The Caduceus Project:

A Blueprint for Health Information Technology
In the 21st Century

in proposed collaboration with:

imagination at work

IHC

EMC² where information lives

altiris intuitive > manageability

NSI SOFTWARE

Novell

suse A NOVELL BUSINESS

hp invent

XMISSION

rsi

SCI INSTITUTE

Executive Summary

The Caduceus Project envisions an industry-wide alliance that would unite a public-private consortium of healthcare organizations and technology vendors, with a shared vision to develop and build an **HIT** (Health Information Technology) ecosystem comprised of an integrated, interoperable, and open-systems architecture on a single platform in Salt Lake City, Utah. This joint-venture collaboration would create an HIT value-chain that would fully integrate and interconnect every element within the hardware and software platform to support the healthcare workflow delivery and correspond to the point-of-care process model. In its completed state, it would function as a Global HIT Showcase Model, Executive Briefing Center, Interoperability/Proof-of-Concept Lab and, finally, as a Virtual/Hands-on Training Center. ***The Caduceus Project*** will exist to educate healthcare professionals on Health Information Technology and its practical application towards reducing medical errors, increasing patient safety and quality, operational efficiency, and cost-effectiveness of delivering healthcare in the 21st century.

☐ Background: The Case for HIT.

According to the Institute of Medicine, somewhere between 44, 000 to 98,000 deaths occur on a per annum basis as a result of medical errors.[1] In addition to this alarming statistic, physicians and hospitals are challenged with the task of balancing the safety and quality of patient care across care settings and disparate systems against the backdrop of a vertical rise in cost of healthcare delivery. This dilemma leaves little option but to perpetuate the cycle of cost increase and human labor and resources overhead (or, conversely, increase the nurse to patient ratio) to fill the widening chasm between a traditional paper-based healthcare model and the needs of modern digitized healthcare.

In response to this looming crisis, the current Presidential Administration, together with U.S. Congress and the **DHHS** (Department of Health and Human Services) has issued a call to action for the HIT community to engineer a solution blueprint to support the federal campaign towards HIT adoption.

[1] **Institute of Medicine** ***To Err is Human: Building a Safer Health System***, November 1999

The solution blueprint would create a standard exchange format of the **EHR** (Electronic Health Record), a longitudinal patient record, which would provide continuity of care across organizational boundaries and disparate systems. The preamble step from concept to reality is the development of an **EMR** (Electronic Medical Record) application ecosystem. The EMR is an electronic patient record created by a **CDO** (Care Delivery Organization) within a collaborative and integrated digitized process framework. The EHR, on the other hand, is a superset record comprised of metadata from EMR's that would be exchanged through the **RHIO**[2](Regional Health Information Organization). There are several pilot projects in place[3] that will demonstrate how the RHIO would serve as the nucleus model of healthcare delivery, within a defined regional community, by exchanging the EHR through a common protocol. The eventual goal of the RHIO is to evolve as the building blocks of the **NHIN** (National Health Information Networks) where the EHR could be securely exchanged within an inter-RHIO framework.

Snapshot: Why do we need HIT?
❖ Medical Errors ❖ Increasing Cost of Care Delivery in Paper-based model ❖ Pandemic Disease Surveillance ❖ Patient Safety and Quality ❖ Clinical Decision Support Systems ❖ Digitized Medical Images

[2] See Appendix B: Glossary for definition
[3]

☐ The HIT Vision: Seeing Healthcare through a Digital Lens.

The central proposition of this project is to engender a consortium of best-in-class talent and industry expertise within the health and technology sectors. The consortium would align its unique capabilities to execute a collaborative effort within the overarching goals of the HIT initiative. In the spirit of promoting open-systems architecture and interoperable standards, the project would require the commitment of its stakeholders to the vision of a holistic and multi-vendor ecosystem. This cooperative effort would seek to transform the way that healthcare is delivered within the U.S. and around the world using information technology. The result of this effort would be to reduce medical errors, improve the safety and quality of patient care, protect patient confidentiality, reduce and control costs and achieve greater operational efficiencies. In turn, healthcare organizations will see the incentives to adopt HIT through lower **TCO** (Total Cost of Ownership), higher **ROI** (Return on Investment) within a simplified solution blueprint using mature and proven health information technology.

☐ The Mission: Technology Connecting Health with Care.

The Caduceus Project would be designed and showcased as a prototype in accordance with proven methods and best practices that builds on a standards-based, open-systems architecture. It will be implemented and piloted using multi-vendor products and configurations within a vendor-neutral *plug & play* framework. While on one hand, a digital healthcare model will solve many existing issues, it will produce new set of challenges that will also need to be considered. ***The Caduceus Project*** will seek to address the existing issues and examine the new set of challenges as follows:

❖ **Exponential Data Growth/Retention Management:** design an ILM (Information Lifecycle Management) strategy that will enable rule-based engines to automate business procedures and apply information policies in the data and resource management process framework.
❖ **HIPAA Privacy Requirements:** a comprehensive set of security policies standards that address physical access, permission and role-based access, access audit controls, firewall, anti-virus and data encryption.

❖ **Healthcare Specialization/Multi-Disciplinary Collaboration:** examine methods to enable vertical integration and cross-collaboration between different organizational roles and medical disciplines which sometimes result in conflict and ambiguous decision-making. One example of this would be of who maintains medical jurisdiction in a collaborative setting, where a primary physician is remotely sharing and diagnosing a patient's prognosis, when the patient is outside of his primary area of care.
❖ **Incompatible Systems/Technologies:** technologies that once were endemic to one another can now co-exist in the same hardware ecosystem and can be conjoined through the application of virtualization software that abstracts the physical platform or medium to which the data or application is connected.
❖ **Patient Safety:** through electronic data entry and a consistent user interface, patient-critical data can be shared across care settings in a secure, real-time exchange thus reducing the probability rate for human error and the time-to-diagnosis.
❖ **Quality Patient Care:** with **CDSS** (Clinical Decision Support System) and **CPOE** (Computerized Provider Order Entry) support, healthcare providers will be able to access patient-relevant data to render context-specific decisions based on patient profile, history and other demographic data provided through disease surveillance initiatives.
❖ **Reduced Cost of Healthcare Delivery:** a large portion of the cost burden in healthcare is due to the administrative overhead needed to support the manual processes involved in maintaining patient record lifecycle management from data entry, chart management, information updates to the transfer and disclosure of medical records to support continuity of care across multi-disciplinary and geographic settings. With digital records, cost is fractionalized as information will be transmitted electronically through secure channels thus eliminating the cost burden and time delays associated with the overhead of manual labor.
❖ **Operational Economies of Scale:** technology allows for application platforms to reside on the same physical space but logically partitioned and provisioned to server role-based access within the organization. In this way, physical media that would otherwise be dedicated to one application platform can be split to scale on a fractional cost factor.
❖ **Continuity of Care across medical care settings:** web-based technology allows for the secure exchange of patient data to overcome traditional geographic and time-lapse boundaries. Thus the logistics to mobilize patient information can

be reduced only to the throughput limitations imposed by network speed and data transfer rates.

❖ **Dynamic linking to create EMR⇒EHR:** the application ecosystem should create a patient record supply-chain with dynamic linking of patient information and medical images to a master patient index. The patient chart would then render a synoptic and relational view of the patient's medical and medication history, demographic information and digital images.

☐ The Opportunity: Revolutionize Healthcare.

Today there are several key developments that have coalesced to form the ideal tipping point in the standardization, interoperability and adoption of HIT within the healthcare community. These have germinated from four distinct sources:

1. **National Agenda**
2. **Healthcare Community**
3. **Technology Vendors**
4. **Business/Market Trends**

The figure below illustrates how the HIT puzzle is being solved and bullet-points the respective initiatives adopted by each stakeholder:

The HIT Puzzle

National Agenda:

During his State of the Union Address in 2004, President George W. Bush issued a call to action for advancing the nationwide adoption of the EHR by 2014. A task force delegation, **PITAC** [4](recently reconstituted as PCAST), was commissioned to articulate the key tenets and initiatives needed to address the challenges and interstitial gaps in the healthcare sector using information technology. PITAC has published[5] its vision to the federal government in a report outlining four key measures to be addressed:

- EHR (Electronic Health Records)
- CDSS (Clinical Decision Support Systems)
- CPOE (Computerized Provider Order Entry)
- Secure, private and interoperable HIT exchange

In concerted effort, the U.S. Senate **HELP** (Health, Education, Labor and Pensions) committee has passed several key legislative bills[6] through U.S. Congress designed to promote and support the widespread adoption and effectiveness of HIT. Within the broader context of this effort, the U.S. Congress has authorized the DHHS to execute a strategic plan to further accelerate HIT development and adoption. As a corollary measure, the Federal government has appropriated a multi-million dollar budget to subsidize and incentivize the efforts within this initiative.

The DHHS has engendered the above funded program, in close collaboration with the **AHRQ** (Agency for Healthcare Research and Quality), to sponsor and oversee the development of demo projects that would cross-examine all of the business, medical, and technology drivers within a controlled environment. This would allow the analysis and certification of vendor interoperability in a standards-based approach of healthcare delivery to support the RHIO and the NHIN.

[4] President's Information Technology Advisory Council
[5] Source: PITAC *Revolutionizing Health Care through Technology*
[6] See Appendix A

HealthCare Community:

Within the Healthcare community, there is a strong movement towards embracing proven technology which has been successfully implemented across other commercial sectors such as banking and retail manufacturing. Historically, HIT systems have resided on proprietary systems to reflect the autonomous organizational model within hospital departments. This scenario created highly fractured organizations and data silos where in many cases duplicate systems were purchased. Each department required its own IT staff and vendor to install and support the environment which resulted in high, uncontrolled costs and inefficient processes. Some of the most prevalent pain points are bullet-pointed in the caption below:

Snapshot: Healthcare IT Pain Points

- Organic Applications (lack of ongoing software lifecycle maintenance cycle)
- Fractured IT Environments (Duplicate staff, equipment, processes, etc…)
- Lack of standards-based offerings (too much customization and complexity in the decision-making process)
- Lack of IT process alignment to business objectives and model
- Lack of an understandable TCO/ROI incentive framework
- Need for cultural indoctrination (Learning curve for medical staff training)
- Medical errors due to inefficient manual processes that result in the lack of task completion, misinterpreted handwritten notes, lack of information continuity between staff members and care settings.
- Cost-ineffective and time-consuming procedures involving patient record transfer across care settings.
- Accessibility to real-time patient data and information to render time-sensitive critical decisions.
- Lack of a synoptic and relevant patient record (i.e. Master Patient Index Record)
- Lack of operating budget to spend on IT initiatives

With the recent acceleration of joint-venture collaborations and strategic alliances across technology vendors, best-in-breed technologies can be contextualized and commoditized to scale within the healthcare industry.

National organizations such as the **HIMSS** (Health Information Management Systems Society) and **AMIA**[7] (American Medical Informatics Association) have been formed as think-tank organizations that help to define the roadmap and agenda for HIT initiatives within the healthcare community. They further serve as advocacy groups that shape industry-standards policy and influence public awareness of the EHR vision.

These organizations seek to achieve three key goals:

1. Create the HIT supply-chain that would produce the EMR
2. Create the adoption and secure exchange format of the EHR within the context of the RHIO.
3. Extend the RHIO model to a national matrix within the context of EHR secure exchange format through the NHIN framework.

HIMSS (Health Information Management Systems Society))[8] promotes an initiative called IHE (Integrating Healthcare in the Enterprise) to provide a standards-based model for the secure and reliable exchange of electronic data and patient records. They have also recently constituted the formation of a RHIO Federation where RHIO members, from divers' states, can join to exchange information and best practices.

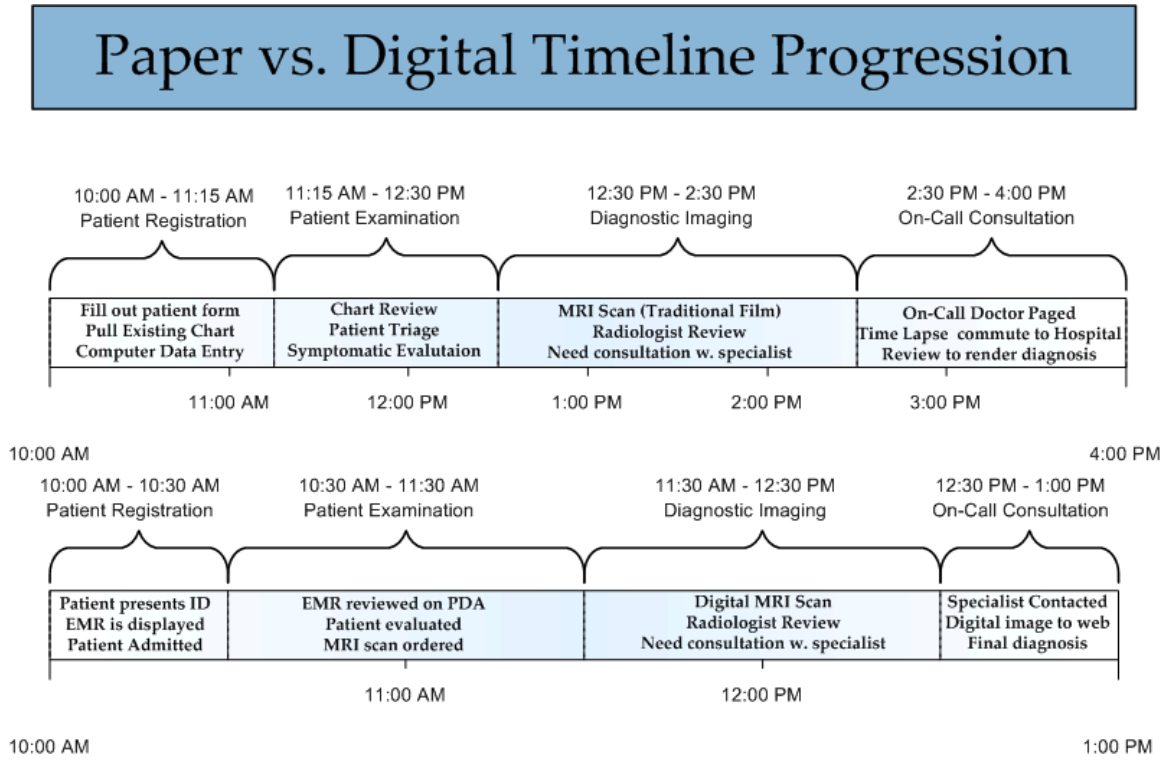
AMIA[9] (American Medical Informatics Association) sponsors a ***Got EHR?*** initiative that seeks to bridge the challenges within three main stakeholders: Patients, Clinicians and Policymakers.

Both have been vanguard evangelists of the need to create a digital healthcare framework to reduce medical errors, reduce costs and increase patient safety and quality care.

[7] http://www.amia.org
[8] http://www.himss.org

[9] http://www.amia.org

An example of digital architecture improving the quality and cost of patient care is found in the scenario below. It should be noted that this timeline is hypothetical and assumes extrapolated values. The Human Resources column should assume a workforce necessary to create and support a paper and film based operational delivery model such as a film technician and a medical office assistant to prepare charts and perform data entry.



	Paper-based	Digital	Net Difference
Human Resources	8	5	+3 staff count
Total Time	6 hours	3 hours	+3 hours
Patient Safety	Undiagnosed state for 2 ½ hours	Undiagnosed state for ½ hour	+2 hours
Patient Quality	Manual process subject to human error	Digitization = consistent presentation/routing of information	Higher probability of correct diagnosis
Cost of Delivery	3 additional staff x labor hours Long Patient Stay	Right-size staff Focus on competency Shorter Patient Stay	Quantifiable savings with HIT workflow delivery

Technology Vendors:

The landscape of IT Vendors has changed. Given the maturity of current technologies, consumers are increasingly directing their attention to vendors who possess deep industry knowledge of their business model and operations. This paradigm shift has caused technology vendors to rethink their product development and market strategy which has resulted in increased vertical product and service offerings that align to industry-specific sectors. The Healthcare/Life Sciences vertical market is no exception. Gartner Dataquest forecasts that the U.S. healthcare market will grow at a compound annual growth rate (CAGR) of 7 percent from $34.1 billion in 2001 to $47.9 billion in 2006.[10]

This growth rate, coupled with regulatory compliance and federal sponsorship, has fueled significant interest among vendors who wish to capture this market. The maturity of technology has allowed vendors to scale vertical solutions on proven architecture platforms and begin to focus on industry-specific application of technology.

Market Factors:

High-end technology, traditionally viewed as customized and complex, has undergone a major commoditization that is now more cost-effective and accessible to the market. This factor when viewed against a backdrop of regulatory compliance and federal incentives has created a market convergence. It has exponentially increased IT spending as compared to earlier and more conservative linear growth predictions that precluded these dynamic market shifts.

Corporate executives have increasingly turned their focus towards TCO and ROI metrics as these economic models have matured and allow for financial measurements to take a more meaningful forecast around cost to benefit ratios.

[10] **Institute of Medicine** ***To Err is Human: Building a Safer Health System***, November 1999

Standards-based IT management models such as **ILM** (Information Lifecycle Management), **ITIL** (Information Technology Infrastructure Library) and **COBIT** (Common Objects for Information Technology) will

be increasingly regarded as de facto standard protocols to understand IT investment strategies. They provide a flexible and cost-adaptive framework that healthcare organizations can incorporate to quantify and control **CAPEX** (Capital Expenditures) and **OPEX (**Operating Expense) spending in the broader context of overall IT budget planning.

☐ Adoption Barriers: Creating an HIT Culture.

The challenges and pain points felt in healthcare may make for an obvious business case for the quick adoption of HIT, but there are also legitimate barriers that must be considered. While there is general, if not unanimous, consensus for the digitization of healthcare delivery, the philosophy of patient care and the ***modus operandi*** of hospital administration have not kept up with the pace of technology. For instance, an agreed-upon methodology is difficult to achieve within, what is arguably, the most tightly regulated industry in the country. Among some of the key and legitimate issues raised within the healthcare industry:

- Past Failed attempts: There have been previous attempts such as CHIN (Community Health Information Networks) that were unsuccessful in the past
- Incidental Disclosures
- Privacy Violation: Audit & Access Control Policies and Mechanisms
- EHR Metadata Composite (what information is placed into the EHR)
- Cost/Benefit Factor for CDO's (Care Delivery Organizations): where is the return on investment for smaller CDO's?
- Caregiver Jurisdiction: who makes the final decision in a shared caregiver model?
- Lack of IT capital and operating budget[11]
- Identity Management: Non-existence of a unique, universal Patient ID
- Lack of a true standards-based IT blueprint

[11] Source: Robeznieks, *Modern Physician*, 10/11

☐ Key Success Factors: The Blueprint to Win.

Given the challenges and threats to the success of an interoperability project, there must be a plan to win. The opportunity cost to not address these long-standing issues poses an even bigger threat. The following factors will be imperative to the success of ***The Caduceus Project***:

- ❖ Well defined Project Management framework and Governance Structure
- ❖ Intra-vendor roles and expectations well defined within a Consortium Agreement
- ❖ Alignment of project goals to the HIT agenda and initiatives defined by the PITAC, U.S. Congress and the Department of HHS
- ❖ Formation of a **Healthcare Advisory Council** to advise on the workflow delivery model and to perform mock-up simulations
- ❖ Phased rollout approach with a quorum set of technologies to be implemented in a phased-approach basis
- ❖ HIT Knowledge Library
- ❖ Stage environment to continuously evolve and integrate
- ❖ Integrate a real-world project that can be targeted to low-income and/or rural areas and benchmarked as a case study per Senate bill provisos
- ❖ Support EMR/EHR modeling initiative
- ❖ Establishment of a virtual and hands-on resource center to promote mindshare and acceptance of end users in the healthcare community
- ❖ Establishment of a proof-of-concept and interoperability lab to introduce new concepts and products to the project.
- ❖ A Solution Blueprint to simplify adoption in the healthcare community

☐ Measures of Success: Creating a Value-Chain of Care.

In its completed state, the ***Caduceus Project*** will serve the following roles:

Global Case Study Model: a reference study to observe and understand the technological building blocks towards creating an HIT infrastructure in a multi-vendor architecture. It may further serve as a discussion forum for sharing success stories and exchanging ideas on how to optimize and improve vendor interoperability and process flow efficiency.

Executive Briefing Center: the project will serve as a platform to demonstrate the value of HIT implementations, from a financial investment, patient safety and quality and operational efficiency perspective, to an executive audience spanning from government agencies, healthcare and academic organizations, and corporations.

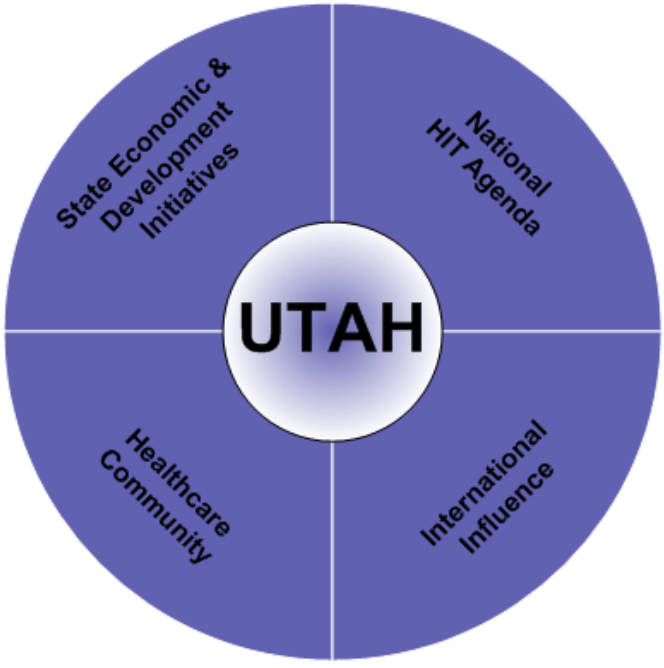
Proof-of-Concept/Interoperability Lab: a controlled and regulated environment with the framework and flexibility to absorb evolving concepts and incorporate them into the body of the project.

Education/Training Center: a state-of-the-art facility that would attract healthcare professionals and IT professionals to deepen their knowledge on HIT best practices and proven methods by providing hands-on workshops and virtual simulated training through web-based course offerings.

☐ Location: Utah, "This is the Place".

Utah is in a unique position to build on its status as a recognized model of HIT, by leveraging its state economic development initiatives[12] and its influence on global markets. The **UDOH** (Utah Department of Health) has a long standing relationship as a sister organization to the Beijing Health Bureau and will be participating in the medical training of Chinese healthcare providers for the **2008 Beijing Olympics**. Utah is at the epicenter for strategic growth and to provide visibility on a global platform in four key areas:

1. Local Healthcare Community: The RHIO
2. State Economic & Development Initiatives: Tripartite R&D Initiatives (Applied Research, Academic and Commercial)
3. National Policy Agenda towards NHIN and EHR creation and adoption
4. International Relations: Key relationship with the Chinese Ministry of Health, the CDC (Center for Disease Control), and the BHB (Beijing Health Bureau)



[12] http://www.utah.gov/governor/economic_development.html

Prior to his appointment to President Bush's cabinet as Secretary of the DHHS, Secretary Mike Leavitt served as Utah's longest tenured governor and was a central force behind the vision and evangelization of HIT advancement and adoption. Secretary Leavitt supported key measures and strategic planning such as the "Healthprint"[13] initiative towards early adoption and implementation of HIT projects within Utah's regional medical community. This has secured a legacy of a strong HIT maturity model and acceptance within the state of Utah. One key example to this is **IHC** (Intermountain Health Care) who, in addition to being Utah's largest employer, has been the recipient of the prestigious **IHN** (Integrated Health Network) award five times in the last six years. This award is based on the evaluation of doctors, hospitals, and health plans that work together in a coordinated manner for the benefit of the patient.[14]

Utah has a recognized pool of intellectual capital and a highly regarded research park presence through its on-the-ground representation with such industry leadership such as Novell, GE, IHC and the University of Utah. This panel can be used to achieve a fully-scaled effort towards a 360° platform integration. The 2004 Milken Report ranks Utah ninth in the nation for its "inventory of technology and science assets that can be leveraged to promote economic development".[15]

[13] http://www.utah.gov/governorleavitt/biography.html
[14] http://www.ihc.com/xp/ihc/aboutihc/news/article25.xml
[15] **Milken Institute:** ***State Technology and Science Index 2004***; Available at www.milkeninstitute.org

Furthermore, the 2002 State New Economy Index ranks Utah 12th in fostering the new economy, ranking especially high in the area of high-tech innovation, presence of scientists and engineers and Information Technology jobs.[16]

The University of Utah has been a collaborative force in the development of technology through its **T2M** (Technology to Market)[17] and its **TTO** (Technology Transfer Office) founded in 1968.

Furthermore, the **UTIC**[18] (Utah Technology Initiative Council), created in 2003 as a result of Utah Senate Bill 151, serves to evaluate and support the strategic planning and execution of technology business initiatives that will promote and foster the economic and growth development of the state.

[16] http://www.neweconomyindex.org/states/2002/utah.html

[17] http://www.t2m.com/

[18] http://goed.utah.gov/UTIC/background.html

☐ The Vendor Consortium: A Winning Team.

The Caduceus Project will be built at a vendor-neutral location where stakeholder interests can be represented in a democratic forum and greater access can be provided to the public and private sectors wishing to participate or attend consortium-sponsored events. The suggested location of the project will be at XMission. Located on x? square feet of class-A real estate in the heart of historic downtown Salt Lake City, X-Mission was founded in 1993 and stands today as the largest independent ISP in the state of Utah. As an xSP, X-Mission has state-of-the-art datacenter facilities and enterprise-class infrastructure capabilities featuring Fiber Optic cable and media. Also, with over x? square feet of floorspace, X-mission has the ability to grow with the project and host a variety of custom settings such as a hospital (CDO) floor replica for the simulation and modeling of the workflow process framework.

The remaining vendors identified for the initial scope of this project were selected using a criteria matrix that examines the following attributes:

Vendor Selection Criteria Matrix

- Unique Contribution to the Project
- On-the-Ground Presence at Proposed Location
- **Informal** Product CMM (Capability Maturity Model) Rating
- Global/National Market Presence
- Deep Industry-Knowledge of Healthcare Vertical
- Organizational Commitment towards Interoperability of Open-Systems and Open-Standards HIT Ecosystem.
- Interoperability-readiness: joint-venture synergies in place

Proposed Vendor Consortium:

Vendor/Organization:	Value-Proposition:	Value Contribution:
Novell	❖ Support current efforts in China market ❖ Personnel, Resources & IP "on-the-ground" Utah ❖ Deepen market presence within HIT vertical sector ❖ Promote Utah Technology Business	❖ Showcase Linux HPCC , Zenworks & Identity Management ❖ R&D/Marketing Opportunity to showcase recent partnership w/ HP Blade Server on HPCC
RSI	❖ Proven capabilities in Storage and multi-vendor solutions ❖ Co-develop the solution blueprint of the turnkey architecture ❖ Represent mutual interests of all stakeholders: win-win value proposition.	❖ Organize and moderate meetings to define agenda, objectives, deliverables and milestones ❖ Promote HIT as a Systems Integrator: front-line advocates of HIT in the market. ❖ Provide Project Management of a multi-vendor consortium
XMission	❖ Promote a Utah Technology Business ❖ Promote HIT Agenda	❖ Technology Showcase ❖ Proof-of-Concept & Interoperability Lab ❖ Executive Briefing Center ❖ Hands-on Training & Resource Center ❖ Infrastructure/IT Services

General Electric	❖ GE has just signed a $US 100M/10yr. R&D joint-venture agreement with IHC to co-develop their clinical applications in SLC, UT ❖ GE|IHC "on-the-ground" presence in UT ❖ PR/Marketing opportunity for GE to promote mindshare of their collaboration with IHC ❖ Support current efforts in China	❖ Provide strong engineering presence ❖ Provide mature and proven Health Information product line through Centricity and IHC organic clinical applications ❖ Replicate solution blueprint to GEMS (Medical Park in Beijing) to further push HIT adoption in China ❖ IHC recognized as top IHN (Integrated Healthcare Network)
EMC²	❖ SAN Hardware platform ❖ EMC currently has a JV agreement GE for vertical PACS/DICOM architecture ❖ Support current efforts in China: recent strategic alliance with Neusoft will include plans to construct new R&D center in Shenyang City	❖ Deep industry-knowledge of storage technology and HIT architecture ❖ HIT solutions, primarily medical imaging, on open-systems architecture
University of Utah (Scientific Computing & Imaging Institute)	❖ "On-the-ground" presence ❖ Appoint Project Director from SCI Division given industry credentials and qualifications. ❖ Promote a Utah Technology Organization	❖ R&D Academic credibility and endorsement to project ❖ Industry Leaders with proven experience in medical imaging technology and high-performance computing models ❖ Academic sponsorship through the Technology Transfer Office

rsi

Intermountain Health Care	❖ R&D/PR/Marketing opportunity to co-promote partnership with GE ❖ Attract nationwide and international visibility of CIS application and IHN ❖ "On-the-ground" presence	❖ Promote a Utah Technology Business ❖ Existing cross-section panel of medical staff to engineer a BPM/Workflow Analysis of healthcare delivery model tied to technology platform
KLAS	❖ Utah based Organization ❖ Independent think-tank organization ❖ Provide value to end consumer market by publishing results of independent studies	❖ Provide independent benchmark testing for vendor interoperability ❖ Contribute industry expertise by drafting benchmark statistics, validation testing and certification requirements
Altiris	❖ Promote Utah Technology Business ❖ Support current efforts in China ❖ Support current efforts in HIT vertical market	❖ System state recovery ❖ Asset management ❖ Version control management ❖ Systems Resource Management ❖ Software Distribution ❖ Bare-metal server deployment and
Hewlett-Packard	❖ Support and promote recent joint-venture with Novell SuSE Linux ❖ Support joint-venture for HP Blade Servers	❖ Blade server to be used in HPCC and VMWare blueprint design
VMWare	❖ Support and promote interoperability certification on Linux ❖ Support certification for HP Blade Servers	❖ OS virtualization capabilities ❖ Inter-server clustering ❖ Inter-OS clustering within virtual sessions

☐ Architecture: Anatomy of a Health Information Society.

At the very nucleus of ***The Caduceus Project*** is the architecture design that will form the basis of a standards-based, interoperable, open-systems solution blueprint. This goal will be achieved by developing a nexus architecture that will endorse and promote vendor interoperability. HIT Architecture can fundamentally be classified into two main platforms: **Administrative** and **Clinical**.

Given the magnitude and scope of this project, it is advisable to adopt a phased approach where a prioritized set of interoperability goals are defined. The initial scope of this project will focus on a core set of technologies that will support the clinical information systems and delivery, with limited aspects of administration. The architecture section is broken down into 4 main elements:

1. **The Strategic Initiatives:**
   Describe the architectural goals of the project and which elements in the blueprint design need to be considered to achieve the security, manageability, scalability and stability of the HIT platform.

2. **The Value-Chain:**
   Describes what applications and functionality need to exist within the architecture to engender a 360° platform integration of the health information supply-chain.

3. **The Reference Model:**
   Visually maps the architectural element to the layer model in which it resides.

4. **The HIT Wiring Diagram:**
   Provides an x-ray view of the software and hardware blueprint and how it maps to the healthcare workflow delivery.

∈ The Strategic Initiatives:

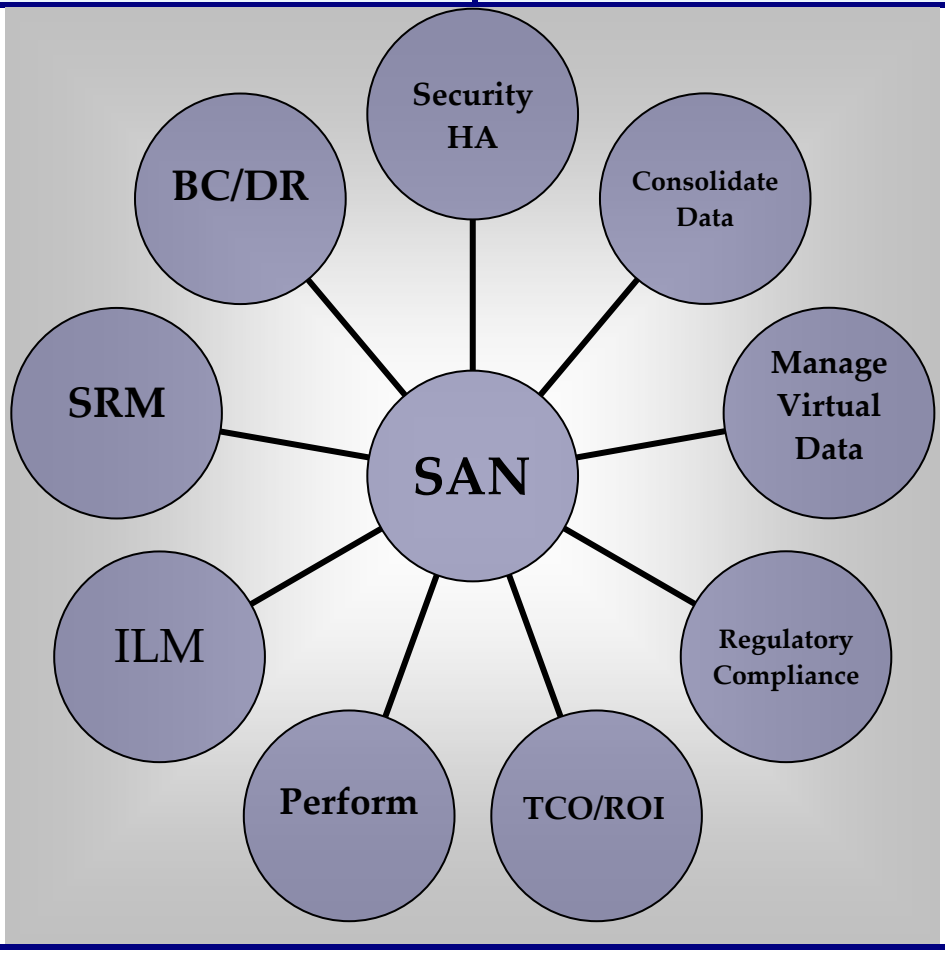
HIT Strategic Initiative	Elements
1. Business Continuity/Disaster Recovery	
In the healthcare industry downtime is measured not only in dollars, but in lives. In a digital environment, the need for access to real-time data cannot be guaranteed on paper by SLA's. Also, Intellectual Property & Medical Research needs to be protected.	* IP SAN technology/Ethernet backbone * Asynchronous & Synchronous Data Replication * Block-level & File-level Data Replication * Geo-cluster technology (off-site failover) * Off-site DR considerations * Backup Strategy: RTO & RPO planning
2. Security	
In order to comply with HIPAA requirements, a comprehensive set of security standards must be developed to protect patient confidentiality from unauthorized access from internal sources as well as external sources.	* Policy-based engine * Audit controls * Data Encryption * Role-based access permissions * Disk-based encryption * Vulnerability Threat Assessments * Intrusion Detection/Penetration Testing * Anti-Virus/Firewall Design
3. Data Consolidation	
Provides CDO's & Hospitals ability to pull together data into common storage pool and segment according to logical partitions	* Reduce footprint in datacenter * Eliminate random server proliferation/data silos * Optimized storage utilization of disk capacity
4. Application/Network Performance Optimization	
Performance measures response times that data is retrieved by end-users. One example is in diagnostic comparison studies that are CPU -intensive. If delays are created in rendering image/multi-slice studies, diagnosticians may lose time to focus on thorough diagnoses.	* Data Retrieval/Access Benchmarking * High-Performance Computing for CPU-intensive applications * I/O Disk Subsystem Architecture designed consistent with I/O attributes and patterns * Shared spindle architecture * Dynamic LUN design and implementation
5. Centralized Administration/Storage Resource Management	
A very common problem is staff redundancy duplicating efforts in IT management causing "split-brain" decisions. Also, manual discoveries can highly inefficient, and accurate, in this model. A single platform allows for a single pane of glass management model.	* Standardize change management and version control * Define pre-configured policies to monitor systems health and performance * ITIL-based framework to define and automate data classification and retention policy

6. Information Lifecycle Management: TCO/ROI	
While the initial goal of HIT is interoperability, ILM will provide a structured framework to manage exponential growth and data classification techniques. Also, it will address the underlying issue of cost and IT budget planning for health organizations.	* FC/SATA Intermix Enclosures * IP SAN: SAS & SATA Disk Drives * Content Addressable Data * Policy-based automation of data classification *
7. Capacity Planning	
Understanding the application system requirements, data structure, how it will be accessed, how often and by whom. An important element in capacity planning is tiered storage design and understanding where the data	* Application Sizing
8. High-Availability	
SLA's and 5 "9"'s requirements.	* Fault-Tolerant Cluster Architecture * Geo-Cluster Architecture
9. Data Virtualization	
As most organizations currently manage heterogeneous environments, this will be the starting point. Data virtualization allows IT staff to virtually connect to any storage device or node on the network through a central management console to manage and grow	* Platform flexibility from existing "starting point" of environment
10. Regulatory/SLA Compliance: HIPAA & SOA (Service-Oriented Architecture)	
HIPAA measures must comply with Record-keeping requirements: Privacy & Security, Confidentiality, Integrity and Availability regulations as well as Tracking and Review mechanisms in accordance with Sections 164.530, 164.306, 164.308 and 164.312.	* Document Management (Knowledge Library) * Content-Addressable Storage * Data retention and archival planning and policies * All aspects of Security Initiative considerations

Focus on SAN: the point-of-confluence

One notable area where technology has been a point of confluence towards the accelerated adoption rate in HIT is the SAN (Storage Area Network). To render a medical analogy, the SAN is best described as a substrate layer where the application platform behaves much like an enzyme catalyst that affects the entire organism. In the SAN, the hardware platform interconnects every application and network component within an IT ecosystem.

As a single, virtual hardware platform, the SAN has addressed conventional IT barriers in the areas of data consolidation, centralized management, lower TCO, higher ROI, business continuity and disaster recovery planning, high-availability, data consolidation (reduced footprint), optimized capacity planning, and performance-driven application design.

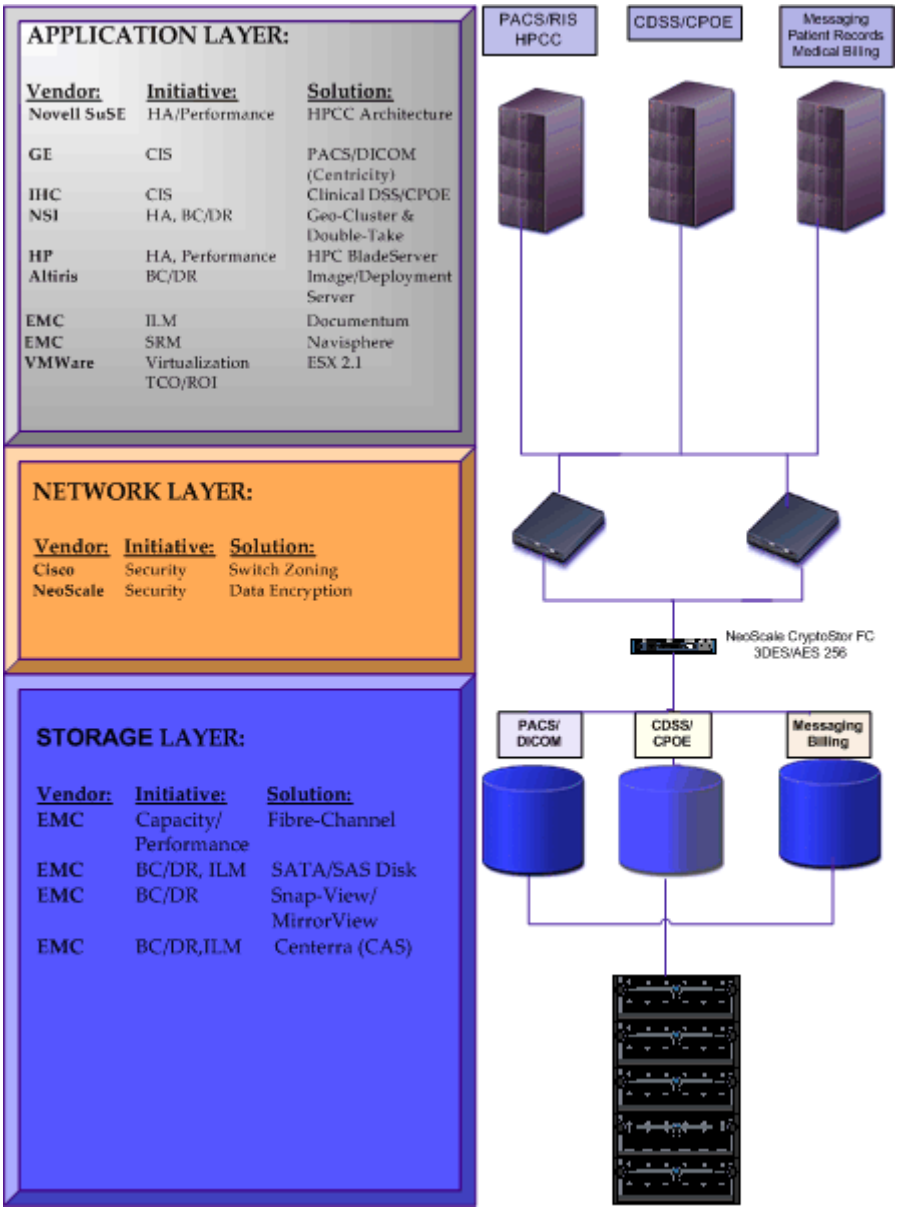


∈ The Value-Chain:

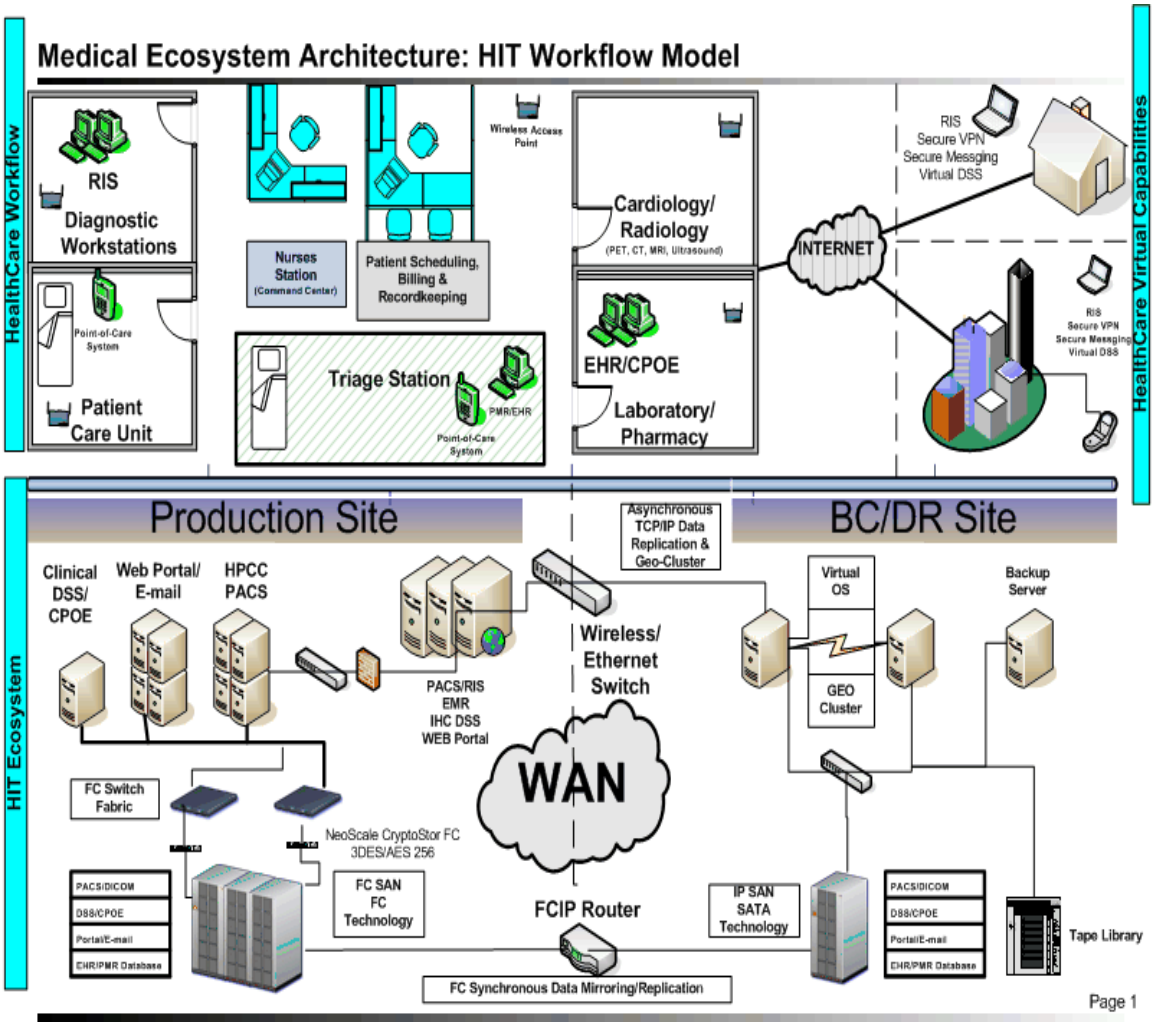
	Business Need/ Application	Strategic Initiative(s)	Vendor Solution
Admini	HIPAA Compliance	1, 2, 6, 8, 10	Novell Identity Management
	SLA Compliance	1, 2, 4, 8	**TBD**
	Medical Billing Application	TBD	**TBD**
Clinical(CIS)	PACS/RIS Architecture	1-10	NSI Geo-Cluster & Double-Take GE Centricity PACS Novell SuSE Linux HPCC NeoScale CryptoStor EMC Clariion SAN EMC CAS Centera HP Proliant Servers
	CDSS/CPOE Application Platform	1-10	NSI Geo-Cluster & Double-Take GE Centricity PACS Novell SuSE Linux HPCC NeoScale CryptoStor IHC|GE CDSS/CPOE
	CDR (Clinical Data Repository)	1-10	
	Messaging Infrastructure	1-10	NSI Geo-Cluster & Double-Take VMWare ESX Server HP Blade Server EMC IP SAN EMC Documentum Altiris

HIT Reference Model:

The reference model below provides an abstract view of how the infrastructure schema will be built on a layered model. It is important to understand the covariance that exists between these layers in order to design an optimized platform to deliver scalability, performance and high-availability within the architecture.



The HIT Wiring Diagram:

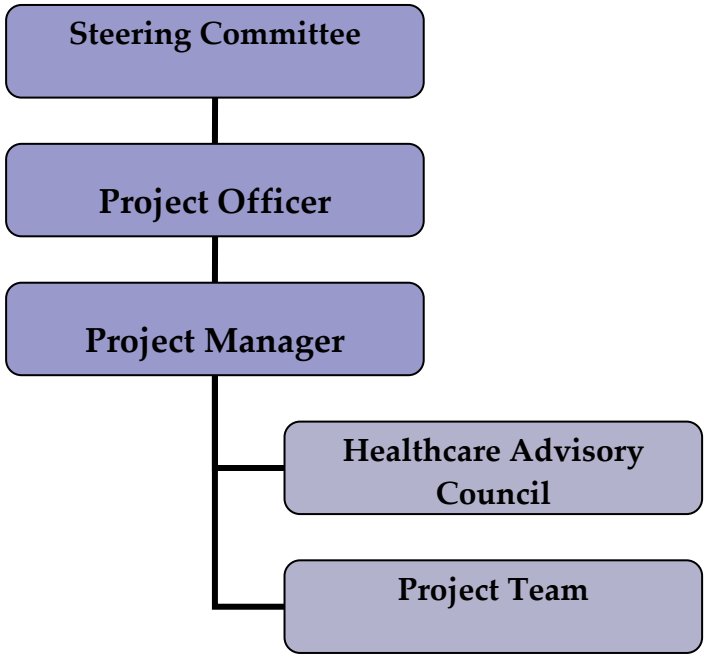


The workflow diagram provides a synopsis of how the underlying architecture will map to the point-of-care workflow delivery. The figure above represents the base elements that need to be supported in a CDO floor. With this goal in mind, the figure shows how this can be achieved by integrating the application platform on a single hardware platform while addressing the 10 strategic initiatives delineated in the previous table of this section.

☐ Project Governance: A Model of Reciprocity.

This Project must achieve a synergistic balance within the context of a multi-vendor consortium and create a non-zero-sum proposition for every stakeholder represented. In keeping with sound business and financial principles, ***The Caduceus Project*** will be developed and governed within a **PMI** (Project Management Institute) framework. The eventual goal of the project is to create a self-sustaining business model that can operate within a specified time frame or indefinitely. It is important that a well-developed and effective business delivery model encompassing **Project Management** and a **Project Governance** code be adopted in the earliest phases of the project.

The Project will further adopt the governance framework developed by the EU (European Union) Framework Programme[19], currently in its seventh edition. This framework has been designed to govern multi-vendor stakeholder projects and has been successfully proven within the context of tripartite R&D efforts encompassing Applied Research, Academic and Commercial projects.



[19] europa.eu.int/comm/research/**fp6**/ working-groups/model-contract/pdf/**checklist**_en.pdf

Project Governance:

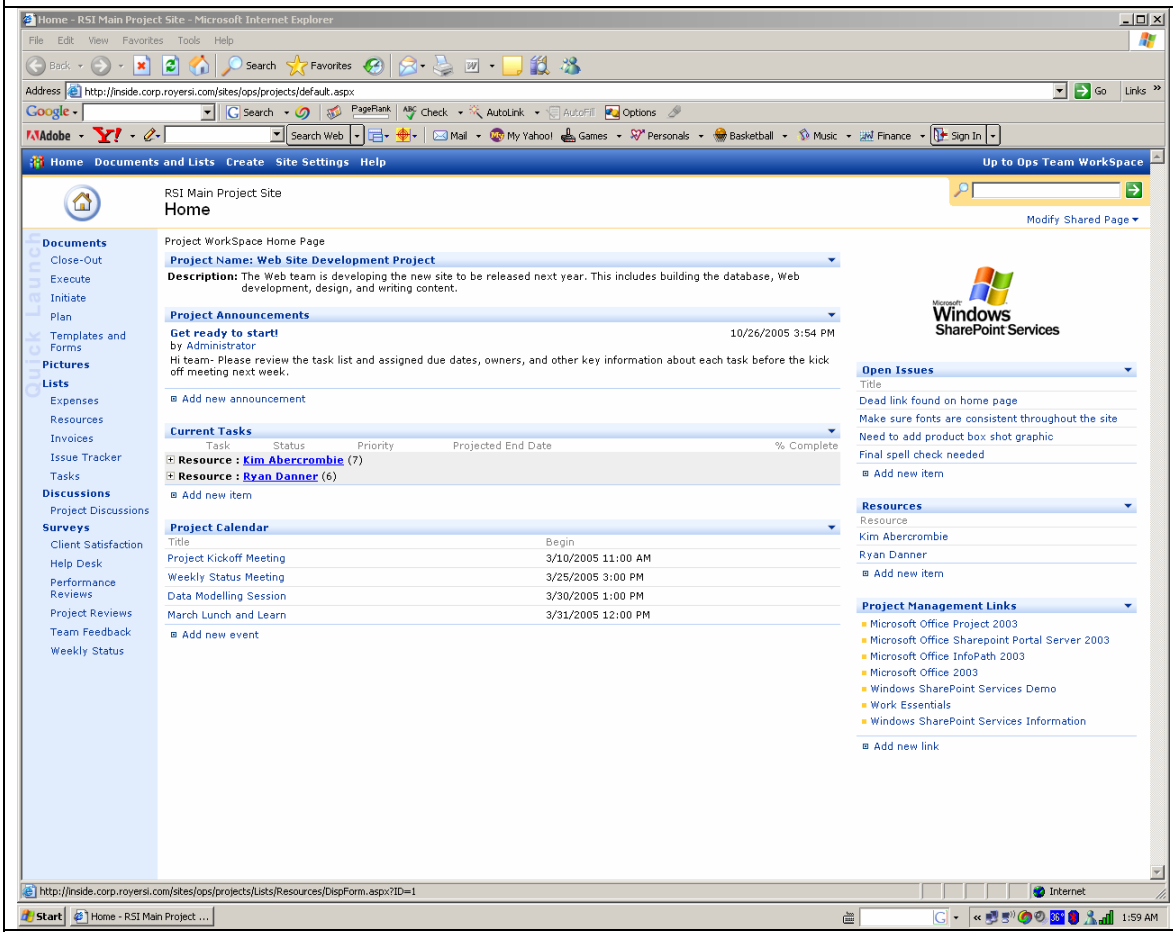
Steering Committee: Cross-section delegation of stakeholder representatives
Project Director (Officer): TBD
Consortium Agreement: Legal Framework (IP Management)

Project Management:

PMO Team
Project Manager: TBD
Healthcare Advisory Council:
The Healthcare Advisory Council (HAC) should be a cross-panel representation of healthcare professionals to advise on the multi-dimensional facets of care delivery and point-of-care process flow.
Project Team: TBD
Project Charter: TBD
Website: a project website would be created as a collaborative workbench for all stakeholders. A benefit breakdown of the use of a website is provided on the following page.

Snapshot: Project Website

Virtual workspaces – Create a collaborative environment that allows distributed participants to work as if they were at the same location.
Effective strategizing – Generate ideas and solve problems faster and more creatively while enabling better re-use of best practices.
Project visibility – Provide managers and stakeholders with instant access into the status of multiple projects and business processes.



☐ Conclusion: Next Steps to a Healthy Conscience.

The healthcare industry is at a unique crossroads to raise the bar of excellence in healthcare delivery and create a world-class consortium of industry leaders to exemplify and transform the cost, quality and efficiency in healthcare in the 21st century. It must be assumed that a project of this magnitude will require a long-term vision and strategy, coupled with the foresight of the positive influence this unique proposition will have upon healthcare providers, payors and vendors for years to come.

With the cost and quality of healthcare in the balances, time is of the essence. In order to gain the endorsement and support of executive sponsorship of this proposal, it is necessary to gain consensus among the proposed vendors of the project cited within this document. An action plan delineating the next steps coupled with a timeline is proposed below:

- Round-Table Vendor Review of Prospectus "The Caduceus Project "
- Information-gathering phase to determine scope, locations, resource requirements, cost and timeline of "The Caduceus Project": RFI
- Initial Draft of "Consortium Agreement"
- Round-Table Review and Referendum Vote of "Consortium Agreement"
- Presentation of Project for application of state and federal grant allocations: RFP
- Election of Steering Committee and appointment of Project Director
- Appointment of Project Manager and creation of PMO
- Project Kick-Off Meeting

APPENDIX A: Senate Bills At-a-Glance

Senate Bill	Short Title:	Key Legislative Measures:
s. 1223	**Information Technology for Health Care Quality Act**	❖ Designation of Federal funds to promote HIT adoption ❖ Interoperability ❖ Training ❖ Clinical Decision Support ❖ Electronic Exchange
s. 1227	**Health Information Technology Act 2005**	❖ 5 year/$US 4B program to stimulate investment of HIT ❖ purchase, lease, and installment of computer software and hardware; ❖ upgrade of existing computer technology; ❖ purchase of communications infrastructure necessary for clinical data access, storage, and exchange; ❖ support services associated with acquiring, implementing, or optimizing the use of new or existing computer software and hardware; and ❖ training of staff on information systems and technology.
s. 1262	**Health Technology to Enhance Quality Act 2005**	❖ establish the Office of the National Coordinator of Health Information Technology (ONCHIT), ❖ are designed to promote a national interoperable health information technology infrastructure, ❖ authorize the designation of a private entity to certify the implementation of the interoperability standards, ❖ direct HHS to study how to provide for the harmonization of state laws to promote the secure electronic exchange of health information, ❖ promote the use of telemedicine, which is especially important in rural areas, ❖ provide narrow and specific safe harbors from federal self-referral and anti-trust statutes for those who share technology and software for the exchange of health information, and ❖ permit arrangements between hospitals and physicians that promote implementation of health information technology.
s. 1355	**Better Healthcare Through Information Technology Act 2005**	

