

Can Cloud Computing Benefit Health Services?

A SWOT Analysis



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Background

- Many obstacles to adoption of health IT by health professionals and institutions
 - Start-up expenses
 - Lack of reimbursement for implementation
 - Cost to purchase systems
 - Complexity and cost to maintain systems

What is Cloud Computing?

- A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources
- Can be rapidly provisioned and released with minimal management effort or server-provider interaction



-- Mell & Grance, CACM

Cloud Computing



- Basically services (applications, storage etc.) that are offered remotely and virtually over the WWW by a third party
- Are available when needed, and can be scaled dynamically in response to need
- Model is of “you pay for only what you use”

Characteristics of Cloud Computing (ideal)

- Provides a wide range of computing services and resources on demand “to anywhere and anytime”
- Eliminates a large up-front monetary commitment by cloud users
- Allows users to pay for use of computing resources on a short-term basis as needed
- Has high utilization by multiplexing of workloads from different organizations

Three Models of Cloud Computing

■ Software as a Service (SaaS)

- Applications e.g. EHRs (and their functions) are hosted by a cloud service provider and made available over a network, typically over the Internet (e.g. using model like Google Apps, Google Docs and Salesforce.com)

■ Platform as a Service (PaaS)

- Development tools are hosted in the cloud and accessed through a browser

■ Infrastructure as a Service (IaaS)

- The cloud user outsources the equipment used to support operations, including storage, hardware and networking components (E.g. Amazon EC2)

Deploying Cloud Computing

■ Public cloud

- A cloud service provider makes resources (applications and storage) available (for rent) to the general public over the Internet

■ Private cloud

- A proprietary network or data center supplies hosted services to certain groups

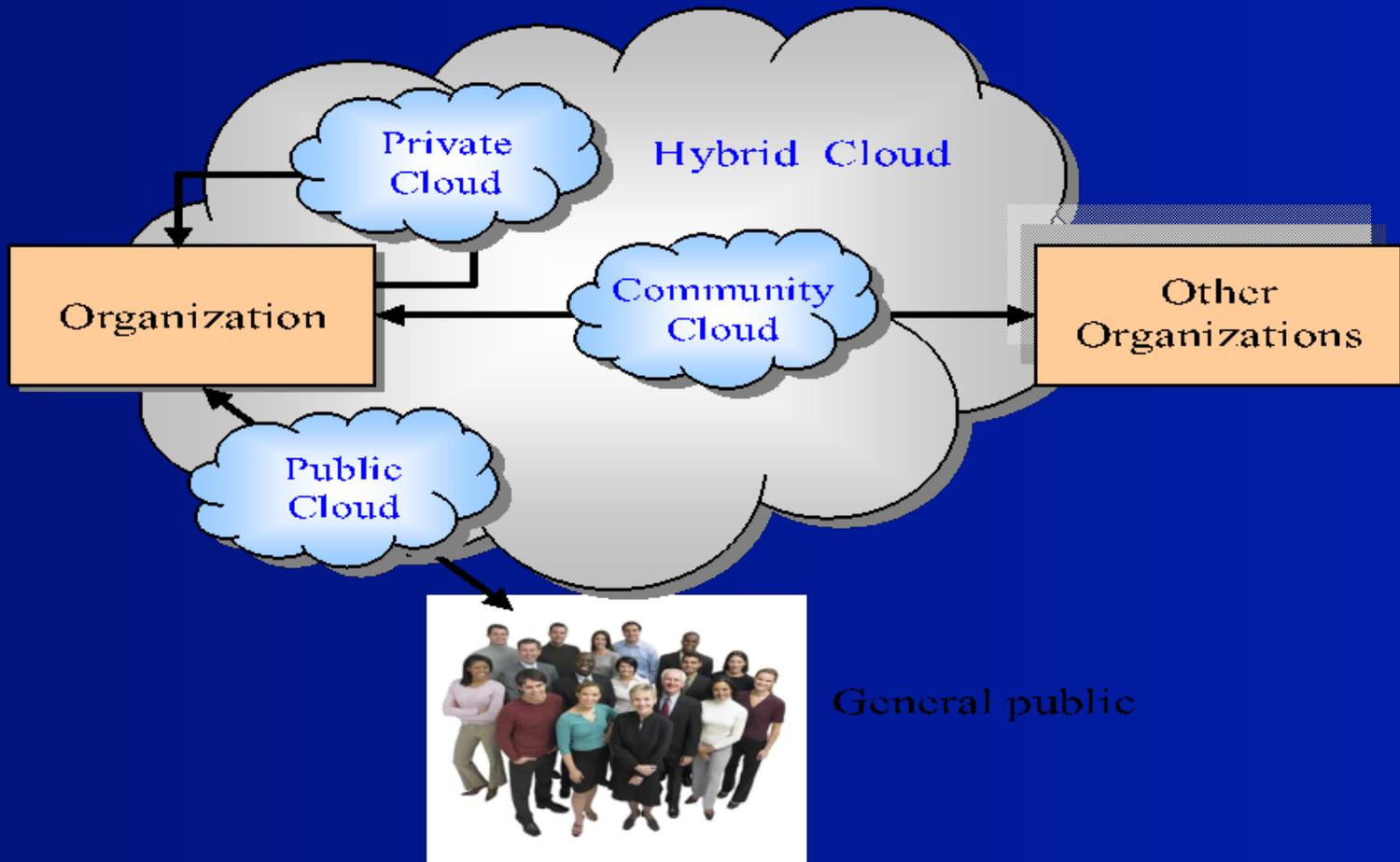
■ Community cloud

- The cloud infrastructure is shared by several organizations based on common concerns (e.g. mission, security, policy etc.)

■ Hybrid cloud

- Composed of two or more clouds (private, public or community)

Cloud Computing Deployment Models



State of Cloud Computing in Healthcare

- “In the cloud” medical record services such as Microsoft’s Health Vault and Exalogic Elastic Cloud have promised an explosion of storage of Health data (though it should be noted Google Health is no longer being continued!)



Example: Amazon's Web Service (AWS)

- Amazon's Web Service (AWS) plays host to a collection of healthcare IT applications
 - E.g Salt Lake City-based Spearstone's healthcare data storage application
 - Uses Amazon's Simple Storage Service as its scalable infrastructure
 - MedCommon (a Mass based health record service provider) uses AWS to build its personal health record (PHR) offering

Examples of Collaborations Involving Cloud Computing

- In Europe announcement of a consortium (Portugal and Italy) that has contracted Trustworthy Clouds (TClouds) to develop a patient-centric home healthcare service to remotely monitor, and assist patients outside the hospital
- American Occupational Network used cloud-based software from IBM MedTrak Systems to improve billing processes

Example R & D Application

- Pharmaceutical company Eli Lilly is using the Amazon AWS cloud as a platform for its high-performance computing R & D
- Able to set up 64-node Linux cluster that can be brought online in only 5 minutes (which formally took 100 days)
 - Made available to hundreds of scientists (with plans to extend to use with collaborating research partners)

SWOT Analysis

- SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis is a well-known strategic planning methodology used by organizations to ensure that
 - there are clear objectives for an effort/project and that relevant factors related to the effort (both positive and negative) are considered
- In this paper we applied SWOT analysis to evaluate the feasibility of health sectors adopting cloud computing to improve healthcare services (based on review of the literature)

A SWOT Analysis of Cloud Computing

Internal	Strengths <ul style="list-style-type: none">• Lower upfront cost• A trend to adopting advanced health IT	Weaknesses <ul style="list-style-type: none">• Insufficient evidence of successful application• Lack of domain experts to evaluate its feasibility.
External	Opportunities <ul style="list-style-type: none">• The capability of rapid elasticity and ubiquitous access to health resources	Threats <ul style="list-style-type: none">• Lack of users' trust• Lack of mandate or regulations to support full cloud adoption.
	Positive	Negative

Strengths



- Hardware and server headaches (costs, complexity) that exist for locally-installed, legacy systems are largely eliminated
- Smaller hospitals and medical practices typically don't have internal IT staff to maintain and service in-house infrastructure



- Pay as you go model would be attractive to physicians and many healthcare organizations
- Can provide resources that would allow applications to scale as needed
- Can provide inexpensive disaster-recovery options
- Reduces need for organizations to maintain large IT staff

Weaknesses



- Currently not the norm for healthcare applications (such as EHRs) – lack of familiarity and experience (limited health IT vendor offerings)
- Insufficient evidence to show new approach is suitable for healthcare
- Lack of expertise to evaluate and guide the new approach in healthcare sector
- Successfully applied in other domains but differences to healthcare may prove difficult
- Issues of security and privacy

Opportunities

- The new model of delivering computing resources is set to see massive global investment in many sectors
- Many cloud providers have commitments to develop advanced IT technologies to provide high quality services over the cloud
- Internationally, governments are undertaking to produce regulation and legislation to protect customer data security and privacy

Threats



- Healthcare professionals' lack of trust in the new approach
- Current lack of national or international mandates or regulation
- Obstacles
 - Possible data lock-in
 - Data privacy and confidentiality issues
 - Auditability
 - Data transfer bottlenecks
 - Performance unpredictability
 - Bugs in large-scale distributed systems
 - Data jurisdiction, data interoperability
 - Legal issues

Discussion

- Cloud computing promises to provide more flexibility, less expense and security
- Could be key in improving Health Information Technology adoption making services more easily available
- However, there are a number of issues, with greatest resistance related to data security and privacy concerns, followed by performance/availability concerns (IDC 2009 Annual Survey)

Conclusion

- Promising but not for all health applications!
 - E.g. Would not be suitable for processing MRI brain scans to provide real-time view of the brain
 - as would have to rely on connectivity over the web, mission criticality requirement (100% flawless uptime) would limit its use for this
 - Issue of confidentiality of patient data (HIPAA privacy requirements) – but possibilities even here
 - e.g. through strong encryption of data before “placing it in the cloud”

QUESTIONS ?

