

# **IERC European Research Cluster on the Internet of Things**



## **IERC –Internet of Things European Research Cluster Liaison with oneM2M and Semantic interoperability cooperation**

**oneM2M interim plenary 10 April 2014, Berlin**

**IERC Service Openness and Interoperability (AC4)**



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## Agenda of the presentation

- Quick tour on IoT European Research Cluster (IERC)
- Status of IERC AC4 and position paper on semantics interoperability
- Cooperation with oneM2M and look for Common semantics interoperability event - mid 2015

## IERC - IoT European Research Cluster -Role










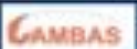



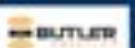

- Bring together the EU-funded projects and policy activities with the aim of:



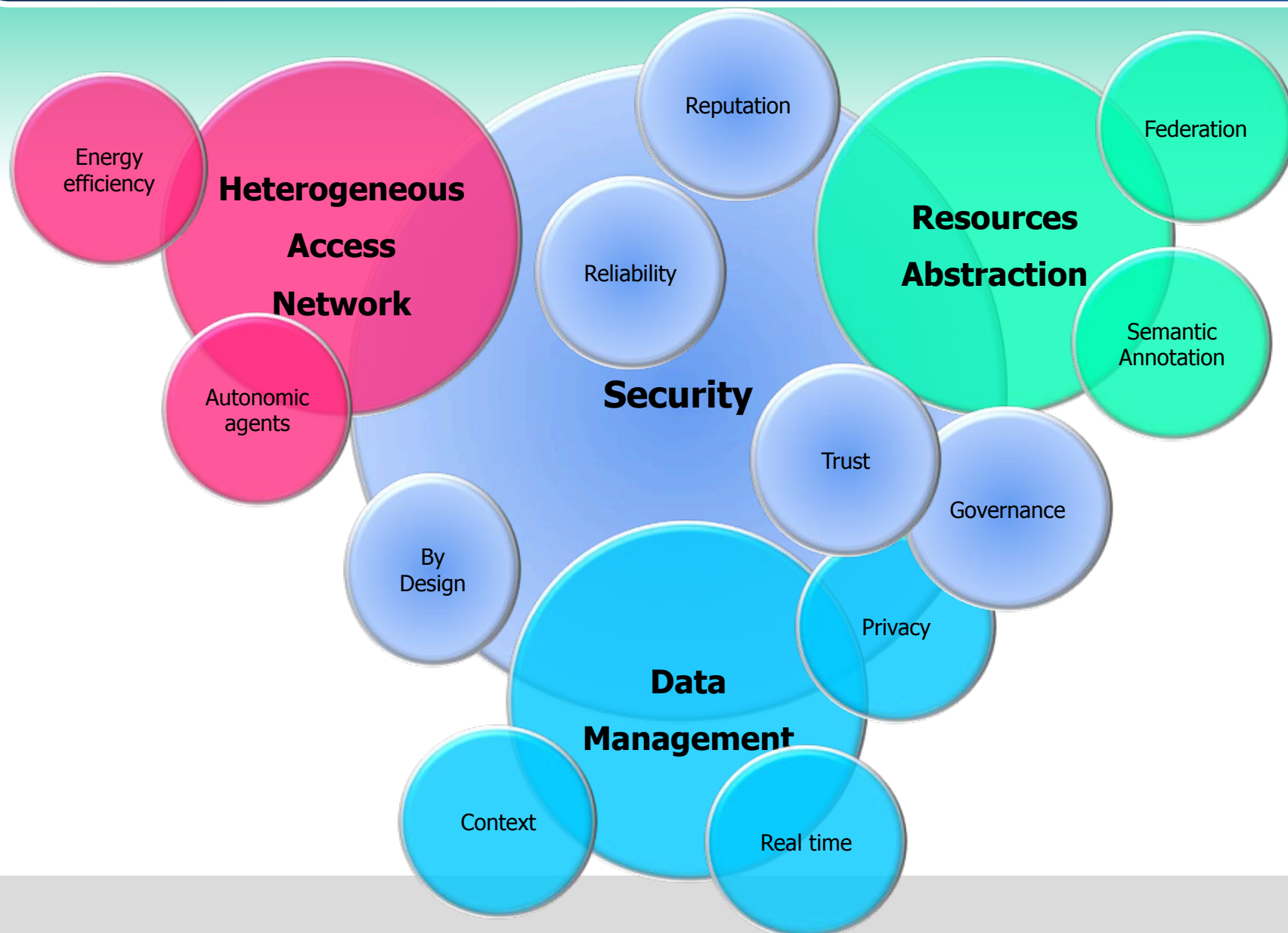
*Sustaining Europe's  
leading position in the  
future **Internet of Things**  
within a global context*

# On-going projects

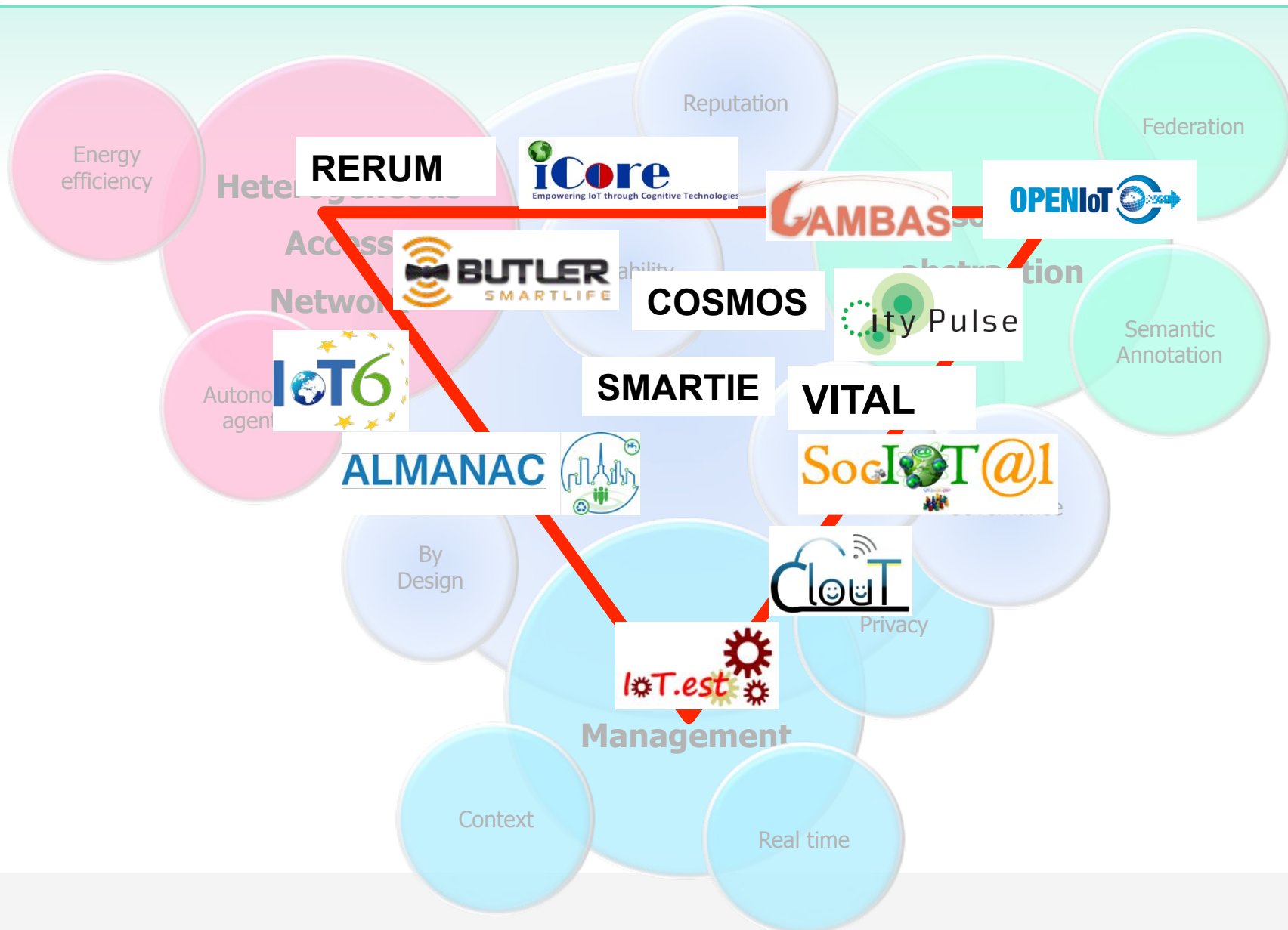
**15 running projects (6+9)**  
**76 M € ( 41+ 35)**

2011	2012	2013	2014	2015	2016
			 ALMANAC 7 partners 4.1 M€/ m.m		
			 CityPulse 7 partners 3.7 M€/ m.m		
			 ClouT 7 partners 4 M€/ m.m		
			 COSMOS 7 partners 4.7 M€/ m.m		
			 RERUM 7 partners 5.2 M€/ m.m		
			 SMARTIE 7 partners 4.8 M€/ m.m		
			 SOCIOTAL 7 partners 3.7 M€/ m.m		
			 VITAL 7 partners 4.2 M€/ m.m		
			 SMART-Action 7 partners 0.7M€/ m.m		
	 GAMBAS GAMBAS 7 partners 3.1 M€/ 333 m.m				
	 IoT.est IoT.est 8 partners 3.8 M€/ m.m				
	 IoT6 IoT6 9 partners 4 M€/ 367 m.m				
	 iCore iCore 20 partners 13.4 M€/ m.m				
	 BUTLER BUTLER 18 partners 14.5 M€/ 1234 m.m				
	 OPEN-IoT OPEN-IoT 7 partners 2.4M€/ m.m				

# Technical focus



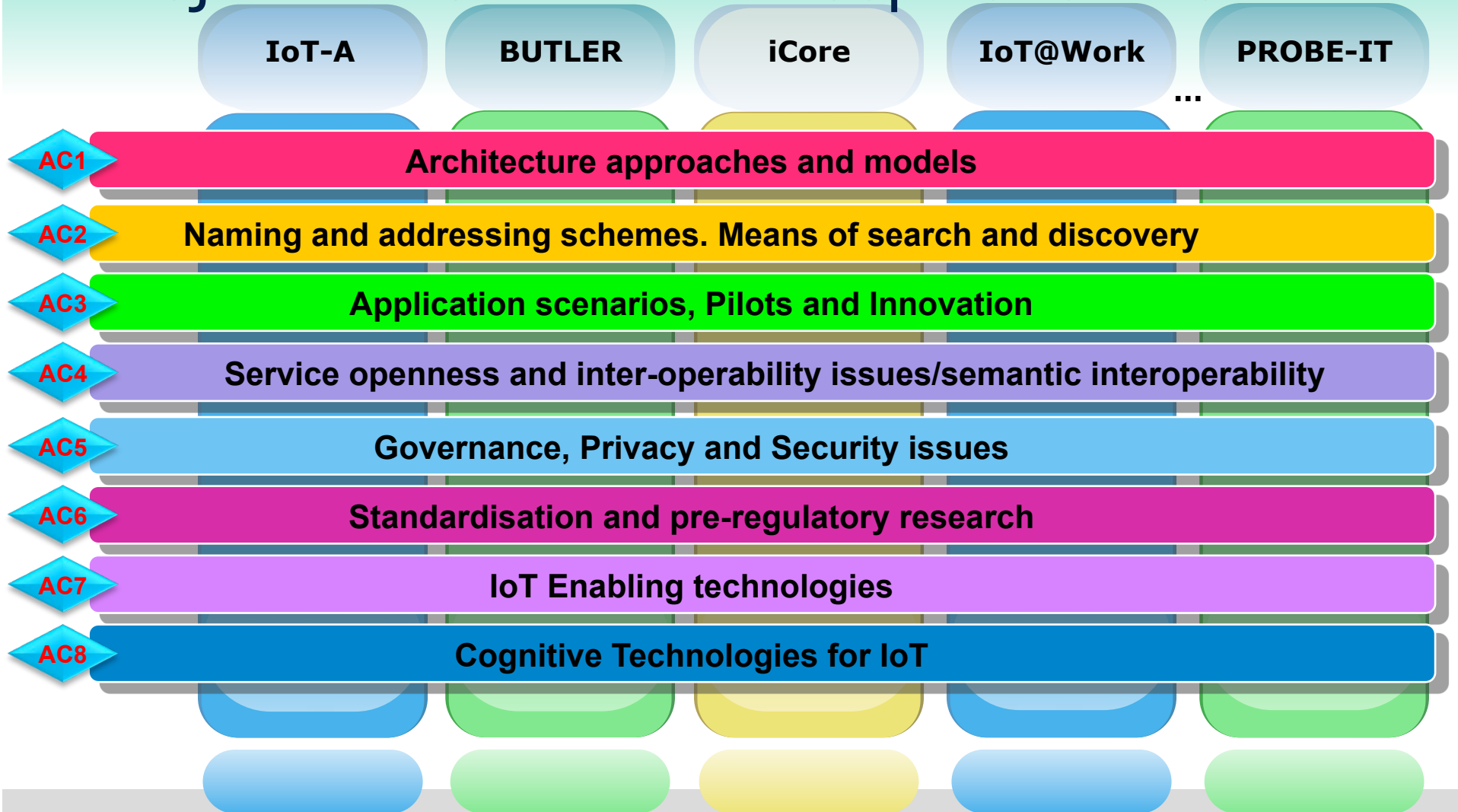
# Technical positioning





# IERC Activities Chains

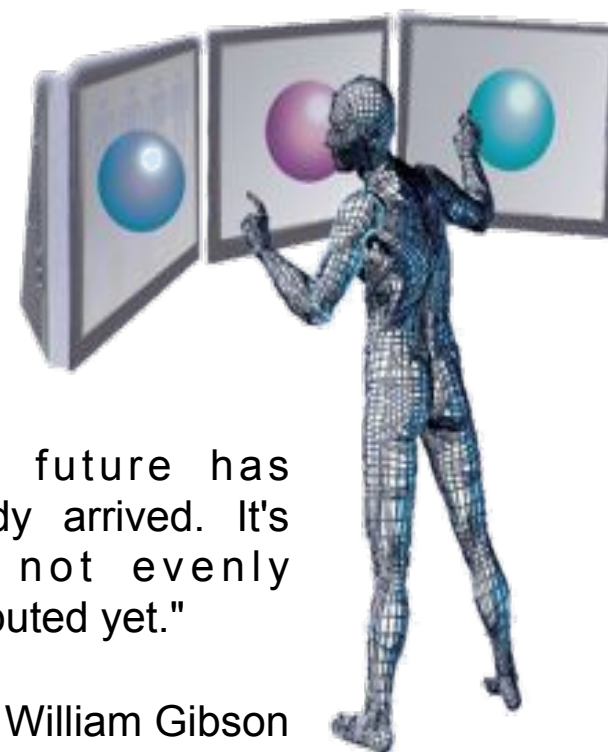
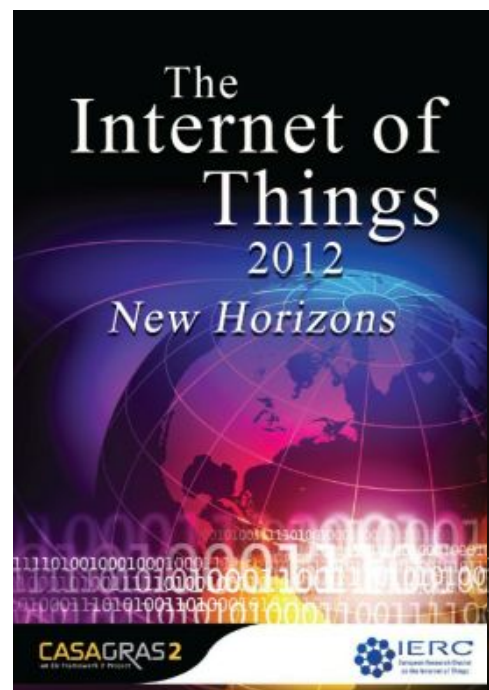
## ■ Projects Involvement – Cooperation Matrix





## IERC Cluster Book- Strategic Research Agenda

- Cluster Book 2013... 2014 book coming (june)
- Strategic Research & Innovation agenda (SRIA)

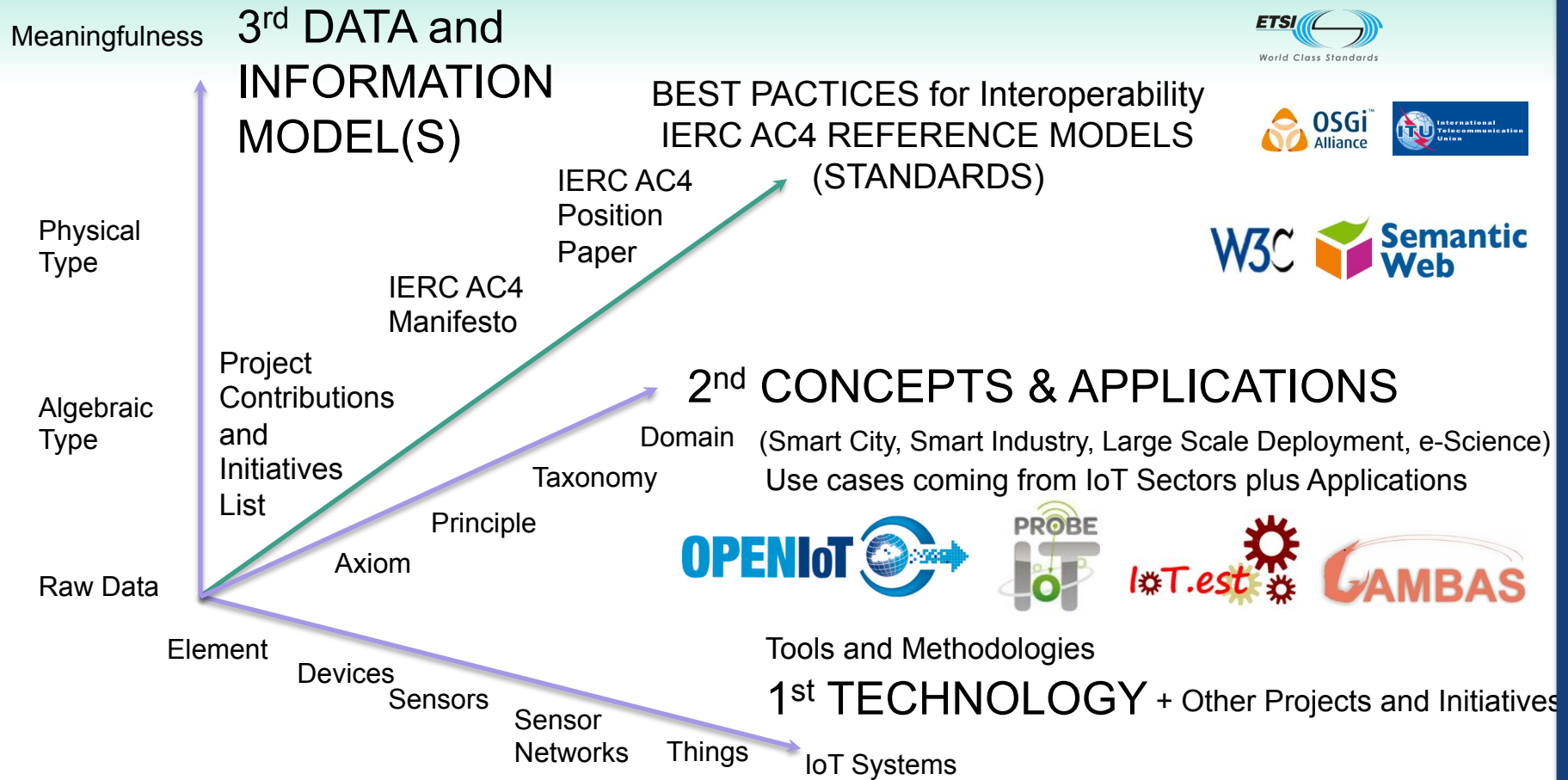


"The future has already arrived. It's just not evenly distributed yet."

William Gibson

# IERC Manifesto & Position Paper

## Dimensions in Semantic Interoperability in IoT - Considerations



# AC04 Position Paper

## Dimensions in Semantic Interoperability in IoT

### 1<sup>st</sup> TECHNOLOGY

Tools and Methodologies used for enabling IoT

### 2<sup>nd</sup> CONCEPTS & APPLICATIONS

Use cases coming from IoT projects and initiatives (Sectors plus++ Applications)

### 3<sup>rd</sup> DATA and INFORMATION MODEL

Simple Sensor Data Services and their extensions into semantic interoperability



# AC04 Position Paper

## Focus and Methodologies

### 1) The **scientific aspects**

- architectural pictures
- rigorous definitions?
- Reference Model?
- Reference Architecture?
- Reference Framework?

### 2) The **IoTness** of the document

- Where is interoperability?
- Diagrams one for the reference architecture
- Diagram for the lifecycle of an IoT system .



# AC04 Position Paper - Content Update

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# The Dimensions of Interoperability

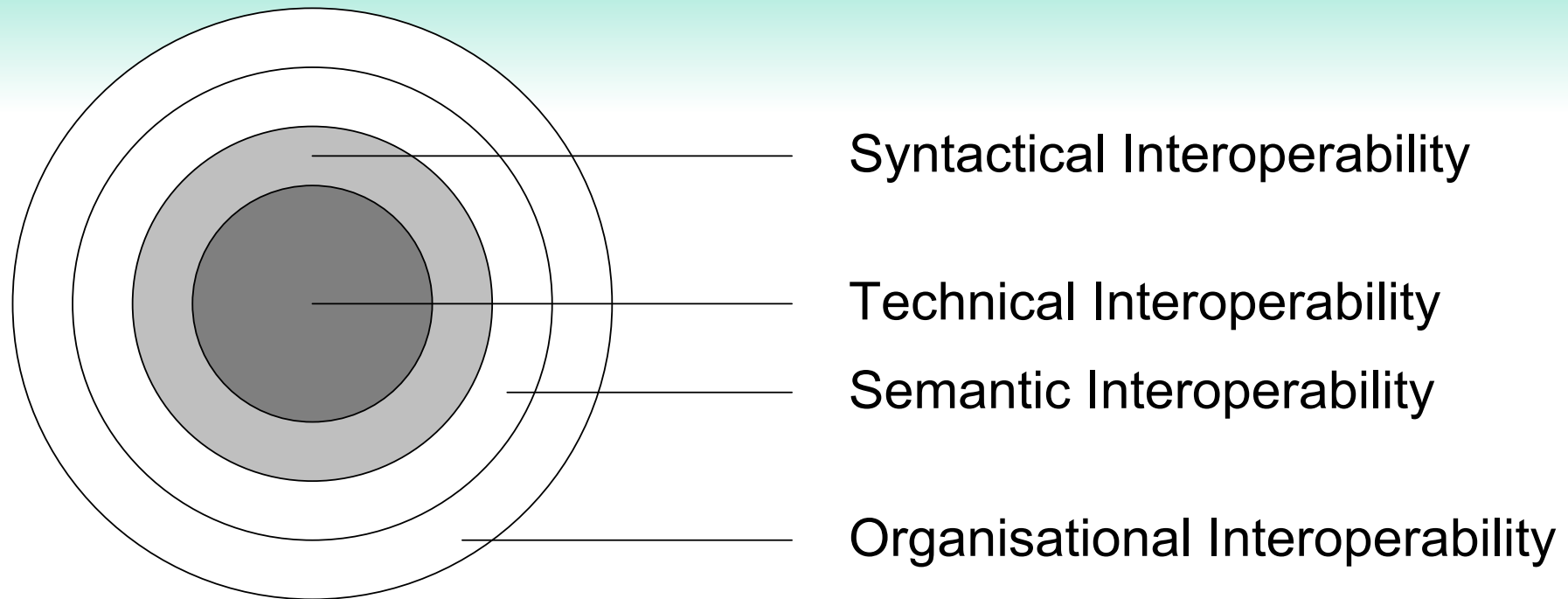


Figure 1. The Dimensions of Interoperability  
(IoT Technical and Semantic Interoperability Challenges/Requirements)

# The IoT Dimensions for Interoperability

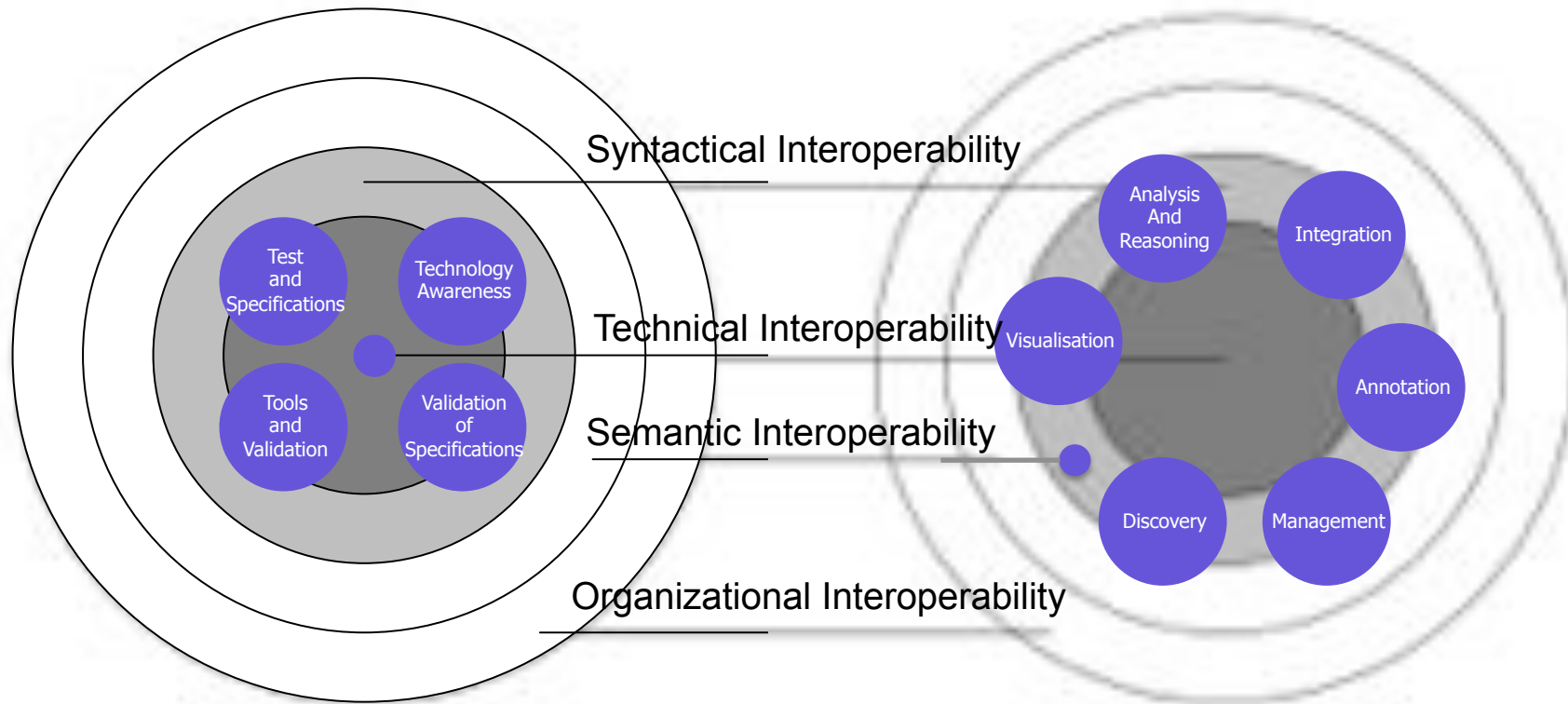
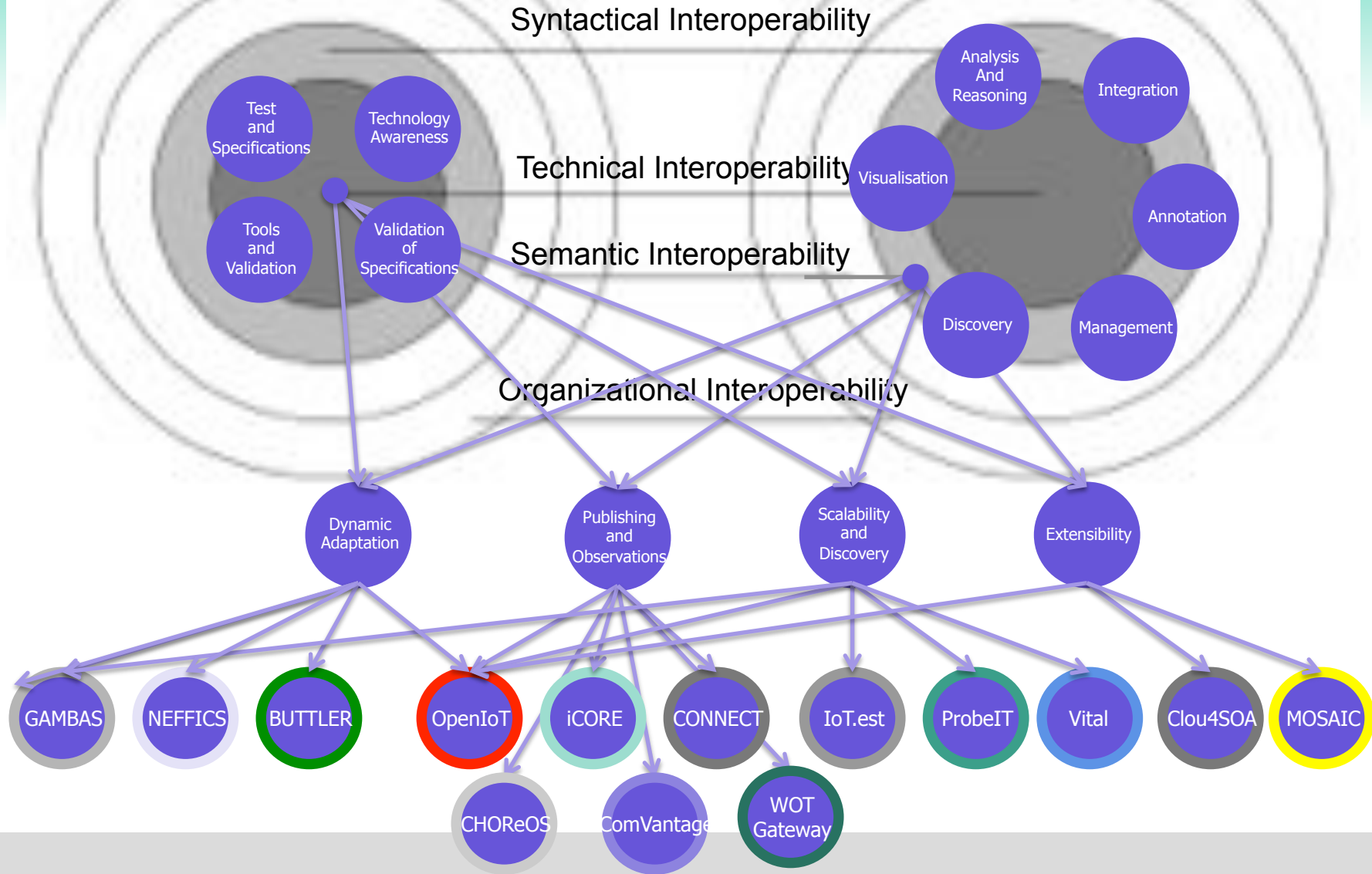


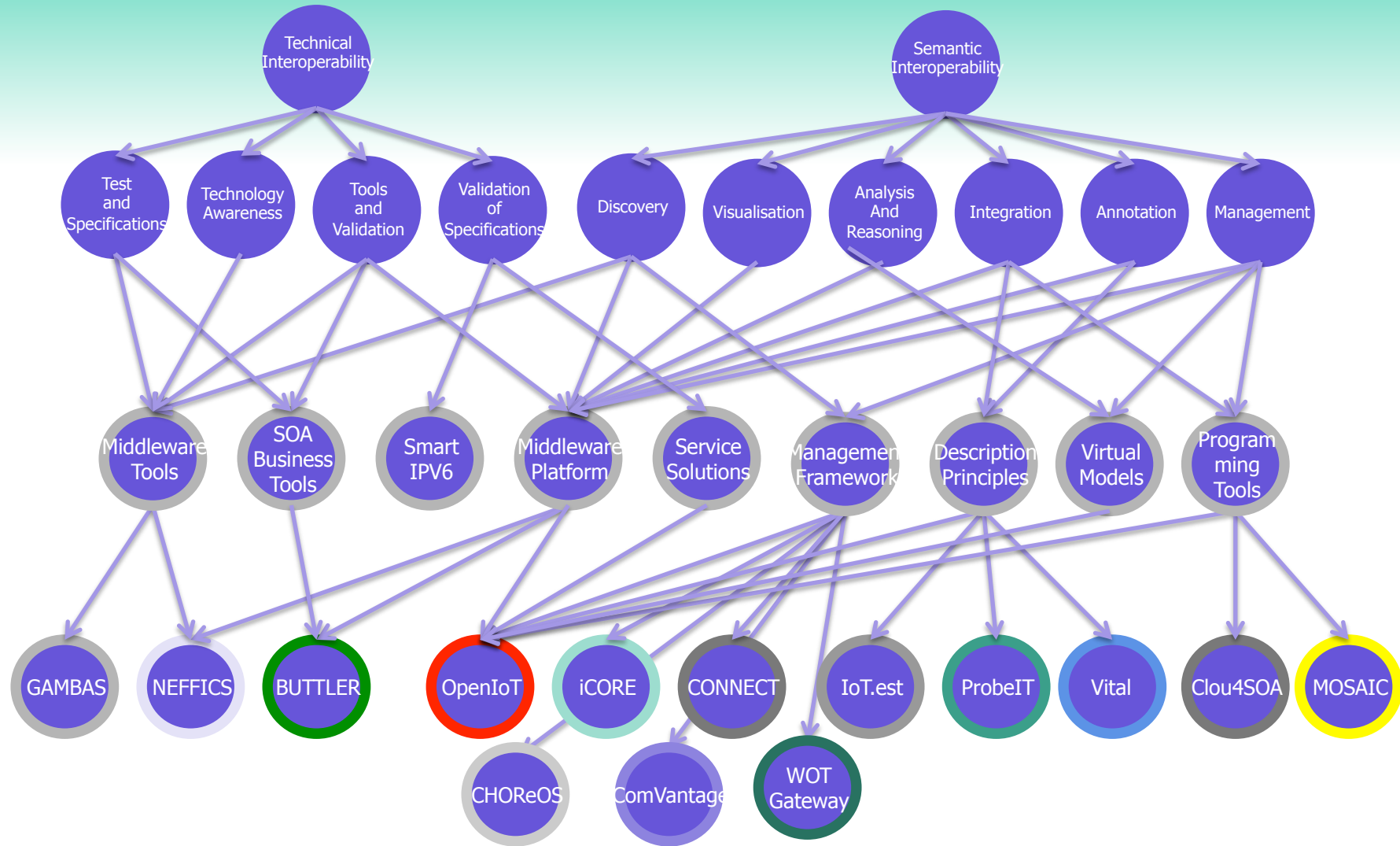
Figure 1. The Dimensions of Interoperability (Multi-Domain)

# IoT Best practices for Interoperability overview



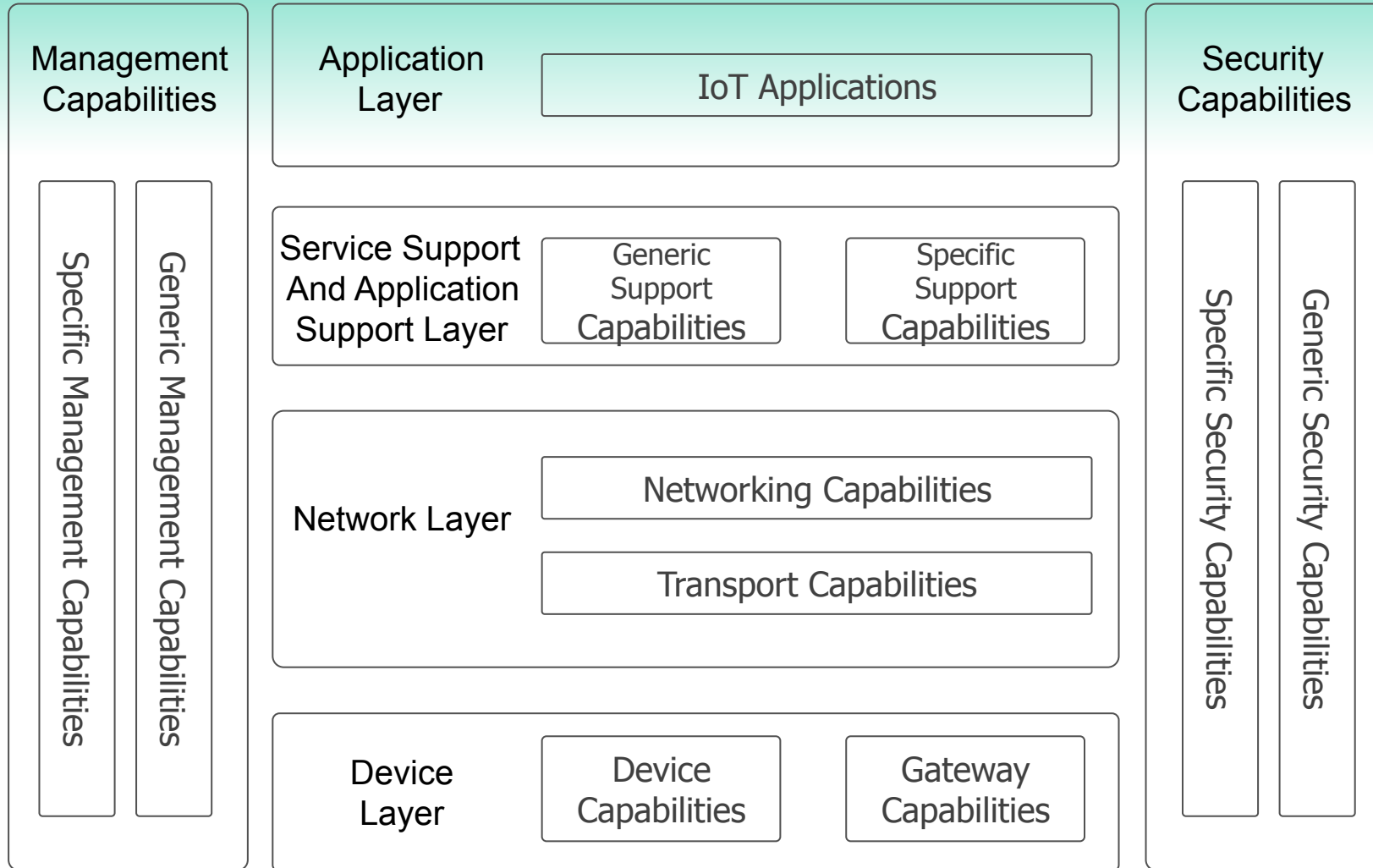


# IoT Best practices for Interoperability overview



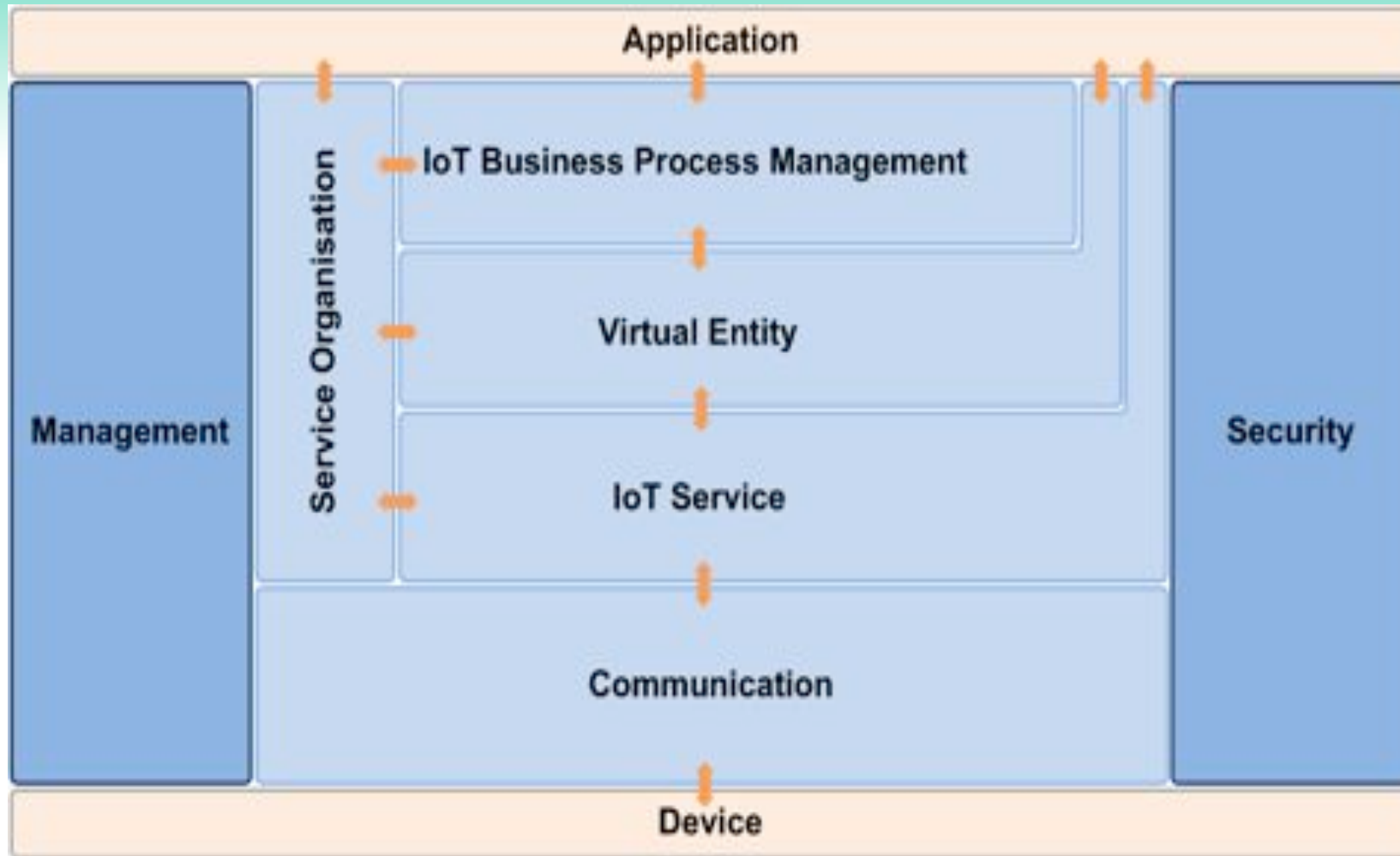
IoT IERC AC4 Technical and Semantic Interoperability Challenges/Requirements Schema

# IoT Reference Model (ITU-T Y.2060)



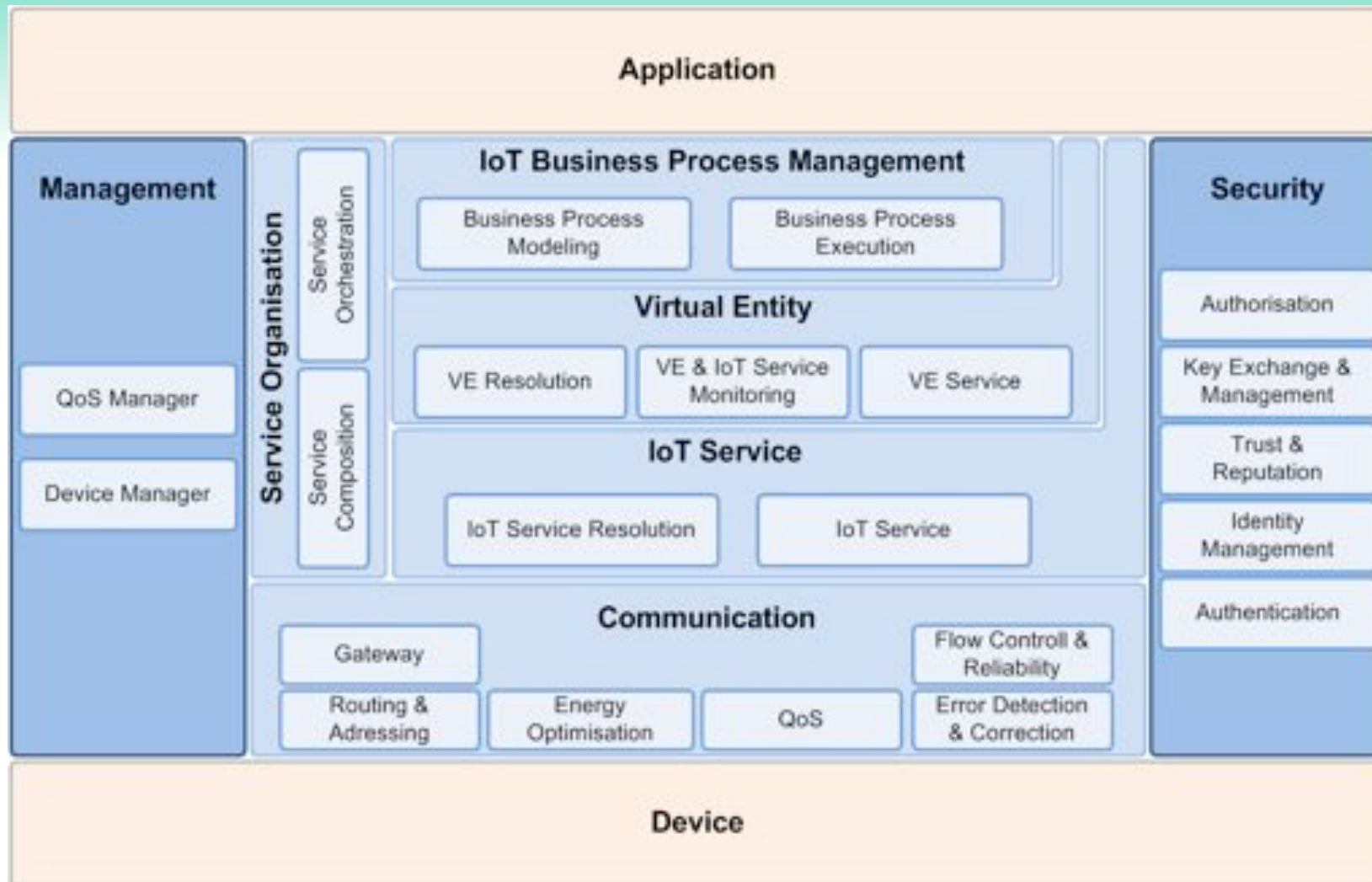
Source: ITU-T Y.2060, 2012

# IoT Architecture Reference Model (ARM)



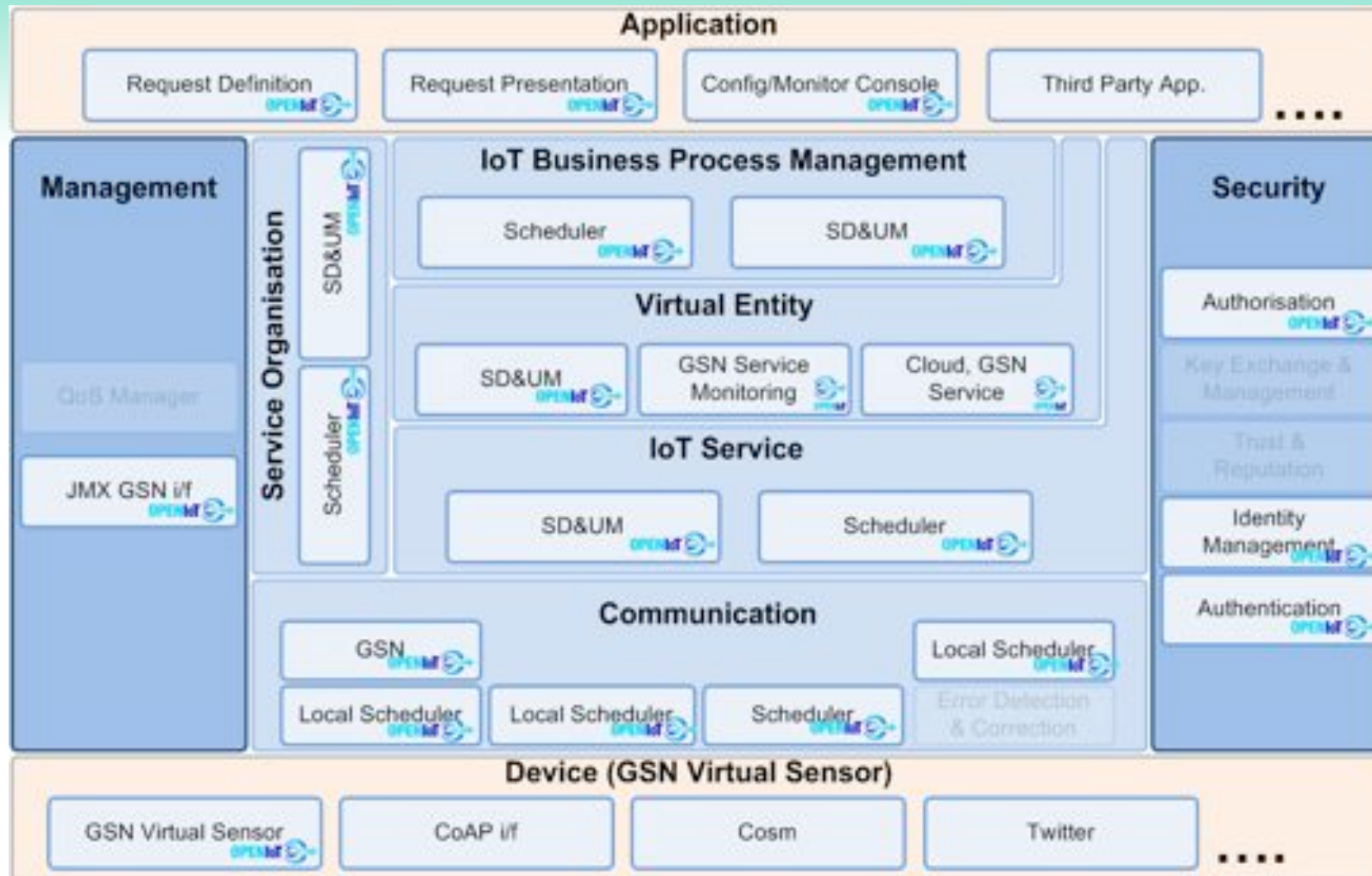
Source: EU IoT-A Project

# Reference Architecture Components



Source: EU OpenIoT Project

# Reference Architecture Implementation



Source: EU OpenIoT Project

# IoT Reference Framework Capabilities

Visual IoT Service Definition & Deployment

Dynamic Sensor/  
ICO Discovery

IoT Platform  
Architecture  
&  
Capabilities

IoT Service  
Visualization

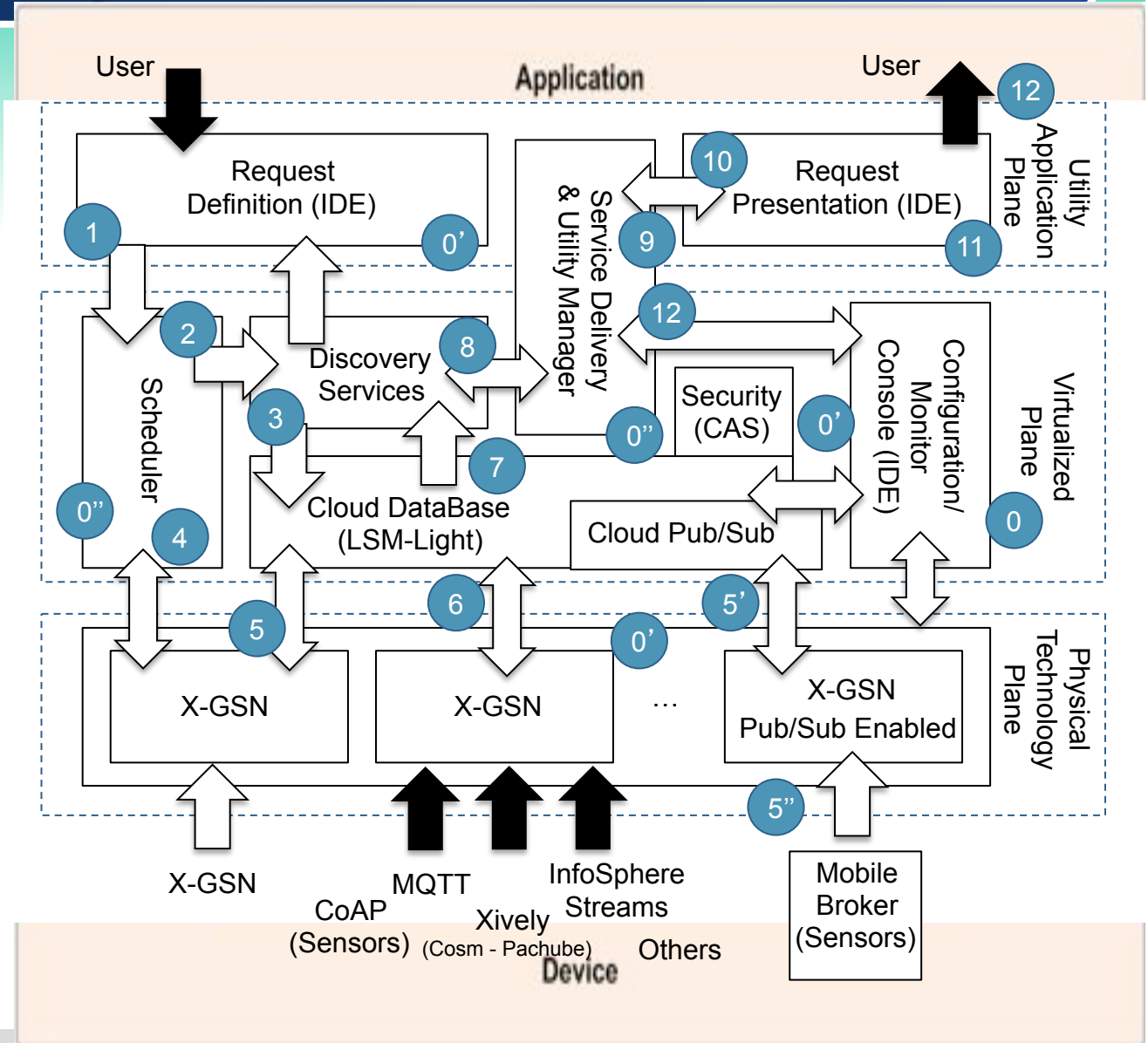
Sensor/ICO  
Deployment &  
Registration

Resource  
Management and  
Optimization

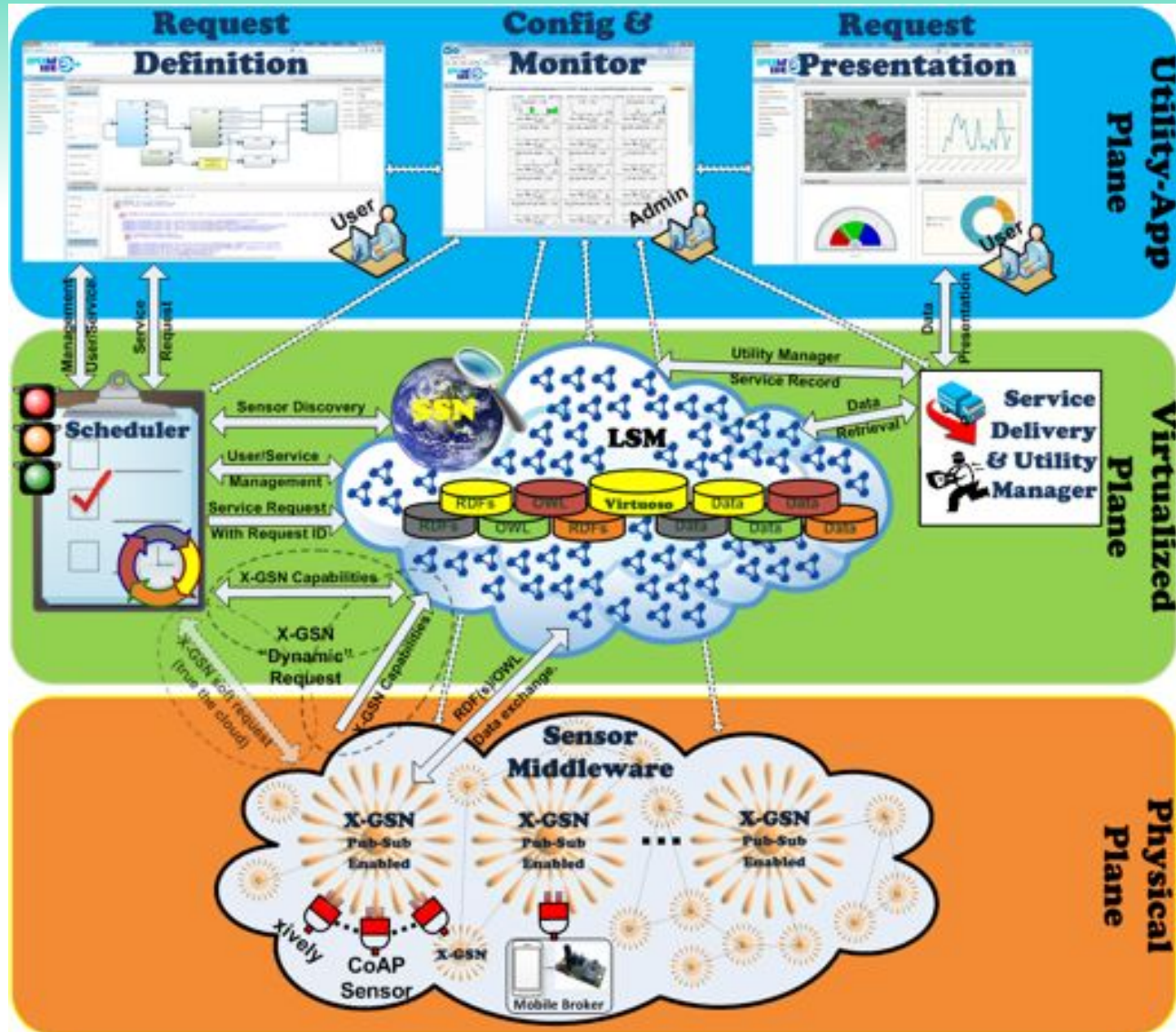
Device Registration and Annotation

# IoT Service LifeCycle

- 0 Setup and Management
- 1 End User Request
- 2 Discovery Services
- 3 Query Content
- 4 Sensor Configuration
- 5 Collect Content / Mobile
- 6 Content Adaptation
- 7 Utility Service Feedback
- 8 Service Delivery
- 9 Service Visualisation
- 10 Get Visualisation
- 11 Data Presentation
- 12 Utility Metrics / Services Report

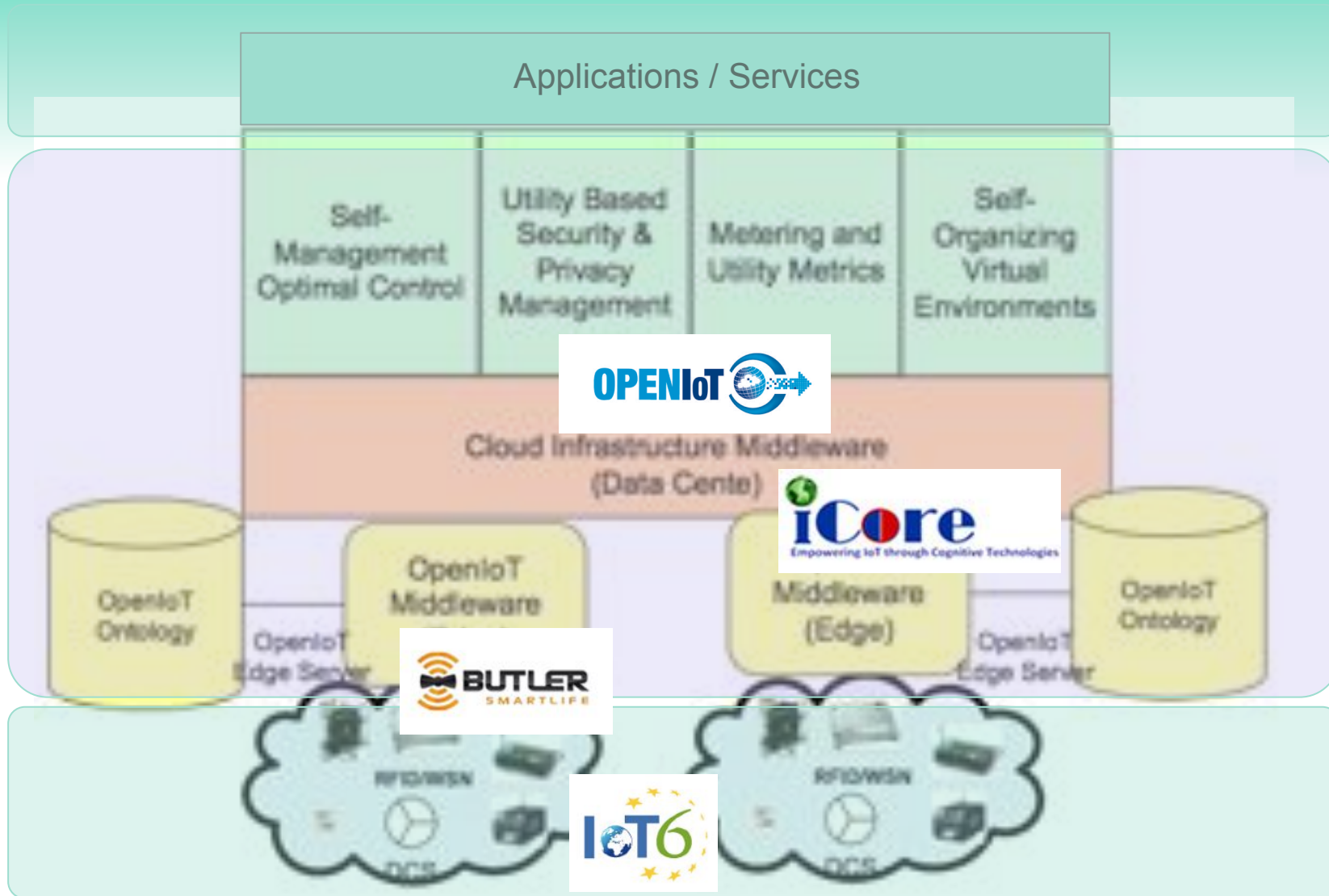


# High Level Reference Framework for Interoperability





# Reference Framework for Interoperability



IoT Domain a

IoT Domain n

# The Dimensions of Interoperability

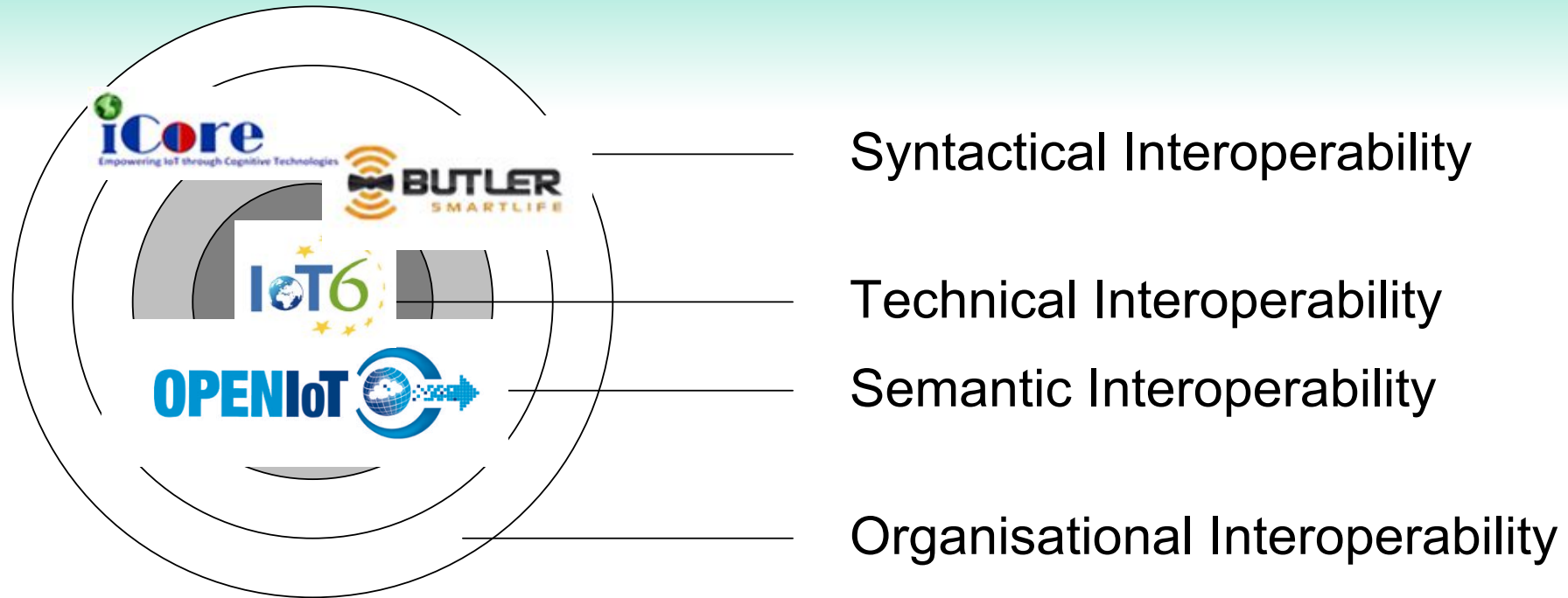


Figure 1. The Dimensions of Interoperability  
(On-going Experiments)

## Additional Activities

- IoT Week – Organized every year in June.
- Presentations of demonstrations and pilots.
  - IoT applications and technology developments
  - Practices for business networks.
- Innovation Incubators concepts.
- International cooperation
- Strategic Research Agenda
- Standardization
  - ETSI, CEN/CENELEC, oneM2M, W3C, IETF, OASIS

# IERC Web Space

**Coordinating and building a broadly based consensus on the ways to realise the Internet of Things vision in Europe.**

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## **IERC OBJECTIVES**


**Identifying IoT technology research challenges at the European level in the view of global development.**

[www.internet-of-things-research.eu](http://www.internet-of-things-research.eu)

# First IoT semantic interop 2012

## 22 October afternoon



**Advanced IoT Semantic Tutorial : *Designing Semantic models for IoT*** (coordinated by Wei Wang, University of Surrey with support Martin Serrano Deri). 

- Knowledge engineering methodology
- IoT domain modeling :
  - sensor and sensor networks (W3C SSN Ontology)
  - linked sensor data platforms
  - IoT service modeling (IoT-A and IoT.est Ontologies)



## 23 October morning



**Practices on semantics for resource-gateway interaction and semantic model interoperability** (coordinated by Wei Wang, University of Surrey with support Martin Serrano, DERI). 

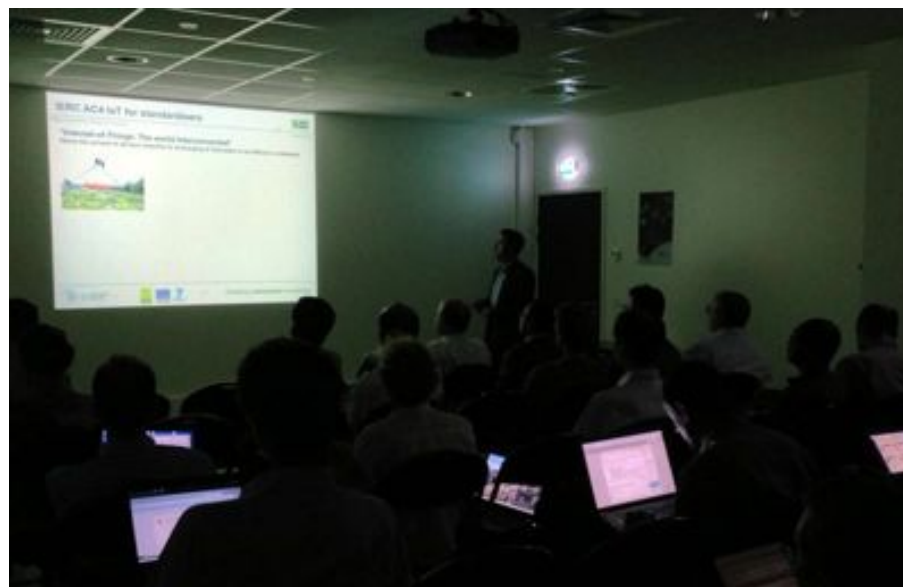
- Introduction on ontology engineering tools
- Practice with ontology tools:
  - Ontology development with Protégé
  - Ontology interoperability tool
  - Query linked data using SPARQL endpoint
- semantic interoperability checking tools
- tools for resource-gateway interaction and development of the gateway clients

# Tutorial for Standardisers oct 2012

23 October 2014 afternoon

**IoT Semantics for standardisers** (coordinated by Martin Serrano, DERI with support of Wei Wang, Frider Ganz University of Surrey).

- Ontology basics:
- RDF
- OWL
- SPARQL
- Reasoning
- Linked data:
  - Principles
  - linked open data
  - recent development
- IoT domain modeling:
  - sensor and sensor networks (W3C SSN Ontology )
  - linked sensor data platforms
  - IoT service modeling (IoT-A and IoT.est Ontologies)



## 2<sup>nd</sup> and 3<sup>rd</sup> semantic interop

- 2<sup>nd</sup> Semantic interop

Guilford April 2013

- Profiled for Ontology Experts

- 3<sup>rd</sup> semantic interop Sept 2013 – Remotely

- Webinar

- 4<sup>th</sup> Semantic interop June 2014

London@ IoT-week.eu

- More pragmatic approach

- Interop challenges /Hackaton

## 5th semantic interop june 2015 with oneM2M ?

- semantic interoperability a critical topic also link to standards
- oneM2M is progressing its work
- June 2015 could be good milestone for organising a common interoperability event:
  - Use experience from IERC AC4
  - Offer oneM2M specifications to participants
  - Based on Challenges / Hacktsondo  
organise a “plugfest” to check understanding and interoperability





**Thank you!**

**oneM2M interim plenary 10 April 2014, Berlin**

**IERC Service Openness and Interoperability (AC4)**

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