Benefits of Cloud Computing in EHR implementation

The solution of Dedalus for application interoperability in the eHealth sector

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SHAPING A CONNECTED DIGITAL FUTURE
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In the last decade Dedalus has focused on **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”

It is not EMR: **Enterprise** Electronic medical records - restructures and optimizes the records of a specific Department

It is not 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

Extraenterprise Systems
- PHR
- QIO or Payer Pay for Performance Systems

Context Systems
- EMPI
- Registration and ADT
- Managed Care

Cooperating Systems
- Scheduling
- Pharmacy
- Laboratory Pathology
- PACS/RIS

Subscriber Systems
- Data Warehouse
- Patient Billing
- Claims Support

Under-served Population

Mobile Health “m-Health”
- Telemedicine

Genomic&DNA Sequencing
- Eldercare

Regional Health Information Organization
- External Knowledge Source

Ubiquitous Healthcare
- ADT = admission, discharge and transfer
- EMPI = enterprise master person index
- PBM = pharmacy benefit management
- QIO = quality improvement organization
- RIS = radiology information system

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

In-home Healthcare

Gartner
Healthcare Enterprise
Convergence of major technologies: New ICT modalities

The Ambient Intelllicence
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
Can Cloud Computing 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

Sounds promising!!
Cloud based EHR: DEDALUS approach

Cloud-based Interoperability and cooperation platform

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

Dedalus EHR

Service Provider

ESB
SAML, WS-Sec, WS-Trust, WS-Rest, POP3

IHE XDS.b
Registry XDS.b
Repository XDS.b
Repository XDS.b

IHE NAV
SMTP/POP3

Medicina di Famiglia
Millewin
Applicativi Refertanti
Web Client
Mobile Client
Pronto Soccorso
CUP
ADT
Farmacia

SSO
Viewer

Identity Provider
LDAP

Global Forum
Shaping the future 2012
Virtualization of EHR in order to improve **scalability** and/or **reliability** of the system

- X1.V1 is deployed as a set of virtual machines. We are testing cloud mechanisms (Opennebula) for configuring them in order to automatically optimize the resources (performance) and to guarantee the continuity of services (reliability)

- Scenario: In the operative time the application level of X1.V1 needs most of the resources for interacting with document consumer and document producer actors and for efficiently manage these procedures. In the NON operative time (e.g. in the night) the DB of X1.V1 needs more resources for supporting data warehousing procedures
Through personalized and easy scheduled configuration of Opennebula, we are testing procedures to allocate different resources to the different VMs of X1.V1 in the different times.

With static allocation of the resources to the VMs of X1.V1, the completion time of the queries for datawarehousing could be very long and sometimes not executable.
The blackbox (or greybox) testing of services architectures is a very challenging issue for deploying **reliable, secure and efficient systems in healthcare** as well as in other critical domain.

Dedalus is coordinator of a STREP R&D project, co-funded by the EC in the FP7:

- **MIDAS** “Model and Inference Driven - Automated testing of Services architectures” aims to implement an integrated framework for the automation and intelligent management of SOA testing as a Platform as a Service for supporting all the testing activities – test generation, execution, result analysis, planning and scheduling.

- By adopting eHealth standards (HSSP, IHE) Dedalus will contribute to provide mechanisms for effectively writing test cases of complex services applications and efficiently perform test campaigns of services architectures.
Benefits and advantages of cloud based-EHR

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

- 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

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

- Effective allocation of resources and expertise
- Accelerate standard adoption
- Build the network value model of exchange
- TESTING
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
ON_DEMAND approach

- Testing Facilities
- 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, ...

Challenging opportunities!!
New vision: entrepreneurial approach

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

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

- 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, 2012: 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
- New funds → improved QoS for all the citizens

Towards PRIVATE healthcare model
Quality of health assistance depends on the class of the assurance contract
What could the Healthcare structures get and offer?

- **Authentication**
  - 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**
  - Availability of new document or episode is notified to a Consumer Actor

- **Booking**

- **Activity reporting**

- **Network of pathologies**
Thank you for your attention

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