. **Alert Box.** June 30, 2003

Associated functions

129. Formulate query
133. Re-formulate query

Observation

When users search information systems they often miss key documents.

Extension

As anyone who uses a keyword-based search engine knows, finding the right set of documents for a given query can be a challeng. Defining a query broadly can result in a high number of false positives, documents that don't relate to the subject matter. On the flip side, over constraining a query can return documents that do not include important, relevant data. According to Xerox PARC research, web users have adapted a strategy called information foraging in which they will "keep clicking as long as they sense (to mix metaphors) that they're 'getting warmer' -- the scent must keep getting stronger and stronger, or people give up. Progress must seem rapid enough to be worth the predicted effort required to reach the destination" (Nielsen 2003).

Design Strategies

Expand narrow queries

Narrow broad queries

Solution Elements

Speculative S030 suggestive Rightsizer

Version 3 Date: 10/1/00

Date of first version: 9/28/03

Design Factor

Title: Unable to verify users

D52

Project	HealthNet Infrastructure
Mode	Integrity Management
Activity	Verifying
Originator	Michael Winnick
Contributors	Brandon Schauer

Sources
Personal observation

Associated functions
143. Return response
144. Allow access to requested data
146. Deny application request

Observation
Users that should have access to HealthNet could be unable to access key information due to technical or user error.

Extension
Human or technical errors could prevent qualified individuals from accessing critical information that they need through HealthNet. Most systems suffer from technical errors like bugs and data corruption as well as user errors like erroneous data, poor memory or failure to follow instructions. In a medical context, these errors can have adverse consequences on a care giver's ability to perform treatments and a patient's ability to monitor their health. Rigid security protocols could, if designed poorly, exacerbate this problem, leading to situations where users have little recourse if an error does occur.

Design Strategies
Provide human alternatives

Solution Elements

Speculative	S002	1.800.override
Speculative	S001	Local Super User

Version 1 Date: 10/13/03

Date of first version: 10/13/03

Design Factor

Title: Wide range of contexts | **D53**

Project	HealthNet Infrastructure
Mode	Integrity Management
Activity	Verifying
Originator	Michael Winnick
Contributors	Brandon Schauer

Sources
Personal observation

Associated functions
141. Input request
142. Check validation criteria

Observation
Users will access HealthNet from a wide range of environmental contexts.

Extension
Users will access HealthNet in a wide range of environments. In addition to hospitals and doctors' offices, homes, ambulances, community centers and non-fixed locations will all have access to HealthNet. Managing security and access in these heterogeneous environments can prove extremely challenging. At a hospital, for instance, one can depend upon security guards and key cards to control access to certain areas and sensitive data. Outside the confines of a traditional healthcare environment, none of these safeguards exist. System architects cannot assume the availability of physical and human security measures. Simply closing system access to these environments is not an option, because expanding access to health information is a de facto goal of HealthNet.

Design Strategies
Configure security requirements appropriately

Solution Elements
Speculative S004 Concentric Access

Version 2 Date: 10/13/03

Date of first version: 10/13/03

Design Factor

Title: Returned data could overwhelm users

D54

Project	HealthNet Infrastructure
Mode	Medical Use
Activity	Synthesizing
Originator	Michael Winnick
Contributors	Brandon Schauer

Sources

Managerial information overload. **Communications of the ACM** 45 , No. 10 (October 2002): 127 - 131

Associated functions

138. View data items
139. Select additional items or views

Observation

Users could be swamped with the amount of information received in HealthNet.

Extension

According to a recent survey conducted with business managers in four countries, respondents feel that information overload exists and is a serious problem (ACM 2002, 127). Health providers that access HealthNet could have similar reactions to both the quantity of information found in HealthNet and the number of communications they receive through the system. Compounding this challenge is the fact the most technical means of dealing with information overload seem to be of limited success. According to the same survey, only 14 percent of those surveyed use a technological solution to reduce their overload (ACM 2002, 127). HealthNet should be designed with this challenge in mind. If the system replaces inifficient current tasks with additional inifficient tasks like wading through volumes of email, it will greatly limit its success.

Design Strategies

Provide template views

Summarize critical data

Solution Elements

Speculative	S036	Collaborative Templates
Existing	S037	Digester
Speculative	S038	Fly Over

Version 2 Date: 10/13/03

Date of first version: 10/13/03

Design Factor	**Title: Too many different platforms**	**D55**

Project	HealthNet Infrastructure	Sources Personal observation	Associated functions 135. Establish context of use 137. Display relevant data items
Mode	Medical Use		
Activity	Synthesizing		
Originator	Michael Winnick		
Contributors			

Observation

The wide range of devices supported by HealthNet could lead to great complexity for application developers.

Extension

HealthNet will provide connectivity to a very large number of medical devices and information technology devices. In addition to cell phones, computers, servers and phones, HealthNet will also support monitoring equipment, diagnostic equipment and even surgical equipment. Each of these devices could have its own data model for storing relevant information it collects and its own requirements for surfacing that information to users. Without careful planning, flexible infrastructure and standards development, these thousands of devices could create overwhelming complexity for application developers. Tremendous time could be wasted customizing, porting and testing applications to the requirements of specific devices.

Design Strategies

Convert and application data via central device repository

Solution Elements

Speculative S035 Context-Aware Rendering Engine (CARE)

Version 2 Date: 10/13/03	Date of first version: 10/13/03

Design Factor

Title: Uninsured patients don't receive preventive care

D56

Project	HealthNet Infrastructure
Mode	Administrative Use
Activity	Billing
Originator	Michael Winnick
Contributors	

Sources

Coverage Matters: Insurance and Healthcare. **Institute of Medicine**: Washington D.C. September 2001

Associated functions

082. Collect claim information

Observation

Uninsured patients typically don't receive preventive care; a fact that has very negative consequences for their health.

Extension

Uninsured adults are less than half as likely as the insured to receive needed care for a serious medical condition (IOM 2001, 2). Studies show that "they are less likely to see a doctor within a given year, have fewer visits annually, and are less likely to have a regular source of medical care. Uninsured persons receive fewer preventive services and less care for chronic conditions than the insured" (IOM 2001, 2). Without preventive care and access to health professionals, the uninsured develop more critical illnesses and have substantially shorter life expectancy than insured adults. Not only is this an issue of great ethical concern, it is also one of financial impact. Treating severe, chronic conditions is far more expensive than identifying and treating conditions early or preventing them all together.

Design Strategies

Incent preventive behaviors

Solution Elements

Speculative	S053	Prevention Credit Bank
Modified	S054	Prevention Grants

Version 2 Date: 10/14/03

Date of first version: 10/14/03

Design Factor

Title: Security breaches are unavoidable

D57

Project	HealthNet Infrastructure
Mode	Integrity Management
Activity	Tracking
Originator	Michael Winnick
Contributors	

Sources

Nuttall, Chris. *Hacking usually "an inside job."* **BBC News.** <http://news.bbc.co.uk/1/hi/sci/tech/203547.stm> October 29, 1998

Associated functions

147. Identify objects and events to be tracked
148. Select tracking criteria for objects and events

Observation

It is nearly impossible to protect large, complex systems from breaches of security.

Extension

Millions of people will access HealthNet from a wide range of contexts, many of which aren't secure. Given this complexity, even with preventive measures in place, security breaches will occur. The scope of the problem is underlined by a 1998 survey that found that 70% of security breaches in companies were inside jobs, meaning that they were committed by employees (Nuttal 1998). Given that misuse will occur, system developers must place a premium on identifying misuse and quickly responding to it.

Design Strategies

Identify and punish violators

Minimize damage

Constantly test system

Solution Elements

Speculative	S005	Guard Dog
Speculative	S006	Data Quarantine
Existing	S007	White Hat Attacks

Version 2 Date: 10/13/03

Date of first version: 10/13/03

Design Factor

Title: Unable to discern critical issues

D58

Project	HealthNet Infrastructure
Mode	Integrity management
Activity	Regulating
Originator	Matt Hamlin
Contributors	

Sources
Personal observation

Associated functions
F 167. Consult stakeholders
F 168. Gather performance data
F 169. Turn data into insights

Observation
Developing new regulations for HealthNet may be difficult if it is unclear what the critical issues are.

Extension
Staying abreast of how users perceive your service is critical. Discovering what the problems need to be addressed isn't easy. This is made more difficult as the depth and breadth of services offered expands.

In order to best discover what are the issues affecting your users perceptions of your service, a two-pronged approach should be taken. The first requires managers to be proactive as possible to find out how users feels about the service. By being proactive, one can discover any problems circulating before they get too larger and unmanageable. Secondly, one should make it easy for your users to make their comments known.

Design Strategies
Capture a holistic understanding
Eliminate partisanship reporting

Solution Elements

Modified	S008	HealthAssemblage
Modified	S009	HealthNet Census
Modified	S010	Respond to HealthNet

Version 2 Date: 15-Oct-03

Date of first version: 1-Oct-03

Solution Element

Status: **Speculative** Title: **Patient Dispatcher** **S041**

Project	**HealthNet Infrastructure**
Mode	Administrative Use
Activity	Admitting
Originator	Michael Winnick
Contributor	

Description

A service that allows non-trauma patients to review wait times in nearby waiting rooms, get incentives for choosing less crowded ERs and sign in before arriving to hospitals.

Source

Properties – *what it is:*

> Software procedure that aggregates patient volume data from hospitals
> Software procedure that analyzes volume data
> Software procedure that generates alternatives based on location and condition
> Rules system for determining patient incentives
> Call center
> Web site for patient interaction

Features – *what it does:*

> Allows patients to get care faster by re-directing them to other facilities
> Takes burden off of over crowded ERs improving quality of care
> Speeds patient processing by already transferring basic information

Associated Function/s	Source Design Factor/s
081. Sit and wait	D28. Long waits

Version 3 Date: 6-Oct-03 Date of first version: 11-Sep-03

Solution Element

Status: **Modified** Title: **Structured Data Generator** **S033**

Project	**HealthNet Infrastructure**
Mode	Medical Use
Activity	Collecting
Originator	Brandon Schauer
Contributor	

Description

Data to be collected is fed through the Structured Data Generator software to produce standard tagging of data elements and give meaning to the information.

Source

> eXtensible Markup Language (XML)
> Resource Description Framework (RDF)

Properties – *what it is:*

> Flexible data input interface
> Customizable data labels
> Referenced external data
> Universal Resource Indicators (URIs)

Features – *what it does:*

> Supports a wide array of data inputs
> Converts data and its structure to a standard data description format
> Allows for references to external data
> Creates description of the data using to create relationships between data elements
> Allows references to URIs to identify system objects associated with the data

Associated Function/s	Source Design Factor/s
F123. Identify type and format of data	D14. Unknown data types

Version 2 Date: 3-Oct-03 Date of first version: 26-Sep-03

Appendix C

Means/Ends Forms

Information Structure

Ends/Means Forms

Feature/Function Check Matrix

System Element Relationship Matrix

Means/Ends Analysis

Cluster: 307

Project: HealthNet Infrastructure

Functions

F006	Review measurement data
F007	Evaluate level of criticality
F008	Hypothesize cause
F010	Draw conclusions
F067	Review results
F071	Analyze potential trends
F073	Monitor forecast models
F006	Review measurement data
F007	Evaluate level of criticality
F010	Draw conclusions
F071	Analyze potential trends
F073	Monitor forecast models
F075	Measure forecast accuracy
F006	Review measurement data
F095	Monitor improvements or regressions

means →

Ends

123	Solving anticipated problems
124	Anticipating future trends
125	Monitoring improvements

Means to What End?

means →

Ends

213	Future problem presentation
214	Response monitoring

Means to What End?

means →

End

307	Problem prevention and supervision

Means to What End?

Means/Ends Analysis

Cluster: 314

Project:
HealthNet Infrastructure

Functions (means)

F068	Share results
F069	Disseminate
F074	Report forecast
F123	Identify type and format of data
F124	Determine method of storage
F125	Acquire data
F122	Determine means of collection from source
F124	Determine method of storage
F125	Acquire data
F126	Transmit data to storage
F099	Establish connection between users
F106	Connect with practitioner
F109	Connect with potential practitioner
F111	Hold stakeholder conference
F115	Make contact with other user
F117	Introduce additional users and applications
F093	Record performance
F114	Record communication
F119	Enter communication in database

Ends (means)

148	Agggregating data
149	Collecting data
150	Provisioning resources
151	Collecting data

Means to What End?

Ends (means)

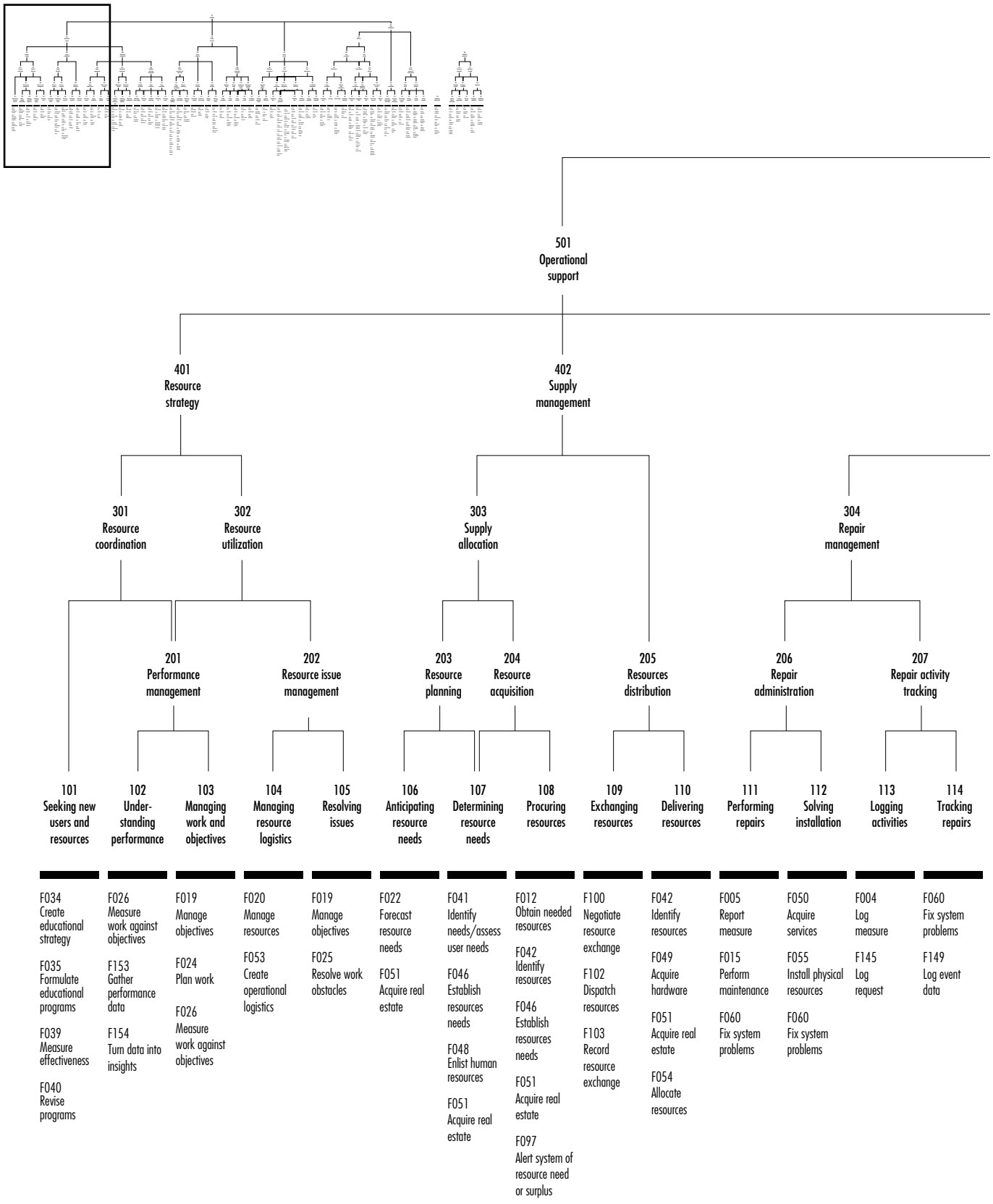
229	Data aggregation and storage
230	Data resource provision

Means to What End?

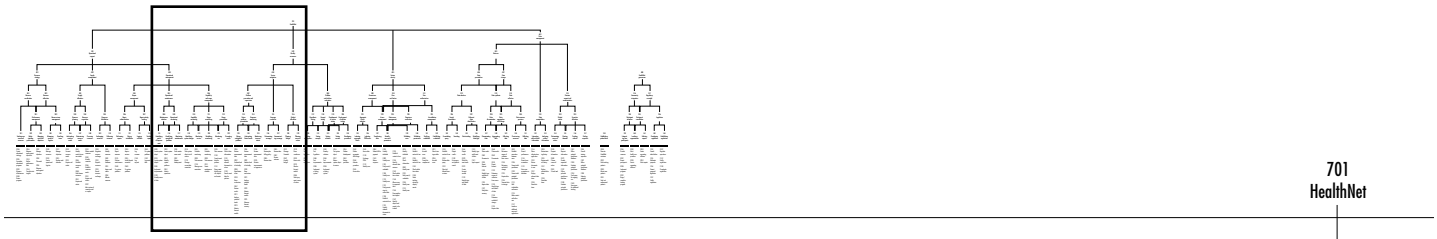
End

314	Data collection

Means to What End?


501 Operational support
401 Resource strategy
402 Supply management
301 Resource coordination
302 Resource utilization
303 Supply allocation
304 Repair management
201 Performance management
202 Resource issue management
203 Resource planning
204 Resource acquisition
205 Resources distribution
206 Repair administration
207 Repair activity tracking
101 Seeking new users and resources
102 Under-standing performance
103 Managing work and objectives
104 Managing resource logistics
105 Resolving issues
106 Anticipating resource needs
107 Determining resource needs
108 Procuring resources
109 Exchanging resources
110 Delivering resources
111 Performing repairs
112 Solving installation
113 Logging activities
114 Tracking repairs
F034 Create educational strategy
F035 Formulate educational programs
F039 Measure effectiveness
F040 Revise programs
F026 Measure work against objectives
F153 Gather performance data
F154 Turn data into insights
F019 Manage objectives
F024 Plan work
F026 Measure work against objectives
F020 Manage resources
F053 Create operational logistics
F019 Manage objectives
F025 Resolve work obstacles
F022 Forecast resource needs
F051 Acquire real estate
F041 Identify needs/assess user needs
F046 Establish resources needs
F048 Enlist human resources
F051 Acquire real estate
F012 Obtain needed resources
F042 Identify resources
F046 Establish resources needs
F051 Acquire real estate
F097 Alert system of resource need or surplus
F100 Negotiate resource exchange
F102 Dispatch resources
F103 Record resource exchange
F042 Identify resources
F049 Acquire hardware
F051 Acquire real estate
F054 Allocate resources
F005 Report measure
F015 Perform maintenance
F060 Fix system problems
F050 Acquire services
F055 Install physical resources
F060 Fix system problems
F004 Log measure
F145 Log request
F060 Fix system problems
F149 Log event data

HealthNet Infrastructure *A 21st Century Approach to Healthcare* Information Structure with node titles 14 November, 2003



701 HealthNet

502 Quality assurance

403 Operational management

404 Service mitigation

305 Operational maintenance

306 Capability and usage management

307 Problem prevention and supervision

208 Maintenance initiation

209 Operational monitoring

210 Capability monitoring

211 Usage monitoring

212 Usage presentation

213 Future problem presentation

214 Response monitoring

215 Coverage resolution

216 Budget allocation

115 Identifying points of improvement

116 Identifying operational problems

117 Monitoring maintenance

118 Identifying system outages

119 Monitoring service

120 Scheduling monitoring

121 Monitoring use

122 Presenting results

123 Solving anticipated problems

124 Anticipating future trends

125 Monitoring improvements

126 Determining coverage

127 Communicating coverage

128 Planning budget

129 Planning course of action

F002 Locate system object
F013 Locate system objects
F045 Implement improvements
F120 Identify source of data

F002 Locate system object
F059 Identify system problems
F061 Initiate operations

F018 Track maintenance work
F057 Monitor development

F014 Take system object out of service
F113 Manage secure data connection

F001 Schedule monitoring
F003 Take measure
F118 Manage communication

F001 Schedule monitoring
F003 Take measure
F011 Create maintenance schedule

F003 Take measure
F150 Search event data for patterns
F151 Query event data for specific objects and events

F082 Collect claim information
F131 Identify relevant documents to return
F150 Search event data for patterns

F006 Review measurement data
F007 Evaluate level of criticality
F008 Hypothesize cause
F010 Draw conclusions
F067 Review results
F071 Analyze potential trends
F073 Monitor forecast models

F006 Review measurement data
F007 Evaluate level of criticality
F010 Draw conclusions
F071 Analyze potential trends
F073 Monitor forecast models
F075 Measure forecast accuracy

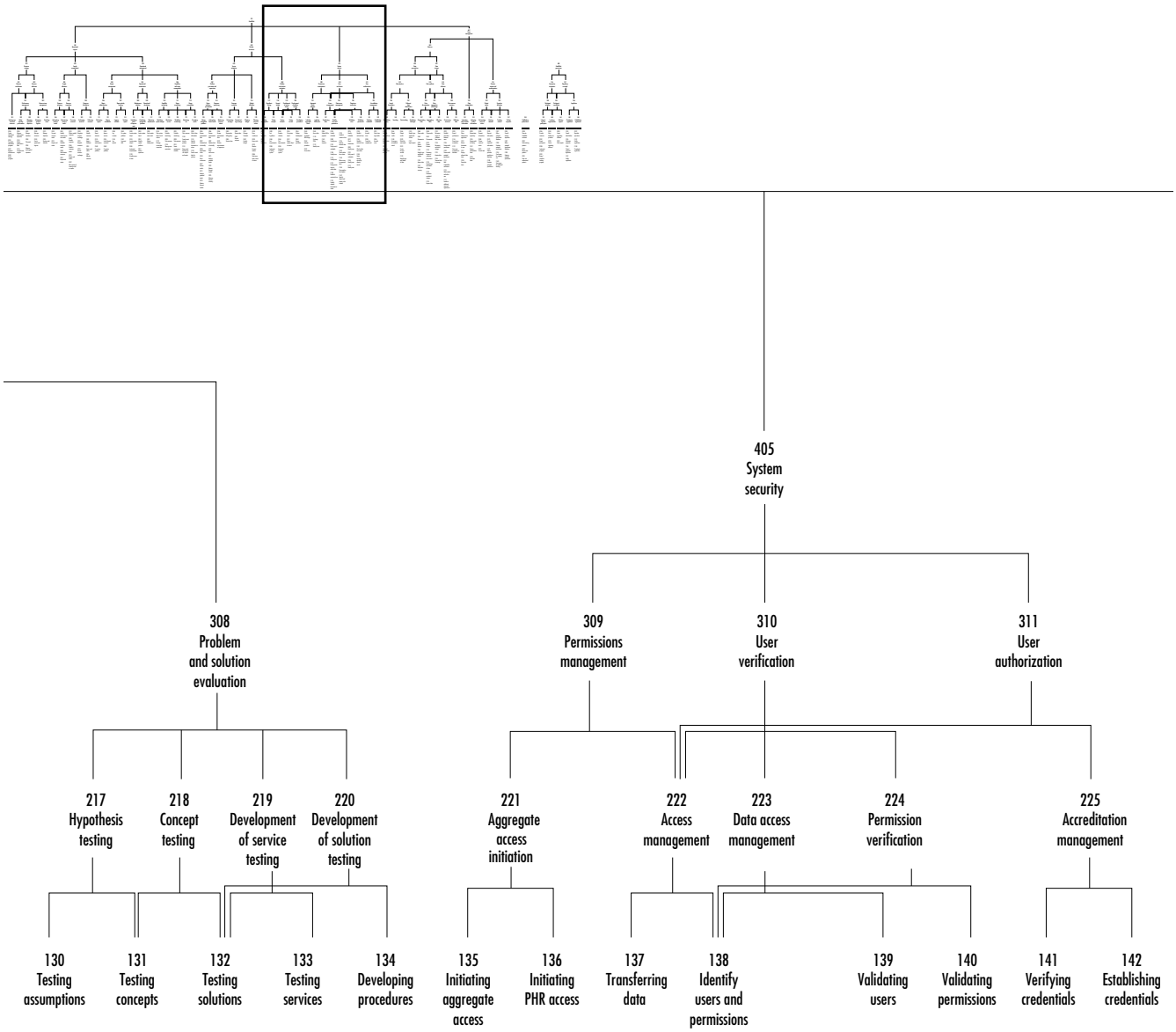
F006 Review measurement data
F095 Monitor improvements or regressions

F083 Review plan billing policy
F085 Review claim

F085 Review claim
F087 Receive outcome

F021 Manage financials
F047 Identify budget

F010 Draw conclusions
F023 Assess risks
F073 Monitor forecast models
F086 Select payment course of action



F009 Test hypothesis
F010 Draw conclusions

F009 Test hypothesis
F044 Test improvements
F058 Implement a testing system

F043 Develop solutions
F044 Test improvements
F058 Implement a testing system

F016 Test system object
F017 Return system object to service

F056 Perform development
F062 Design procedure

F063 Define aggregate data usage
F064 Activate procedure
F065 Access data

F065 Access data
F110 Exchange PHRs
F112 Identify user

F084 Submit bill for payment
F143 Return response

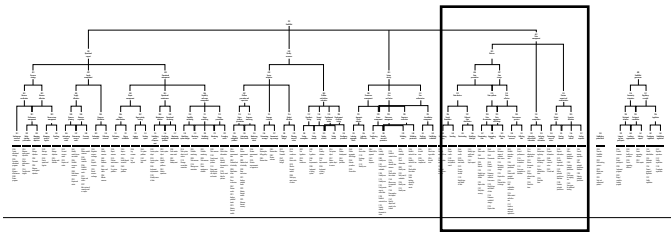
F076 Identify individual
F089 Identify user
F101 Verify user(s) credentials
F104 Identify user
F112 Identify user
F121 Verify permissions to collect data
F128 Establish context of use
F131 Identify relevant documents to return
F135 Establish context of use
F136 Identify relevant data universe
F142 Check validation criteria
F144 Allow access to requested data
F146 Deny application request
F147 Identify objects and events to be tracked

F076 Identify individual
F077 Check information
F089 Identify user
F101 Verify user(s) credentials
F104 Identify user
F112 Identify user

F128 Establish context of use
F135 Establish context of use
F142 Check validation criteria
F148 Select tracking criteria for objects/events

F096 Accredit users
F098 Search for complement

F091 Select training module
F096 Accredit users



601
Data management

503
Data use

406
Data presentation

407
Data storage

312
Data selection

313
Data synthesis

314
Data collection

315
Decision support and communication

226
Search formulation

227
Relevant data identification

228
Data dissemination

229
Data aggregation and storage

230
Data resource provision

231
Data manipulation

232
Patient intake

233
Expertise allocation

143
Formulating query

144
Searching

145
Data tracking

146
Identifying data type

147
Disseminating data

148
Aggregating data

149
Collecting data

150
Provisioning resources

151
Collecting data

152
Interacting with surfaced information

153
Analyzing surface information

154
Determining course of action

155
Routing demand

156
Tracking referral

157
Finding expertise

F128
Establish context of use

F133
Re-formulate query

F139
Select additional items or views

F066
Output results

F130
Enter query and perform search

F066
Output results

F070
Watch for new trends

F072
Create forecast models

F123
Identify type and format of data

F123
Identify type and format of data

F141
Input request

F068
Share results

F069
Disseminate

F074
Report forecast

F123
Identify type and format of data

F125
Acquire data

F127
Verify data accuracy

F068
Share results

F069
Disseminate

F074
Report forecast

F122
Determine means of collection from source

F123
Identify type and format of data

F124
Determine method of storage

F125
Acquire data

F122
Determine means of collection from source

F124
Determine method of storage

F125
Acquire data

F126
Transmit data to storage

F099
Establish connection between users

F106
Connect with practitioner

F109
Connect with potential practitioner

F111
Hold stakeholder conference

F115
Make contact with other user

F117
Introduce additional users and applications

F093
Record performance

F114
Record communication

F119
Enter communication in database

F116
Share infrastructure application

F132
Return documents to user

F137
Display relevant data items

F138
View data items

F090
Review training history

F105
Review medical history

F137
Display relevant data items

F138
View data items

F078
Request information

F080
Choose course of action

F081
Sit and wait

F078
Request information

F079
Provide requested information

F107
Utilize potential practitioner database

F108
Evaluate potential practitioner

F107
Utilize potential practitioner database

F108
Evaluate potential practitioner

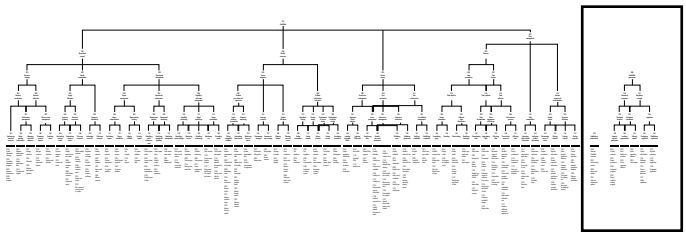
F134
Track query for ongoing use

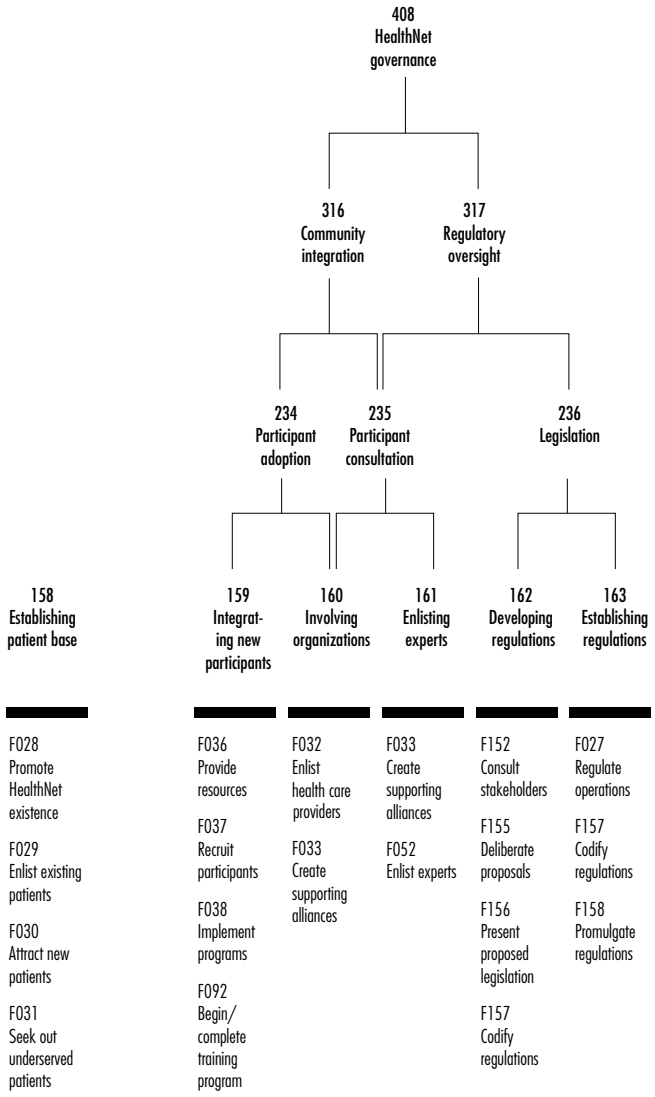
F140
Save views for additional tracking

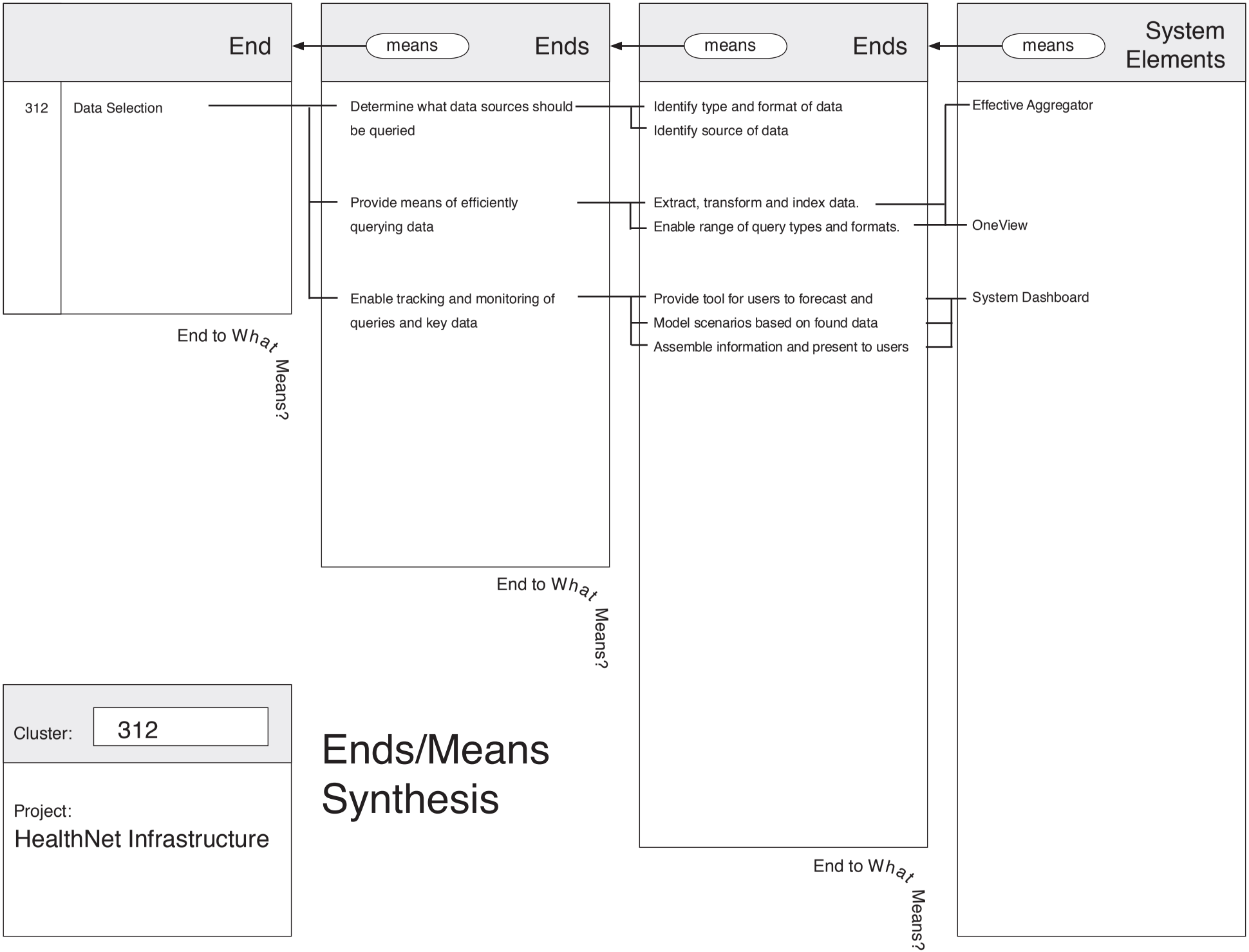
F094
Consult training supervisor

F107
Utilize potential practitioner database

F108
Evaluate potential practitioner



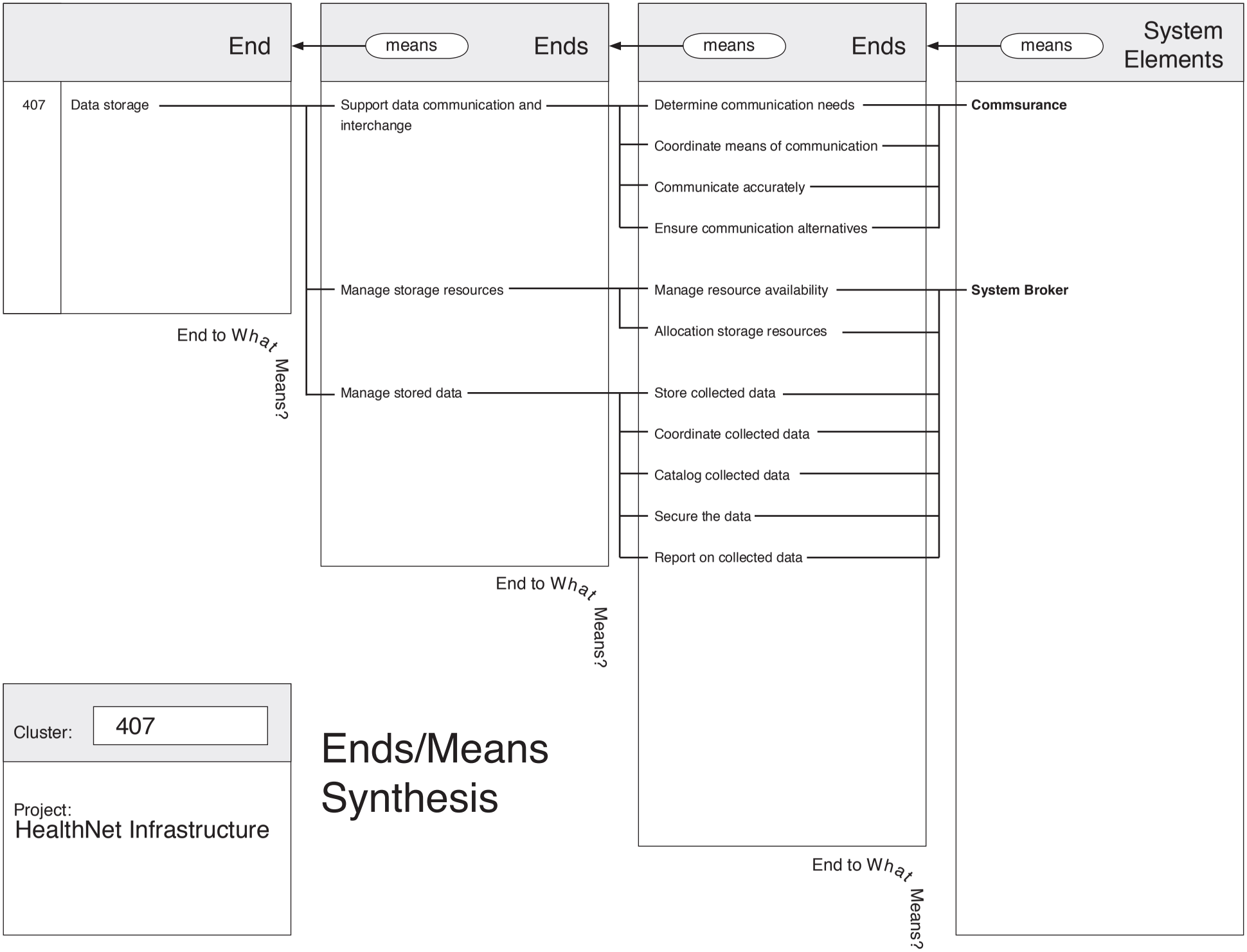

408
HealthNet
governance
316
Community
integration
317
Regulatory
oversight
234
Participant
adoption
235
Participant
consultation
236
Legislation
158
Establishing
patient base
159
Integrat-
ing new
participants
160
Involving
organizations
161
Enlisting
experts
162
Developing
regulations
163
Establishing
regulations
F028
Promote
HealthNet
existence
F029
Enlist existing
patients
F030
Attract new
patients
F031
Seek out
underserved
patients
F036
Provide
resources
F037
Recruit
participants
F038
Implement
programs
F092
Begin/
complete
training
program
F032
Enlist
health care
providers
F033
Create
supporting
alliances
F033
Create
supporting
alliances
F052
Enlist experts
F152
Consult
stakeholders
F155
Deliberate
proposals
F156
Present
proposed
legislation
F157
Codify
regulations
F027
Regulate
operations
F157
Codify
regulations
F158
Promulgate
regulations



Cluster: 312

Project:
HealthNet Infrastructure

Ends/Means Synthesis



Cluster: 407

Project:
HealthNet Infrastructure

Ends/Means Synthesis

Project: HealthNet Infrastructure **Cluster:** 407 **Page:** 1

Functions		System Elements	Commsurance						System Broker						
		Features	1	2	3	4	5	6	1	2	3	4	5	6	7
	F068	Share results	■	▪	■	▪	▪	▪							
	F069	Disseminate	■	▪	■	▪	▪	▪							
	F074	Report forecast	▪		■	▪		▪							
	F093	Record performance	▪		▪	■			■	▪	▪	▪			
	F099	Establish connection between users	■				■			▪	▪				
	F106	Connect with practitioner	■	▪		▪	■	▪		▪	▪				
	F109	Connect with potential practitioner	■	▪		▪	■	▪		▪	▪				
	F111	Hold stakeholder conference	▪	▪	■		■	▪							
	F114	Record communication		▪	▪	■	▪		■	▪	▪	▪	▪	▪	
	F115	Make contact with other user	■				■			▪	▪				
	F117	Introduce additional users and applications	▪	▪		▪									
	F119	Enter communication in database		▪	■	▪			■				■	■	▪
	F122	Determine means of collection from source			■					■	■		▪	▪	■
	F123	Identify type and format of data		■			■			▪	▪				
	F125	Acquire data			■	▪		■	▪	■	■	■	■	■	■
	F126	Transmit data to storage	▪	▪	■			■	▪	▪	■		■	■	▪
	F127	Verify data accuracy	▪	▪		▪		■			▪				
	F124	Determine method of storage	▪								■	■	■	■	■

■ Strongly supports fulfillment of the Function ▪ Supports fulfillment of the Function

Project: HealthNet Infrastructure **Cluster:** 312 **Page:** 1

Functions		System Elements	Effective Aggregator					One View						System Dashboard					
		Features	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6
	F128	Establish context of use				■			■										
	F133	Re-formulate query									▇								
	F066	Output results				▇	▇												
	F070	Watch for new trends											■				▇	▇	
	F072	Create forecast model										■	■			▇	▇	▇	
	F123	Identify type and format of data			▇						▇								
	F141	Input query						▇	▇	■									

▇ Strongly supports fulfillment of the Function ■ Supports fulfillment of the Function

System Element Relationships

Project: HealthNet Infrastructure

System Element Pairings: 1-4 (row elements) with 5-8 (column elements)

Page: 2

Score
3. Critical relationship
2. Strong relationship
1. Slight relationship
0. No relationship

01	**System Broker**	score 3 1. **Commsurance** delivers information to the storage devices specified by **System Broker**			
02	**Secure Foundation**	score 2 1. **Secure Foundation** ensures new network implementations fully support **Commsurance.**	score 0		
03	**Effective Aggregator**	score 0	score 2 1. **Effective Aggregator** accesses diverse data in the **Health Knowledge Base** to create training and support materials.	score 3 1. **Effective Aggregator** pulls together information for presentation in the **System Dashboard**.	
04	**Context Aware Rendering Engine**	score 3 1. **Context Aware Rendering Engine** structures and reformats information as needed to ensure effective communication via **Commsurance**.	score 2 1. **Context Aware Rendering Engine** structures and reformats information as needed from the **Health Knowledge Base**.	score 0	score 1 1. **The Context Aware Rendering Engine** structures and reformats expertise and financial information for presentation in **Med Pathway**.
System elements		**Commsurance** System elements 05	**Health Knowledge Base** 06	**System Dashboard** 07	**Med Pathway** 08

Some questions to ask:

1. How should System Element X work with System Element Y?

2. What new feature/s are possible if System Element X works with System Element Y?

3. What new property/ies would make System Element X work with System Element Y?

Project: HealthNet Infrastructure

System Element Pairings: 1-4 (row elements) with 9-12 (column elements)

Page: 3

System Element Relationships

Score
3. Critical relationship
2. Strong relationship
1. Slight relationship
0. No relationship

		OneView (09)	ClaimNet (10)	SupplyNet (11)	SafetyNet (12)
01	System Broker	score 0			
02	Secure Foundation	score 0	score 0		
03	Effective Aggregator	score 3 1. **Effective Aggregator** pulls disparate data together for **OneView** to present.	score 1 1. **Effective Aggregator** pulls together claim-related data from various sources for **ClaimNet** to process.	score 2 1. **Effective Aggregator** pulls together inventory and supply chain data for **SupplyNet** to manage.	
04	Context Aware Rendering Engine	score 2 1. **Context Aware Rendering Engine** generates context-appropriate data views for **OneView** to present.	score 1 1. **Context Aware Rendering Engine** generates context-approrpriate data views for network terminals accessing **ClaimNet**.	score 0	score 0

System elements

Some questions to ask:

1. How should System Element X work with System Element Y?

2. What new feature/s are possible if System Element X works with System Element Y?

3. What new property/ies would make System Element X work with System Element Y?

Appendix D

System Elements

Communication Structure

System Element

Status: ☐ Existing ☐ Modified ☒ Speculative

Title: **Effective Aggregator**

02

Originator: Michael Winnick

Contributors

Source

Superset Element/s:

Subset Elements:

SNOMED

Related Elements:

oneView

Description:

An integrated set of software tools and procedures that identifies and indexes data stored within the various system connected via HealthNet. **Effective Aggregator** goes beyond the simple indexing of a web-based search engine, seeking to both understand and classify information based on content and it's structure. In doing so, the system "effectively" integrates disperse systems in HealthNet without going through the laborious, costly efforts of custom integration.

Properties - what it is:

- Relational databases
- Knowledge base of medical terms organized in a taxonomy using SNOMED
- Data definition file creation and storage for major documents: PHRs, Claims, etc
- Mapping software that can automatically map files and database fields to data definition standards
- Indexing algorithms that can summarize a range of unstructured media including text, images and sound
- Algorithms that can create structure from an unstructured document set by examining the documents' content

Features - what it does:

- Provides a "single view" into the disparate data found in HealthNet
- Supports structured and unstructured documents
- Indexes a range of media: text, images, audio and structured data
- Works with **System Broker** to identify heavily used data or queries and caches data where necessary
- Enables application developers to create custom "lens" into the data that limit queries to a document sub-set

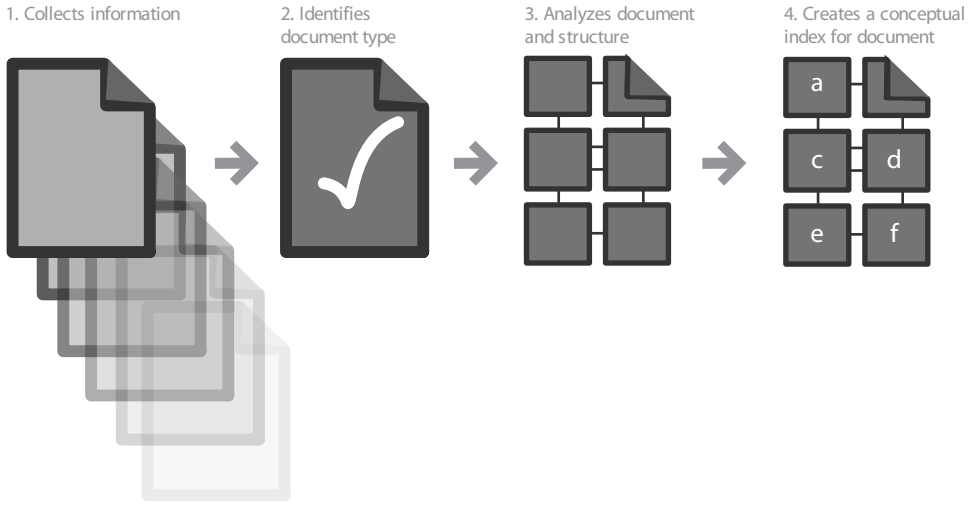
Version 3 **Date:** 17 Nov., 2003 **Date of first version:** 10 Oct., 2003

Fulfilled Functions

065 Access data (Researching)
066 Output results (Researching)
120 Identify source of data (Collecting)
121 Verify permissions to collect data (Collecting)
122 Determine means of collection from source (Collecting)
123 Identify type and format of data (Collecting)
131 Identify relevant documents to return (Searching)
136 Identify relevant data universe (Synthesizing)

Associated Design Factors

D34 Visual or aural content is difficult to search
D48 Unknown data types
D50 Vocabulary inconsistencies
D59 Barriers to application



Discussion

Effective Aggregator collates and indexes the millions of documents found in HealthNet so they can be queried and accessed quickly by other applications. To do so, **Effective Aggregator** must work with documents that are structured and unstructured in a wide range of formats and media types. While various health providers may have unique twists on structured documents like Claim forms and Prescription Requests, application developers will be able to use **Effective Aggregator's** mapping software to quickly map fields to a standard HealthNet definition. Doing so, enables the system to, in effect, aggregate these files and make comparisons between them even though their structures aren't mirror images of each other.

It's important to note that this method of real-time aggregation provides a far more dynamic model for patient data management than a document-centric notion like a Personal Health Record. With **Effective Aggregator**, a PHR is nothing more than a query constrained to a specific users unique identity. Resulting data is collated and presented in a single format, but it is not a static, atomic document.

Effective Aggregator also creates relationships between fields and document types across these structured files. For instance, a patient profile may have the fields SSN, DOB and BLOOD_TYPE. A claim form may have SOCIAL and BIRTH_DATE. Effective Aggregator uses basic lexical analysis and simple rules to create matches across these fields and rank documents on field similarity. This allows care givers to search across and assemble a diverse range of fields from various documents at the patient or population level. It also enables records to be quickly assembled from a wide range of previous documents during text input operations.

This structured information is augmented through the a set of tools that indexes different media types including text, audio, video and still images and where possible attempt to get a basic understanding of their meaning using lexical analysis and ontology-based matching. When document are created or updated, **Effective Aggregator** looks at the contents of various fields, and index them against the large structured vocabulary found in SNOMED.

By organizing documents and information around concepts, the

Effective Aggregator enables much more powerful relationships between different documents that wouldn't be discovered by simply looking at their structure and basic keywords.

Scenario

At the successful completion of Sven Koneig's bypass surgery at 9:16 am, Dr. Bidlsbee reviews a few electronic charts and spends a few minutes dictating a review of the surgery itself. In his comments Dr. Bidlesbee notes a few frustrations with his bypass surgery tools and a few minor complications that resulted from their use. After wrapping up his comments and releasing the post-operative summary at 9:21 am, Bidlesbee moves on to see the next patient in his day. The data regarding Koneig's bypass surgery is saved locally at Cook County Hospital in a relational database in their proprietary format.

As a participant in HealthNet, County's local servers are installed with **Effective Aggregator**. **Effective Aggregator** has as an XML-enabled interface to County's database, specifically designed to extract and index relevant medical data, particularly that found in personal health records. **Effective Aggregator** pulls updated patient information from County at regular intervals. At 9:25 am, the effective aggregator makes another call to the County database and finds that amongst others, Sven Koneig's record has been updated and released with a post-operative summary. **Effective Aggregato**r begins the task of extracting this data by converting it from County's proprietary data model to the HealthNet's procedure summary definition standard, utilizing the rapid mapper data model developed by County's application development team. During this conversion, the **Aggregator** discovers that Koneig's record contains multiple forms of media and documentation including images taken during the surgery, a log of all monitoring data captured during the operation, structured data including the type of procedure and the procedures duration, and Bidlesbee's unstructured oral comments.

Effective Aggregator treats each of these media types differently as it indexes. It tags surgery images with a code denoting the procedure type, then are they analyzed for their histogram, color properties and basic shape contours. The structured data, itself, is analyzed to ensure that it maps to HealthNet data standards. In this case, the duration field used by county is HH:MM:SS, while HealthNet stores all time data in seconds only. This conversion is done on the fly. Effective Aggregator compresses monitoring equipment logs through a series of snapshots and denormalized against a standard for logging data.

Lastly, Bidlesbee's oral comments are indexed by pulling out time-coded keywords using a combination of his personal speech model, a large standard vocabulary and SNOMED's rich ontology of domain-specific terminology. In performing this routine, **Effective Aggregator** not only identifies keywords like "percutaneous in-situ coronary venous arterialization" the surgery's official name, but then takes the step to index this procedure in a hierarchy under bypass surgeries, under coronary surgeries. Doing so means that the record also gets tagged with synonyms and acronyms for the procedure like PICVA, it's abbreviated name. **Effective Aggregator** goes one step further, developing an "understanding" of basic concepts mentioned in the oral history, in this case indexing his mentioned frustration about tool use and minor complications that arise from it to concepts including "equipment problems" and "surgical complications."

System Element	Status: ☐ Existing ☐ Modified ☒ Speculative	Title: **Commsurance**	07

Originator: Michael Winnick

Contributors

Source

Superset Element/s:

Subset Elements:

Related Elements:

Effective Aggregator
OneView

Description:

Commsurance assures secure and timely communication via multiple media types: text, voice, or video. **Commsurance** intelligently connects resources via Comm Coordinator and mitigates the risk of corruption or miscommunication via Comm QA.

Properties - what it is:

- Communication request clearinghouse
- Comprehension and reinforcement support tools
- Communication configurator and translator
- Secure data envelopes

Features - what it does:

- Prioritizes communication resource requests
- Assimilates data formats
- Translates communication content for end-users
- Records communication messages
- Brokers mutually beneficial communication formats
- Packs data for secure and timely routing to its destination

System Element

Continuation Page: 1

Title: **Commsurance**

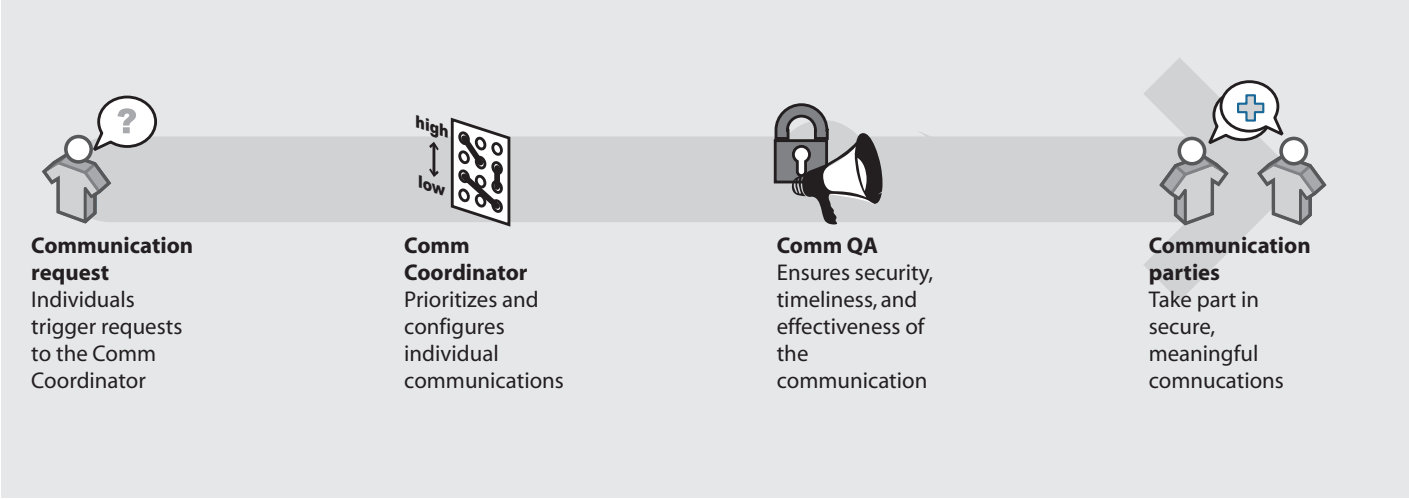
07

Fulfilled Functions

F068 Share results
F069 Disseminate
F074 Report forecast
F093 Record performance
F099 Establish connection between users
F106 Connect with practitioner
F109 Connect with potential practitioner
F111 Hold stakeholder conference
F115 Make contact with other user
F117 Introduce additional users and applications
F122 Determine means of collection from source
F123 Identify type and format of data
F125 Acquire data
F126 Transmit data to storage
F127 Verify data accuracy

Associated Design Factors

D027 Errors in transcription
D035 Practitioner maintains limited conferee list
D041 Person-to-person supervision is slow and costly
D044 Contact not responding
D045 Miscommunication between users
D046 Hardware or software is incompatible



Discussion

As an information-based infrastructure, HealthNet must connect and support communications between various parties. Data communication resulting in inaccuracies, misunderstandings, or untimely distribution would undermine related HealthNet services that depend on communication. To avoid such problems, **Commsurance** plans for, moderates, and supervises valuable and accurate communication. At a high level, **Commsurance** is about connecting people via HealthNet. At a low level, it's about coordinating efficient and effective data transfer.

The foundation of effective communication is a defined language. For information networks, this means a common structuring, or encoding, of the data. **Commsurance** works with the **Effective Aggregator** to ensure networked communications share a common structuring to simplify the exchange of "dialog" or data.

The next layer of effective communication is coordination of those parties communicating. In the case of information networks, such parties may be in different time zones with different communication needs using different communication interfaces. And in the case of HealthNet, some communication (such as tele-surgery) may be more critical than other communications. To accommodate these differences, Comm Coordinator receives communication requests, configures the communications based on the capabilities of the parties involved, and prioritizes the communications based on criticality.

The highest layer of effective communication is the assurance of quality, secure, and meaningful communication. Comm QA packages, delivers, and increases the comprehension of the communication. As communication data is created, Comm QA securely packages the information in routing envelopes, specifying the data's destination and priority level to ensure communication is delivered in a secure and timely fashion. In addition, Comm QA works with the communication audience to reinforce the communication by recording the communication and delivering it in additional media types (e.g., sound and text, video and stills, etc.).

Scenario

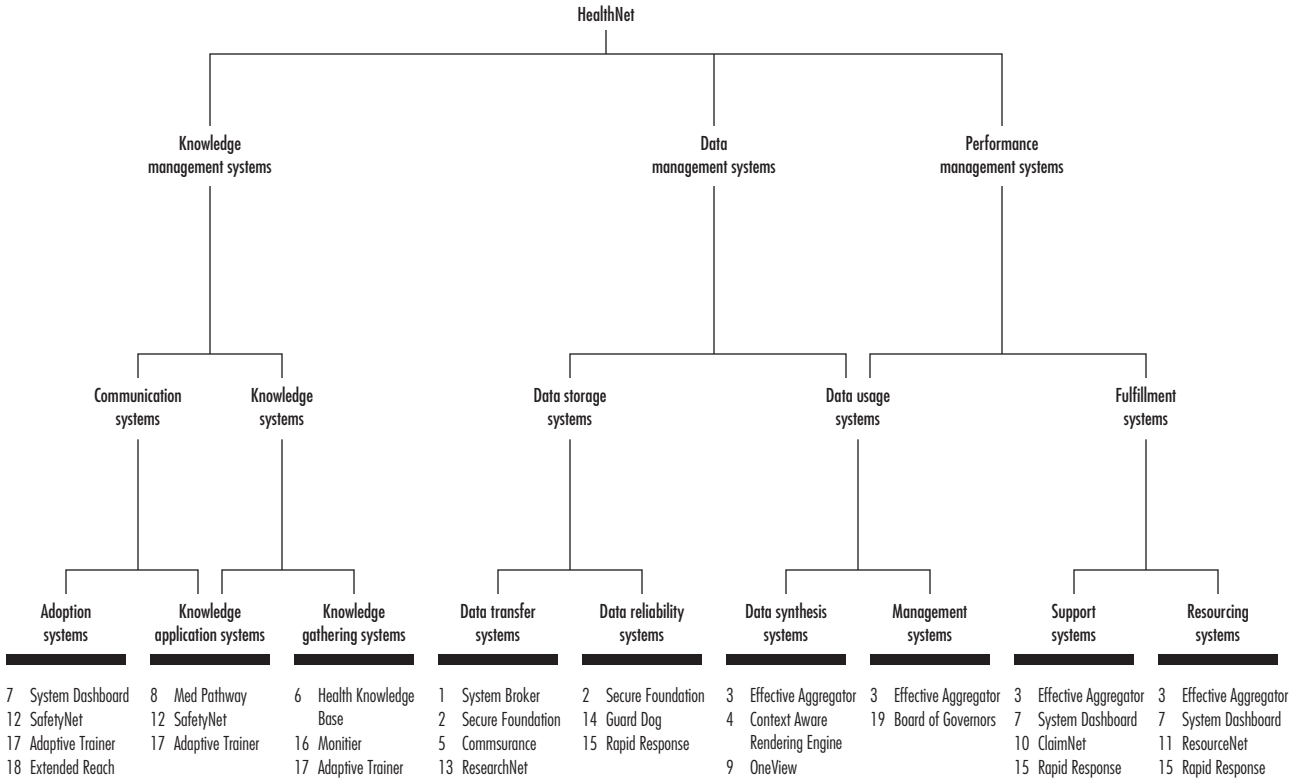
It's been a week since Dr. Bidlesbee performed Sven's non-invasive bypass surgery. Dr. Bidlesbee said it was a routine procedure, but for Sven it was anything but routine. After a day in the hospital recovering, Sven was sent home. It's been a week since his surgery, and today will be his first post-op checkup from home with Dr. Bidlesbee.

Bidlesbee initiates the tele-checkup with Sven. Bidlesbee is using a camera that captures his face and voice alongside a high-resolution display of Sven's files. Meanwhile, Sven has a low-resolution video-display and camera. The cameras that Dr. Bidlesbee and Sven use create video data based on two different formats. This difference doesn't affect their communications because **Commsurance** works with the **Effective Aggregator** to restructure and translate the video formats.

Comm Coordinator negotiates the best configuration between the two parties. Recognizing the limitations on Sven's end, Comm Coordinator gives Dr. Bildlesbee the ability to toggle Sven's video display between the doctor's face and parts of Sven's file that the doctor wants to share.

As the tele-checkup proceeds, Comm QA sends streams of encrypted packeted data between Dr. Bildesbee and Sven, keeping the communication private. Comm QA recognizes that Sven has experienced some hearing loss, so Dr. Bidlesbee's conversation is transcribed as subtitles over the video.

Dr. Bildesbee and Sven complete the checkup. Sven was nervous about what the doctor might say about his recovery, and so Sven didn't feel that he had heard all that the doctor had to say about other matters. Luckily, Comm QA asked if Sven would like to replay the check-up. Sven gladly did, feeling better informed and less confused about what Dr. Bildesbee had to say.


HealthNet
Knowledge management systems
Data management systems
Performance management systems
Communication systems
Knowledge systems
Data storage systems
Data usage systems
Fulfillment systems
Adoption systems
Knowledge application systems
Knowledge gathering systems
Data transfer systems
Data reliability systems
Data synthesis systems
Management systems
Support systems
Resourcing systems
7 System Dashboard
12 SafetyNet
17 Adaptive Trainer
18 Extended Reach
8 Med Pathway
12 SafetyNet
17 Adaptive Trainer
6 Health Knowledge Base
16 Monitier
17 Adaptive Trainer
1 System Broker
2 Secure Foundation
5 Commsurance
13 ResearchNet
2 Secure Foundation
14 Guard Dog
15 Rapid Response
3 Effective Aggregator
4 Context Aware Rendering Engine
9 OneView
3 Effective Aggregator
19 Board of Governors
3 Effective Aggregator
7 System Dashboard
10 ClaimNet
15 Rapid Response
3 Effective Aggregator
7 System Dashboard
11 ResourceNet
15 Rapid Response