Benefits of Cloud Computing In EHR implementation

The solution of Dedalus for application interoperability in the eHealth sector

Sergio Di Bona
Project Manager
R&D Division
DEDALUS SpA
Italy

sergio.dibona@dedalus.eu

March 19th, 2012
Outline

- What is an EHR?
- Emerging healthcare context
- New ICT challenges
- Opportunities provided by Cloud Computing
- Benefits and concerns
- New vision: Entrepreneurial approach
What is an EHR?
“A digitally stored health care information about an individual's lifetime with the purpose of supporting continuity of care, education and research, and ensuring confidentiality at all times”
What is an EHR?

“A digitally stored health care information about an individual's lifetime with the purpose of supporting continuity of care, education and research, and ensuring confidentiality at all times”
What is an EHR?

“A digitally stored health care information about an individual's lifetime with the purpose of supporting continuity of care, education and research, and ensuring confidentiality at all times”

EMR: Enterprise Electronic medical records - restructures and optimizes the records of a specific Department
What is an EHR?

“A digitally stored health care information about an individual's lifetime with the purpose of supporting continuity of care, education and research, and ensuring confidentiality at all times”

EMR: Enterprise Electronic medical records - restructures and optimizes the records of a specific Department
What is an EHR?

“A digitally stored health care information about an individual's lifetime with the purpose of supporting continuity of care, education and research, and ensuring confidentiality at all times”

EMR: Enterprise Electronic medical records - restructures and optimizes the records of a specific Department

EPR: Patient-centered medical records with information from multiple institutions or Departments.
The new healthcare contexts involve larger and larger realities:

- Local Healthcare Units
- Regions
- Nations
- ...

IHE defines these contexts as “Affinity Domains”

Within these contexts the EHR involves:

- Different care environments
- Different actors
- Different domains

We are progressively moving from a need of health towards a need of wellbeing
Emerging Healthcare IT Systems Landscape

- Mobile Health “m-Health”
- Extraenterprise Systems
- Telemedicine
- Ubiquitous Healthcare
- Under-served Population

Context Systems
- EMPI
- Registration and ADT
- Managed Care

Cooperating Systems
- PBM
- NHIN
- E-prescribing Network
- Reference Labs
- External CPR/EMR
- Clinical Trial Data Manager

Subscriber Systems
- Data Warehouse
- Patient Billing
- Claims Support

Pharmacy
- Laboratory
- Pathology
- PACS/RIS

Ubiquitous Healthcare Source
- External Knowledge
- Regional Health Information Organization

ADT = admission, discharge and transfer
EMPI = enterprise master person index
PBM = pharmacy benefit management
QIO = quality improvement organization
RIS = radiology information system
Convergence of major technologies: New ICT modalities

Sergio Di Bona

giovedì 22 marzo 2012
Convergence of major technologies: New ICT modalities

- Mobile
- Video
- Social Networking and Media
- Gaming
- Open Source
- “Large Data”
- ...

Sergio Di Bona

giovedì 22 marzo 2012
Convergence of major technologies: New ICT modalities

Sergio Di Bona

giovedì 22 marzo 2012
Convergence of major technologies: New ICT modalities

The Ambient Intelllicence

Sergio Di Bona

giovedì 22 marzo 2012
This implies new needs and new requirements
Define, deploy, maintain, evolve distributed and heterogeneous environments
This implies new needs and new requirements

- Define, deploy, maintain, evolve **distributed and heterogeneous environments**
- Guarantee resource **scalability and dynamicity**
This implies new needs and new requirements

- Define, deploy, maintain, evolve **distributed and heterogeneous environments**
- Guarantee resource **scalability and dynamicity**
- Provide adequate **capacities and performances**
This implies new needs and new requirements

- Define, deploy, maintain, evolve **distributed and heterogeneous environments**
- Guarantee resource **scalability and dynamicity**
- Provide adequate **capacities and performances**
- Implement new policies to guarantee **security of data and control of access**
How do we face this trend?

What happens in the other major business contexts?
- Finance
- Transportation
- Global trade
- ...

We need to change point of view also for the Healthcare:
- New order of costs
- New methodologies
- New attitude against the opportunities provided by the new technologies
- New demand to ICT providers

May Cloud computing support this trend?

Sergio Di Bona

giuddi 22 marzo 2012
Cloud computing is a **model** for enabling ubiquitous, convenient, on-demand network access to a **shared pool of configurable computing resources** (e.g., networks, servers, storage, applications, and services) that can be **rapidly provisioned and released** with minimal management effort or service provider interaction.
Can be useful for EHR?

Sergio Di Bona

gi游edì 22 marzo 2012
Can be useful for EHR?

Three service models

- **Software as a Service (SaaS).**
- **Platform as a Service (PaaS).**
- **Infrastructure as a Service (IaaS).**
Can be useful for EHR?

Three service models
- Software as a Service (SaaS).
- Platform as a Service (PaaS).
- Infrastructure as a Service (IaaS).

Four deployment models.
- Private cloud.
- Community cloud.
- Public cloud.
- Hybrid cloud.
Can be useful for EHR?

- Three service models
  - Software as a Service (SaaS).
  - Platform as a Service (PaaS).
  - Infrastructure as a Service (IaaS).

- Four deployment models.
  - Private cloud.
  - Community cloud.
  - Public cloud.
  - Hybrid cloud.

- Five essential characteristics
  - On-demand self-service
  - Broad network access
  - Resource pooling
  - Rapid elasticity
  - Measured service
Can be useful for EHR?

- Three service models
  - Software as a Service (SaaS).
  - Platform as a Service (PaaS).
  - Infrastructure as a Service (IaaS).

- Four deployment models.
  - Private cloud.
  - Community cloud.
  - Public cloud.
  - Hybrid cloud.

- Five essential characteristics
  - On-demand self-service
  - Broad network access
  - Resource pooling
  - Rapid elasticity
  - Measured service

DEFINE, DEPLOY… HETEROGENEOUS ENV.
Can be useful for EHR?

- **Three service models**
  - Software as a Service (SaaS).
  - Platform as a Service (PaaS).
  - Infrastructure as a Service (IaaS).

- **Four deployment models.**
  - Private cloud.
  - Community cloud.
  - Public cloud.
  - Hybrid cloud.

- **Five essential characteristics**
  - On-demand self-service
  - Broad network access
  - Resource pooling
  - Rapid elasticity
  - Measured service
Can be useful for EHR?

Three service models
- Software as a Service (SaaS).
- Platform as a Service (PaaS).
- Infrastructure as a Service (IaaS).

Four deployment models.
- Private cloud.
- Community cloud.
- Public cloud.
- Hybrid cloud.

Five essential characteristics
- On-demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service

DEFINE, DEPLOY… HETEROGENEOUS ENV.
PERFORMANCES
DYNAMICITY
Can be useful for EHR?

- **Three service models**
  - Software as a Service (SaaS).
  - Platform as a Service (PaaS).
  - Infrastructure as a Service (IaaS).

- **Four deployment models.**
  - Private cloud.
  - Community cloud.
  - Public cloud.
  - Hybrid cloud.

- **Five essential characteristics**
  - On-demand self-service ➔ DEFINE, DEPLOY… HETEROGENEOUS ENV.
  - Broad network access ➔ PERFORMANCES
  - Resource pooling ➔ DYNAMICITY
  - Rapid elasticity ➔ SCALABILITY
  - Measured service
Can be useful for EHR?

Three service models
- Software as a Service (SaaS).
- Platform as a Service (PaaS).
- Infrastructure as a Service (IaaS).

Four deployment models.
- Private cloud.
- Community cloud.
- Public cloud.
- Hybrid cloud.

Five essential characteristics
- On-demand self-service ➔ DEFINE, DEPLOY… HETEROGENEOUS ENV.
- Broad network access ➔ PERFORMANCES
- Resource pooling ➔ DYNAMICITY
- Rapid elasticity ➔ SCALABILITY
- Measured service ➔ MONITORING, CONTROL
Can be useful for EHR?

- Three service models
  - Software as a Service (SaaS).
  - Platform as a Service (PaaS).
  - Infrastructure as a Service (IaaS).

- Four deployment models.
  - Private cloud.
  - Community cloud.
  - Public cloud.
  - Hybrid cloud.

- Five essential characteristics
  - On-demand self-service
  - Broad network access
  - Resource pooling
  - Rapid elasticity
  - Measured service

Sounds promising!!

Cloud-based Interoperability and cooperation platform

The solution of Dedalus for EHR and application interoperability in the eHealth sector
Historical overview of the interoperability platform

Very first version in 1996: A1.X1

Current version released in 2009: X1.V1

- Compliance with international standards
- Royalties freeness from third parties
- Modularity (more than 20 different specialized components) and scalability

- 5 years for ideating, designing and developing the current solution
- Leveraging 14 years of experience
- >200 man years for development
- >18 MEuro of investment in the last 5 years

Sergio Di Bona
What the platform is …

It is the enabling tool for the implementation of:

- **EHR – Electronic Health Record.** One-stop-shop to access both **health information** related to the patient, and an umbrella of **health services** for the citizens. It provides an **index of (digitally signed) electronic documents** for the patient. It is accessible by citizens and authorized health operators, everywhere and any time. It collects cross-enterprise and health professionals information. The EHR stores information for primary (assistance, emergency, etc.) as well as secondary uses (administrative, governance, etc.);

- **EPR – Electronic Patient Record.** Similar to EHR, positioned at enterprise level;

- **PHR – Personal Health Record.** An overview of the patient clinical history, directly personalized and customized by citizens.
Virtual Platform

Sergio Di Bona

giovedì 22 marzo 2012
Cloud Clients
Web browser, mobile app, thin client, terminal emulator, ...

SaaS
CRM, Email, virtual desktop, communication, games, ...

PaaS
Execution runtime, database, web server, development tools, ...

IaaS
Virtual machines, servers, storage, load balancers, network, ...

Sergio Di Bona
giovedì 22 marzo 2012
ON_DEMAND approach

- Configuration
- Resources
- Storage
- Pay what you need
- Pay-as-you-go
Cloud Clients
Web browser, mobile app, thin client, terminal emulator, ...

SaaS
CRM, Email, virtual desktop, communication, games, ...

PaaS
Execution runtime, database, web server, development tools, ...

IaaS
Virtual machines, servers, storage, load balancers, network, ...

ON_DEMAND approach
- Configuration
- Resources
- Storage
- Pay what you need
- Pay-as-you-go

Sergio Di Bona
giovedì 22 marzo 2012
ON_DEMAND approach
- Configuration
- Resources
- Storage
- Pay what you need
- Pay-as-you-go

Challenging opportunities!!

SaaS
- CRM, Email, virtual desktop, communication, games, ...

PaaS
- Execution runtime, database, web server, development tools, ...

IaaS
- Virtual machines, servers, storage, load balancers, network, ...

Cloud Clients
- Web browser, mobile app, thin client, terminal emulator, ...
Benefits and advantages of cloud based-EHR

**Cost reduction**
- Enormous economies of scale
- Efficiencies in scale, buying power, infrastructure, power consumption
- Help bring the cost of healthcare under control

**Agility**
- Automate workflows to enable consistency, agility and elasticity
- Improve provisioning time from days to hours; pay as you go
- Adapt quickly to changing models of collaborative care

**Availability**
- Deliver high availability for critical healthcare applications
- Protect IP, data and differentiated business processes
- Provide secure, broad network access on authenticated devices

**Healthcare utility & value add services**
- Effective allocation of resources and expertise
- Accelerate standard adoption
- Build the network value model of exchange
Major concerns of cloud-based EHR

**Security & privacy**
- Must protect PHI in transit and at rest
- Costs associated with data breach are rising
- Cloud services and virtualization break traditional security techniques

**Data sovereignty**
- Where is my citizen’s health information?
- Regulatory and statutory requirements may prevent sensitive information from being hosted in a different country

**Auditability & Compliance**
- Data center audits may be impractical for public cloud provider
- National vs international data protection and privacy regulations (certifications)

**Vendor lock-in**
- Service model dependent
- Provisioning & automation software built against proprietary APIs
- Cost of entry may be low, cost of exit may be high

Sergio Di Bona

giovedì 22 marzo 2012
New vision: entrepreneurial approach

Sergio Di Bona

giovedì 22 marzo 2012
New vision: entrepreneurial approach

Cloud providers

- Regional healthcare bodies rely on external Cloud-based EHR providers
- Adopting either Public or Private
Regional healthcare bodies rely on external Cloud-based EHR providers
• Adopting either Public or Private
New vision: entrepreneurial approach

- Regional healthcare bodies rely on external Cloud-based EHR providers
- Adopting either Public or Private

New vision
- The Reg. Healthcare Bodies become cloud-based add-value service provider
- Completely new approach to Cloud-based EHR
- SaaS model from HC bodies to citizens
- Entrepreneurial model
New opportunities of this vision

Sergio Di Bona

giovedì 22 marzo 2012
New opportunities of this vision

- In European Countries, governmental bodies are progressively reducing the financial support to Regional Healthcare bodies;
New opportunities of this vision

- In European Countries, governmental bodies are progressively reducing the financial support to Regional Healthcare bodies;
- Considering also the crisis effects, healthcare structures have less and less support, thus affecting the QoS
New opportunities of this vision

- In European Countries, governmental bodies are progressively reducing the financial support to Regional Healthcare bodies;
- Considering also the crisis effects, healthcare structures have less and less support, thus affecting the QoS
- Italy-Censis March 15th: 2007-2010, 30.6 bil € of private spending (+8%) – in 2017 about 17 bil € gap between needed and provided funding
New opportunities of this vision

- In European Countries, governmental bodies are progressively reducing the financial support to Regional Healthcare bodies;
- Considering also the crisis effects, healthcare structures have less and less support, thus affecting the QoS
- Italy-Censis March 15th: 2007-2010, 30.6 bil € of private spending (+8%) – in 2017 about 17 bil € gap between needed and provided funding

Towards PRIVATE healthcare model

Quality of health assistance depends on the class of the assurance contract

Sergio Di Bona
In European Countries, governmental bodies are progressively reducing the financial support to Regional Healthcare bodies;

Considering also the crisis effects, healthcare structures have less and less support, thus affecting the QoS

Italy-Censis March 15\textsuperscript{th}: 2007-2010, 30.6 bil € of private spending (+8\%) – in 2017 about 17 bil € gap between needed and provided funding

Hybrid model

Towards PRIVATE healthcare model

Quality of health assistance depends on the class of the assurance contract
New opportunities of this vision

- In European Countries, governmental bodies are progressively reducing the financial support to Regional Healthcare bodies;
- Considering also the crisis effects, healthcare structures have less and less support, thus affecting the QoS
- Italy-Censis March 15th: 2007-2010, 30.6 bil € of private spending (+8%)
  – in 2017 about 17 bil € gap between needed and provided funding

Hybrid model
- Public funding guarantees a minimal quality of the healthcare assistance

Towards PRIVATE healthcare model

Quality of health assistance depends on the class of the assurance contract

Sergio Di Bona
New opportunities of this vision

- In European Countries, governmental bodies are progressively reducing the financial support to Regional Healthcare bodies;
- Considering also the crisis effects, healthcare structures have less and less support, thus affecting the QoS
- Italy-Censis March 15th: 2007-2010, 30.6 bil € of private spending (+8%) – in 2017 about 17 bil € gap between needed and provided funding

Hybrid model
- Public funding guarantees a minimal quality of the healthcare assistance
- Entrepreneurial approach: provide paying add-value services to demanding citizens, willing to pay for advanced services

Towards PRIVATE healthcare model

Quality of health assistance depends on the class of the assurance contract
New opportunities of this vision

- In European Countries, governmental bodies are progressively reducing the financial support to Regional Healthcare bodies;
- Considering also the crisis effects, healthcare structures have less and less support, thus affecting the QoS.
- Italy-Censis March 15th: 2007-2010, 30.6 bil € of private spending (+8\%)
  – in 2017 about 17 bil € gap between needed and provided funding

Hybrid model
- Public funding guarantees a **minimal quality** of the healthcare assistance
- Entrepreneurial approach: provide **paying add-value services** to demanding citizens, willing to pay for advanced services
- Healthcare → Wellbeing

Towards PRIVATE healthcare model

Quality of health assistance depends on the class of the assurance contract
New opportunities of this vision

- In European Countries, governmental bodies are progressively reducing the financial support to Regional Healthcare bodies;
- Considering also the crisis effects, healthcare structures have less and less support, thus affecting the QoS;
- Italy-Censis March 15\textsuperscript{th}: 2007-2010, 30.6 bil € of private spending (+8\%)
  – in 2017 about 17 bil € gap between needed and provided funding

Hybrid model
- Public funding guarantees a \textit{minimal quality} of the healthcare assistance
- Entrepreneurial approach: provide \textit{paying add-value services} to demanding citizens, willing to pay for advanced services
- Healthcare $\rightarrow$ Wellbeing
- New funds $\rightarrow$ improved QoS for all the citizens

Quality of health assistance depends on the class of the assurance contract

Sergio Di Bona

giorno 22 marzo 2012
What could the Healthcare structures get and offer?

**Authentication**
- An Actor is authenticated to access the X1.V1 platform. Authorized user is granted with access rights compliant with its role and capabilities.

**Demographic integration**
- Integration of the users’ demographic details.

**Documents integration**
- Document Sources are responsible to produce and publish both documents and metadata.
- Document Consumers should be able to query a registry and retrieve documents.

**Management of events**

**Management of notifications**
- Availability of new document or episode is notified to a Consumer Actor.

**Prescription**

**Booking**

**Activity reporting**

**Network of pathologies**

giovedì 22 marzo 2012
What could the Healthcare structures get and offer?

- Documents integration
- Management of events
- Management of notifications
- Prescription
- Booking
- Activity reporting
- Network of pathologies

PCCR  
Medical  Social/  Personal  

eDocume  

eEvents  
Notification  Management  

eBooking

eStatements

Drugs  Diagnost  Rehabilit  Admissi  Equipme  Transpor

giovedì 22 marzo 2012
Thank you for your attention

Sergio Di Bona
Project Manager
R&D Division
DEDALUS SpA
Italy
sergio.dibona@dedalus.eu