Use Case: e-Health

universität innsbruck

National University of Ireland, Galway
Ollscoil na hÉireann, Gaillimh

Universität Stuttgart
Germany

TU WIEN
Technische Universität Wien
Vienna University of Technology

Freie Universität Berlin

ontotext
Semantic Technology Lab

profium

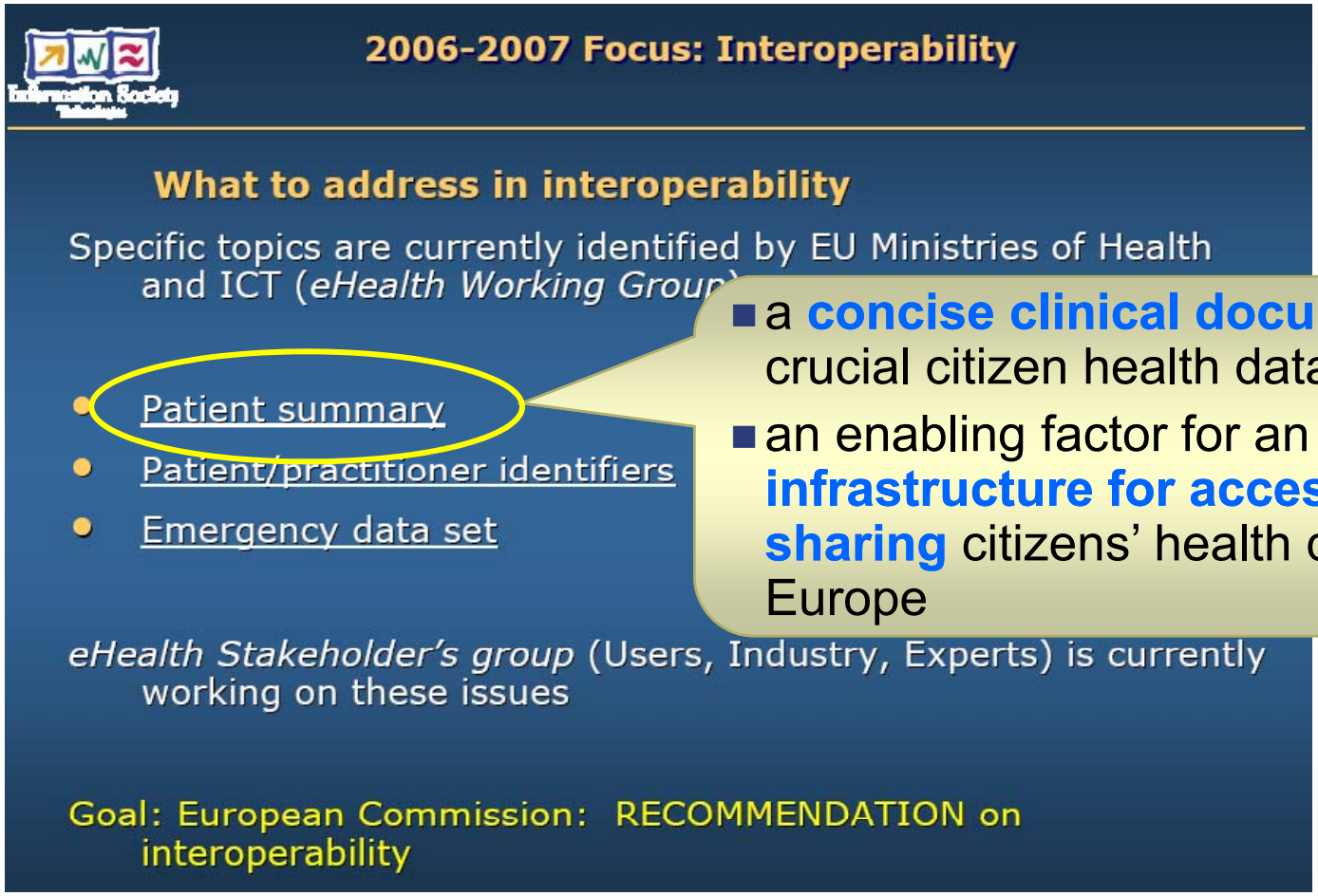
CEFRIEL
FORGING INNOVATION

Telefónica
Telefónica Investigación y Desarrollo

Agenda

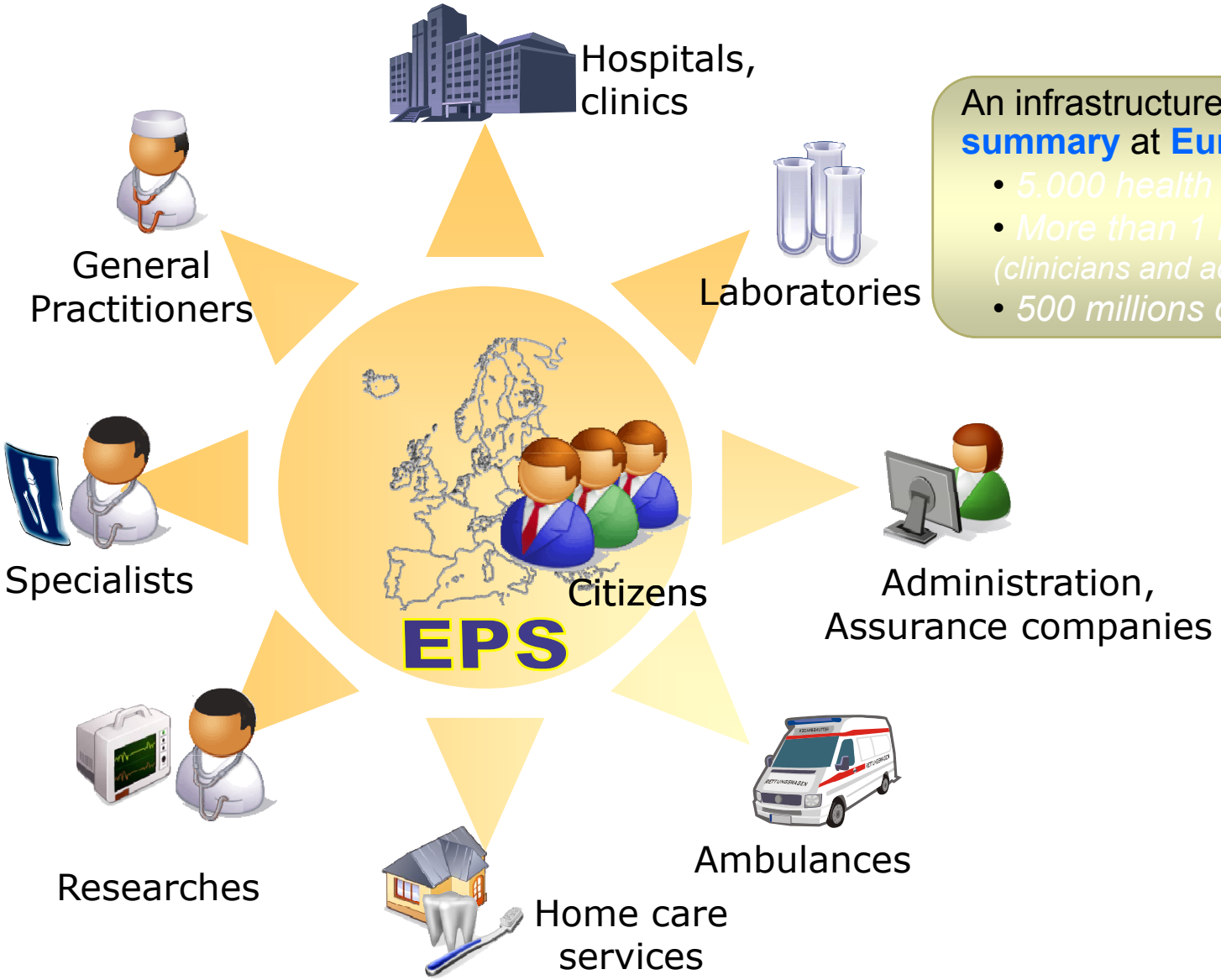
- The European Patient Summary (EPS) Scenario
  - eHealth challenges
  - Requirements for the EPS Infrastructure
  - Triple Space Capabilities
- The EPS Architecture
  - On top of the Triple Space
  - Inside the Triple Space: Subspaces, Roles and Policies
  - The EPS Ontologies
- Reviewers comments and Evaluation Plan
- eHealth Demo

European Strategies in eHealth



Ilias Iakovidis (Deputy Head of Unit – ICT for Health, DG INFOSO, EC) "*European Commission activities in eHealth: The achievements and future prospects.*" Med-e-Tel Luxembourg, April 5, 2006

The European Patient Summary (EPS)



An infrastructure for a **patient summary** at **European level**

- *5.000 health authorities*
- *More than 1 million users (clinicians and administrative staff)*
- *500 millions citizen summaries*

Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project

Requirements for the EPS Infrastructure

- Multilateral Solution
  - **Virtual common** infrastructure distributed among parties
  - **Coordinate** multidisciplinary actors in access data **asynchronously** and from **different locations**
- Scalability
  - 500.000.000 Patient Summaries
  - 5.000 Local Health Authorities
- Privacy and Data Ownership
  - National and Local policies to authorize caregivers to access citizen data
  - Each healthcare party owns the summaries of the cared citizens
- Subsidiarity
  - Overcome the **heterogeneity** of data and applications
    - Intensive use of **knowledge**: structured data and Terminologies

Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project

Key principles

- Ownership of the patient summary lies in the hand of the patient's hand itself, while its medical representative is responsible for its medical content.
  - A patient summary migrates from the kernel(s) of Health Authority A to the one(s) of Health Authority B when the patient moves.
- Local healthcare providers are the owners of data used to “build” a patient summary.

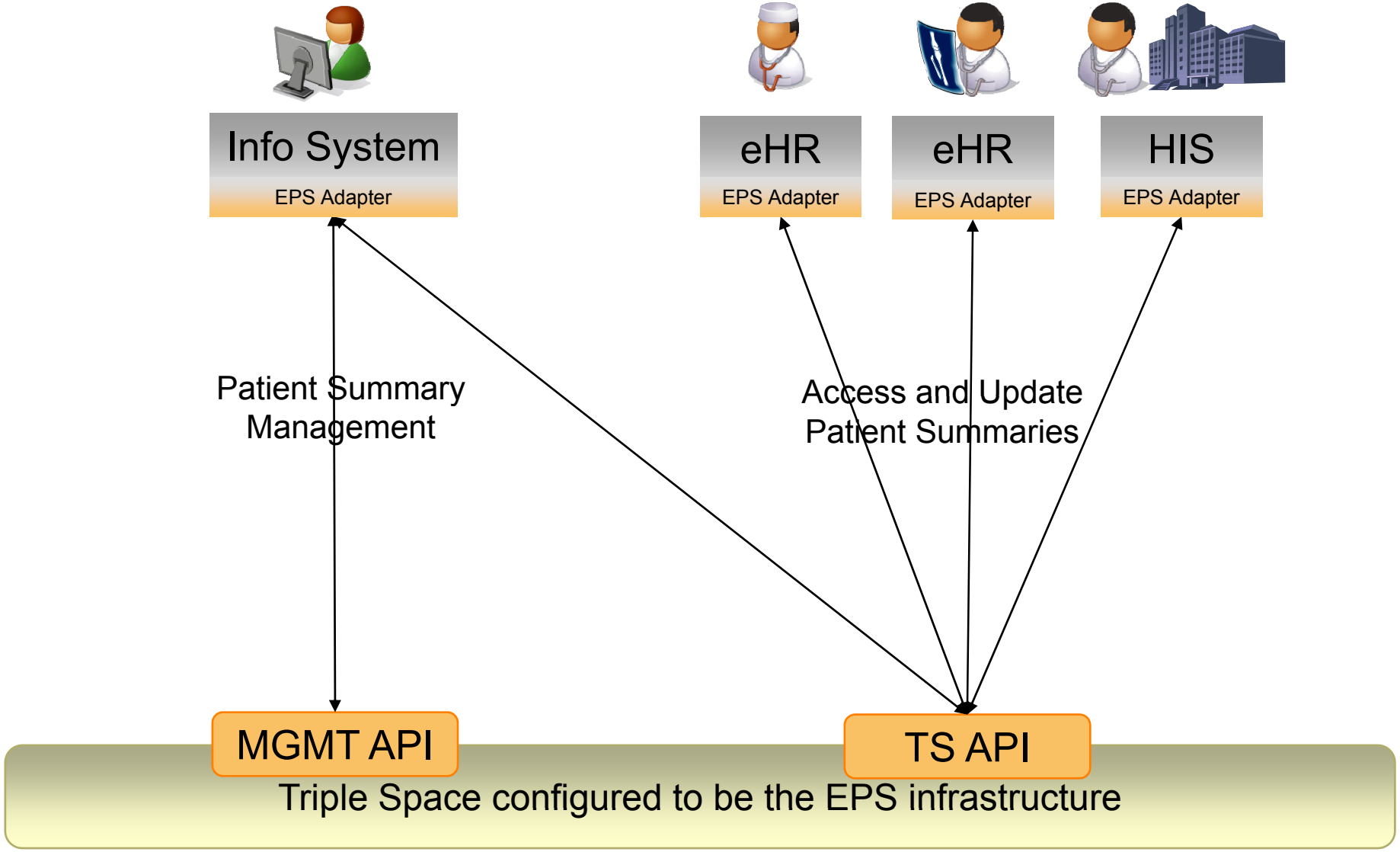
Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project

Triple Space Capabilities

- Decentralized, Distributed and Shared Space
  - Each healthcare party provides resources to the whole space
- Persistent Publication
  - Actors persistently publish and update data in their own subspace, enforcing data ownership
  - Other actors can retrieve the published data
- Security Mechanisms
  - Global and local policies to access data
- Coordination Support
  - Interactions decoupled in time, location and reference
- Semantic Interoperability
  - To cope with heterogeneity among data

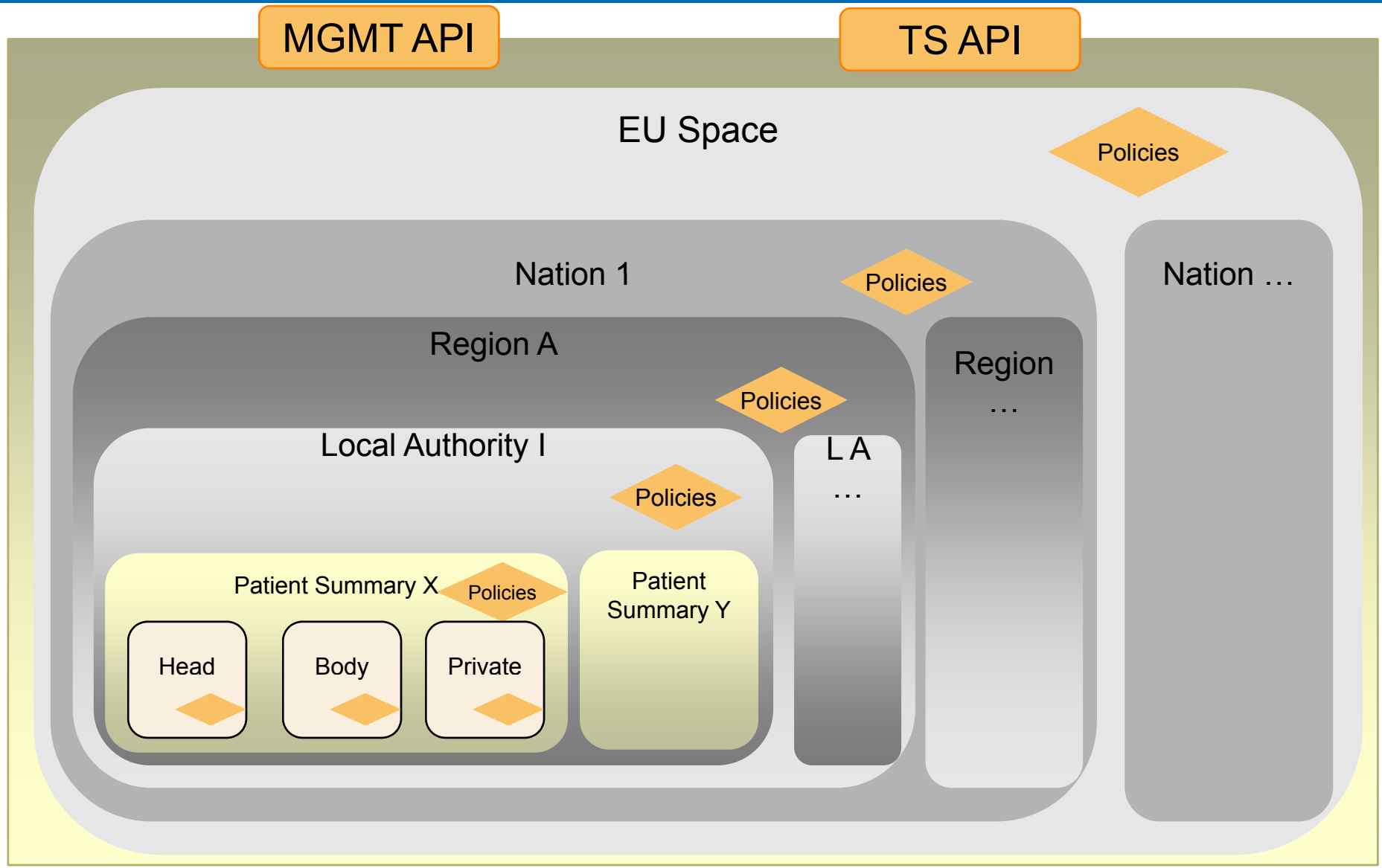
Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project

EPS Architecture
On top of the Triple Space



Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project

Inside the Triple Space



Subspaces, Roles and Policies

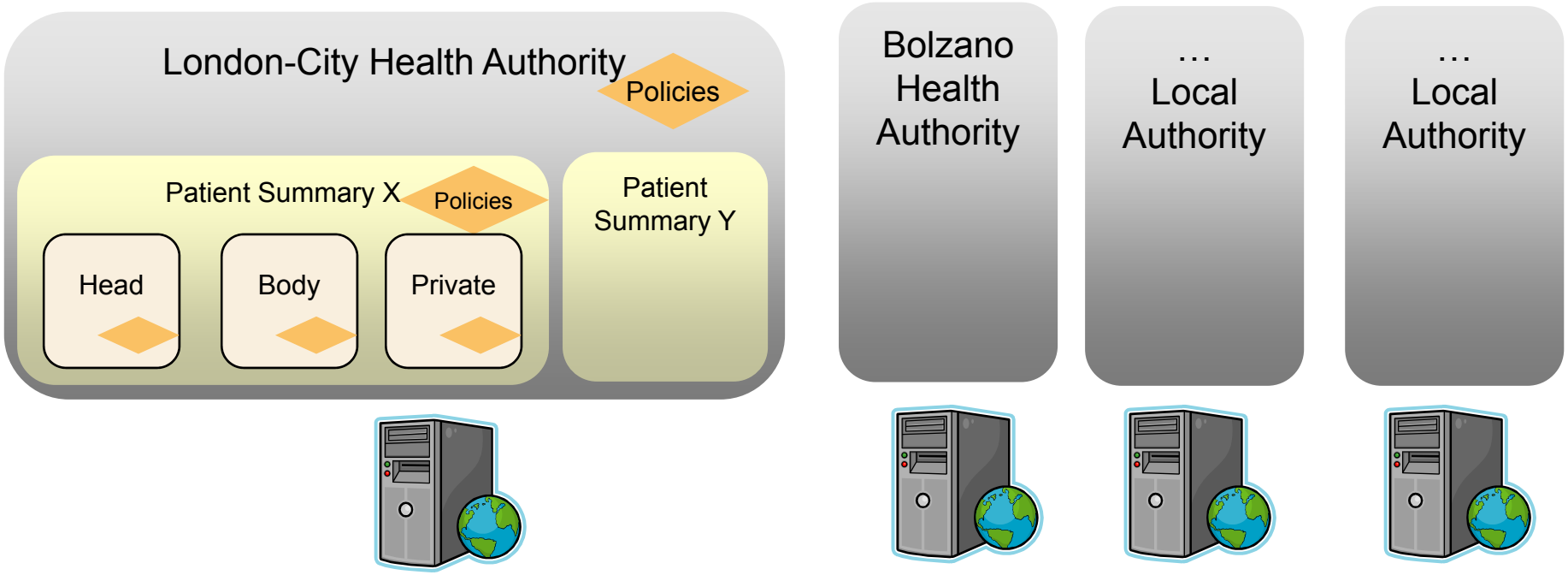
- The Subspaces of a single PS space
  - Head: For administrative accesses
  - Body: For clinical accesses
  - Private: To restrict access to some data
- Roles and Policies (for an Health Authority)

Role	Patient Summary	Head	Body	Private
Administrative Employee	R, W, D	R, W, D	-	-
Personal GP	R	R	R, W	R, W
Specialist	R	R	R, W	-
Paramedic	R	R	R	-

Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project

Physical Deploy

- Each Local Health Authority is responsible of the management of the citizen data
  - Provides resources to the EPS
  - Defines its policies accordingly to regional/national and European policies



The EPS Ontologies

- The EPS Ontologies
  - Based upon the most adopted standard for exchanging patient data, such as HL7 CDA and ASTM CCR
  - Models existing Coding Systems to re-use clinical terminologies, such as: ICD10, ICD9, LOINC, MESH, MTH, NCI, RXNORM, UMLS
- **Head**
  - Registry data (name, date of birth, residence)
  - Administrative data (IDs, insurance info)
- **Body**
  - Problems, Alerts, Medications, Immunizations, Encounters
  - Procedures, Advance Directives, Plan Of Care

Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project

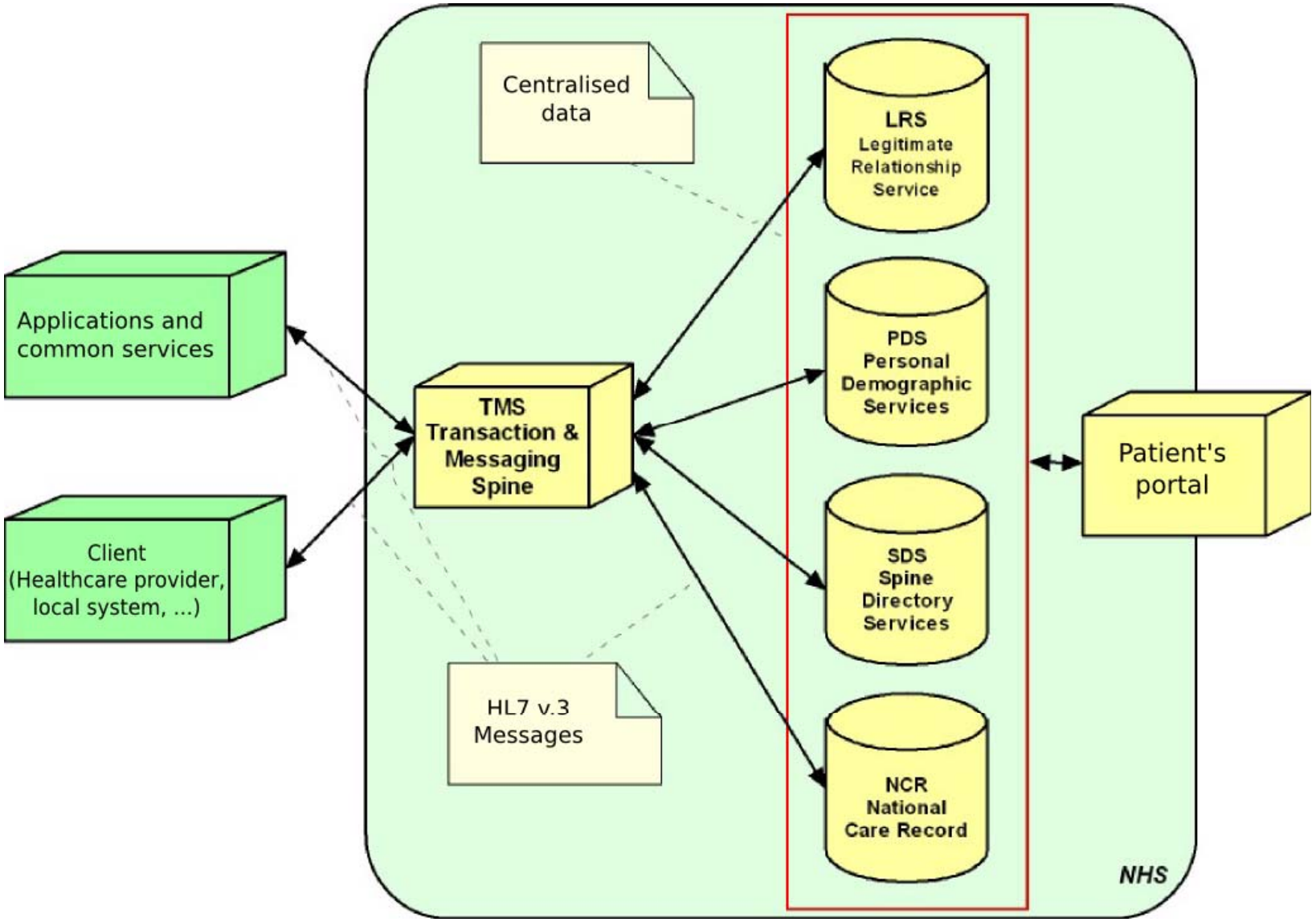
Comparing EPS with state-of-the-art solutions

Some countries are already developing country-wide EHR systems:

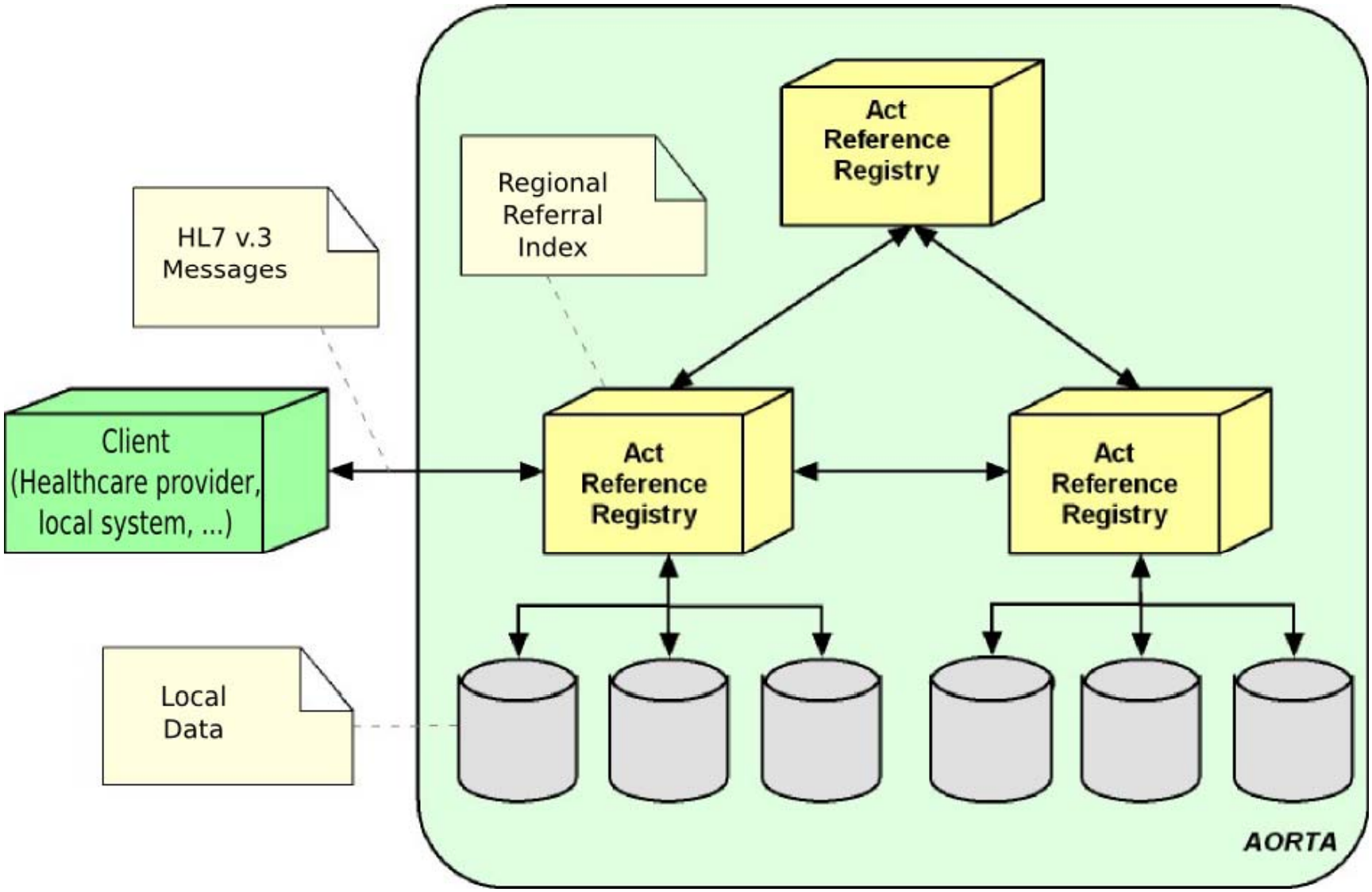
- NHS Spine (UK)
- InfoWay EHRS (Canada)
- AORTA (The Netherlands)
- (Other to be added: IBIS and SISS)

Can they scale at an EU-wide level?

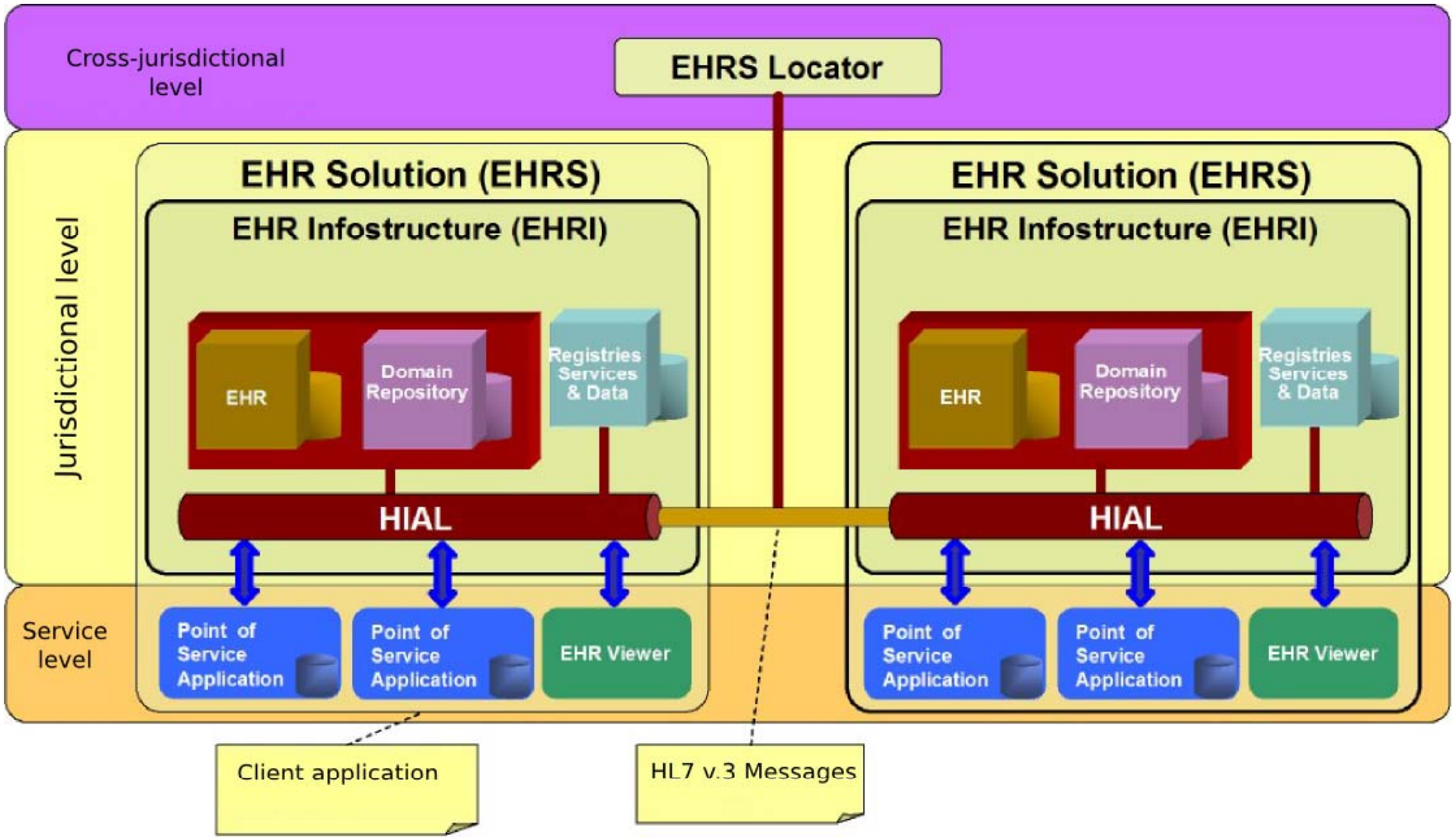
Comparison: NHS Spine



Comparison: AORTA



Comparison: Infoway



Comparison conclusions

Some of the analysed systems tackle data ownership and distribution issues.

BUT

Analysed system cannot (easily) scale at an EU-wide level:

- All of them force the adoption of a particular standard
- All of them assume coherence among the laws regulating the local systems

Large and Realistic Data Sets

- *Special attention should be paid to the use of realistic data sets large enough to demonstrate scalability beyond existing RDF infrastructures*

- The EPS ontologies are based on the most common eHealth message standards and coding systems
- A realistic instance has been manually generated to meet the use case
- The instance is used as a "seed" by a tool for generating millions of different instances

Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project

Performance Requirements

- *The requirements specified in deliverable D8b.1 might be too ambitious especially with respect to the performance requirements*

- Providing good performances is one of the challenges of TripCom
  - Specific attention is paid in the design in order to be flexible in front of the various types of requirements

- The Shared-Care Path storyboard emphasizes the added-values of TripCom
  - Sharing data, coordination support, security policies, scalability

Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project

Evaluation Plan

- *The project should define concrete evaluation plans for testing the achievement of the objectives in the context of the use cases*

- Defined in the scope of T6.6
- Functional and Non-Functional evaluation
  - By measuring and evaluating the capabilities to support the storyboard
  - During M29-M30
- Scalability Evaluation
  - By loading the generated data and making stress tests
  - During M34-M36

Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project

The Shared Care-Path Storyboard

- Multidisciplinary caregivers care for the same citizen
  - Strong need to share and access the same data (decoupling time, location, reference and schema)
  - Respect security and privacy regulations

- Storyboard steps

1: The Initialization of the Patient Summary in London

2: The Surgical Operation at Regional Hospital in Bolzano

3: The Monitoring of the Patient in London

Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project

Step 1: The Initialization of the Patient Summary in London

Please, initialize my data in the EPS

My EHIC number is:
252475363042511723 39

eHR

Update Clinical Data:
Problems: Calcium deficiency (UMLS C0392519)
Medications: Mirapex (RXNORM 218402)
Alerts: Morphine adverse reaction (UMLS C0569385) to Morphine (MTH S0063559)
Immunization: Tetanus (ICD9 037)
…

Read Administrative Data:
Mr. Christian Corrs
Date of Birth
Address
Insurance Data
IDs

Insert private data:
New Problem: Haemorrhoids (ICD10 I84)

TS API

Triple Space configured to be the EPS infrastructure

tsc://london-city.england.gb.eps.eu

Step 2: The Surgical Operation at a Regional Hospital in Bolzano

I have a terrible toothache

My Passport number is:
UK-000274856 S

HIS

Read Patient Summary
Administrative Data: Name, Address, IDs, …
Problems: Calcium deficiency
Medications: Mirapex
Alerts: Morphine adverse reaction to Morphine
Immunization: Tetanus
…

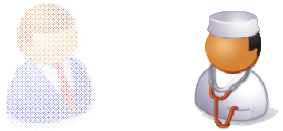
Update Clinical Data
New Encounter: Surgical Operation note about a Bone Grafting to Tooth

TS API

Triple Space configured to be the EPS infrastructure

tsc://bolzano.altoadige.it.eps.eu

Step 3: The Monitoring of the Patient in London



eHR

Monitor the health status of the citizen
Encounter: Surgical Operation note about a Bone Grafting to Tooth

TS API

Triple Space configured to be the EPS infrastructure

tsc://london-city.england.gb.eps.eu

Features used in the storyboard

- Management API
  - Create spaces
  - Set security policies
- Triple Space API
  - Out triples in a space
    - Security enforcements
  - Read triples with SPARQL queries
    - Querying over space hierarchy
    - Security enforcements

Sixth Framework Programme Priority 2
Information Society Technologies (IST)
Specific Targeted Research Project