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Future Internet Research Agenda

www.future-internet.eu

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IASI-CNR

Content of the presentation

1. FI: Future Internet

2. FInES – Future Internet Enterprise Systems.

- The European Commission Cluster, DG InfSo

3. BIVEE: Business Innovation in Virtual Enterprise Environments.

- The European Project in the Factory of the Future Objective

4. Grapevine: Mobile Ubiquitous Mass Participation Platform

Different European contexts of Future Internet

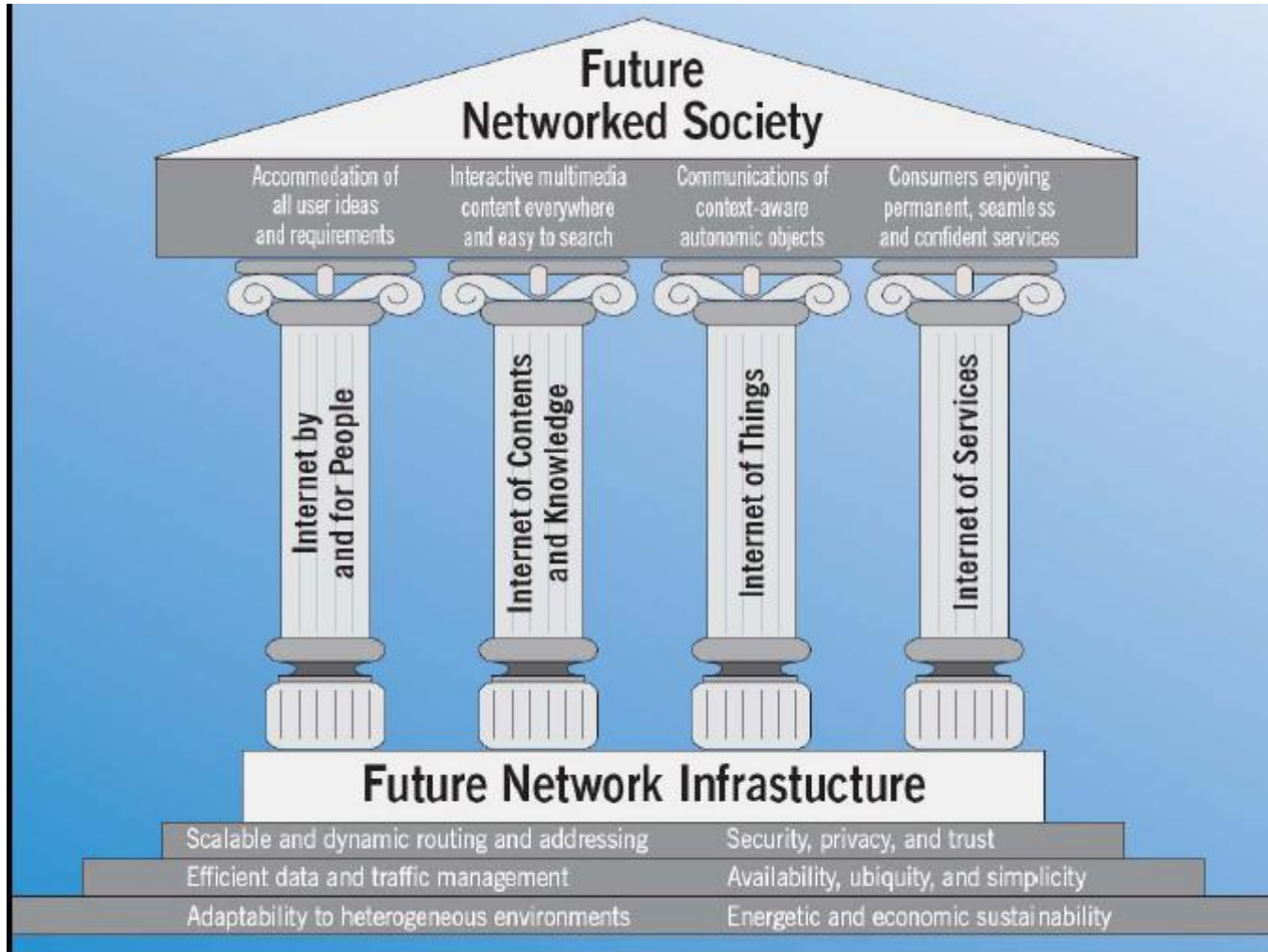
- **Future Internet Assembly: (FIA)**
- **Future Internet – Public-Private Partnership (FI-PPP)**, by European Future Internet Initiative (**EFII**)
- **Future Internet X-ETP Strategic Research Agenda (SRA / FI / X-ETP)**

Research Lines for FI

4 Historical Pillars:

- Internet of **Services**
- Internet of **Things**
- Internet of **Content** and **Knowledge**
- Internet of **People**

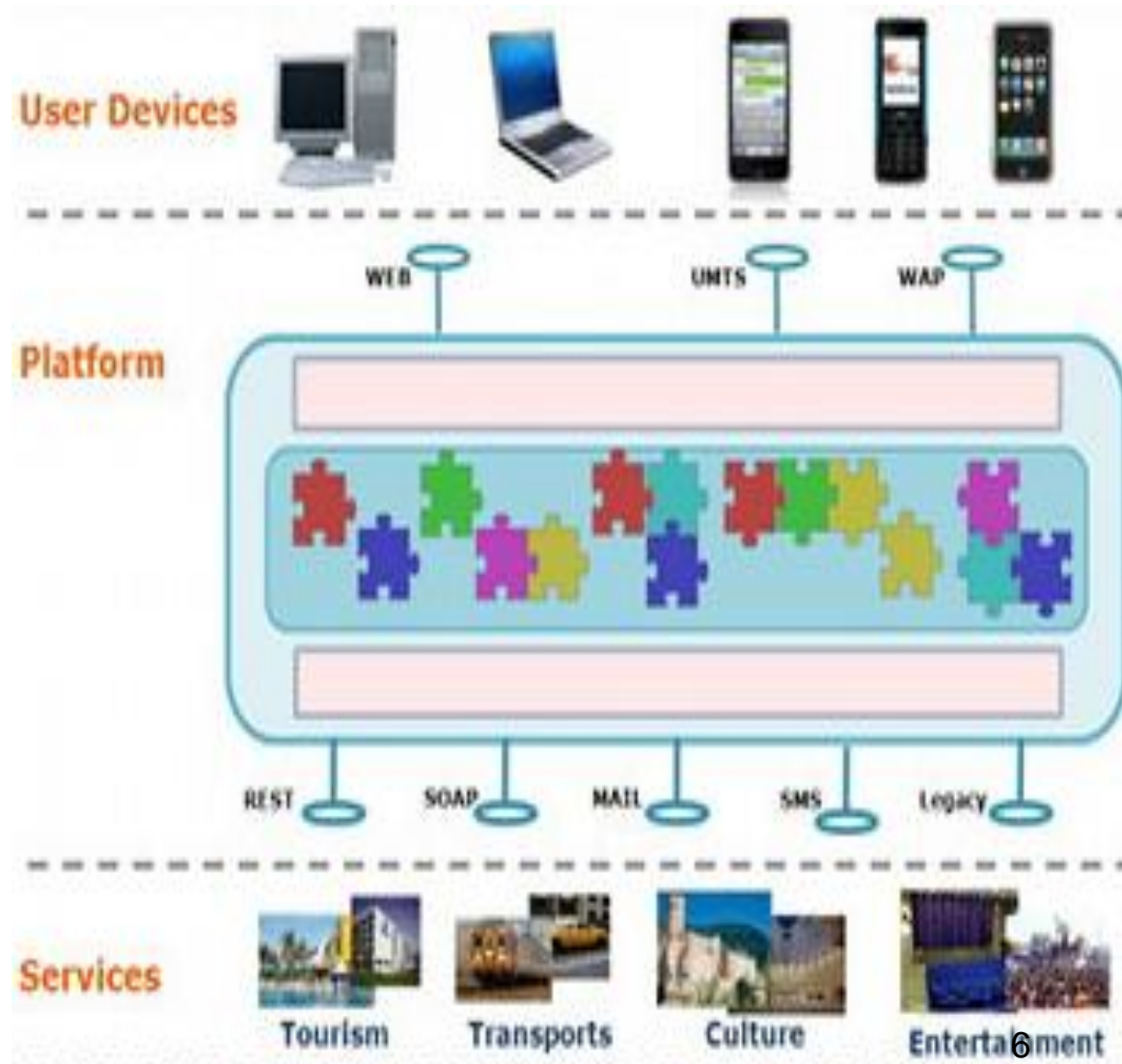
The Future Internet 'Temple'



Are Enterprises a fundamental constituency of EU Future Networked Society? 5

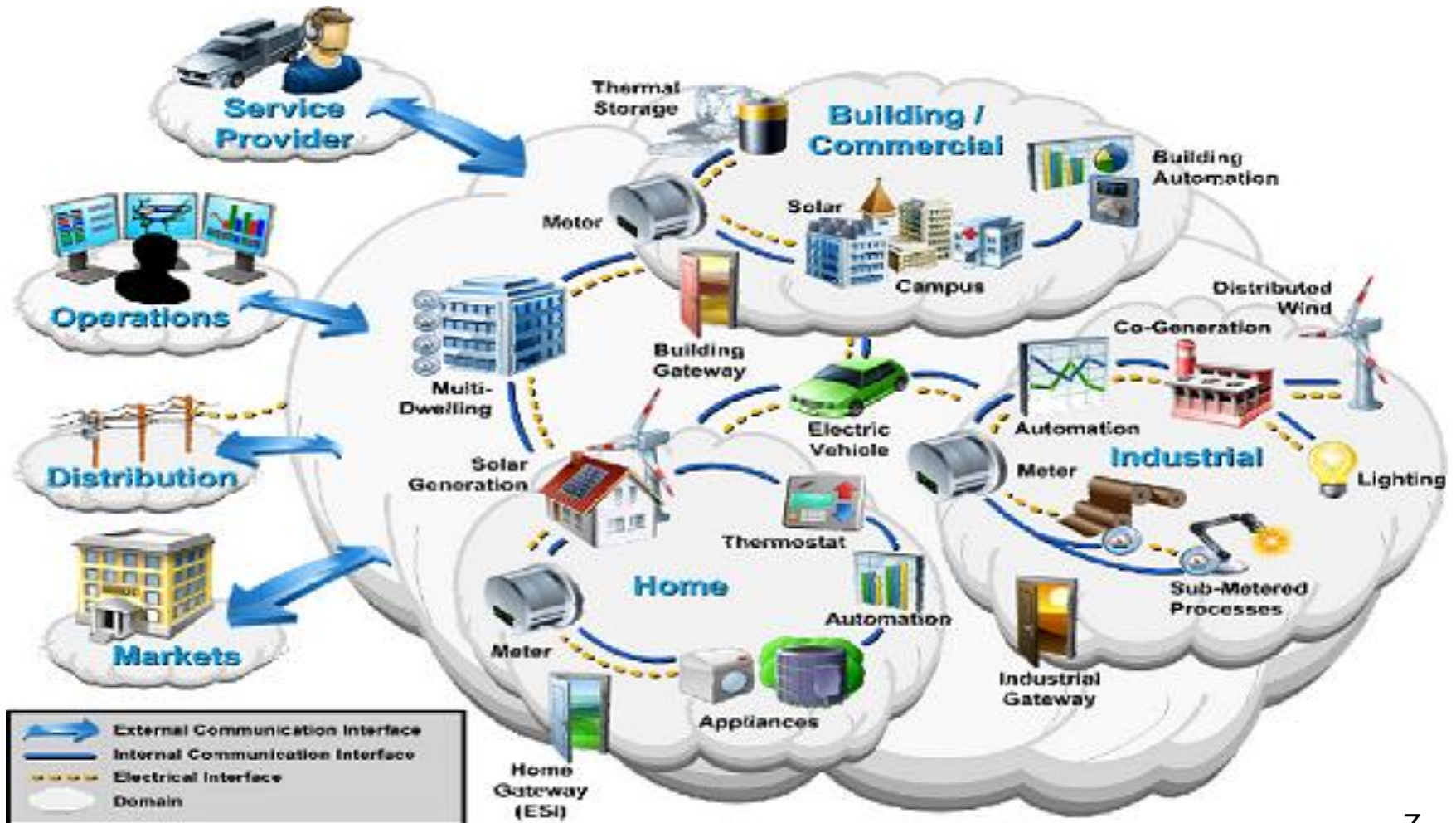
Internet of Services

- Software as a Service: **SaaS**
- Platform: **PaaS**
- Infrastructure: **IaaS**
- Value-Added Services: **VAS**
- Commodity & Utility Service: **CUS**



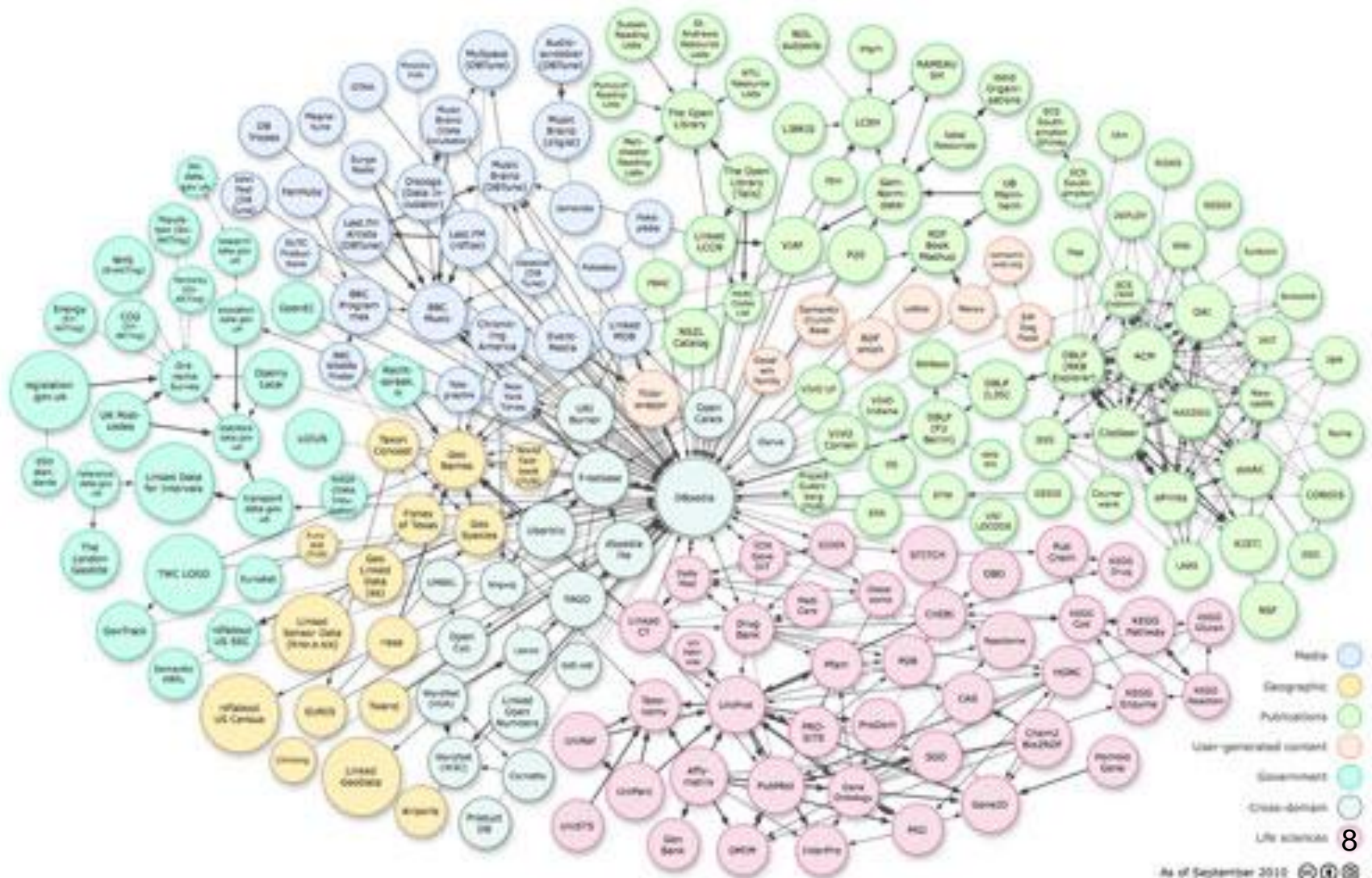
Internet of Things

RFID / ZigBee / Z-Wave / NFC / Bluetooth

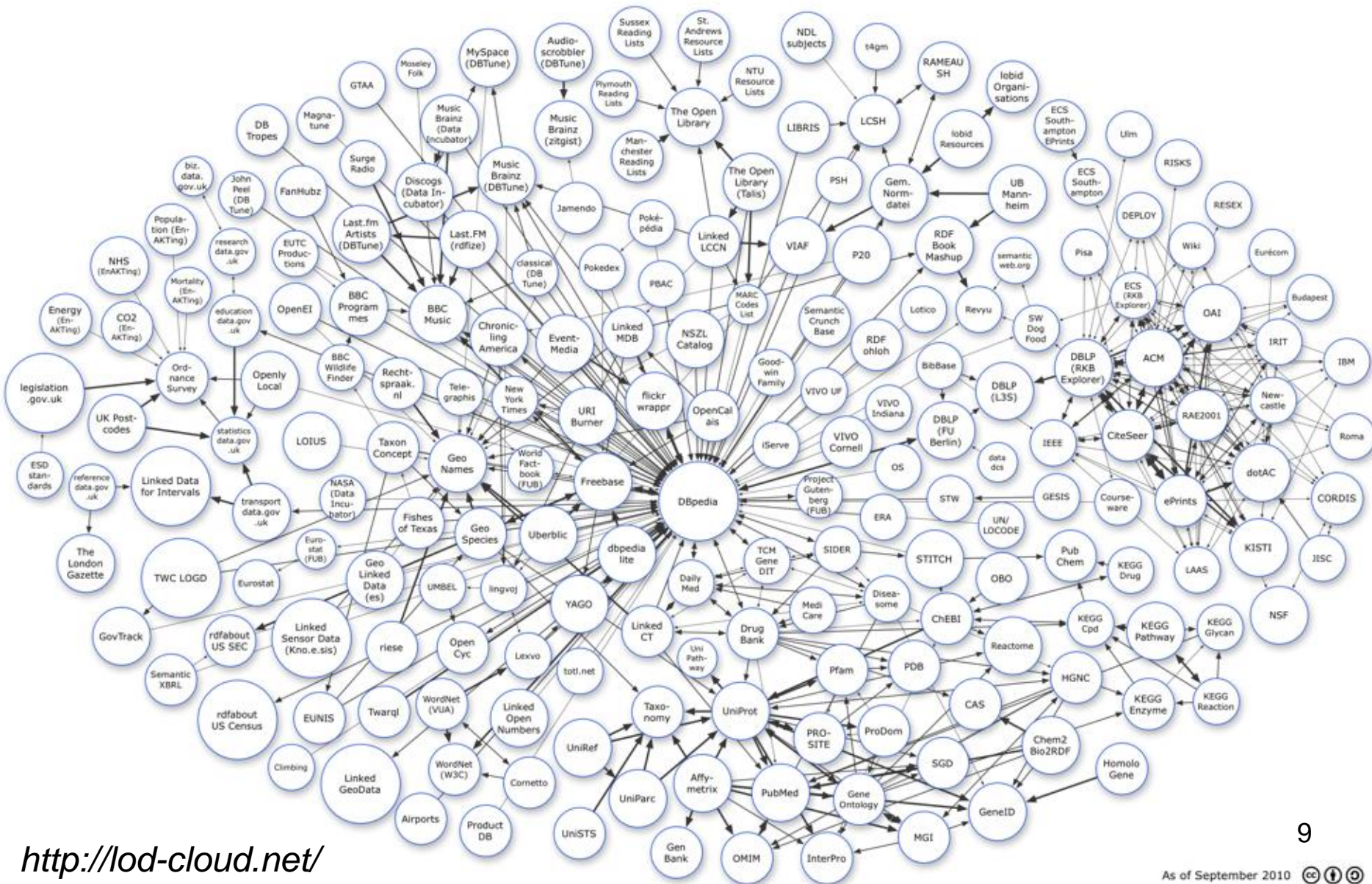


Internet of Content & Knowledge

Linked Open Data / RDF / OWL / NoSQL



... less colored but a clearer version



The Risk of IoC&K



"Nurse, get on the internet, go to SURGERY.COM, scroll down and click on the 'Are you totally lost?' icon."

Internet of People

- **Social Networks**
- Internet of **Experts**
- Internet of *workpreneurs*
- **Community building**
- **Crowd Sourcing**



Problems for IoP?

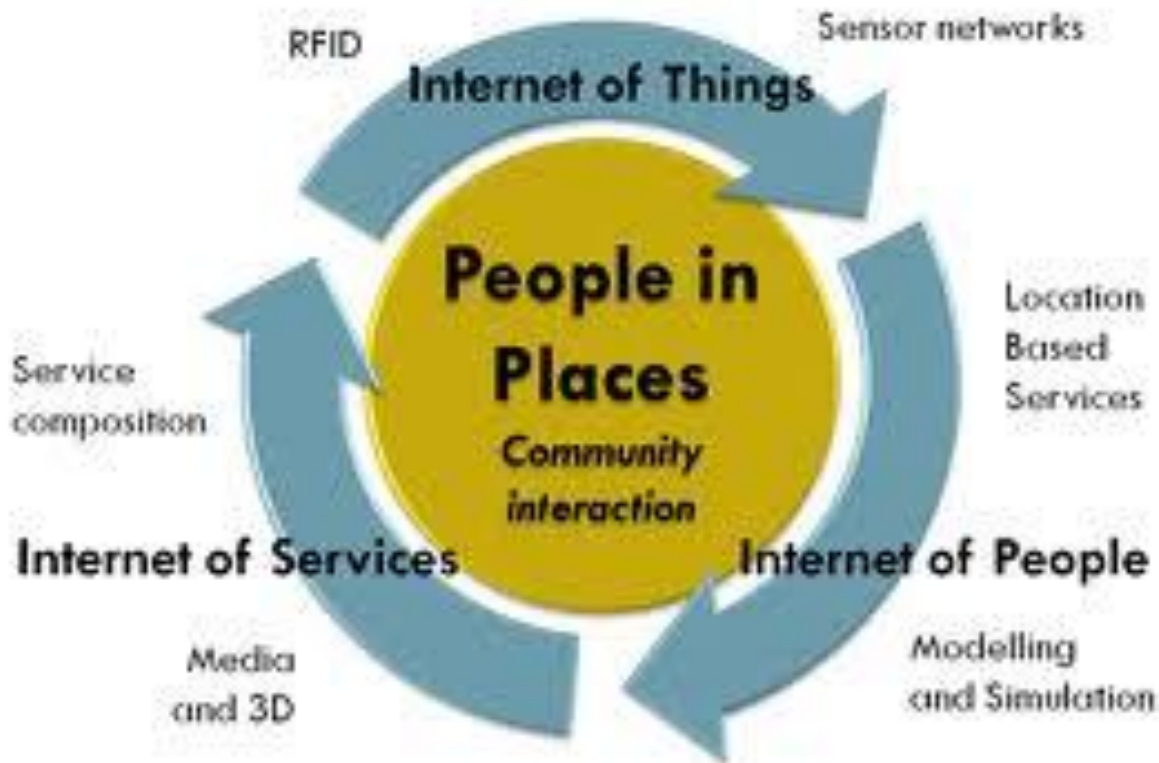
- Trust and Security
- eID
- Federated Identity



"On the Internet, nobody knows you're a dog."

FI Synthesis

- A unified / integrated System of Systems

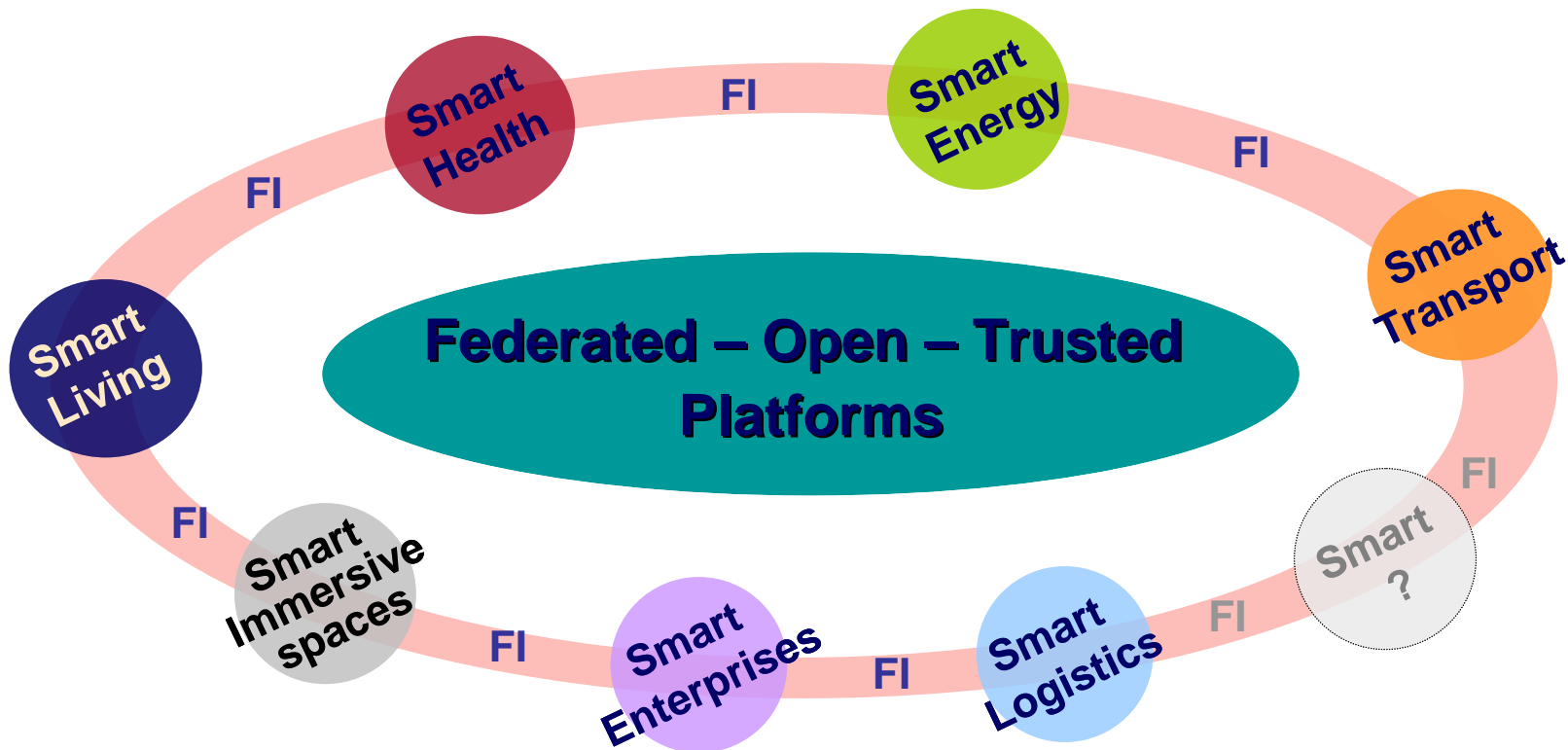


Suggested Application Areas

- (1) Utilities and Environment**
- (2) eHealth,**
- (3) Smart Energy Grid**
- (4) Transport, Mobility and
Logistics**
- (5) Content Management**

FI – Applications Constellation

- ***Future Internet Federated, Open, and Trusted (shortly, F-O-T) Platforms***
- *the ecosystems of the Future Internet on which existing and new “smart” applications could be built upon.*



Future Internet Public-Private Partnership

EFII

European Future Internet Initiative

EFII Funding Members



FI-PPP / EFII

“The main objective of this PPP is to significantly advance the implementation and uptake of **Future Internet services** by **2015** and, in doing so, establish European-scale markets for **smart infrastructures** with **integrated communications** functionality”

*(See **GRAPEVINE** proposal for a crowdsourcing and mass participation platform)*

Main Objectives of FI-PPP

- Increase the **effectiveness of business processes** and applications of high societal value.
- Address **service architectures and platforms**, encouraging European industry to address the challenges of **smart infrastructures**
- Foster **cross-sector industrial partnerships**
- Involving **users and public authorities** at local, regional and national levels,

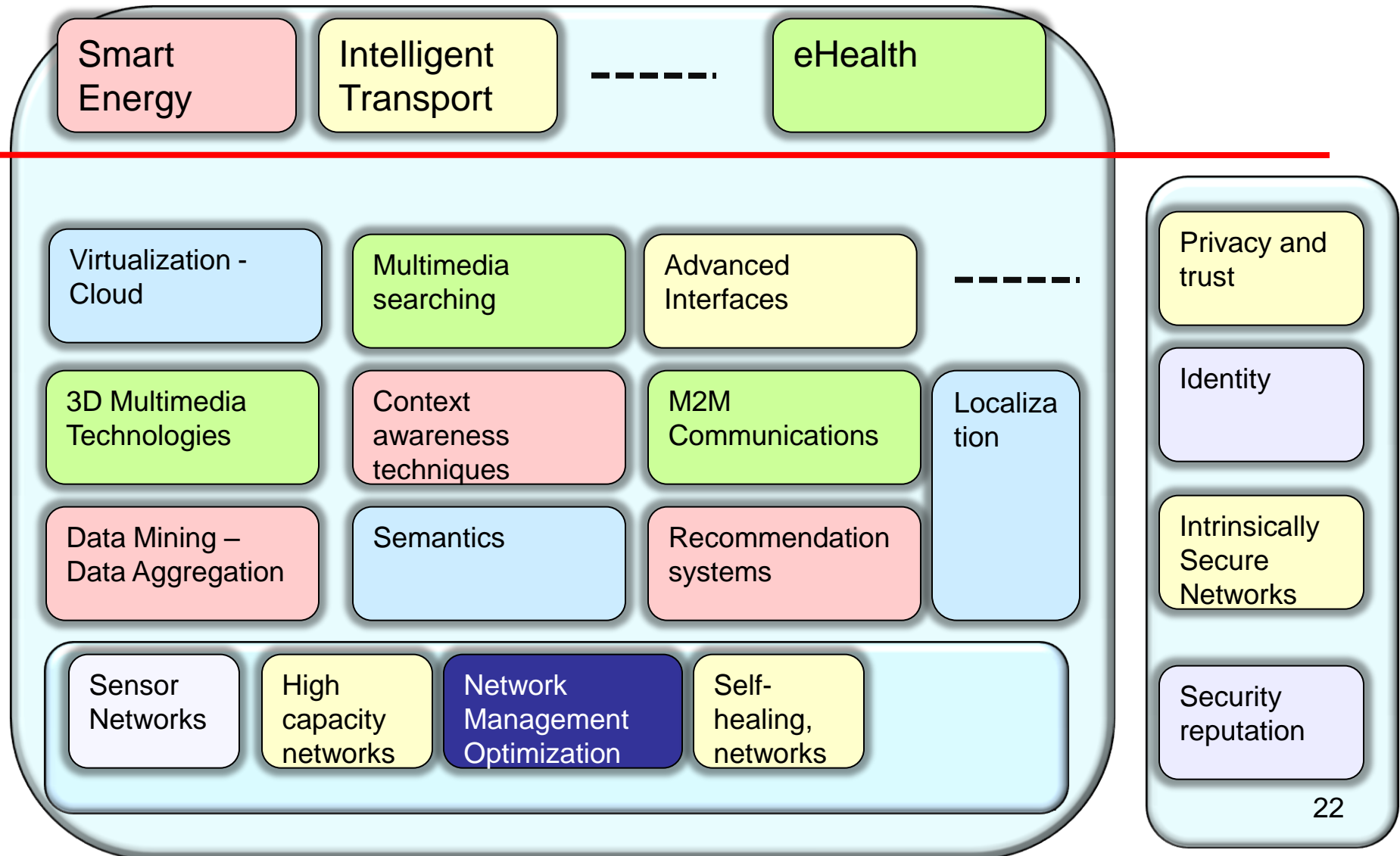
Some Enabling Technologies (1/2)

- Event / Data aggregation, transformation, correlation and Filtering
- Data / Data classification
- Entities Naming Resolution (applicable to services, things, devices, nodes, resources, ...)
- Service Repository
- Service composition, brokering and execution
- Application Communication Infrastructure
- Content/Service indexing, searching and discovery
- Localization
- Context Management
- Recommendation System / Decision Support
- Identity and Access Management
- Confidentiality and data sharing
- User privacy management
- Dynamic adaptability of services / content
- Device Description Repository
- Frontend Channel Maker (frontend access to content and applications)

Some Enabling Technologies (2/2)

- Generic rating, charging, billing
- Applications/Service marketplace
- Provision of shared Infrastructure (communication, computing, storage) as a Service
- Provision of Platform as a Service
- Large-scale media and data delivery
- Cloud federation
- Lifecycle Management Support
- Usage accounting
- Real-time logging
- Support for Analytics
- Tele-traffic analysis/servers
- DRM support
- One-to-many communication support
- Nomadic and mobility Support
- Permanent and Non-permanent Connectivity Support
- Dynamic Multi-homing Support
- Dynamic TCP stack and parameter tuning
- Network protection

Applications and enablers



Some FI Calls – Call 1

Call 1 (end 2010) – budget 70 M€

- **Technology Foundation:** One large project
- **Usage Areas Evaluation:** several mid-size projects (not more than 5)
- **Programme support:** one mid-size project
- **Infrastructure** identification and development

Call 2

Call 2 (mid 2011) – budget 100 M€

- Build **testbeds** to support and demonstrate advanced services on one or more Usage areas: several large projects (not more than 4)
 - There will still be work needed on the **core platform** for further developments and refinements as well as **handover** of results to the testbed projects.
- Open Call on January 2012

Strategic Application Areas

- Smart **Energy** Grids
- Smart **environmental** information system
- Smart systems for **transport** and mobility
- Smart **healthcare** systems
- Smart **Culture** and **Knowledge**
- Smart **Enterprises** (Call 7, Obj. 7.3, 45M)

BIVEE: Business Innovation in Virtual Enterprise Environments. A winning Project with UnivPM, CNR, Loccioni, Engineering

Call 3

Call 3 (mid 2012) – budget 130 M€

- **Enlargement** of Usage Area Testbeds
- **System/Technology** Foundation
- Populate the **application Domain** by application developers:
 - multiple applications in a limited number of **large integrated projects**
 - to achieve coherence versus more **smaller projects** working to interfaces.

Two Innovative Project Ideas

Ideas for

Innovative Factory of the Future

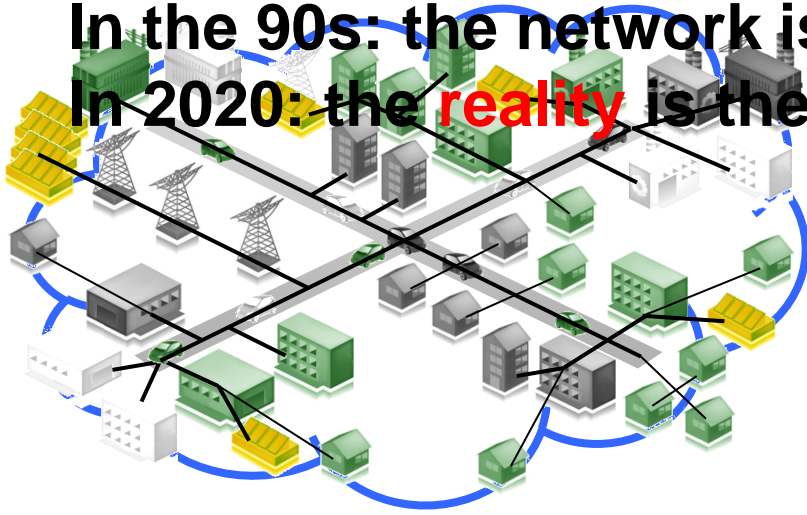
and ***Mass Communication Infrastructure***

Business Innovation in Virtual Enterprises

- Full enterprise digitalization
- Rich, complex, articulated digital world, mirroring the real world
- Emerging Computational Business Components (CBC).
- All possible objects, entities, both simple and complex, animated and inanimate, tangible and intangible
- Each CBC has: Id, Icon, Memory, Behaviour, Communication specs

Cloud Embedding

In the 90s: the network is the computer...
In 2020: the **reality** is the Computer



Grapevine

- FI for Mass Social Participation: the Crowd is the KB
- People are 'living sensors' present in every corner, in every sector of society
- Knowledge fragments exchange: SMS, Posts, emails.
- Semantic analysis and categorization (and dispatching) of messaging
- SMS with unique access point
- Applications: CRM, social environment/security monitoring, mobility management,

- FInES -
Future Internet Enterprise
Systems

A Research Roadmap
Under
FInES Cluster, DG Information Society

Organization

Objective: Prediction of the Future of Enterprises and Enterprise Systems

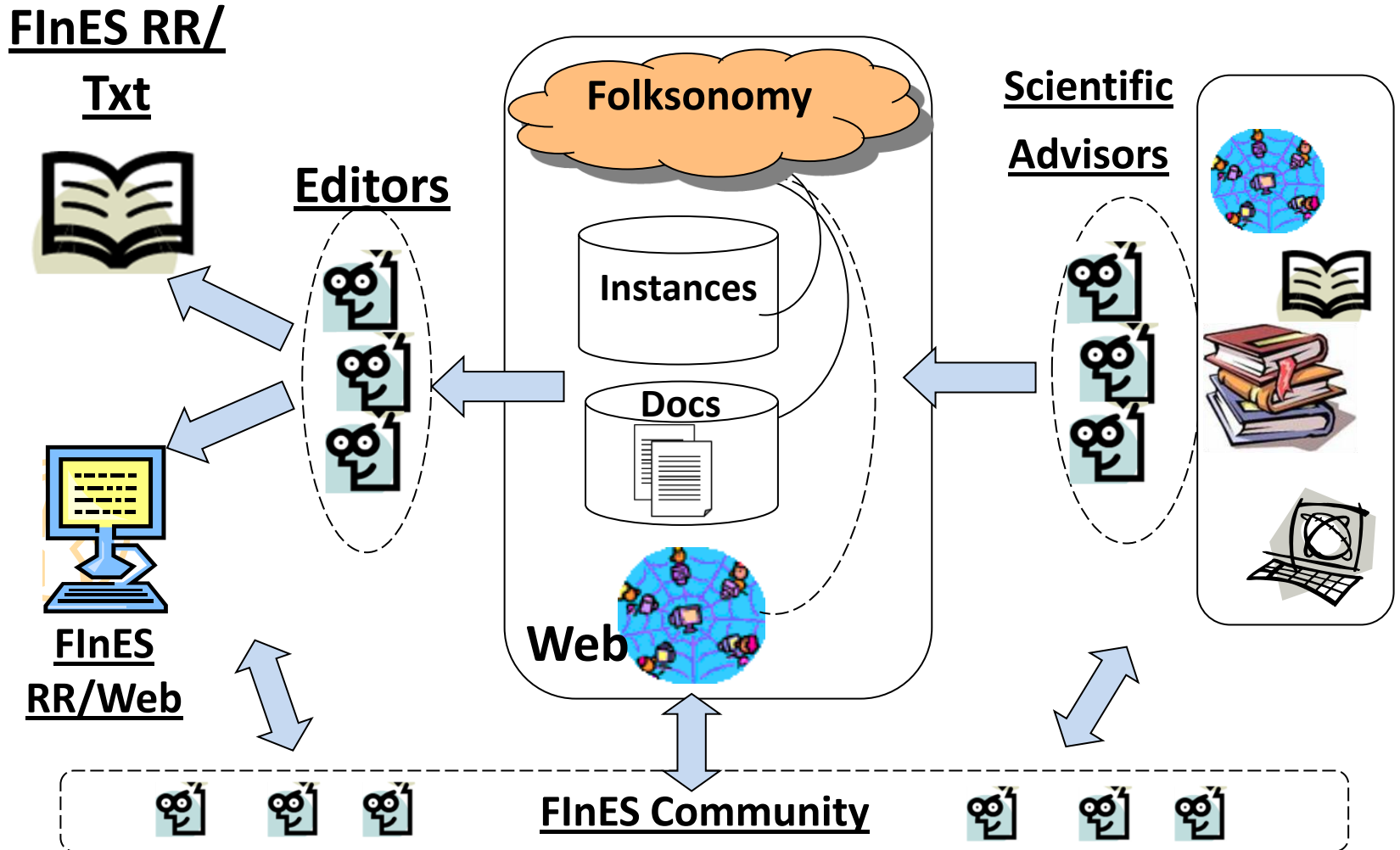
- 4 Knowledge Spaces
- Folksonomy
- Crowdsourcing
- An Open Knowledge Flow

“Prediction is very difficult, especially about the future” (N. Bohr)

FInES Knowledge Spaces

1. **Socio-economic Space** –the larger context in which enterprises operate, including the environment and the system of values beyond the pure financial dimension.
2. **Enterprise Space** –here the key characteristics of future enterprises are addressed, the emerging business and production models, new governance and organization paradigms, etc.
3. **Enterprise Systems, Platforms, and Applications Space** – this space is specifically concerned with FInES, i.e., with the ICT solutions and socio-technical systems.
4. **Enabling Technology Space** – it concerns the ICT solutions, in particular Future Internet solutions, knowledge representation, cooperation and interoperability, trust and security advanced services, etc.

Crowdsourcing & Folksonomy



Future Enterprises

Quality of Being

1. **Inventive Enterprise** (innovation)
2. **Cloud Enterprise** (no defined boundaries)
3. **Cognizant Enterprise** (beyond KM – new way of managing and using knowledge)
4. **Community-oriented Enterprise** (from Social Networking to Crowd-sourcing)
5. **Green Enterprise** (concern of environment as an integral part of the enterprise DNA)
6. **Glocal Enterprise** (to understand and think at a global level, while acting at concrete, local levels)
7. *(QoBs are not independent one another)*

Anatomy of an Enterprise

Structural Approach

- Logistics
- Production
- Human Capital
- Marketing
- Management

Operational approach

- Invent
- Plan
- Build
- Operate
- Manage&Monitor

Future Enterprise Systems

Platforms for

- Invention & Innovation
- Planning
- Building
- Operating
- Managing & Monitoring

Infrastructures for

- Enterprise Knowledge
- Learning organization
- Interoperability
- Collaboration
- Trust & Security

Future Enabling Technologies

- **Cooperation**, among humans (**IoP**)
- **Interoperability**, among artefacts (**IoT**)
- **Computing**: Clouds, Smart objects, Services (**IoS**)
- **Data, Content, Knowledge (IoC&K)**
 - Cloud data and Linked Open Data
 - The Semantic Web
- **Enterprise Applications Dev/Delivery Platform**
(the Business-IT Alignment challenge)
 - The Ultimate Modeling Challenge
 - Autonomic networks & Applications
 - Smart Business Components (FInERs) & User Mashup

- BIVEE-
***Business Innovation in Virtual
Enterprise Environment***

A European Strep
under
FInES Cluster, DG Information Society
'Factory of the Future'

Partners

Engineering (It)

BIBA (De)

BOC (At)

ATOS (Es)

CNR (It)

UnivPM (It)

TAL (UK)

SRDC (Tr)

AIDIMA (Es)

General Impianti (It)

Start: 1 September 2011

Duration: 36 months

Budget/Funding: 4.2 M€ / 3 M€

Objectives, Outcomes

- **Objectives**
 - Monitoring and assessment of value production processes, to identify *innovation needs*
 - Monitoring of world innovation proposals, solutions, etc. to identify *innovation opportunities*
 - **Simulation and data analytics** to understand pros & cons of **innovation adoption**
- **Outcomes:** A Comprehensive framework to support SMEs strategic innovation, based on:
 - **Mission Control Room**, for monitoring of Virtual Enterprises
 - **Virtual Innovation Factory**, for continuous innovation production
 - Advanced **virtual knowledge** repository on: technology, models, markets, competitors, etc.

Enterprise Innovation

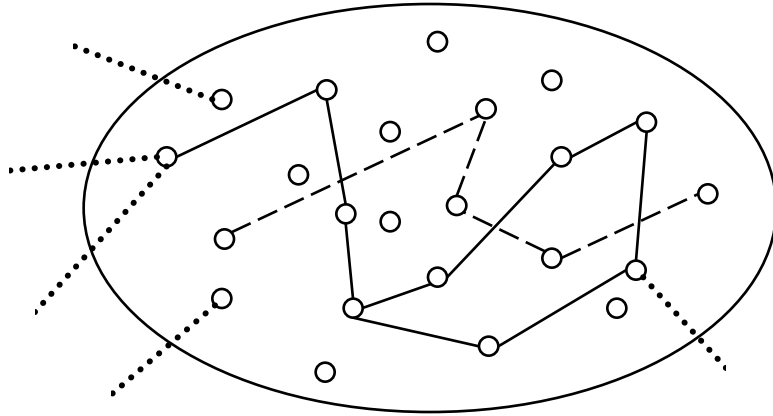
- Change enterprise attitude: from *resource management and planning* to **continuous business innovation**
- Continuous **evolution of the software** applications, to achieve a constant **Biz/IT alignment**
- **Business componentization** as the key paradigm to achieve the needed flexibility
- Beyond Software Engineering: systems will be specified and “created” directly by **business people**, operating on **business entities** (FInER)



The Innovation Mantra

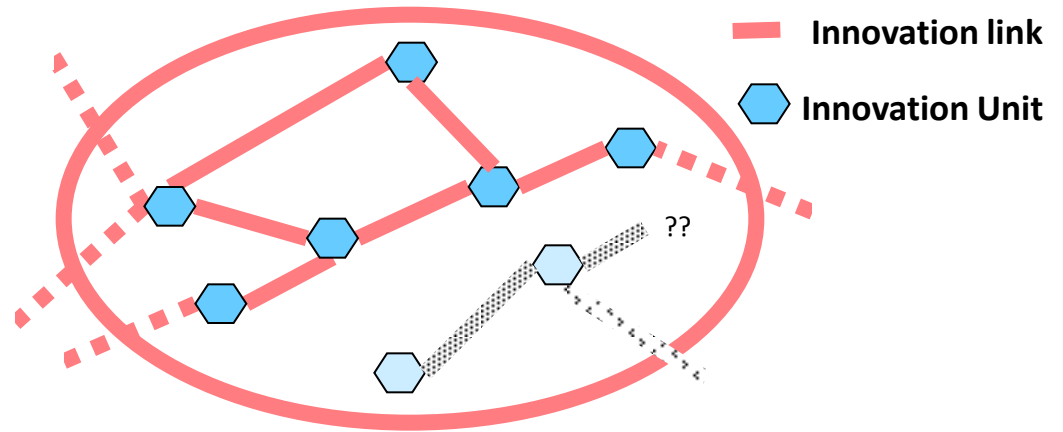
- **Open Innovation** and participation
- from *Toyota Quality Circles* and *Kaizen* to *Crowd-sourcing*
- The two intertwined spaces:
 - Production Space
 - Innovation Space

Production and Innovation Spaces



Production Space & Maps

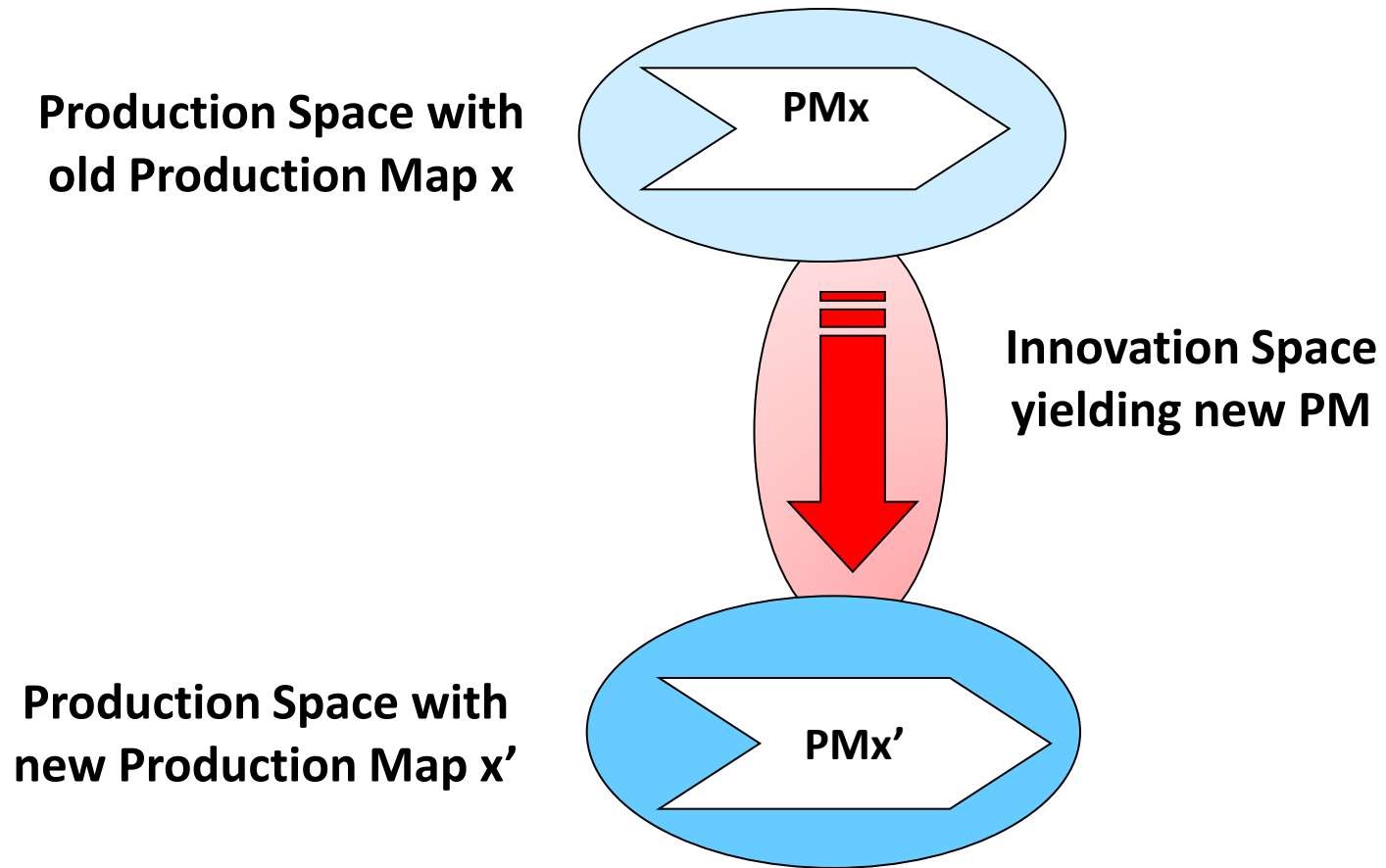
(S1 & S2)



Innovation Space & Maps

(S2 & S3)

A Multi-space scenario



BIVEE Research Challenges

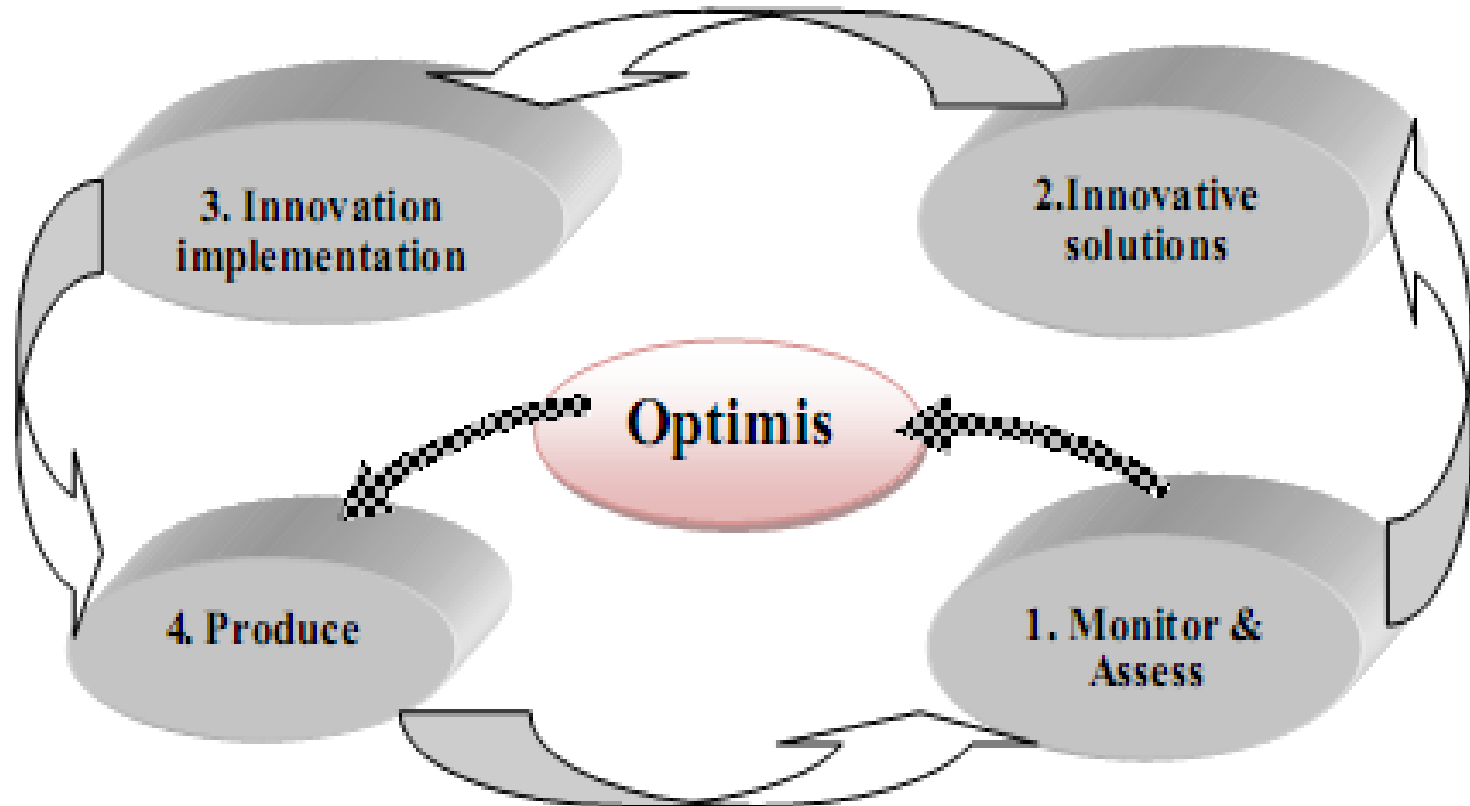
Key issues

- From Software to **Services**, to **Intelligent Business Entities**
- New ICT solutions to
 - Reduce the burden of the '*day-by-day*' business
 - Support **Optimization** and **Innovation**
 - Support **Virtual Enterprises** (i.e., cooperation and interoperability)
- **Enterprise Engineering** to supersede application Software Engineering
- An epochal **shifting** of 'power': from ICT experts to **business** experts.

Innovation Dimensions

- Product
- Process
- Business Model (e.g., revenues & costs)
- Marketing & market (strategies, practices)
- Management
- Organization & Partnership
- Finances
- Human Capital
- Technology

Improvement - Innovation Cycles



Open Innovation

Scopes

- Business Innovation
- Socio-organizational Innovation (and Crowdsourcing)
- Technological Innovation

Approaches

push-mode and technology driven, when generated on the supply side;

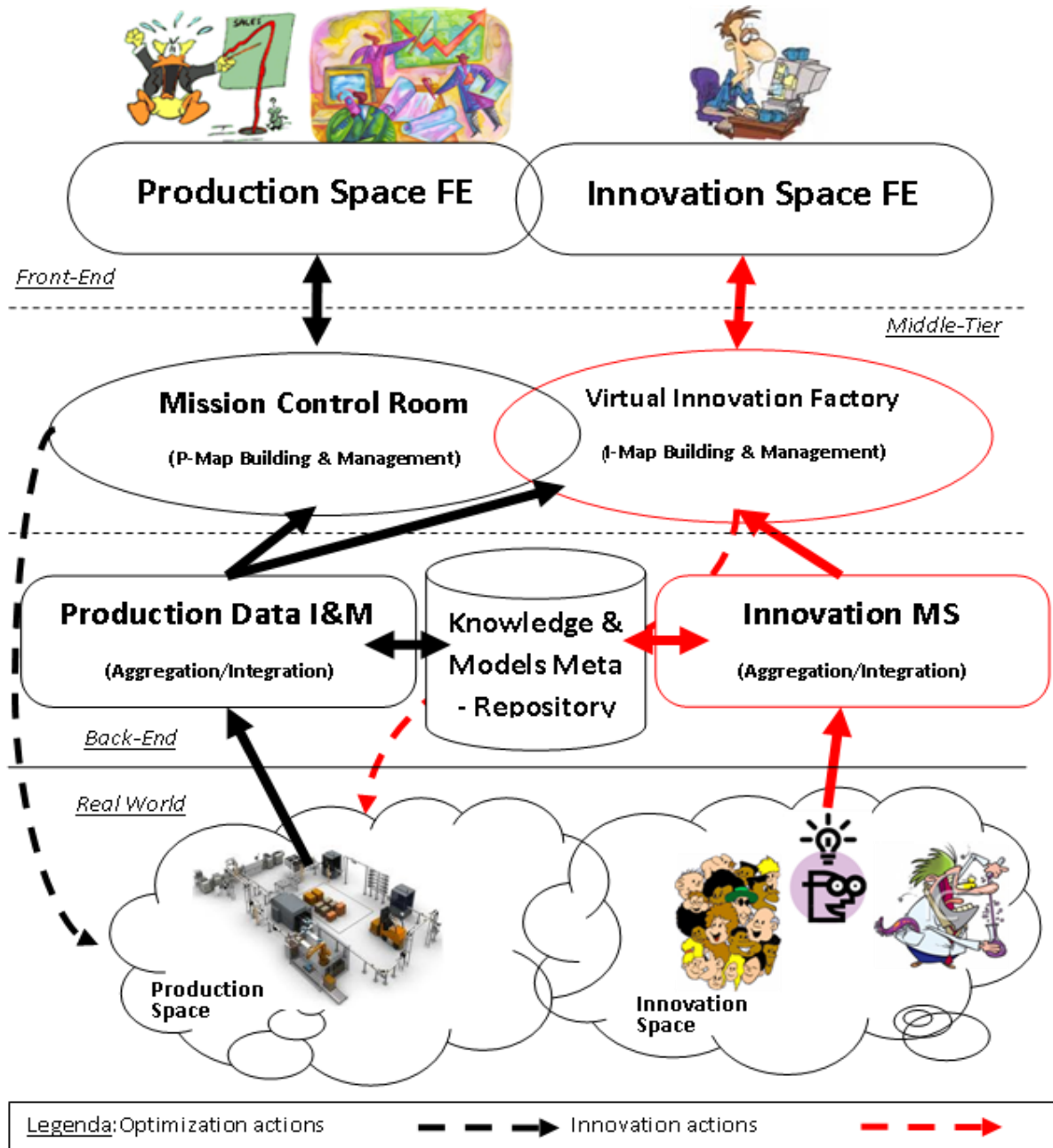
pull-mode and demand driven, when requested by the market/demand side;

co-creation, when all the stakeholders cooperate together to generate product or process innovation.

Endogenous, when ideas come from within the Ecosystem

Exogenous, when ideas come from the rest of the World

BIVEE Framework



- Grapevine -
Mobile Semantic Platform for
Crowdsourcing and Mass
Participation



A National MIUR Project for Academic-
Industrial Spin-Off

(Ex. L. 297, Art. 11)

Grapevine

Piattaforma di partecipazione sociale su base semantica, inizialmente pensata per la ricostruzione dell'Aquila

- ***Informazione integrata*** bidirezionale per i cittadini delle zone colpite dal terremoto
- ***Top-down***: portale unico capace di integrare le diverse informazioni di:
 - Protezione civile, Min. Interno, Progetti e interventi di ricostruzione, VVFF, ...
- ***Bottom-up***: coinvolgimento dei cittadini come soggetti attivi. Crowdsourcing e Web 2.0 di coesione sociale e partecipazione di massa

Piattaforma *Grapevine*

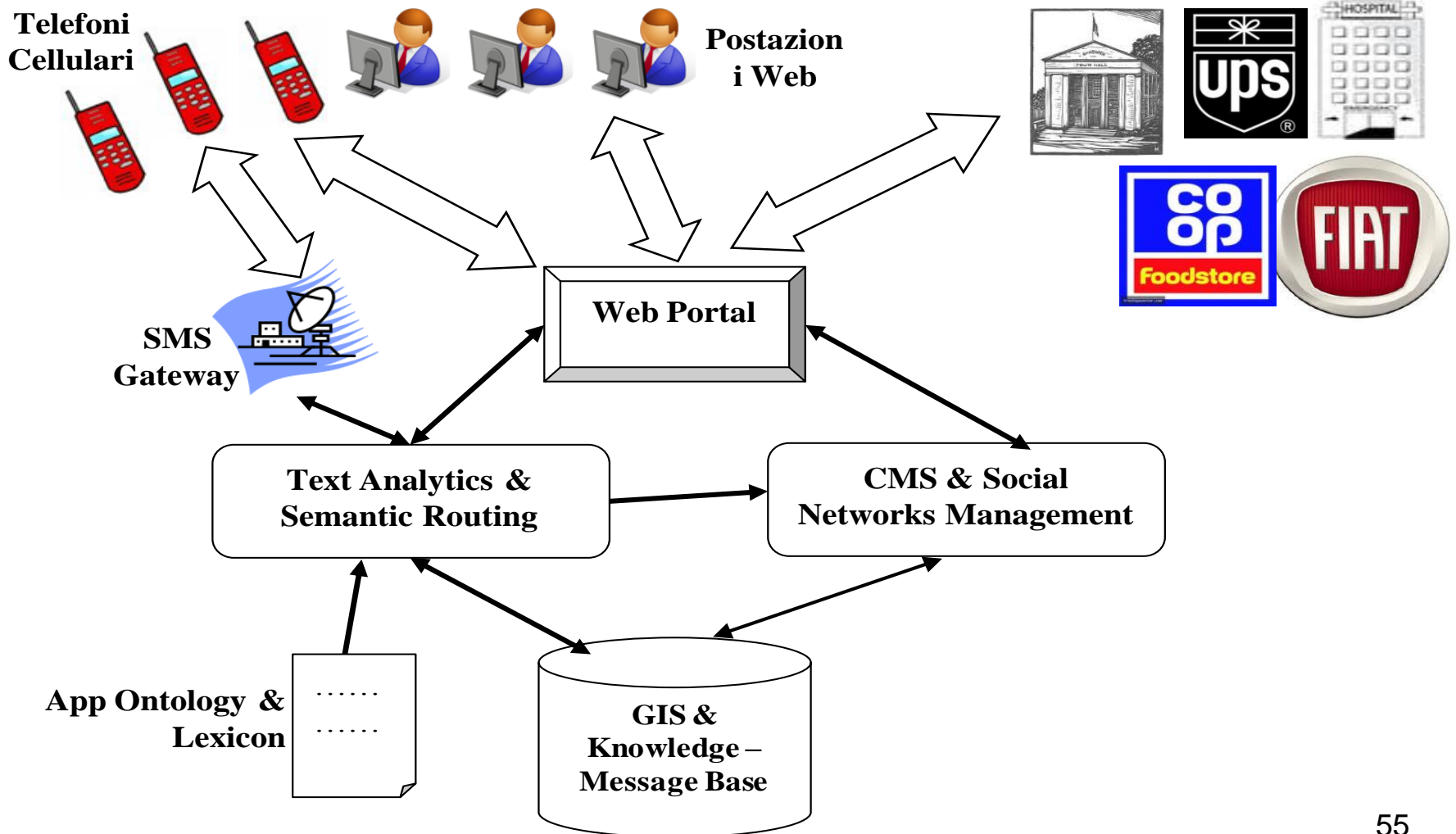
Un sistema di *Social Web 3.0* e *Knowledge Intelligence* basato sulle 3 tecnologie fondamentali:

- Web sociale (i.e., Web 2.0)
- Tecnologie ICT mobili (mobile computing)
- Tecnologie semantiche (ontologie, DB semantici, elaborazione del linguaggio naturale)
- Capacità di **analisi e instradamento automatico** ai diversi soggetti di competenza la sintesi delle segnalazioni ricevute.

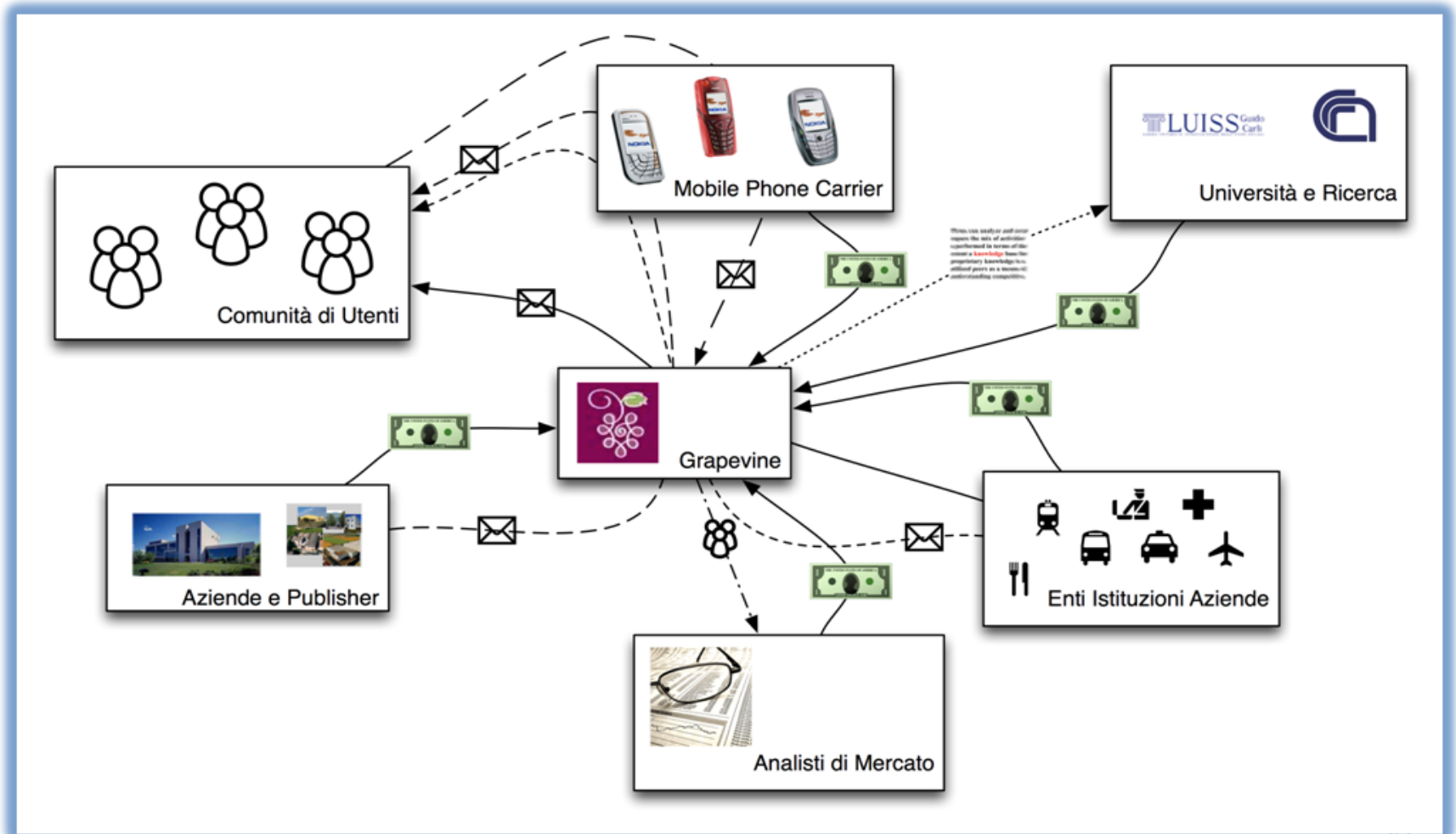
Obiettivi tecnologici

- infrastruttura di **Social Web** con capacità semantiche
- Basata su scambio di messaggi di testo (sms, email)
- **Engine semantico** per catalogare, sintetizzare i messaggi
- Sintesi di una **visione complessiva dei bisogni** e delle aspettative sociali
- Social Web, Mobile Computing, elaborazione del linguaggio naturale,
- le tecnologie di gestione di grandi basi di conoscenza

La Macro-architettura di GV



Modello di Business



un unico punto di ascolto (es. numero cellulare) al quale qualunque cittadino / cliente può inviare un messaggio sms;

- una federazione di Knowledge Base, una per ogni settore oggetto della ricostruzione (scuola, trasporti, sanità, turismo, etc.)
- un ambiente di dibattito e incontro sociale in cui i cittadini possono proporre e discutere idee, osservazioni, valutare proposte e alternative.
- un filo diretto telematico con le autorità e gli organi competenti per avere uno scambio di informazioni, inviare segnalazioni, richieste, etc.
- Es. CRM: di supporto e 'alleggerimento' ai Call Center

Funzionalità di una Grapevine App

- un unico punto di ascolto (es. numero cellulare) al quale inviare un sms;
- una federazione di Knowledge Base, una per ogni settore oggetto della ricostruzione (scuola, trasporti, sanità, turismo, etc.)
- un ambiente di dibattito e incontro sociale
- un filo diretto telematico con:
 - le autorità e gli organi competenti
 - L'azienda, l'ufficio Relazioni con i clienti
- Es. CRM: di supporto e 'alleggerimento' ai Call Center

GRAZIE PER L'ATTENZIONE!!!

