Shared Services and Healthcare Cloud: A Strategy for Adoption

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Healthcare at Intel
Where information and care meet
What is Shared Services?

Countries and regions are struggling to establish a shared services model—a means to cost-effectively share the necessary infrastructure for health information exchange—while creating a collaborative economic model that drives local innovation and accelerates adoption of advanced healthcare usage models.

We will review an HIE/Cloud maturity model in the context of worldwide examples.
Healthcare & Cloud Computing Trends
Care Coordination and Data Sharing for Improved Outcomes

Proactive health and Wellness
- Reduce illness.
- Promote wellness and empowerment

Home Care
- Reduce costly emergency care.
- Better manage chronic disease.

Residential/Community/Ambulatory Care
- Reduce hospital (re) admissions.
- Manage at home.

Acute Care
- Reduce ALOS.
- Earlier Discharge to Ambulatory environments.

Cost of Care

Highest Quality of Life at the Lowest Possible Cost
Evolution of the Datacenter

Discrete Datacenter
- Compute
- Storage
- Network
- Management
- Consolidation
- Discrete networks

Virtualized Datacenter
- VM
- Mgmt
- Unified Network
- Servers
- Storage Arrays
- Flexible Management
- 10G Unified Network

Cloud Datacenter
- Cloud Infrastructure
- Security
- Network
- Storage
- Compute
- Datacenter facilities (e.g. cooling, power)

Efficient and Secure
- Open Architecture
- Flexible Network
The Rise of Healthcare “Big Data”

• Diagnostic Imaging
  – Average hospital requires 175TB for images & clinical records. Consumes additional 15 TB annually\(^1\). Data archive for 20+ years.
  – In 2006, primary copy storage for all U.S. imaging = 24 Petabytes (assumes no duplication for RAID, archive, disaster recovery)\(^2\)
  – By 2014, US primary copy storage expected to reach 100 Petabytes\(^2\)

• Genomic Data
  – The Human Genome consists of 3 billion base pairs, unannotated, requires 3 Gb of storage uncompressed\(^3\)
  – In 2007, Baylor College of Medicine required 125 TB, with projected 25-fold increase in storage over the following two year period\(^4\)
  – Data projected to reach 35 Zettabytes by 2020, a 44-fold increase from 2009\(^5\)

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\(^1\) John Halamka, CIO, Beth Israel Deaconess, [http://geekdoctor.blogspot.com/](http://geekdoctor.blogspot.com/)
\(^3\) Human Genome Project FAQs, [http://www.ornl.gov/sci/techresources/Human_Genome/faq/faq1.shtml](http://www.ornl.gov/sci/techresources/Human_Genome/faq/faq1.shtml)
\(^4\) Baylor College of Medicine, Human Genome Sequencing Center, [http://www.cwhonors.org/viewCaseStudy.asp?NominationID=340](http://www.cwhonors.org/viewCaseStudy.asp?NominationID=340)
\(^5\) IDC Digital Universe Study, sponsored by EMC, May 2010
## Cloud Computing Business Drivers

**Business Benefits**

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>Enormous <strong>economies of scale</strong></th>
<th>Efficiencies in size; buying power, infrastructure, power consumption</th>
<th>Unparalleled <strong>resource utilization</strong></th>
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<tbody>
<tr>
<td>Agility</td>
<td>Improve <strong>provisioning time from days to hours</strong></td>
<td>Automate workflows to enable consistency, agility and <strong>elasticity</strong></td>
<td>Pay for the resources you actually use</td>
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<tr>
<td>Availability</td>
<td>Deliver high availability for all workloads, regardless of location</td>
<td>Protect IP, data and differentiated business processes</td>
<td>Provide secure, <strong>broad network access</strong> on authenticated devices</td>
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<tr>
<td>Services</td>
<td><strong>On demand, self-service portal</strong> to streamline business processes</td>
<td>Establish <strong>measured services</strong> for VM utilization, health and usage</td>
<td>Apply actual application consumption for IT capacity management</td>
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<td><strong>Healthcare Utility &amp; Value-Add Services</strong></td>
<td><strong>Address scarcity</strong> by effective allocation of resources &amp; expertise</td>
<td><strong>Leverage ecosystem for non-core competencies</strong>, achieve economies of scale</td>
<td><strong>Accelerate standards adoption</strong> through lower barriers to entry</td>
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Common Healthcare Usage Models: Care Coordination
National Health Information Exchange, MOH

Local Health Information Exchange

Doctors

Large Hospital

Pharma

Disease Mgmt

Lab

Payers

Caregiver

VN

Patient

Extended Family

Care Coordination
1. Patient gets routine checkup, lab work, mammogram.

2. Patient eligibility, claims adjudication processed automatically.

3. Lab results and diagnostic imaging delivered electronically.

4. Radiologist and Oncologist confer with Patient and PCP.


6. Oncologist tests for biomarkers to ascertain breast cancer subtype.

7. Patient is treated locally, leveraging the expertise of remote specialists.

8. Patient receives personalized medicine with improved outcomes, access & quality at reduced cost.

Care Coordination
Health Information Exchange Maturity Model
HIE Framework

- Capability Maturity Model
- Data Use and Reciprocal Support Agreement (DURSA)
- Health Quality, Healthcare IT & Architecture Adoption Key Performance Indicators (KPIs)

- Interoperability Standards (healthcare informatics, transport, protocol, privacy & security)
- Privacy, Data Protection Laws/Regs
- Healthcare Reimbursement Policies
- Technology Certification Process

Business, solution, data, network & security architecture blueprint
Standard web service methods for healthcare utility services
Traceability to Key Healthcare Business Capabilities
## HIE Capability Maturity Model

### Phase 1
- Scheduling & Triage
- Summary/Longitudinal Health Record
- Care Coordination
- ePrescribing, Lab Results, Diagnostic Imaging

### Phase 2
- Disease Registries
- Clinical Guidelines & Protocols
- Chronic Disease Management
- Remote Patient Monitoring
- Transitions of Care (Discharge, Referrals)

### Phase 3
- Data Services & Secondary Use
- Clinical Decision Support
- Public Health & Population Mgmt
- Quality Metrics & Reporting
- Rural Health & Telemedicine
HIE Collaborative Economic Model

Value Network
- Collaborative economic model shifts revenue and delivers incentives to each according to value derived
- Delivers improved outcomes at reduced costs
Healthcare Utility Services

- Entity Identity Service
- Record Locator Service
- Controlled Terminology Service
- Patient Consent & Authorization Service
- Clinical Data Repository
- Patient & Clinician Portals
The Healthcare Services “Network”

Terminology Service
Record Locator Service
Master Patient Index Service
Patient Consent Service
AuthZ, AuthN Access Control
Clinical Data Repository
Service Bus
Canonical XML Standard Transport
Network Cloud + Orchestration

Healthcare Information Network Core

Physician, Patient, and Other Application Clients

Service Bus
Canonical XML Standard Transport
HL7/EDI EAI

Hospital, Clinic, Physician System
Laboratory Pharmacy System

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Where information and care meet
Centralized

- Optimal sustainable business model; suboptimal for local control
- Optimal for semantic normalization, secondary use of data
- Provides transition path for standards adoption
- Better model for patient consent/auth, privacy and security

Federated

- Optimal for local control; suboptimal for sustainable business model
- No semantic normalization unless all end-points adopt common standards
- Significant burden on end-points to support SLAs
- Inconsistent enforcement of privacy and security

Hybrid

- Compromise to improve performance over Federated
- Same considerations for local control, sustainable business model
- Same considerations for semantic normalization and high availability
- Same considerations for patient consent/auth, privacy and security
Secure Healthcare Cloud: Strategy for Adoption
What is Secure Healthcare Cloud?

- Strategy for adoption with phased implementation
- Best practices, standards and technologies
- Design principles, deployment considerations, and governance models
- Worldwide program, key learnings, virtualization labs
- Industry alliances including
  - Intel® Cloud Builders
  - Open Data Center Alliance (ODCA)
  - European Network & Information Security Agency (ENISA)
  - Cloud Security Alliance (CSA)
- Comprehensive set of latest security technologies & solutions covering end-to-end cloud deployment models
- Robust set of ecosystem partners to deliver complete solutions
Healthcare Cloud Service Mediation

Composite Applications
Modular services deliver advanced healthcare capabilities across the compute continuum

Shared Services
Healthcare utility services provide the necessary foundation to cost-effectively scale-out infrastructure

Rapid Innovation
Deliver value-add data services, improve access to healthcare, create sustainable business models
Cloud Architecture Considerations

Economies of scale demand composite applications, consistent service interfaces, & shared service functionality

Value-add data services, advanced healthcare usage models, and collaborative economic model all depend upon a normalized informatics model
Community Cloud for Toronto Hospitals

Fourteen hospitals share clinical application & EHR data storage
- Provincial government provides hardware in government data center, recoups investment in compute resources through IaaS
- Mt Sinai recoups administrative and support costs through SaaS

Community Cloud Benefits
- Multi-tenant environments for cross-agency interactions
- Private cloud benefits without cost of private cloud
- Licensing and support economies of scale
- Centralized data, consistent vertical application usage

Creating trust in a community cloud
- Privacy, security & data use agreements
- Mutual support and Service Level Agreements
- Must possess some degree of shared goals/objectives (‘political will’)

Source: "A healthcare community cloud takes shape", SearchCIO.com, 21 Dec 2010
Service Models Deliver Real Sustainability
Collaborative Economic Model

Value Network
- Collaborative economic model shifts revenue and delivers incentives to each according to value derived
- Delivers improved outcomes at reduced costs
Institute of Medicine

Rapid Learning Health System

- Data of all types is contributed, analyzed, and disseminated in a continuous feedback loop that integrates research and care

- Such a system provides the gateway to 21st century medicine—personalized, predictive, preemptive, and participatory—where the patient and his/her particular genetic and clinical characteristics are at the center of all activity, playing a key role in both research and self-management of health

Summary

• Overcome scarcity by leveraging expertise and capacity in the cloud
• Focus on innovation, rely on the ecosystem for services outside your core competency
• Adopt standards and best practices leveraging worldwide models
Additional Sources of Information:

- Healthcare Blogs – Intel® Healthcare IT Professionals
- Industry Alliances
  - Intel® Cloud Builders
  - Open Data Center Alliance (ODCA)
  - Cloud Security Alliance (CSA)
  - European Network and Information Security Agency (ENISA)
- Whitepapers
  - CARESTREAM* Increasing the Scalability of Medical Imaging Solutions
  - GNAX Health* Protecting Healthcare Data in the Cloud
  - Secure Healthcare Cloud (TXT whitepaper)
  - VMware* and Intel® 10GbE Best Practices
  - Securing the Enterprise with Intel® AES-NI
  - Enhanced Cloud Security with HyTrust* & VMware*
  - Taking Control of the Cloud for your Enterprise
  - Unified Networking with Cisco* Virtualized Multi-Tenant Data Center*
- Videos
  - Cloud Security: Built from the Ground Up
  - Trusted Execution Technology
  - Virtualization Animation
  - Healthcare Storage Animation
  - Peake Healthcare*, Johns Hopkins*, VMware* Medical Imaging Cloud