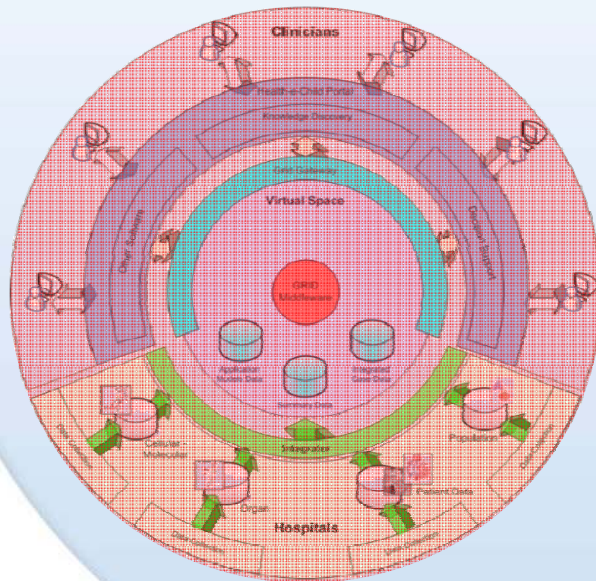




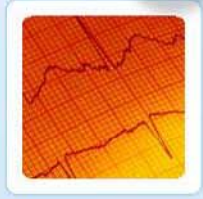
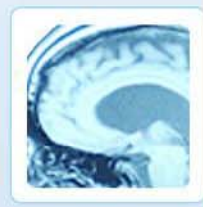
The Health-e-Child Project & Platform

A gLite Adoption Case Study

2007-10-01 EGEE Business Track
Budapest, Hungary




010101
101010
110101



David Manset - dmanset@maat-g.com
maat Gknowledge – MAAT <http://www.maat-g.com>



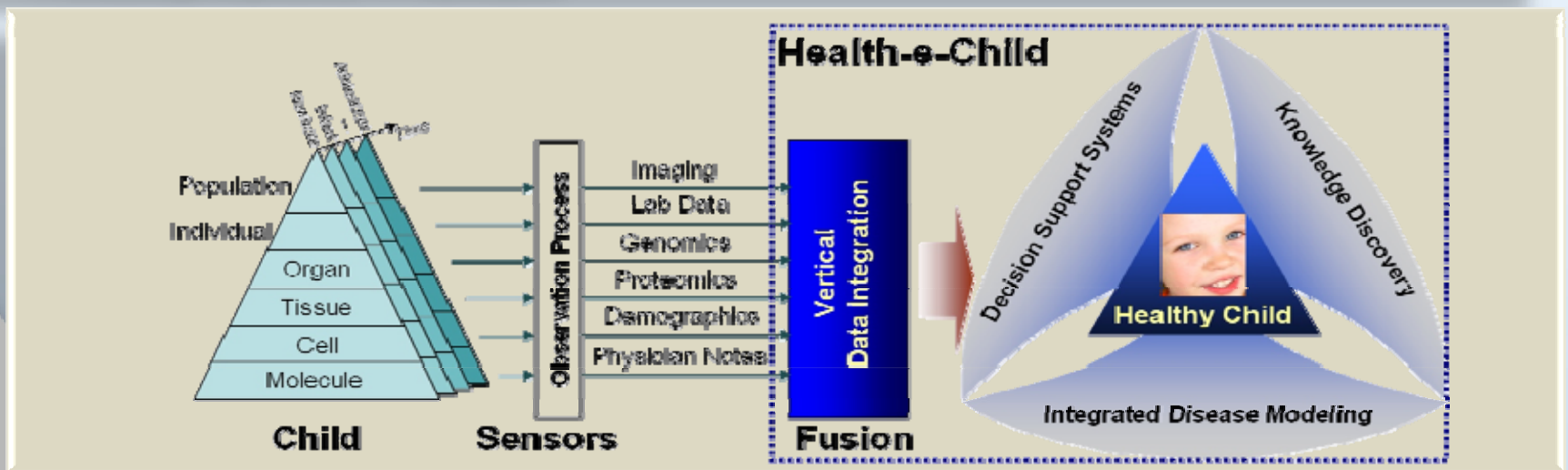
Project Information

- *Instrument* Integrated Project (IP) of the Framework Program FP6 
- *Project Name* Health-e-Child (HeC)
- *Project ID* IST-2004-027749
- *Coordinator* Siemens AG, Dr. Jörg Freund
- *Partner* 14 European (companies, hospitals, institutions)
- *Timetable* 01-Jan-06 to 31-Dec-09 (4 years)
- *Total Cost* 16.7 Mio. €
- *EC Funding* 12.2 Mio. €
- *Web Page* <http://www.health-e-child.org>



Project Objectives

- Establish **Horizontal and Vertical integration** of data, information and knowledge for **Paediatrics**
- Develop a **grid-based biomedical information platform**, supported by sophisticated and robust search, optimisation, and matching techniques for heterogeneous information,
- Build enabling tools and services that improve the quality of care and reduce its cost by increasing efficiency
 - **Integrated disease models** exploiting all available information levels
 - Database-guided **decision support systems**
 - Large-scale, cross-modality information fusion and data mining for **knowledge discovery**
- [A Knowledge Repository for Paediatrics](#)





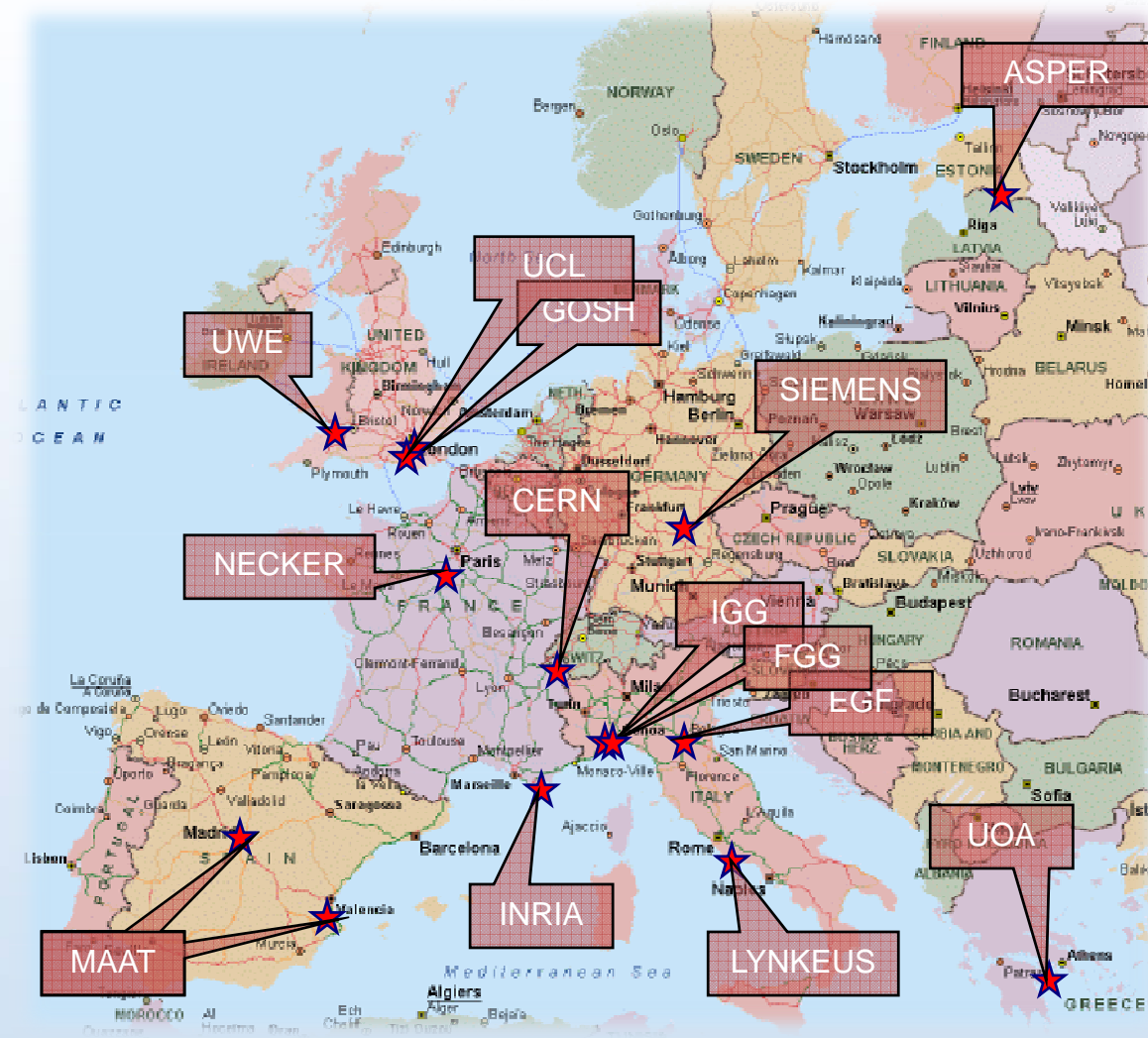
A Distributed Environment



Clinical Site



R&D Site





A Distributed Environment

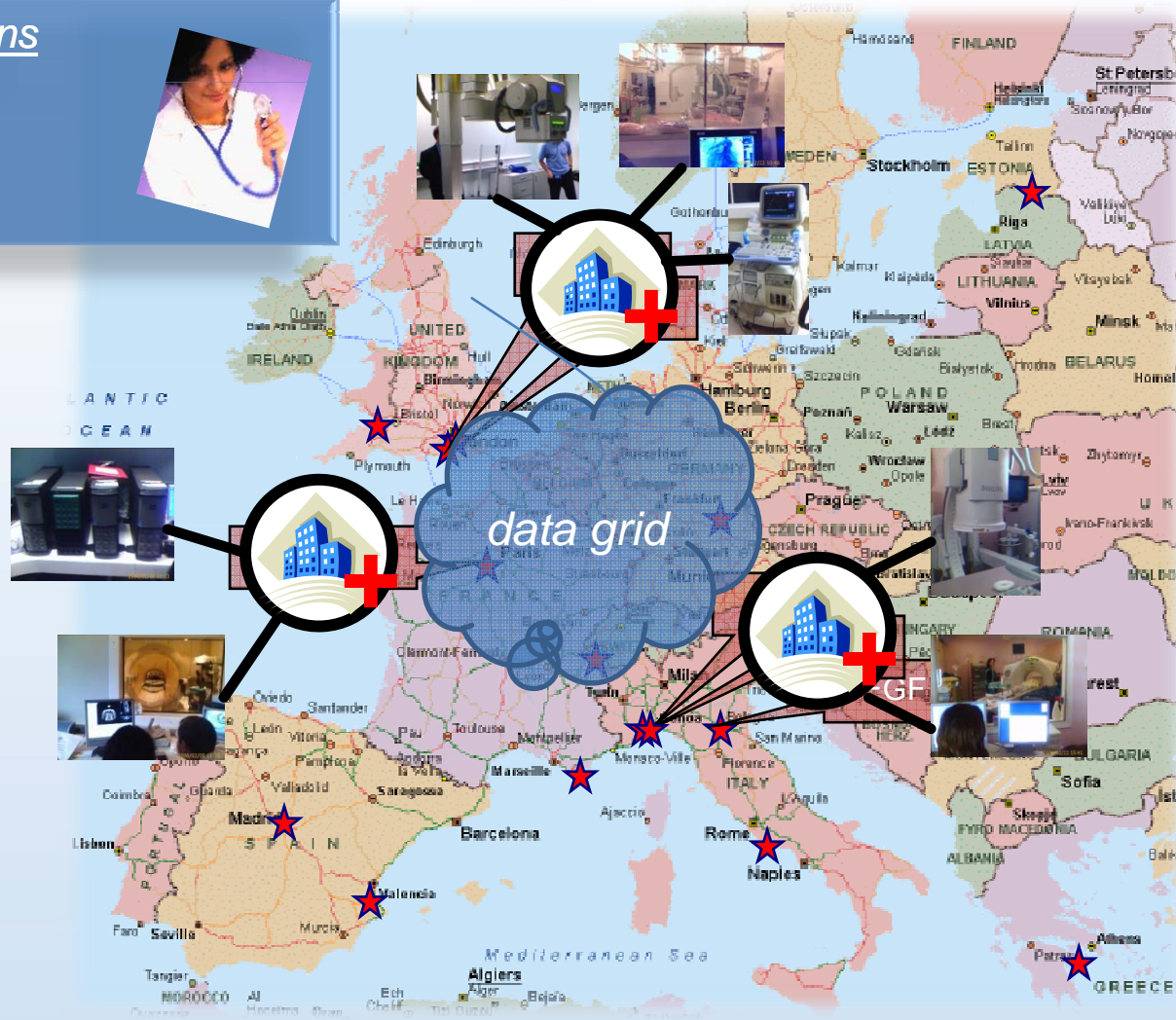
End-Users: Clinicians



Clinical Site



R&D Site





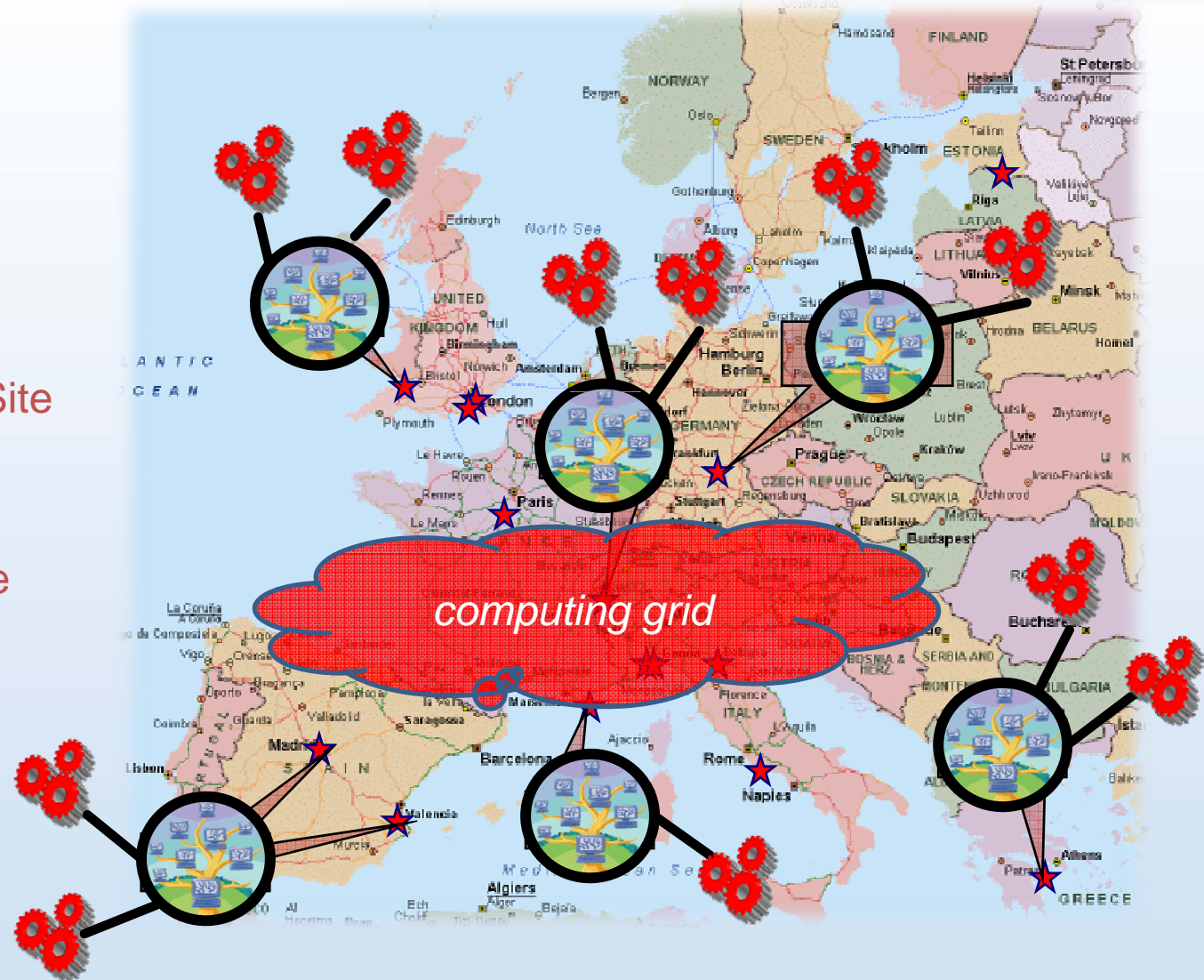
A Distributed Environment



Clinical Site



R&D Site





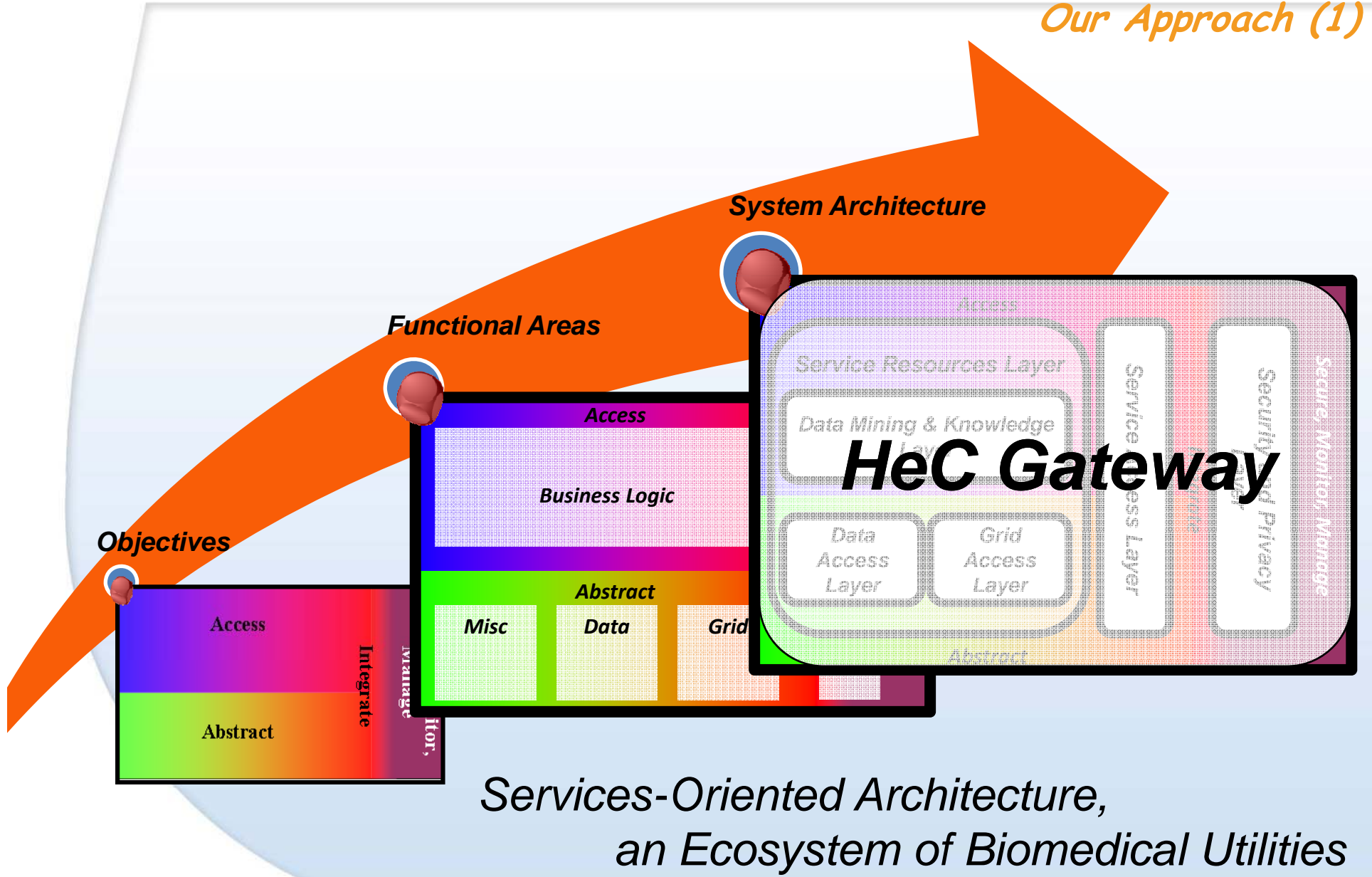
Problem Description

<p>Security</p> <ul style="list-style-type: none">- Interconnecting Hospitals through the Internet- Providing Services & Data Online	
<p>Privacy</p> <ul style="list-style-type: none">- Connecting a Research Platform to Hospitals' Information Systems- Manipulating Patient Data	
<p>Heterogeneity</p> <ul style="list-style-type: none">- Dealing with several imaging devices, technologies, protocols, data, environments...	
<p>Distribution, Scalability</p> <ul style="list-style-type: none">- Coping with geographically distributed sites across Europe (France, UK, Italy...)- Building a scalable system for a future expansion	
<p>Usability</p> <ul style="list-style-type: none">- End-users: Clinicians- Providing a rapid and efficient access to the Platform	

Solution



Our Approach (1)

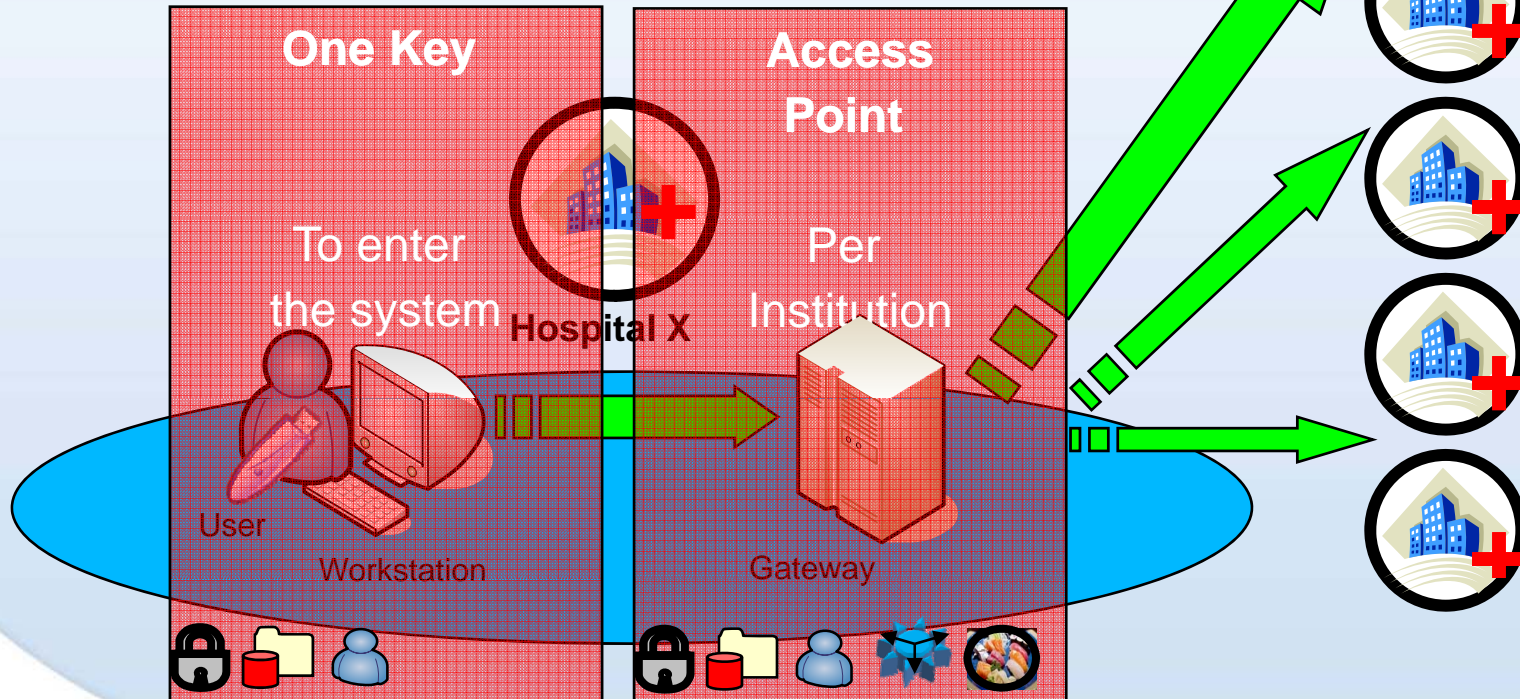




Our Approach (2)

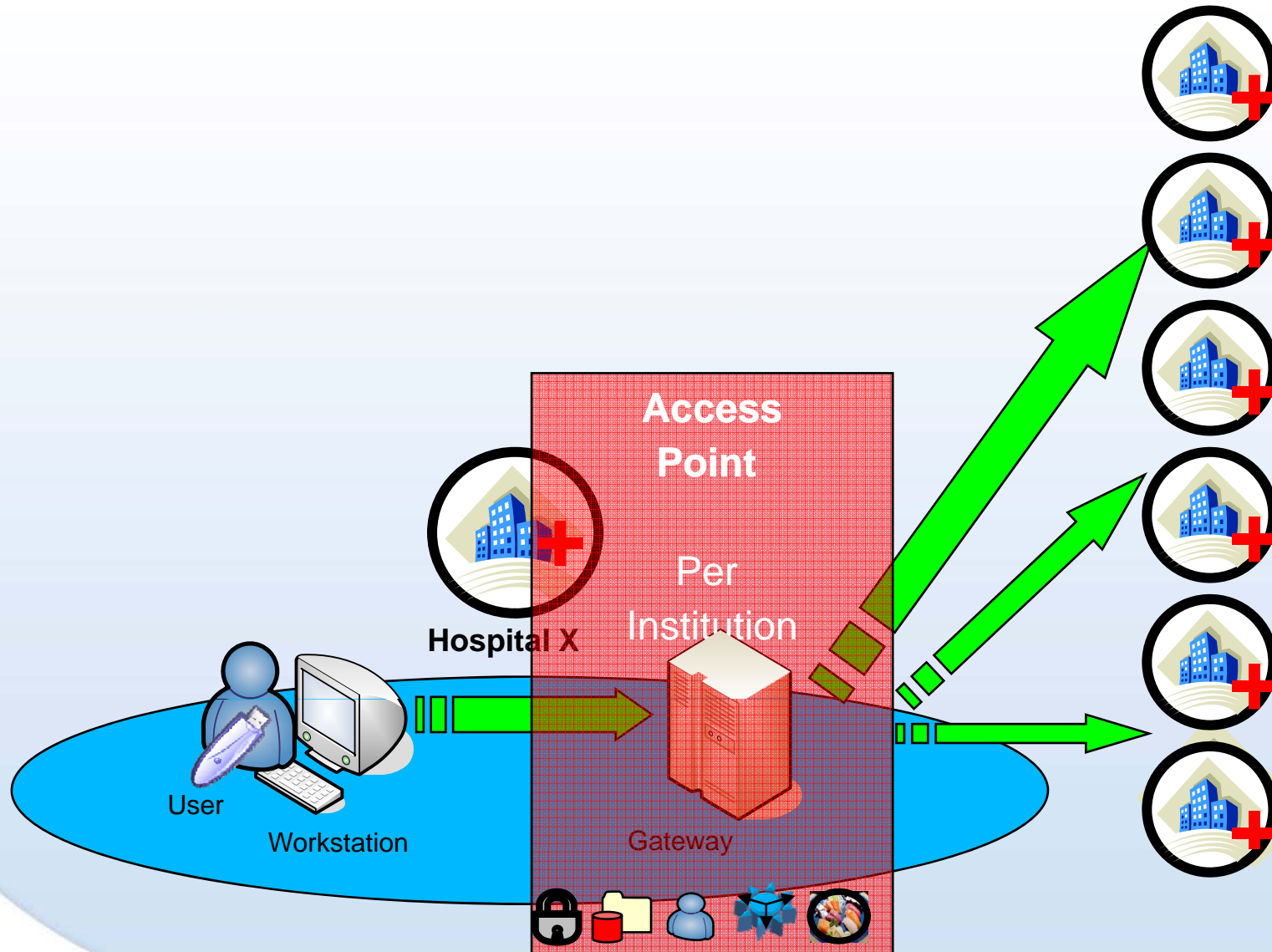
Highlights

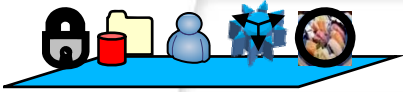
- Simplicity, Abstraction from the complexity of Grid
- Modularity & Scalability, Off-the-shelf components
- State-of-the-art Approaches





Our Approach

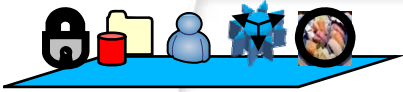




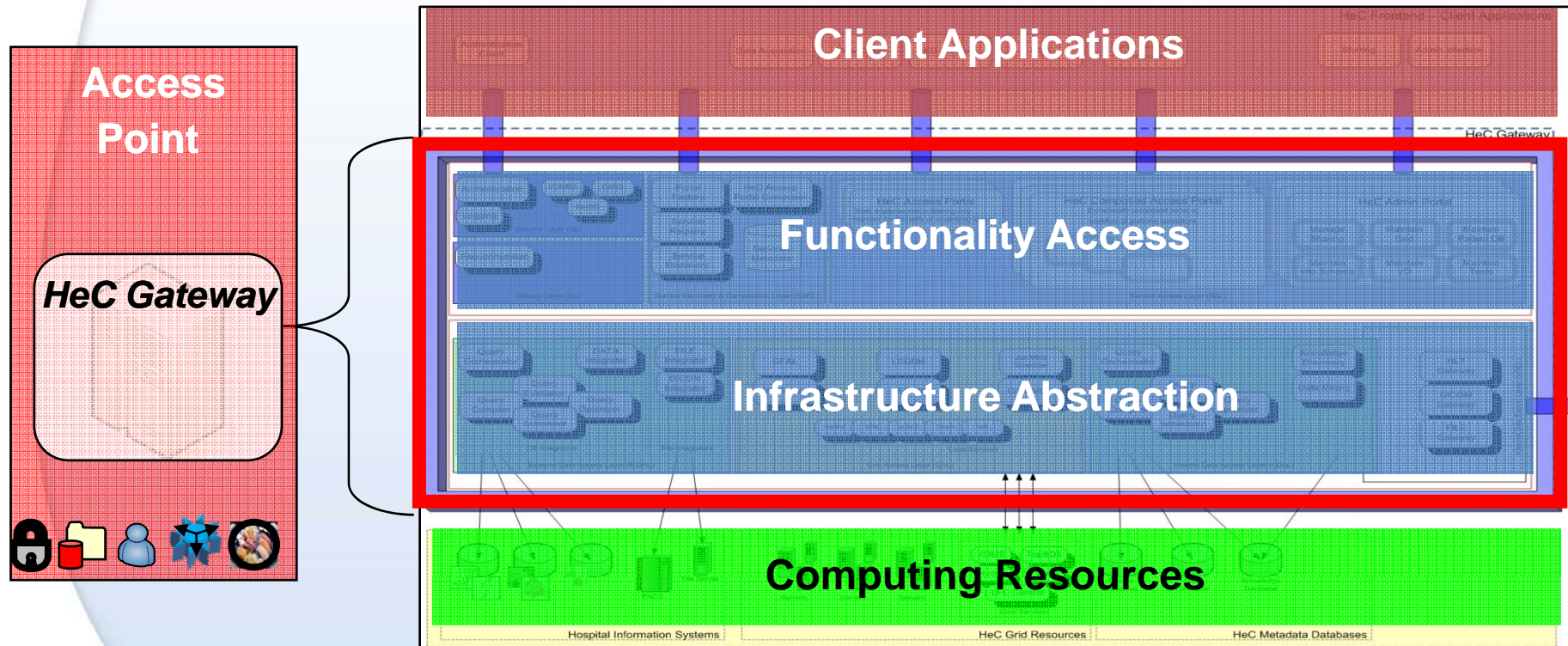
The Health-e-Child Access Point



Virtualization...



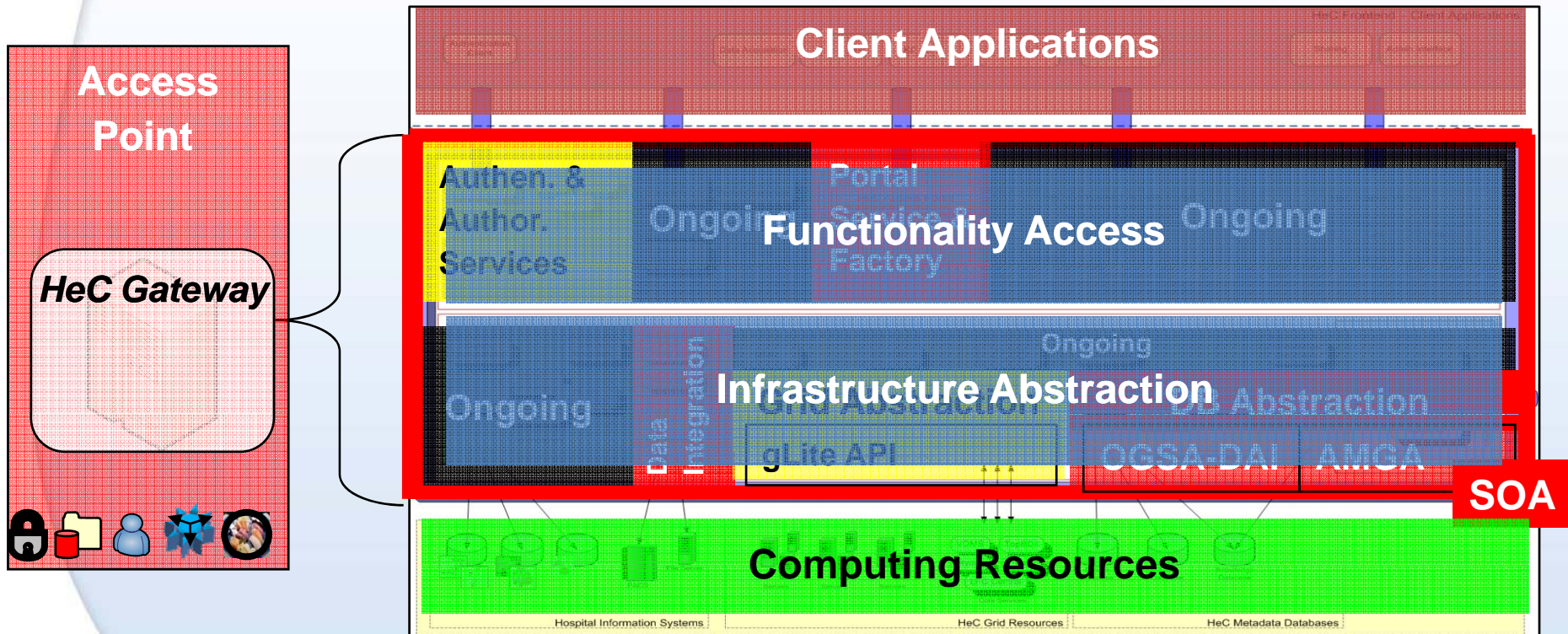
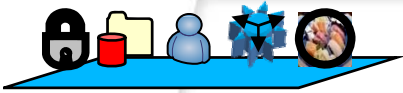
The Health-e-Child Gateway (1)



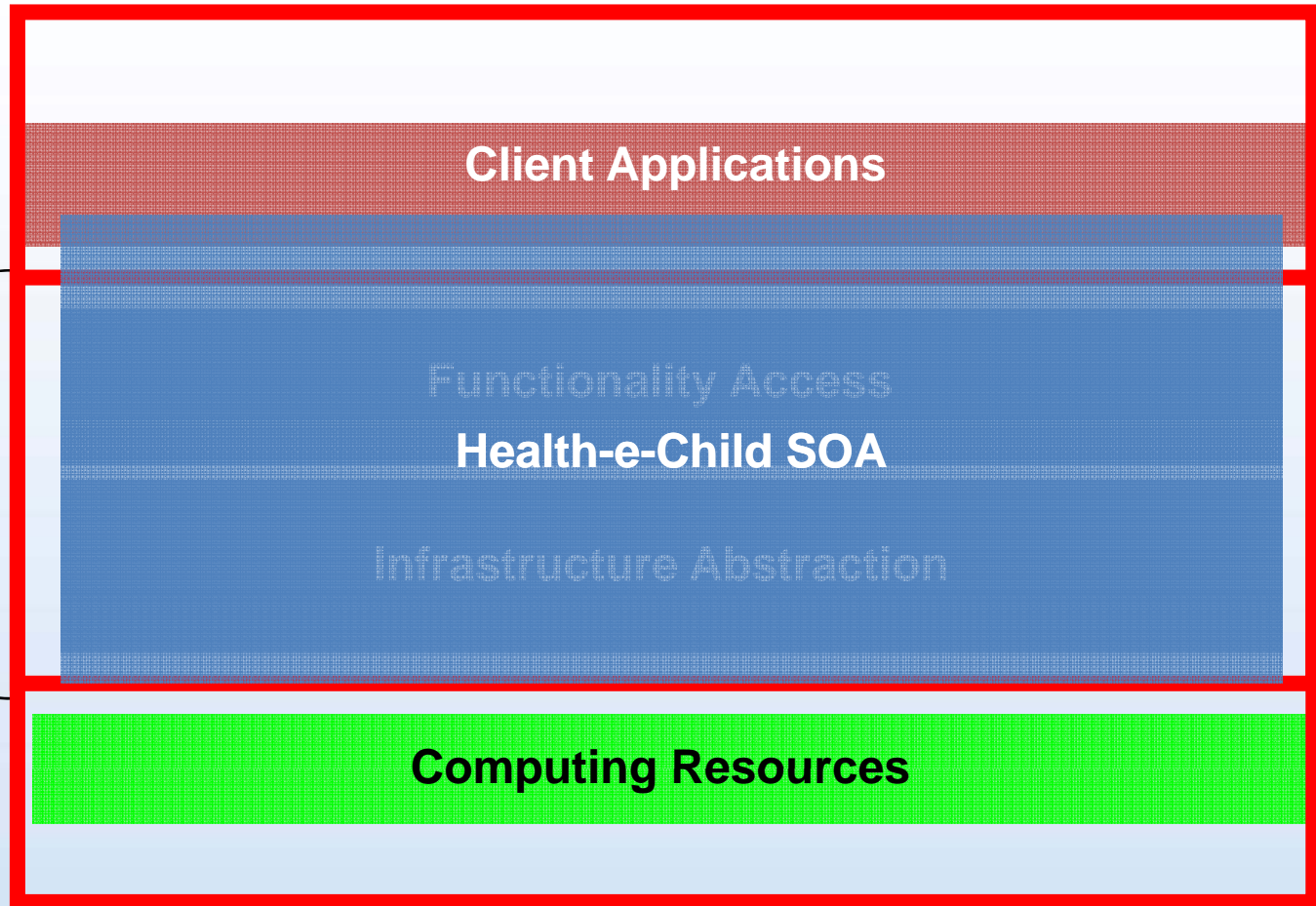
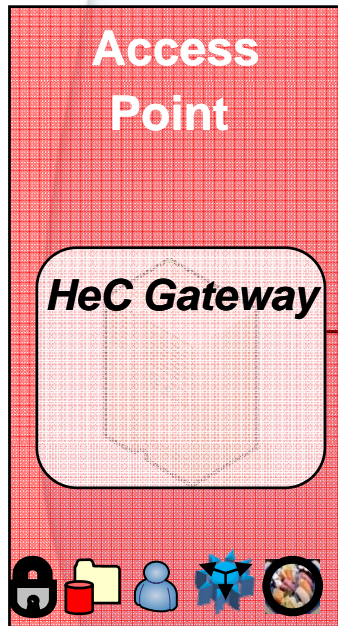
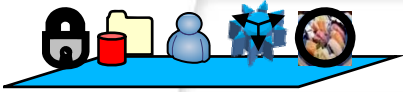
Inside the box...

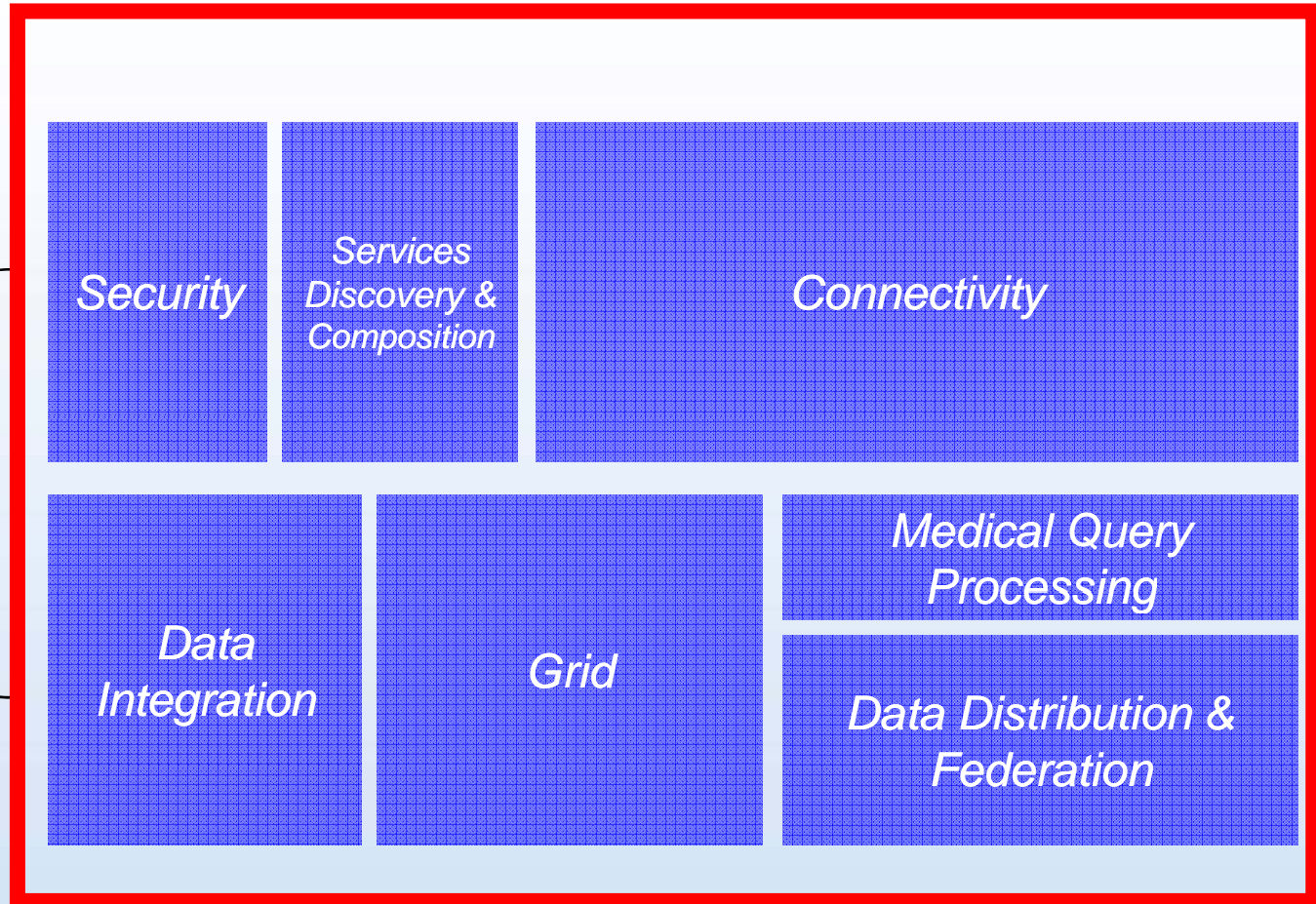
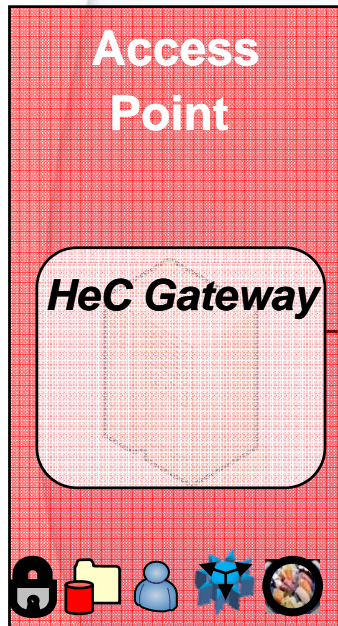
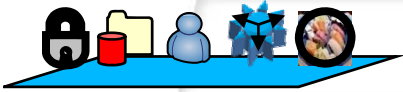


The Health-e-Child Gateway (2)



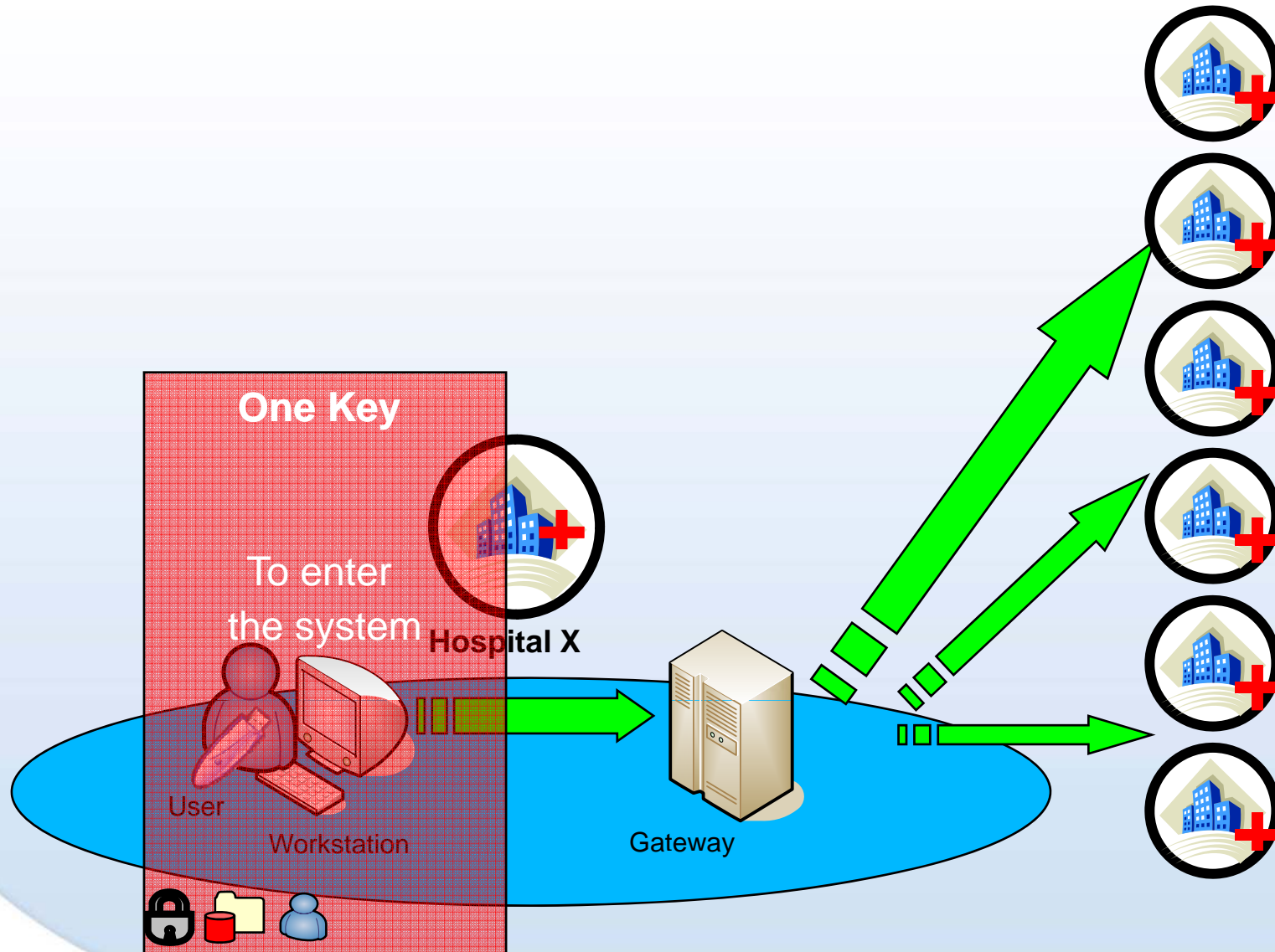
Inside the box...







Our Approach





Authentication

My Term

The Health-e-Child User Certificate was found
----- Welcome -----

The Health-e-Child Gateway seems down
(ORDIWORK/192.168.1.4:8443)

Health-e-Child v0.1

```
HeC # /home/hec_user1> log-infosites --vo hec ce
```

Type	User	Layer	Service	Operation	Message	Occurred On
5	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
6	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:32
7	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
8	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
9	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
10	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:32
11	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:32
12	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
13	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
14	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
15	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
16	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:32
17	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
18	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
19	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
20	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
21	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
22	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:31
23	Michael	si	Authentication	some operation descr	some message	25 11 2006 22:06:32

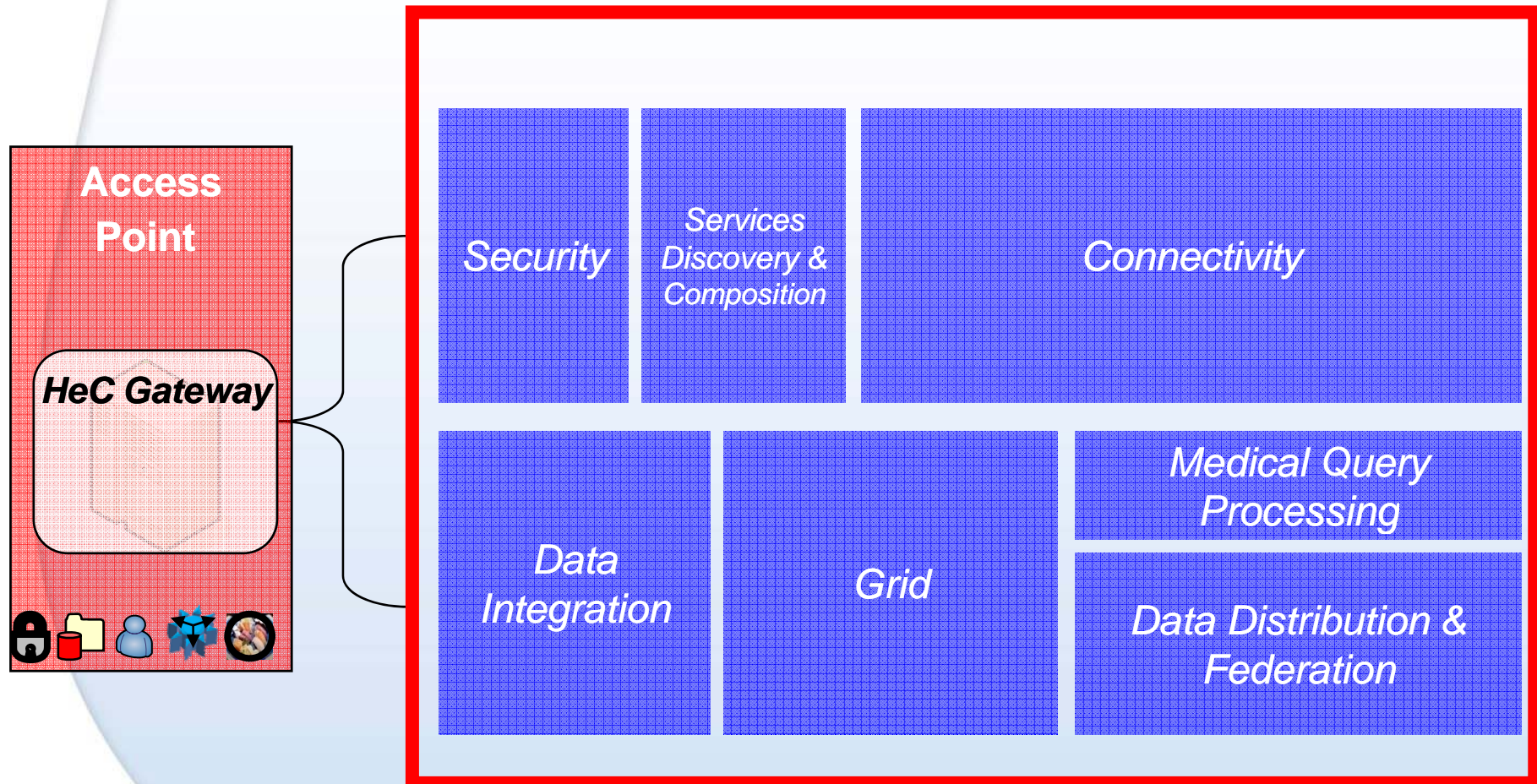
OK - Cert Authentication Successful

OK - Key Registered & Accepted

OK - PIN Code Authentication Successful

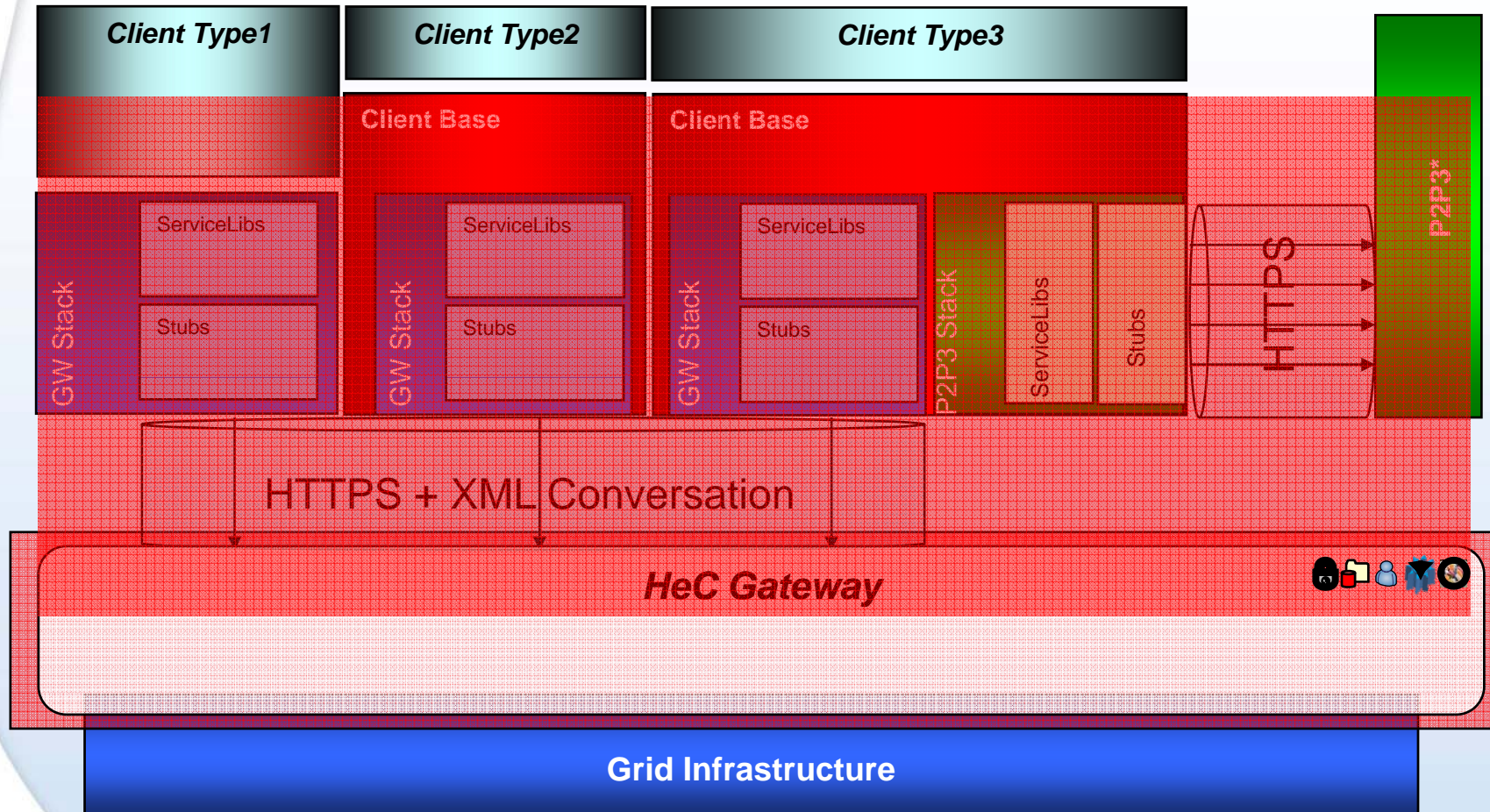
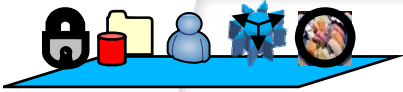
Store Proxy & Endpoint

OK - Interconnect Stored on Key





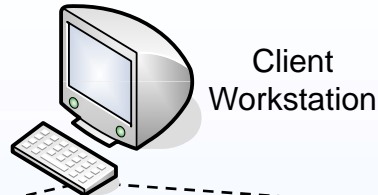
Client Connectivity (1)



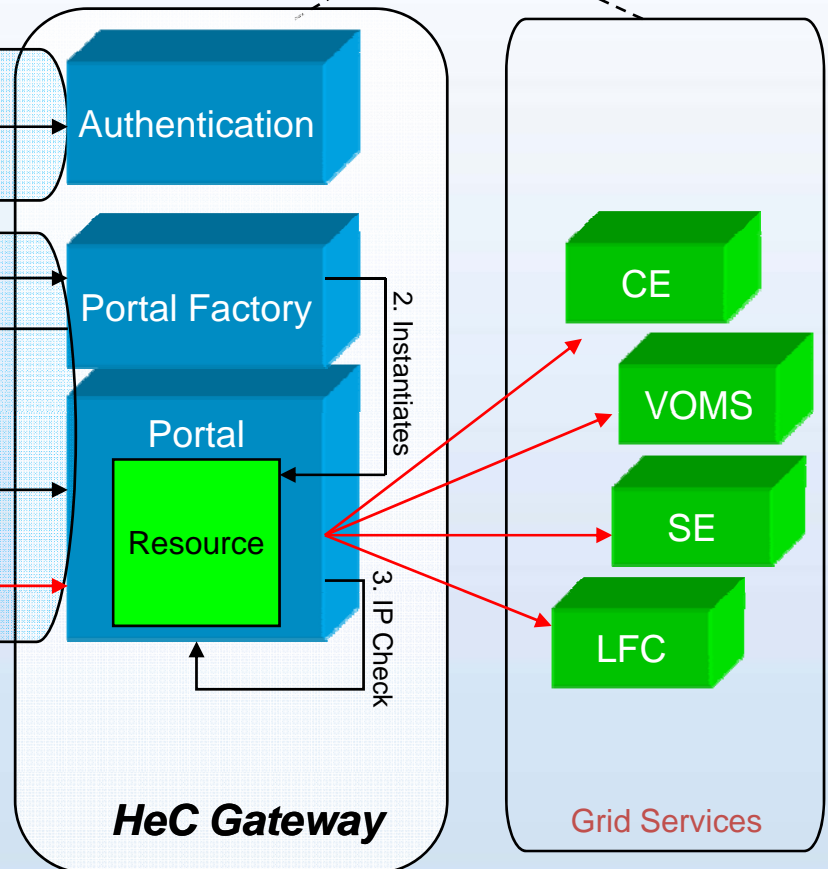
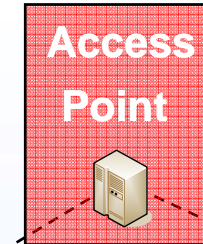
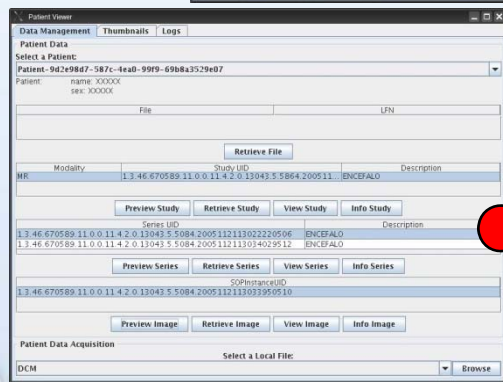
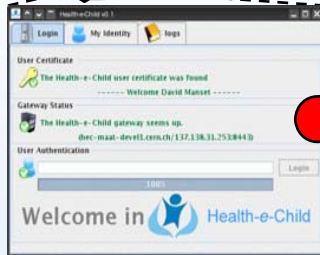
*P2P3: Peer-To-Peer Patient Privacy



Client Type2 - User Session



Client Workstation

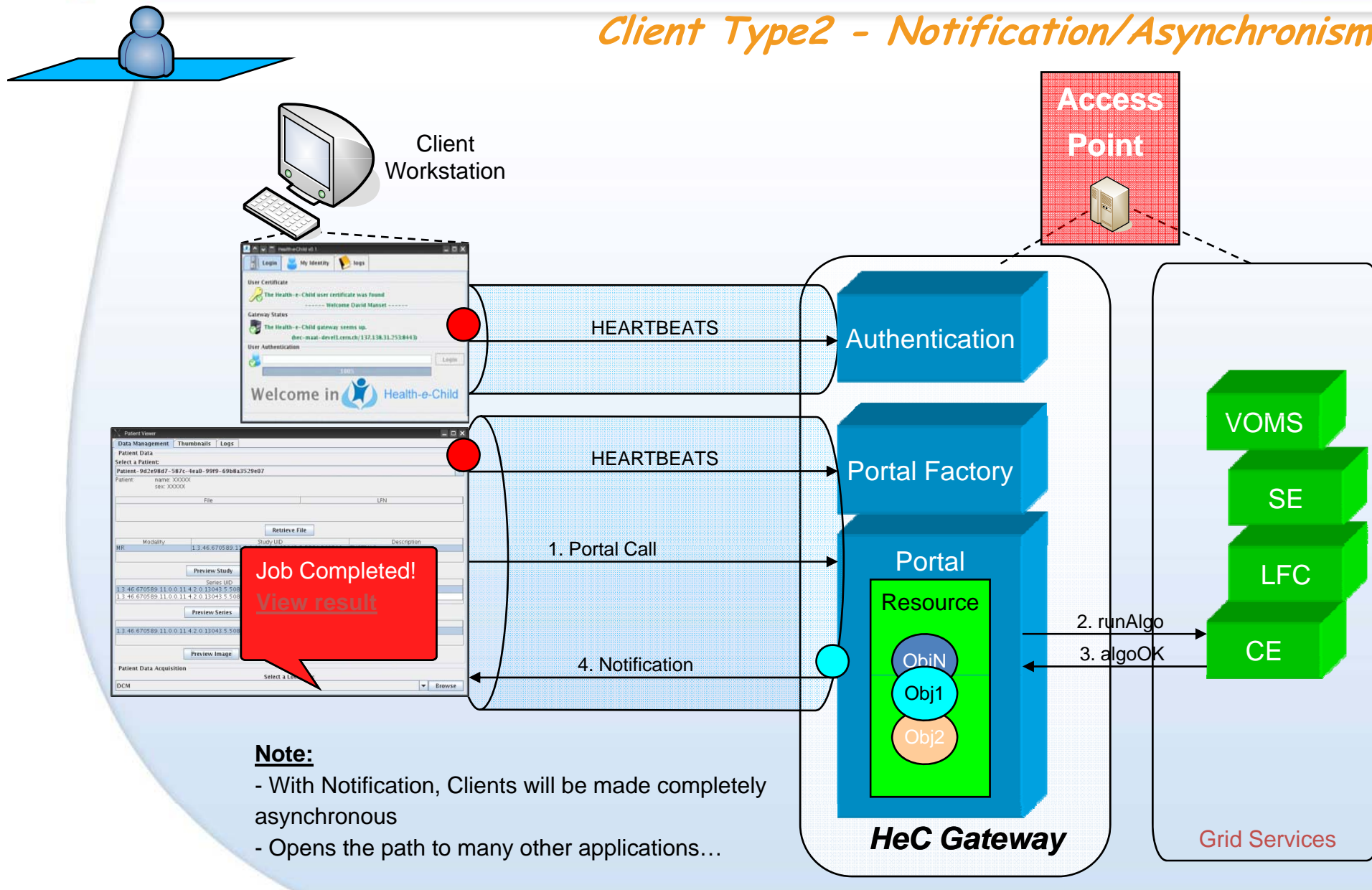


Note:

- Tunnels: HTTPS + GSI Secure Conversation
- Heartbeat = resource lifetime extension



Client Type2 - Notification/Asynchronism

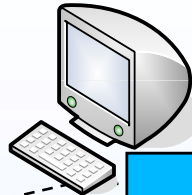


Note:

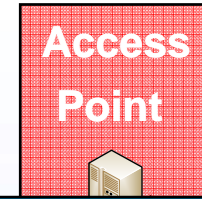
- With Notification, Clients will be made completely asynchronous
- Opens the path to many other applications...



Client Type2 – Operation Management



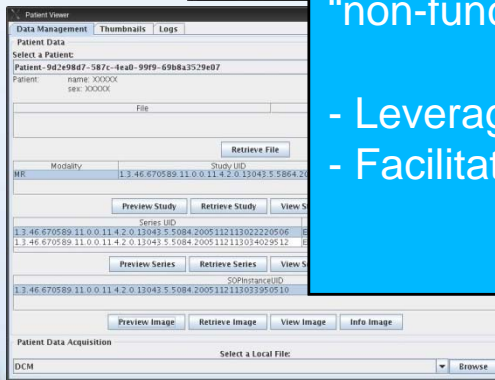
Client Workstation



Access Point

Highlights:

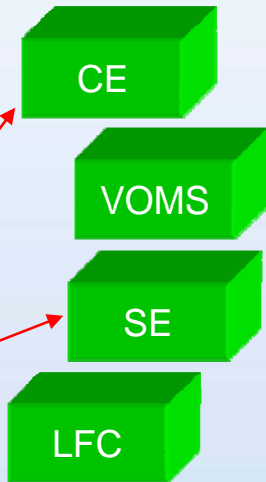
- Lowers the burden on client developers for a number of “non-functional” aspects
 - especially for non-grid experts, thx to abstraction
- Leveraged interactivity for client applications
- Facilitates Integration



4. Notification

HeC Gateway

3. Execution



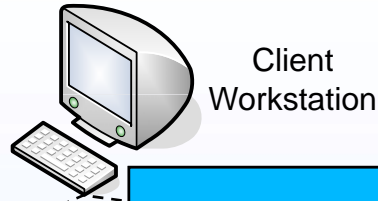
Grid Services

Note:

- Tunnels: HTTPS + GSI Secure Conversation
- Heartbeat = resource lifetime extension



DICOM Files



Client Workstation



Highlights:

- Asynchronous operations
- Thumbnails generated from DICOM slices (useful for efficiently browsing patient records)
- DICOM Compliant

Patient Viewer

Data Management | Thumbnails | Logs

Patient Data

Select a Patient:

Patient: 9d2e98d7-587c-4ead-9919-69b8a3529e07

Patient: name: XXXXX
sex: XXXXX

File

Retrieve File

Modality: MR Study UID: 1.3.46.670589.11.0.0.11.4.2.0.13043.5.5864.2

Preview Study | Retrieve Study | View Study | Info Study

Series UID	Description
1.3.46.670589.11.0.0.11.4.2.0.13043.5.5084.2005112113022220506	ENCEFALO
1.3.46.670589.11.0.0.11.4.2.0.13043.5.5084.2005112113094029512	ENCEFALO

Preview Series | Retrieve Series | View Series | Info Series

SOPInstanceUID

1.3.46.670589.11.0.0.11.4.2.0.13043.5.5084.2005112113033950510
--

Preview Image | Retrieve Image | View Image | Info Image

Patient Data Acquisition

Select a Local File: Browse

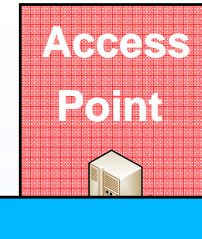
Notification

3. File Transfer

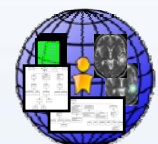
gridFTP

Tmp

HeC Gateway



Access Point



SE

LFC

Grid Services



Step 3 - Data Privacy

Health-e-Child main interface showing patient database management. Includes fields for Patient ID, First name, Last name, Sex, Address, City, and Zip code. A list of mapped patients is visible on the left.

View Case: David Manset (Harbo) - Patient Information window. Shows patient details and a grid of medical images. Includes a 'Retrieve File' button and a table of patient data.

Modality	Study UID	Description
	1.2.840.113619.2.98.3513.1172565788.0.61	null

HiC - Automator window showing workflow configuration. Includes sections for Applications, Orchestration, and Documentation.

Applications:

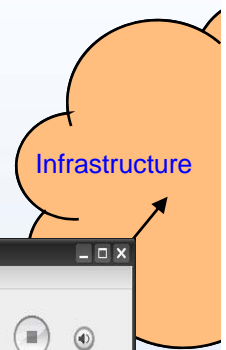
- Queries - look for patients
- Algos - find similars CT, MR, US
- Images - retrieve CT, MR, US

Orchestration:

- Queries - look for patients (Parameters: age <20, sex M)
- Images - retrieve CT
- Algos - find similars CT

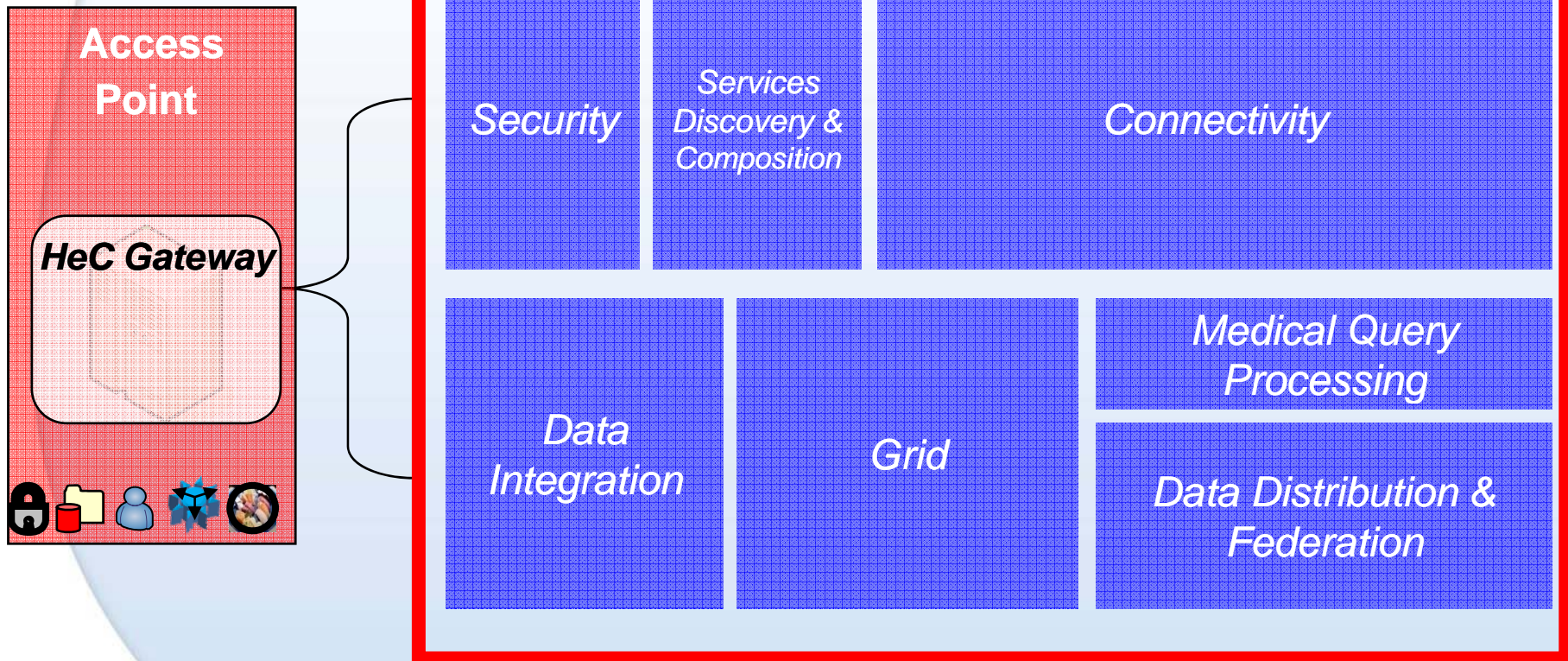
Documentation:

Description: Finding similars CT
Return: The list of CT



Privacy DB is decrypted and reconstructed in once clinician is authenticated in the VO

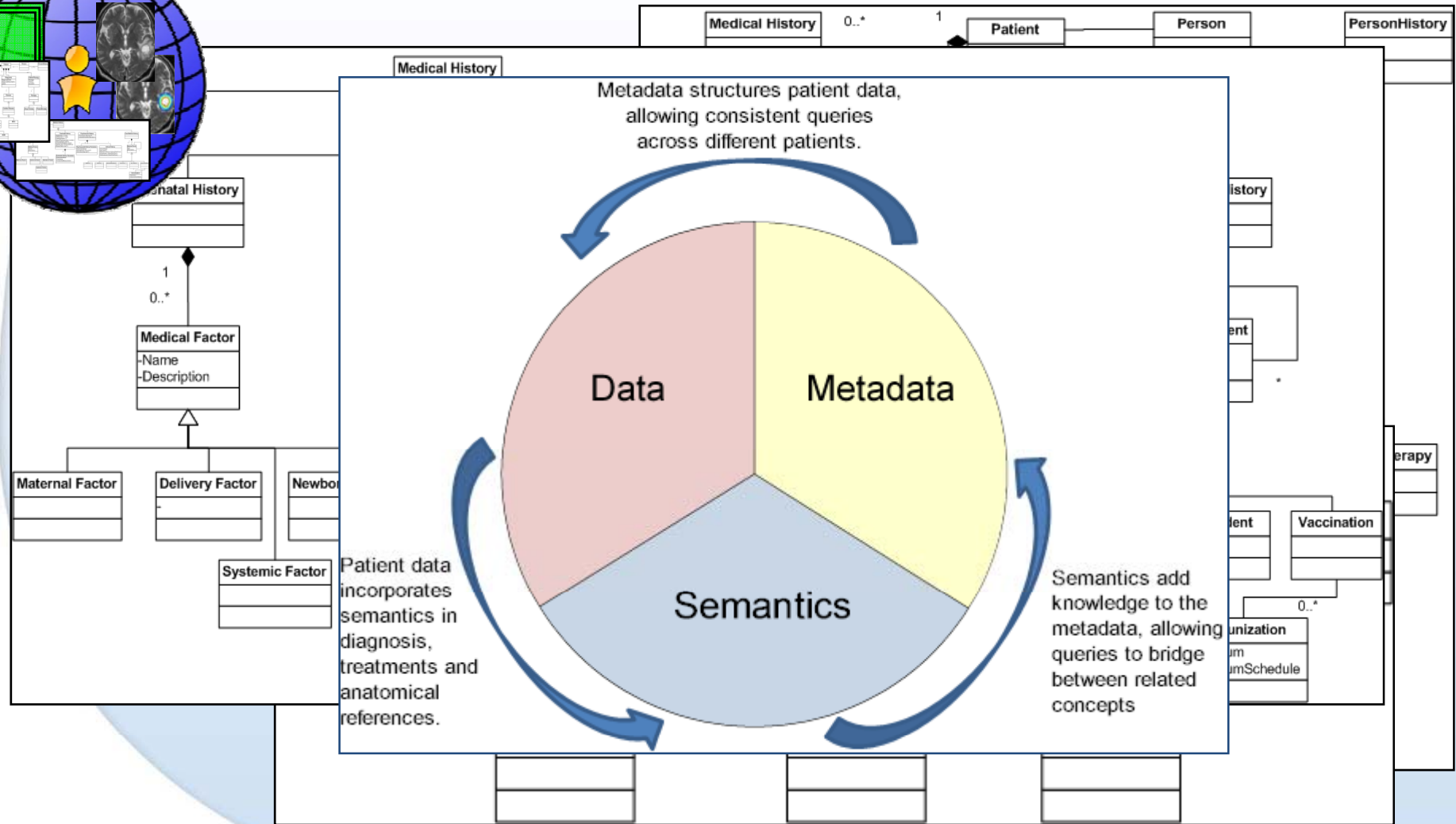
Patient Private Info





Integrated Data Model

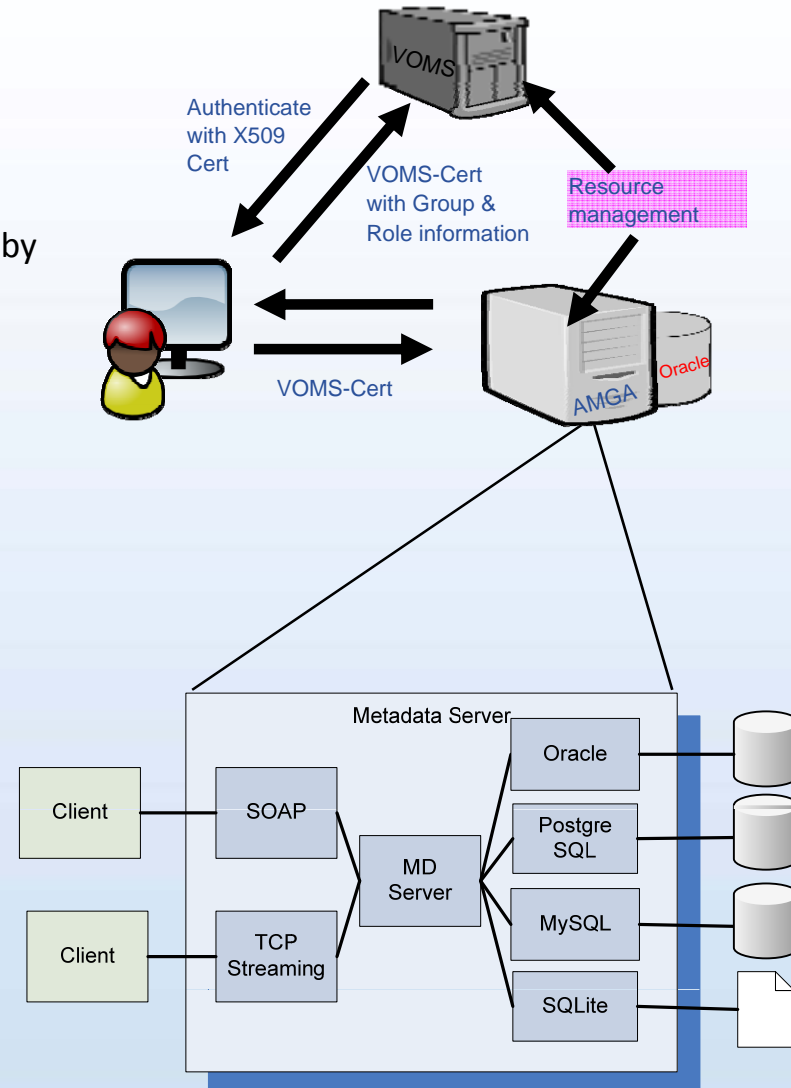
Data Models from WP6

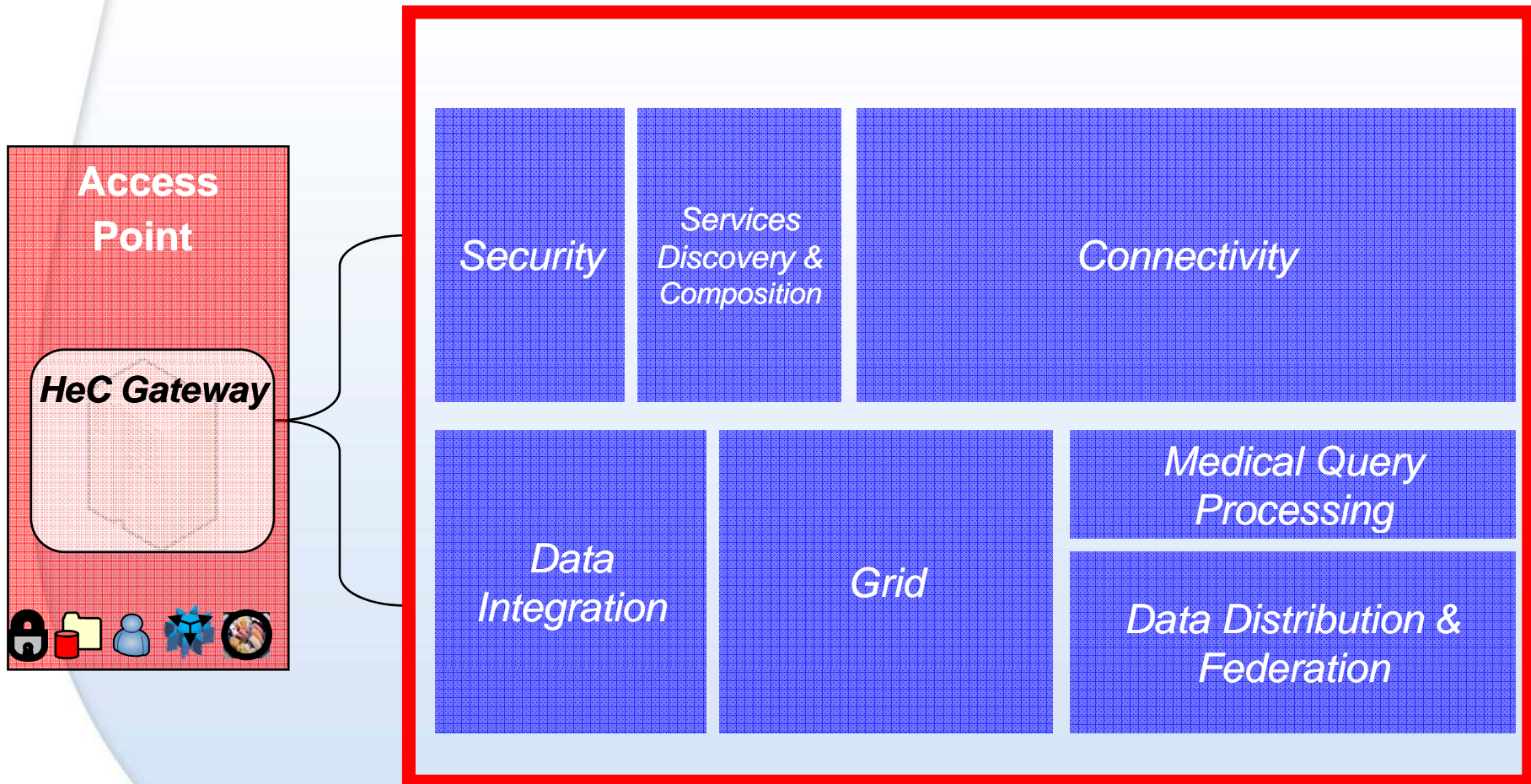




Abstraction Layer - AMGA

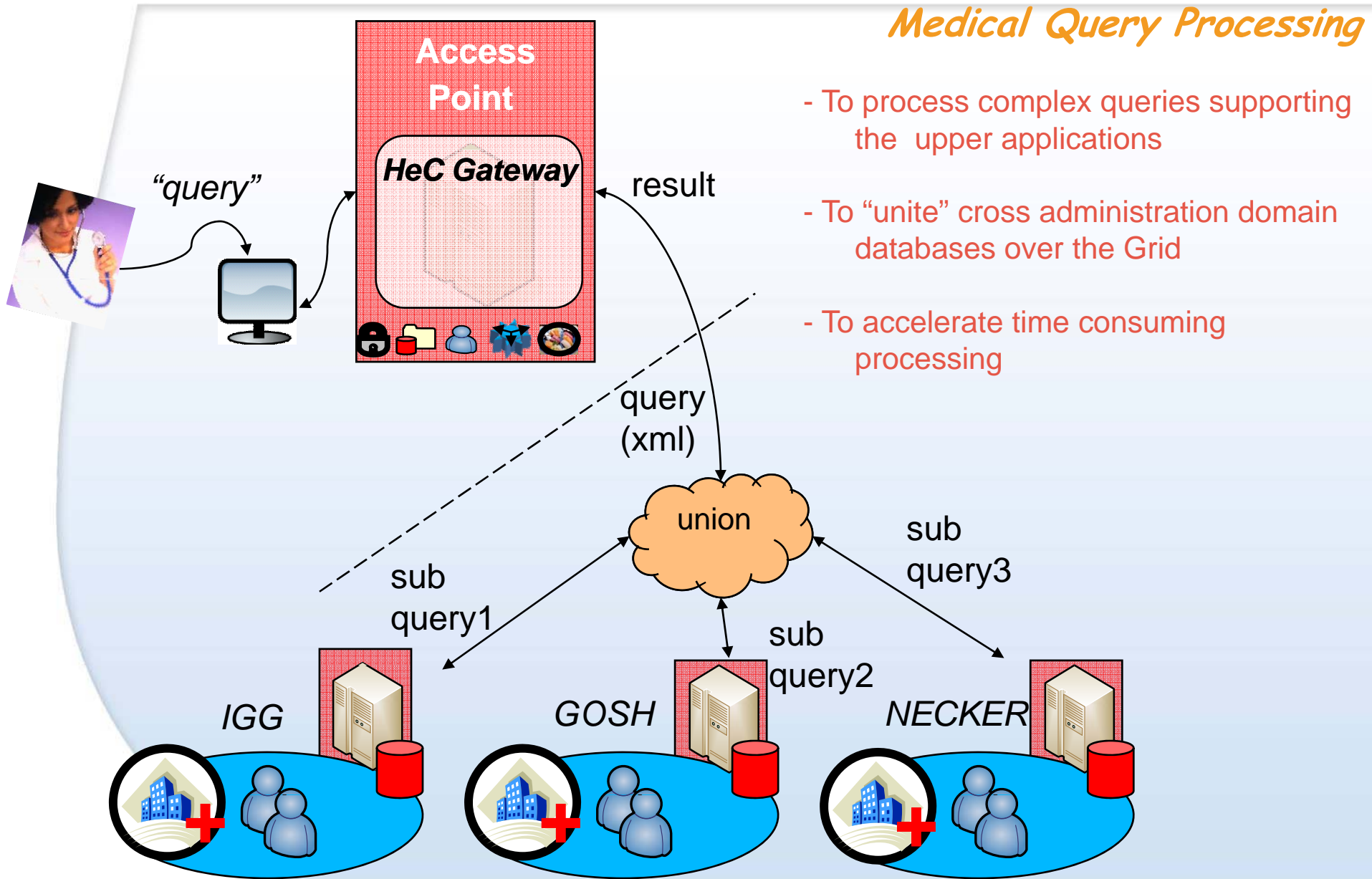
- **Backends**
 - Runs on any Linux flavour
 - Oracle, MySQL, PostgreSQL, SQLite
- **Frontends**
 - TCP Streaming
 - High performance
 - Client API for C++, Java, Python, Perl, Ruby
 - SOAP
 - Interoperability
- **Secure connections – SSL**
- **Authentication based on**
 - Username/password
 - General X509 certificates
 - Grid-proxy certificates
- **Authorisation:**
 - Users/groups
 - Unix style permissions
 - ACLs – Per-collection or per-entry
 - Access control via a VO



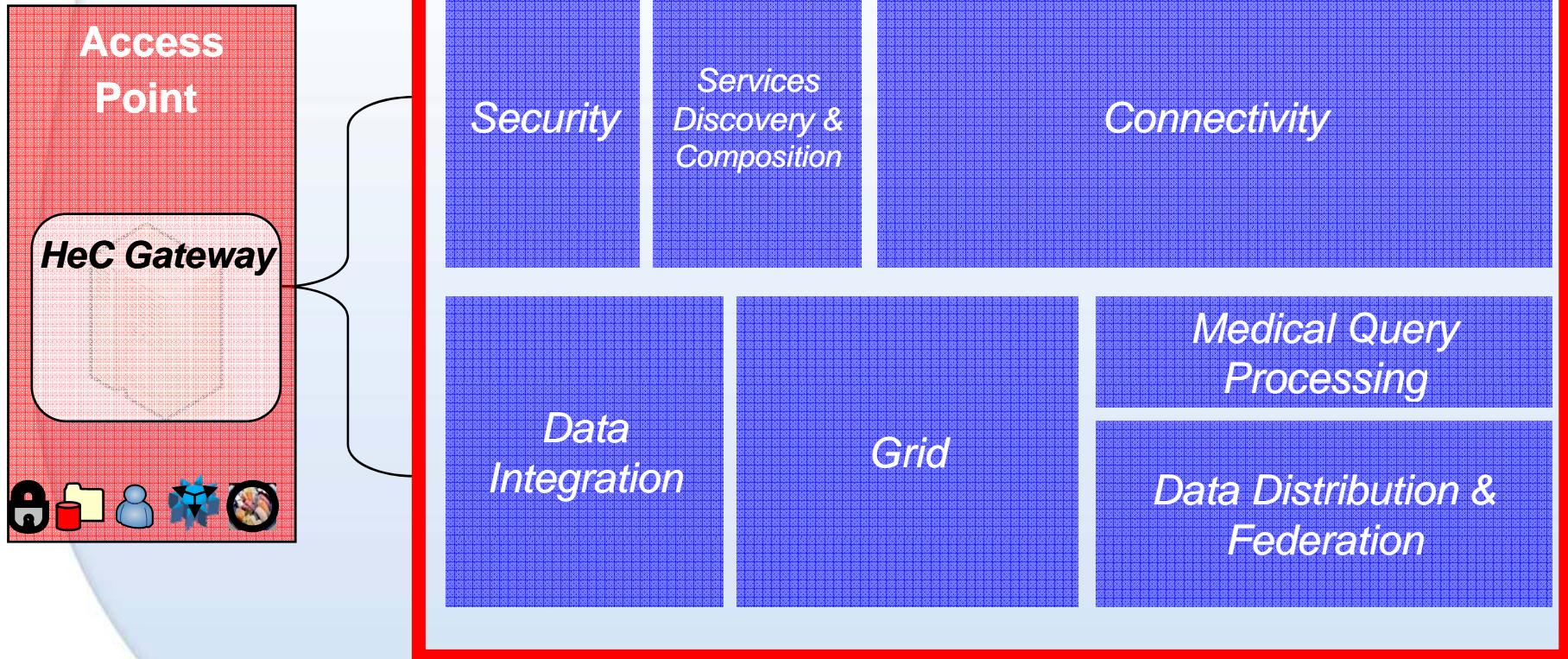




Medical Query Processing

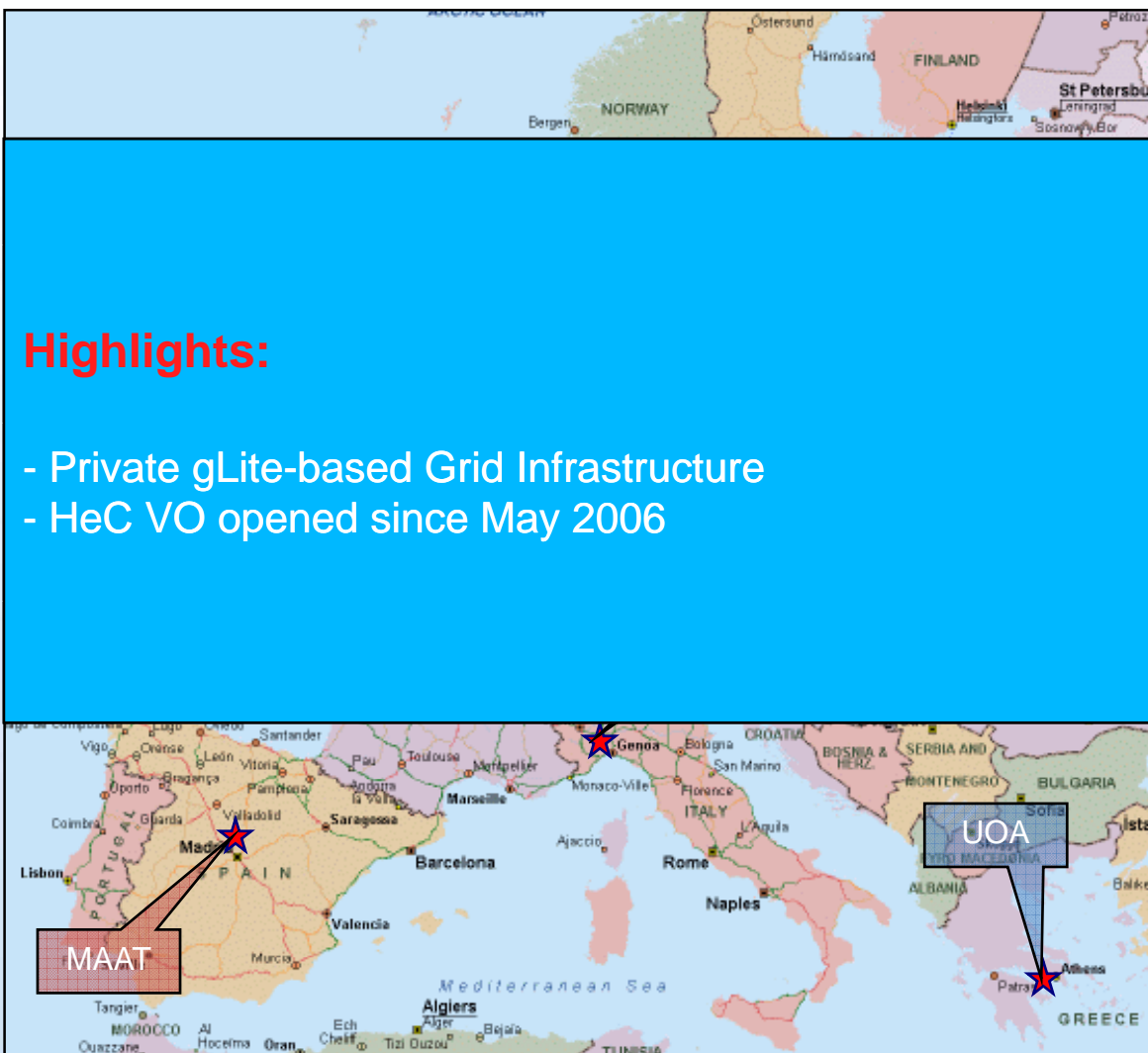


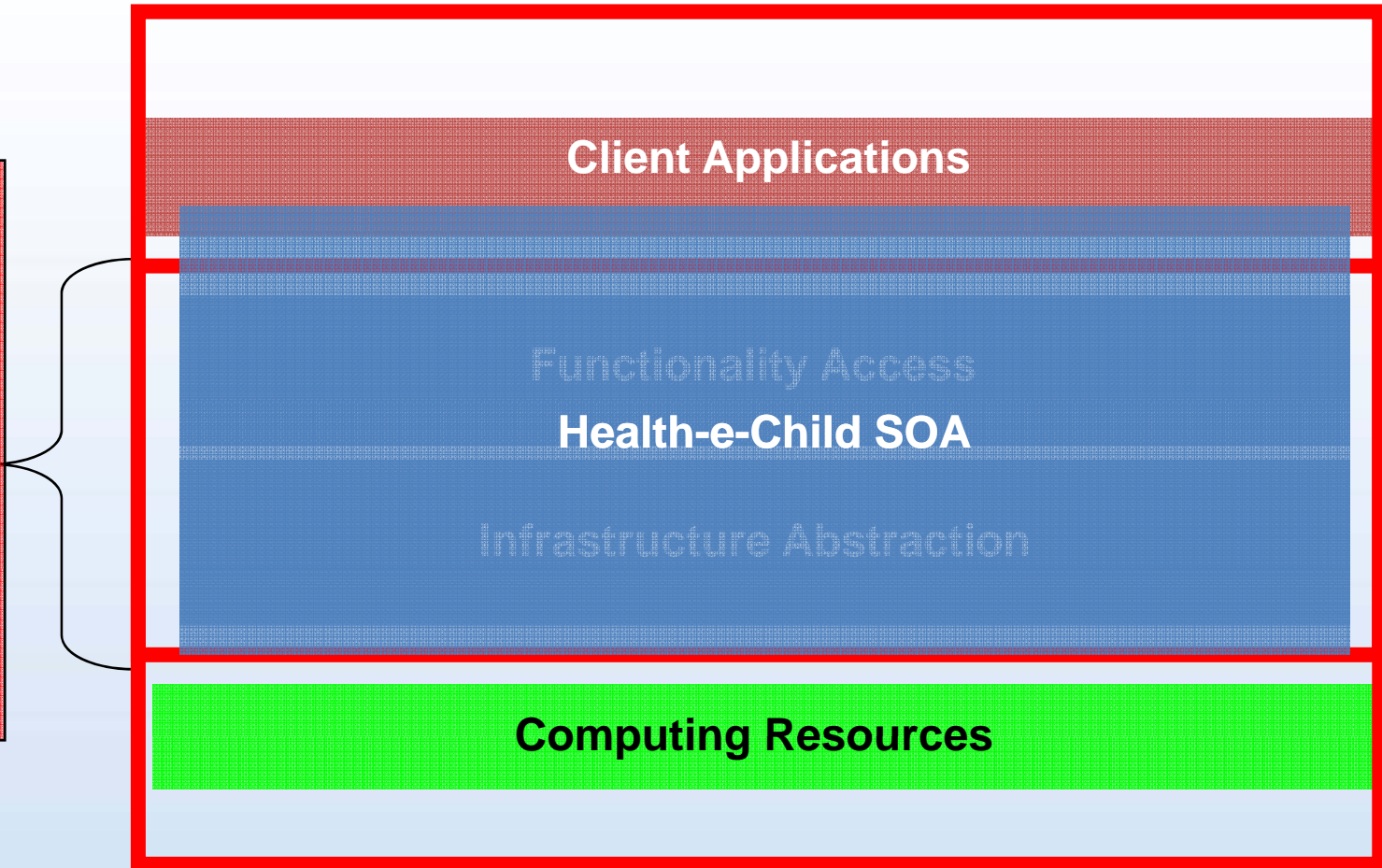
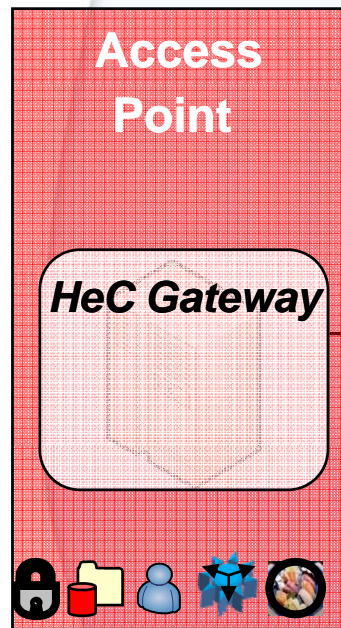
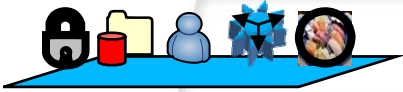
- To process complex queries supporting the upper applications
- To “unite” cross administration domain databases over the Grid
- To accelerate time consuming processing





Grid Infrastructure

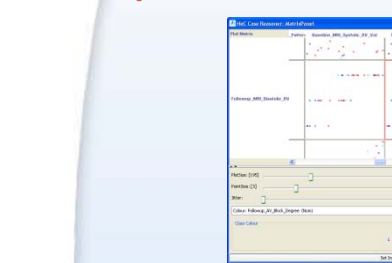




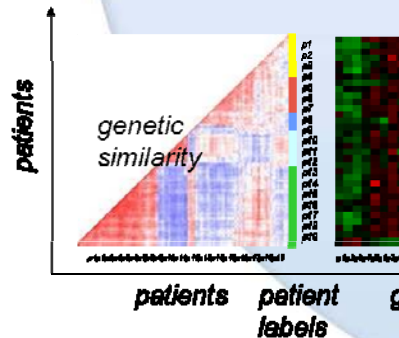


HeC Case Reasoner (1)

- Patient cohort determined by filtering and / or similarity search
- e.g. male patients with a certain condition
- Goal: Visualize patient cohort
- up to 4 dimensions



- more than 4 dimensions
- neighborhood



file
hort

es, tree maps,

end imaging
features



HeC Case Reasoner (2)

Treemaps lately became very popular and have been demonstrated to be significantly faster than spreadsheets to analyze data that is clustered hierarchically

The collage consists of four screenshots illustrating treemap usage:

- Top-left:** A news treemap from www.marumush.com displaying a dense grid of news headlines, where the size and color of each cell represent the relative importance or volume of each article.
- Top-right:** A treemap titled "Salesforce Management" from The Hive Group. It features a grid of colored cells representing sales data, with filters for "GROUP by" (Sales Region), "SIZE represents" (Total Sales - Q4), and "COLOR represents" (1. % of Quota Met - Q4). A legend on the right shows a color scale from red (below) to green (above).
- Bottom-left:** A treemap for "Peet's Coffee & Tea" showing a hierarchy of coffee products. The size of each cell indicates the price, and the color indicates the coffee's body. Categories include "Peet's Blends", "Reserve Coffee", "Africa and Arabia", "Dark Roast", "Decaffeinated", "The Pacific", and "The Americas".
- Bottom-right:** A treemap for "The Hive Group" showing music genres and song popularity. The size of each cell represents the number of songs, and the color represents the genre. The treemap is divided into sections for "Songs Going Up the Charts" and "Songs Going Down the Charts".



THANK YOU FOR YOUR ATTENTION

More Information

www.health-e-child.org

Live demo @ EGEE User Forum in Budapest

<http://indico.cern.ch/contributionDisplay.py?contribId=174&sessionId=23&confId=18714>

HeC/Share/Healthgrid Workshop

<http://indico.cern.ch/sessionDisplay.py?sessionId=50&slotId=0&confId=18714#2007-10-05>