

Keynote at IEEE Africon 2013, Mauritius, September 9, 2013

"Smart Communication Toolkits and Testbeds for Industry and Academia enabling the rapid Prototyping of Emerging Smart City Applications"

Prof. Dr. Thomas Magedanz

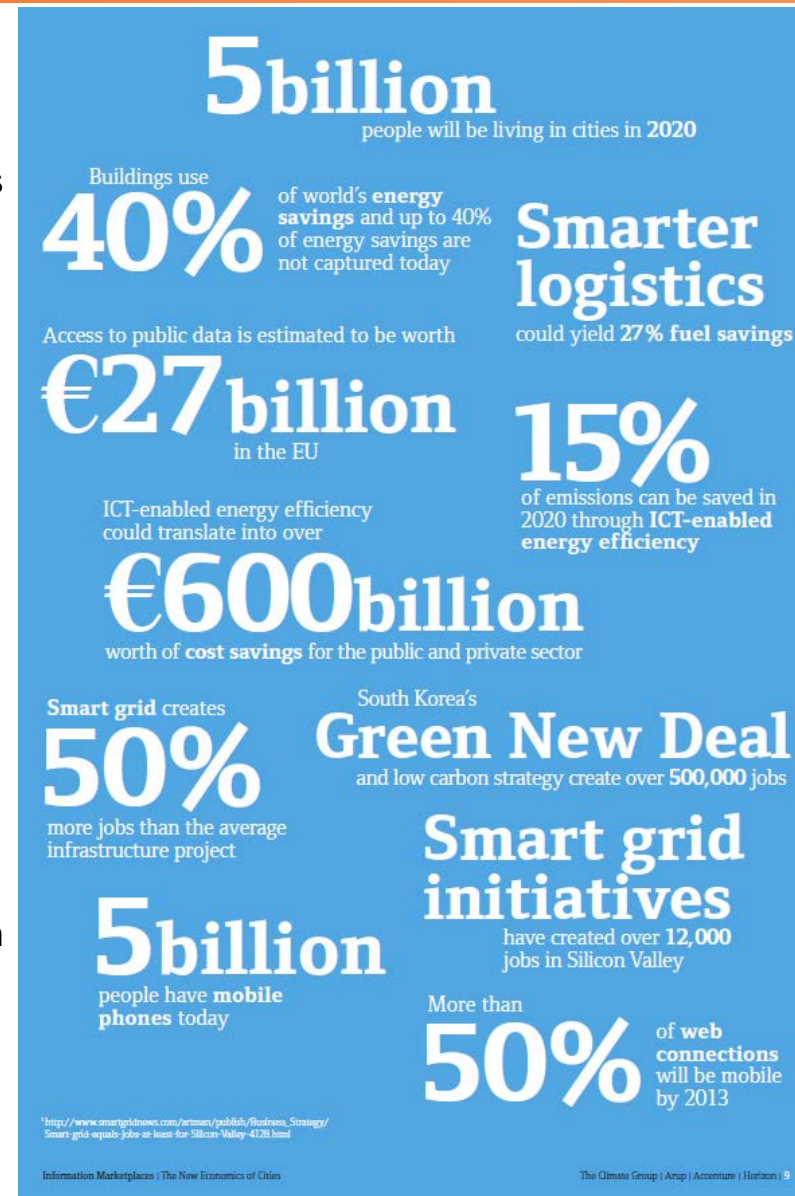
Fraunhofer FOKUS / TU Berlin

Agenda

- Smart Cities as Future Internet Show Case
- Smart City communication infrastructures requirements
- *The Role of IP Multimedia Subsystem, Machine Type Communication, Evolved Packet Core and related Open APIs within emerging Smart City SDPs*
- FOKUS Toolkits and practical examples
- Summary
- *Q&A*

Smart Cities: The Facts

- 50% of the world's population already lives in cities and trends suggest that over 60% will live in cities by 2030
- 50% of global GDP is generated in the largest 600 cities
- There are 484 cities worldwide with populations in excess of one million
- There are 780,000 municipalities and states that are charged with the same functions as cities
- A UN report suggests that 40,000 new cities will need to be built worldwide by 2050
- The global private & public ICT market is \$1580bn per annum; public sector market \$423bn with \$179bn of that local & regional government
- The global ICT market is 15% software and around 85% services and hardware
- Total estimated global budget for improving city ICT- \$35-55bn
- Total ICT public sector city market circa \$5bn software, \$30bn services/hardware
- USA largest market +\$12bn, Europe +\$5bn, China +\$3bn, Japan +\$3bn, India +\$1bn



Challenges for Future Cities – Global Megatrends until 2050



Demographic Change



Urban Development



Globalization



Energy and Resources



Environment



Health



Mobility



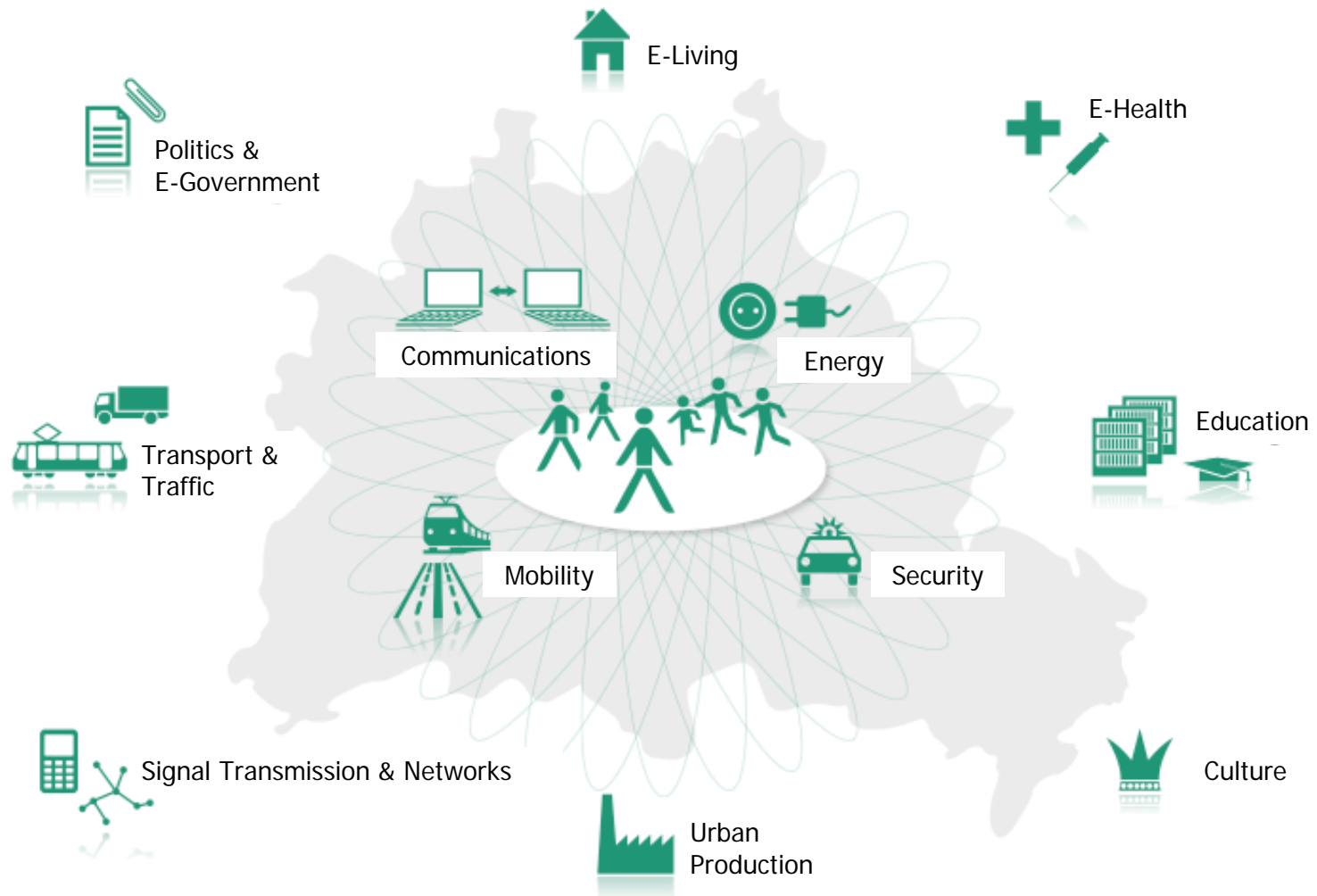
Dialog and Participation



Work & Life

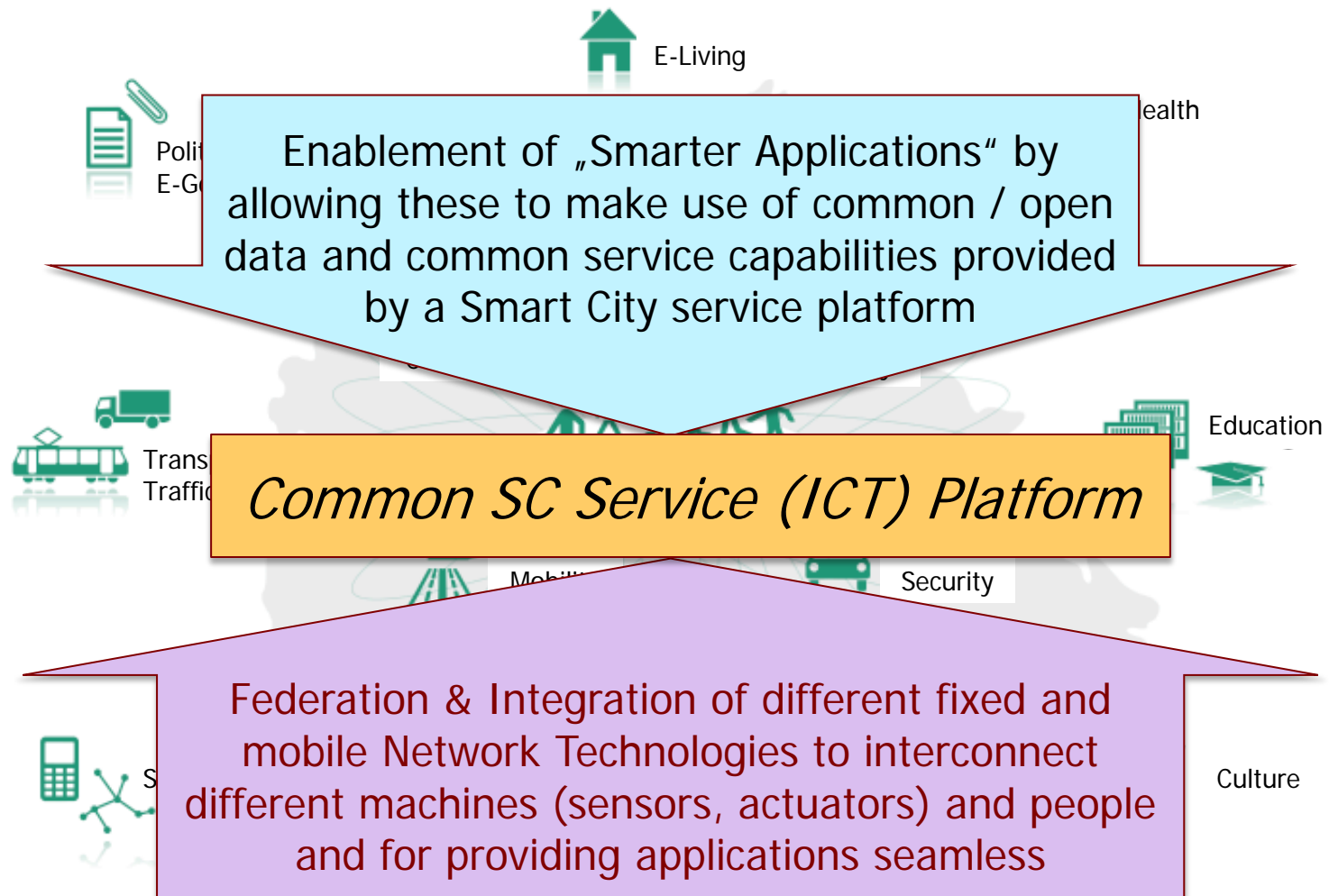
Future Internet ... to make our cities smart

A Smart City is a huge Future Internet Show Case



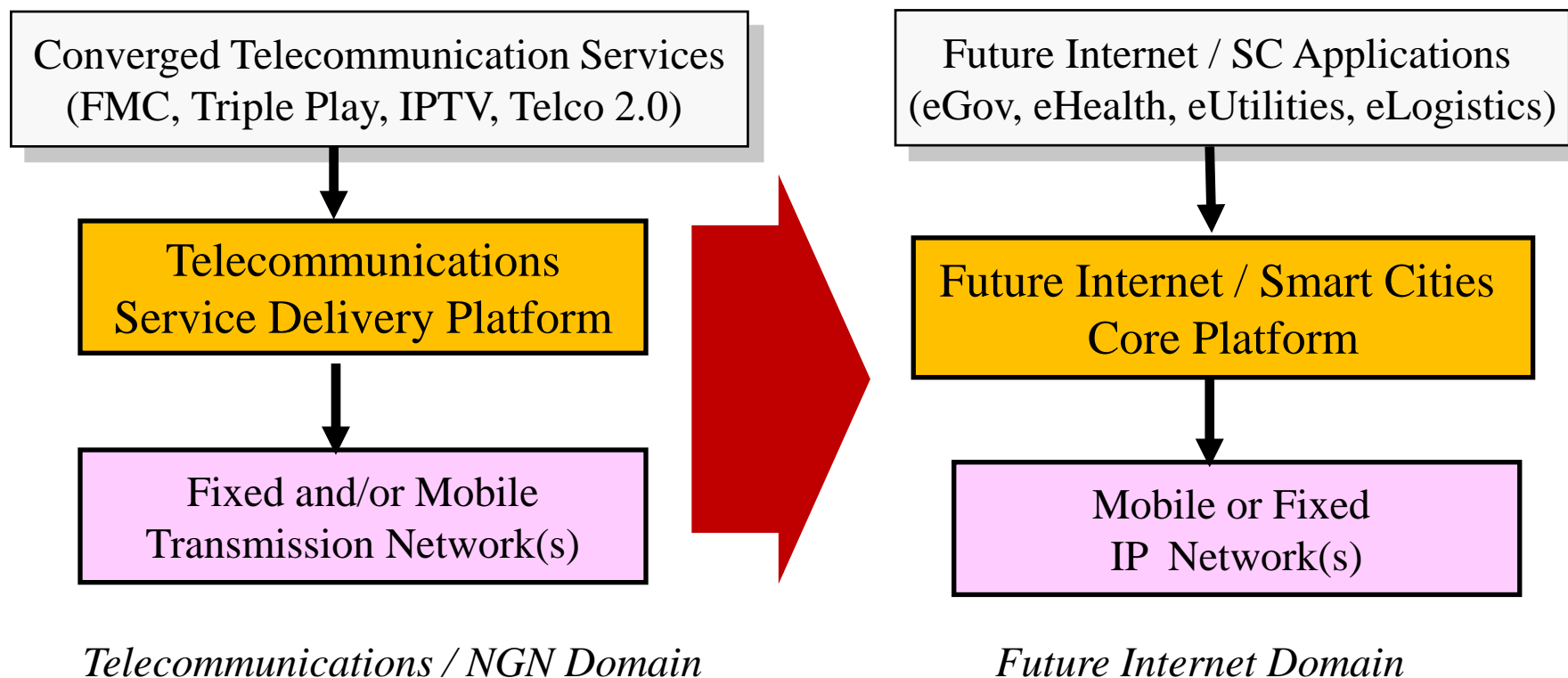
A Smart City relies on Integration & Federation of Systems

Convergence will lead to a Common SC Service (ICT) Platform

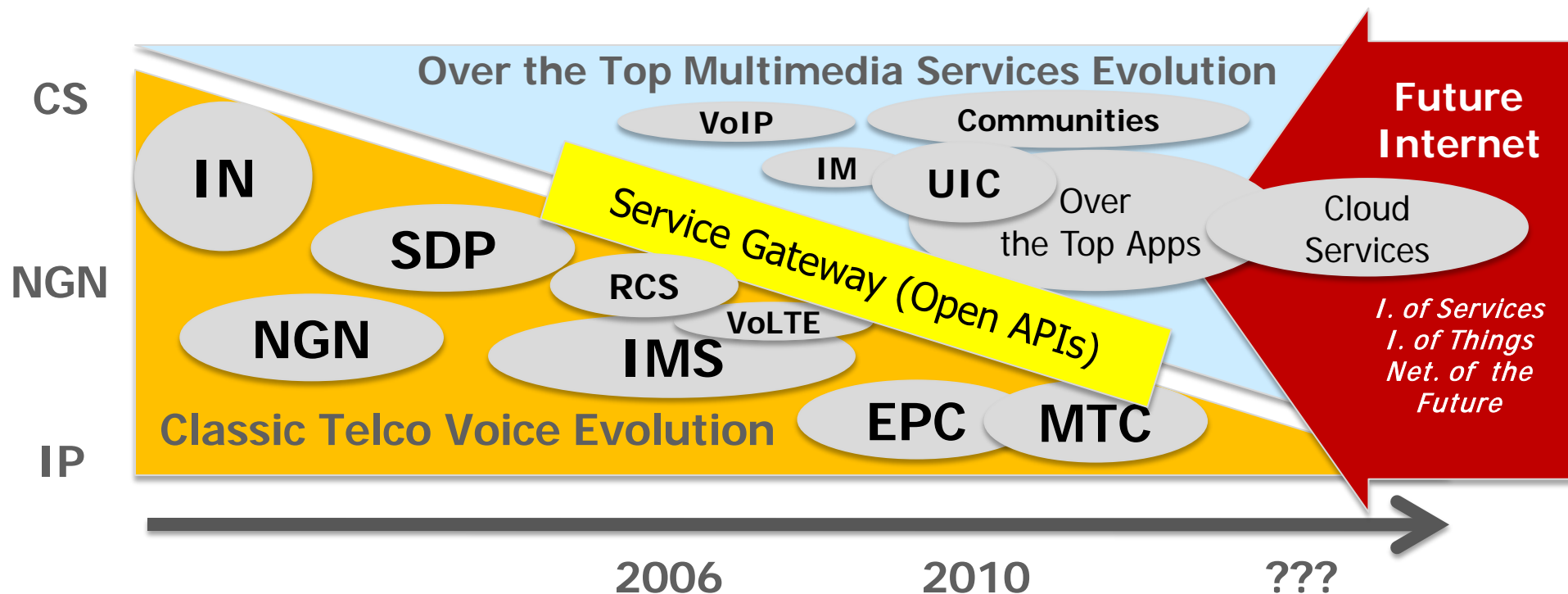


A déjà vu - From NGN towards SDPs for Future Internet / Smart Cities

Main Idea: A Core Platform provides reusable capabilities (→ Enablers) for multiple applications hiding the details of underlying technologies



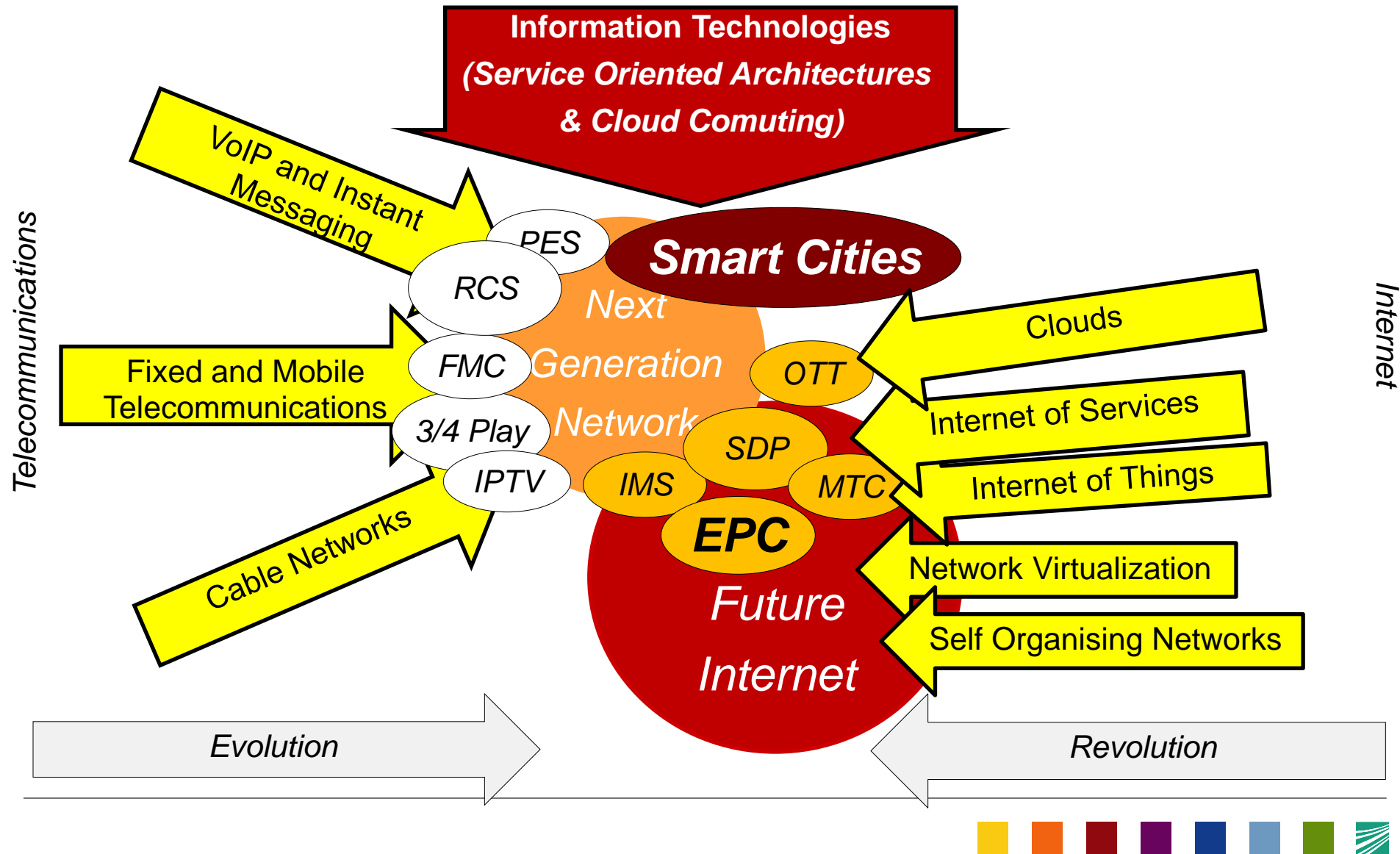
OTT vs. Telco Networks & Platforms – APIs/IMS/EPC/MTC as last resort??



- ✓ All IP Networks will pave the road for Over the Top (OTT) Application
- ✓ Evolved telecom platforms may provide revenue potentials via Service Gateways (APIs) on top VoIP/RCS (IMS), Machine Type Communication (MTC) and Smart Bit pipe approaches (EPC)
- ✓ *RCS will have to compete with Unified Communications (UIC) in OTT area*



NGN2FI Evolution is a Challenge



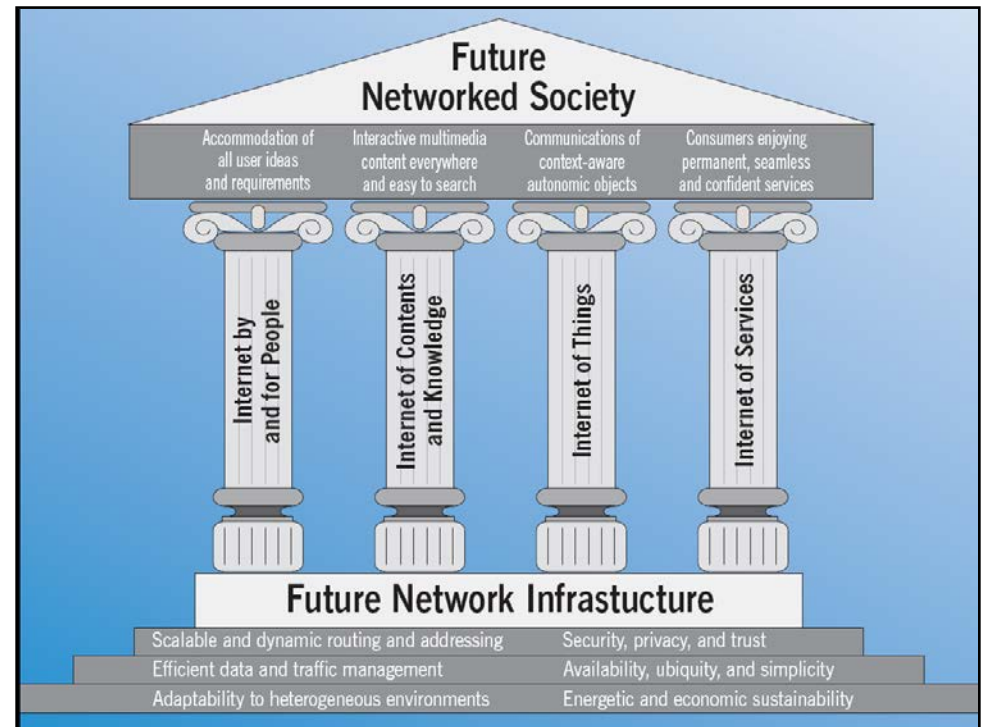
Dimensions of the Future Internet

■ Future Internet Pillars

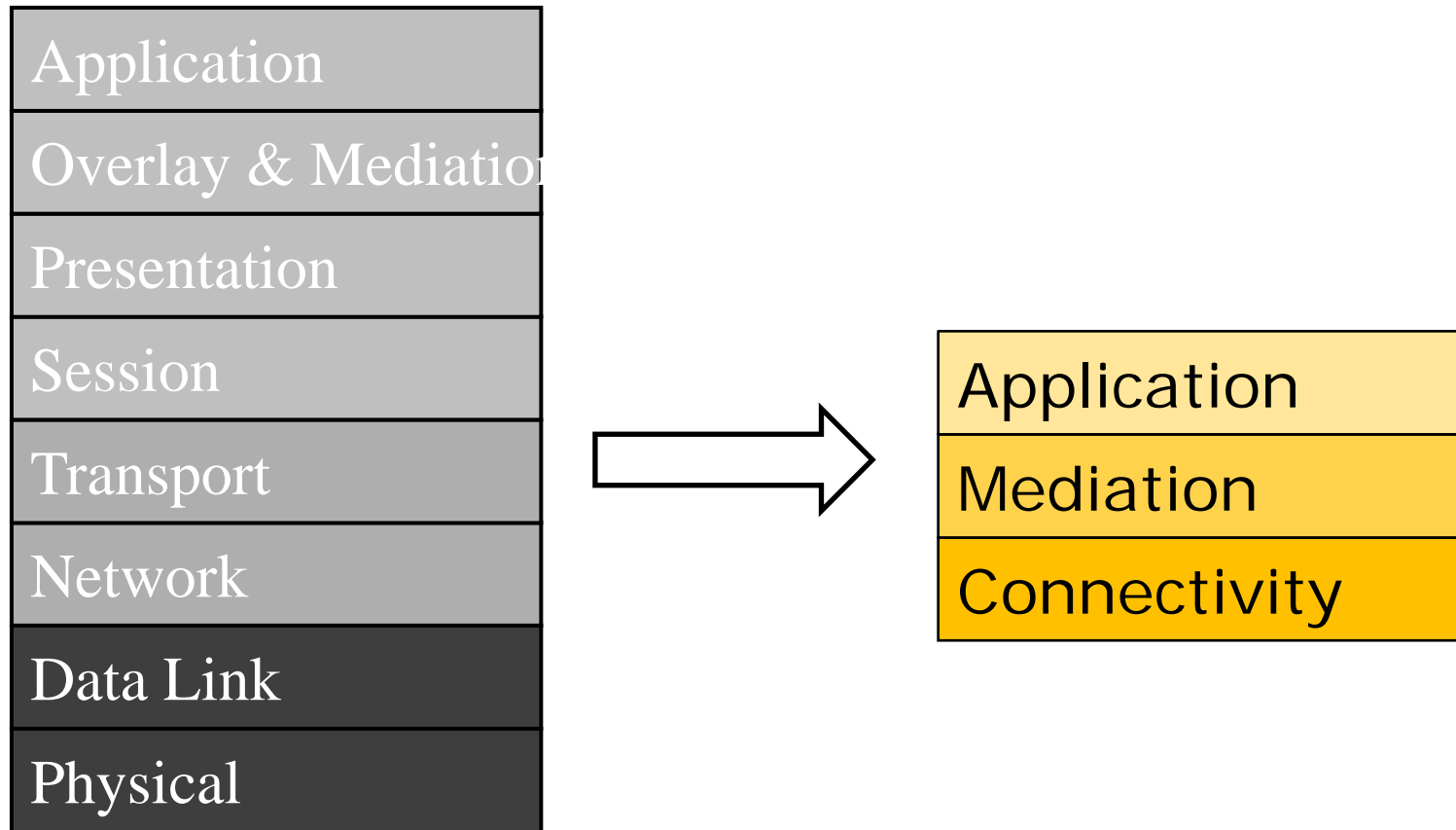
- Network of the future
- Internet of Content
- *Internet of Things*
- *Internet of Services*

■ Infrastructure Foundation:

- Network infrastructure / substrate that supports the pillars
- Shall support capacity requirements of Future Internet

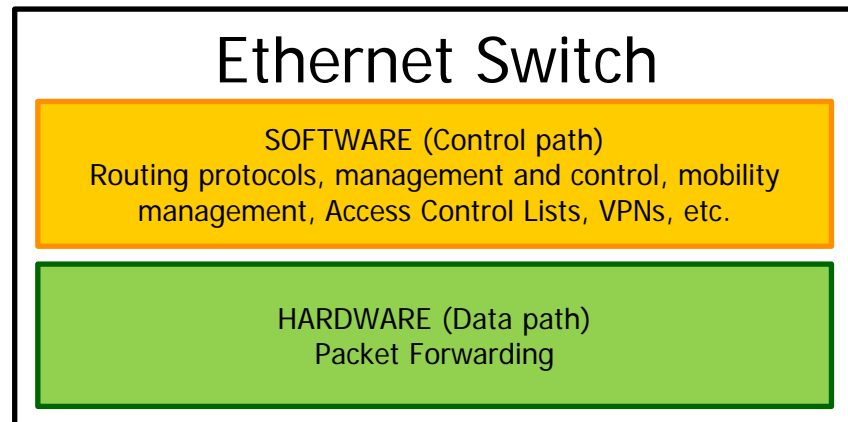


FI = Towards a Thinner Protocol Stack

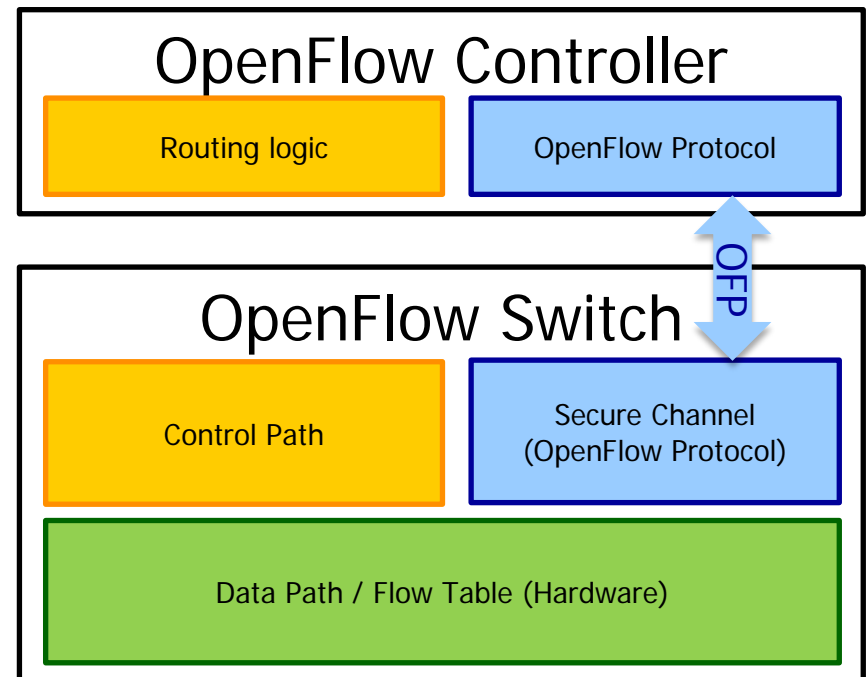


Switch Evolution towards Software-Defined-Networks (SDN)

■ Ethernet Switch Architecture

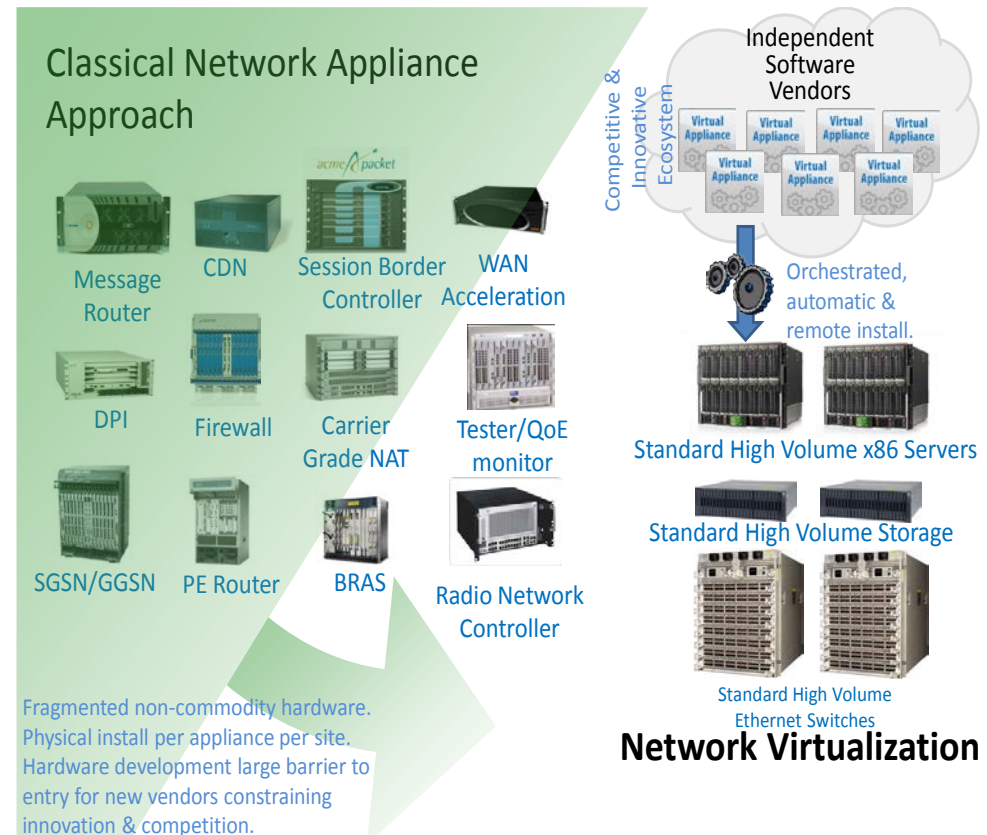


■ OpenFlow Switch Architecture and OpenFlow Controller interaction



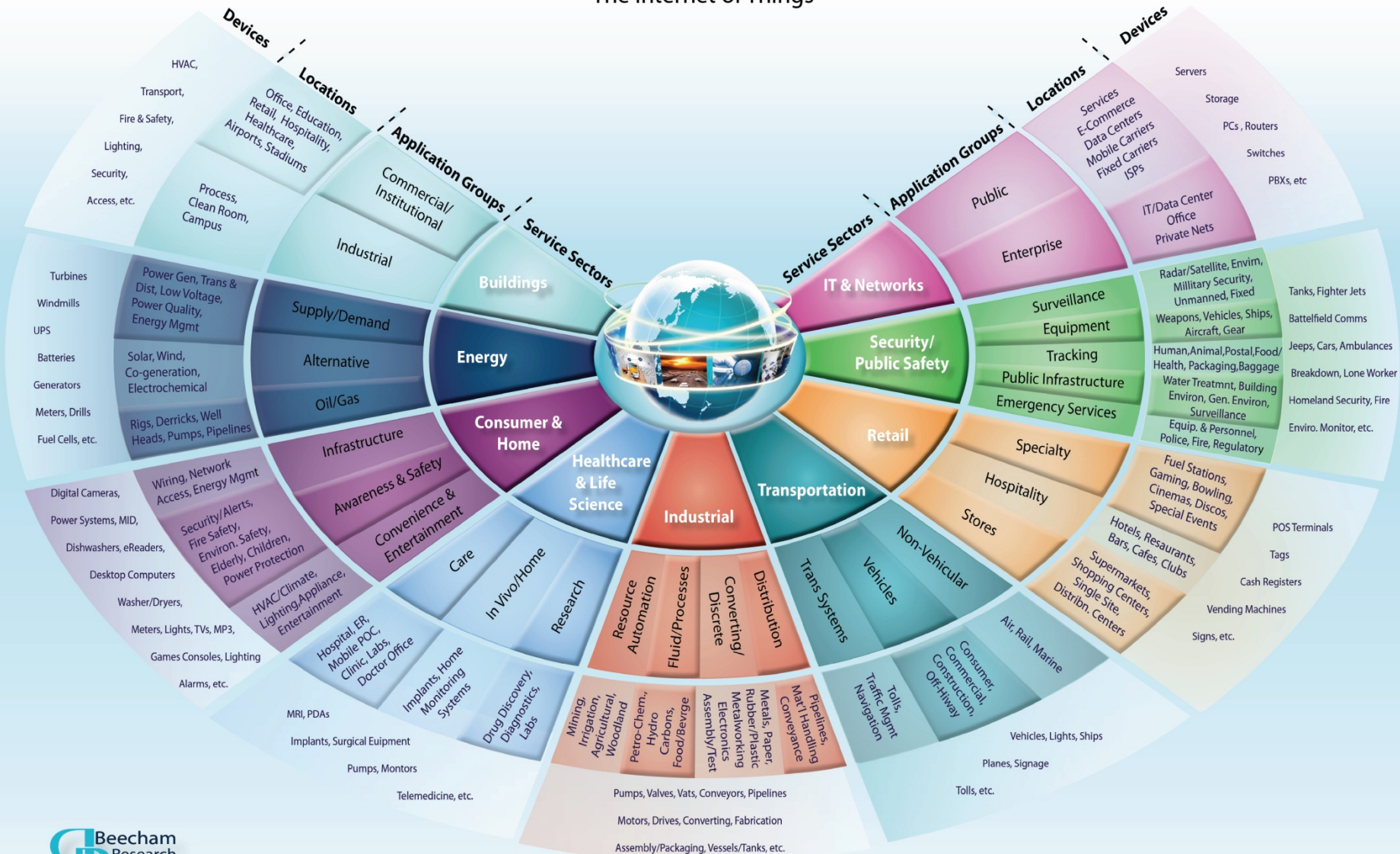
What is Network Functions Virtualization (NFV)

- Network Functions Virtualization (NFV) is a novel paradigm that presumes that the network functions:
 - Are implemented only as software (programs)
 - Can run on top of common servers
- NFV implies that network functions:
 - Can be moved as required
 - Do not require special equipment



M2M World of Connected Services

The Internet of Things



Boston | London

info@beechamresearch.com

+44 (0)845 533 1758

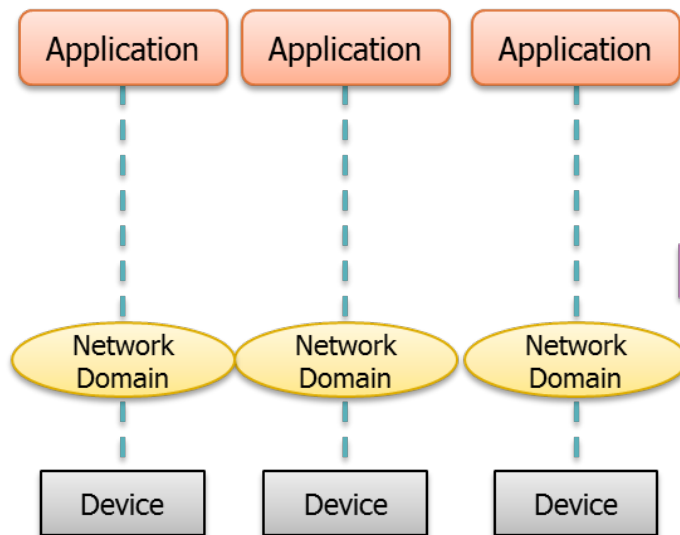
www.beechamresearch.com

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Convergence of M2M Services & Applications

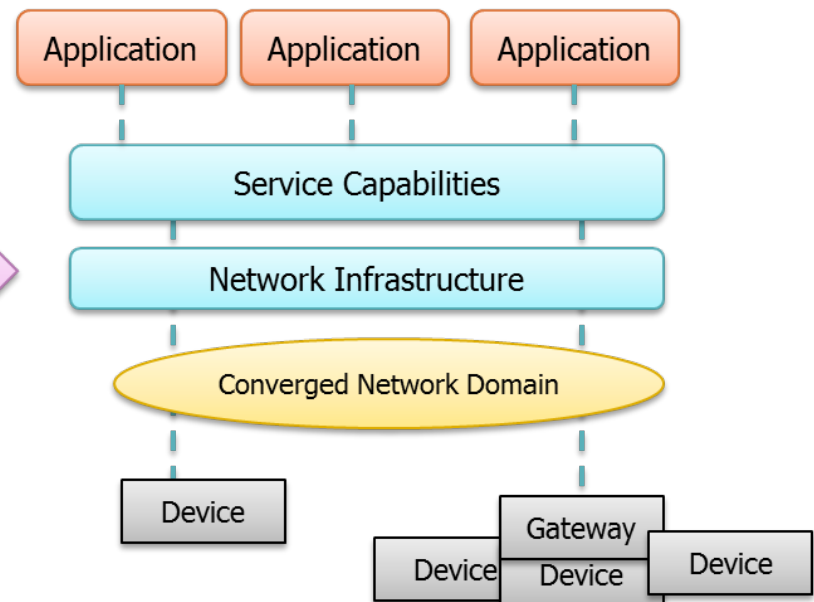
Today

- SMS based.
- Vertical isolated systems.
- INTRANet of Things



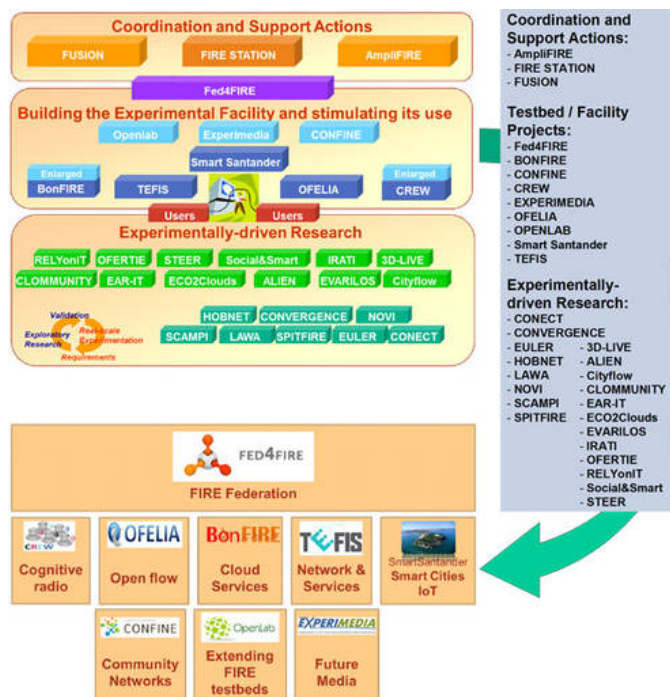
Future

- Global horizontal approach.
- INTERNet of Things

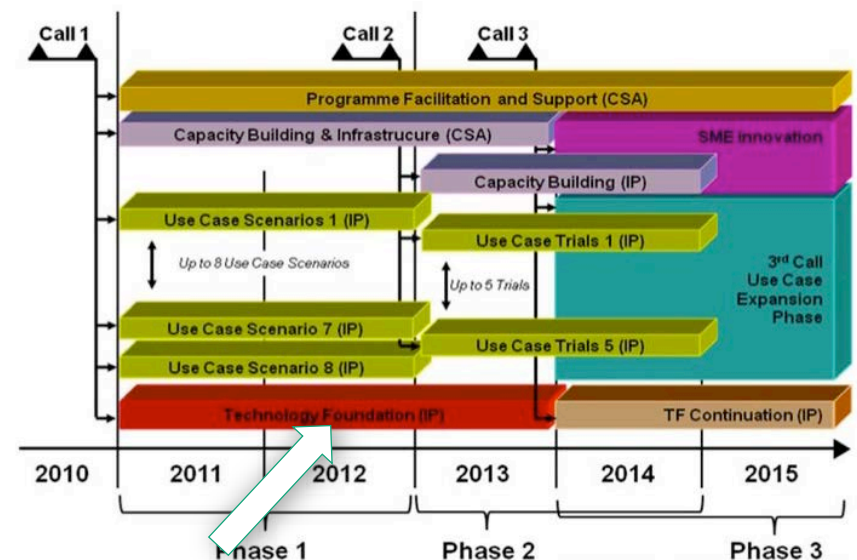


Europe's key Initiatives for Future Internet Research FIRE and the FI-PPP

- Europe's **Future Internet Research and Experimentation Initiative (FIRE)**
- Europe's **Future Internet Public Private Partnership Programme (FI-PPP)**



FIRE



Future Internet Core Platform

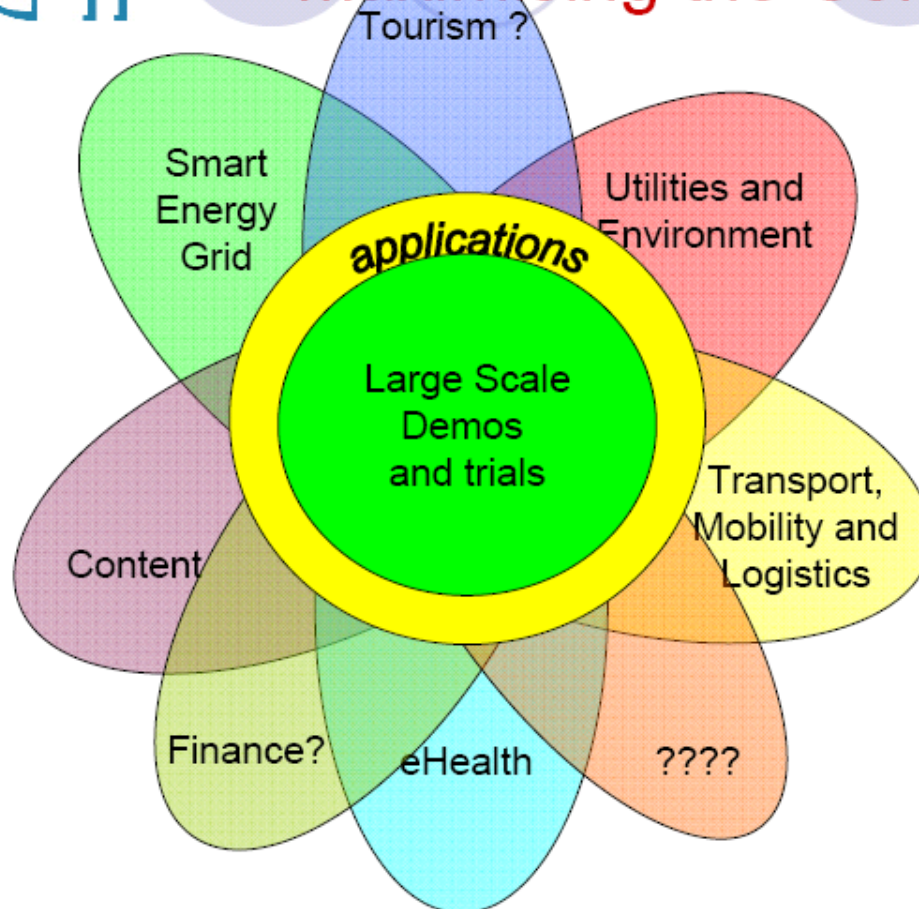
FI-PPP



The Notion of Enablers within the European Future Internet Initiative



Maximising the Common enablers



- Examine the basic enablers in each area
- Determine the common enablers
- Determine the enhanced enablers
- Work out how to provide a core platform that supports the enablers
- Build it and show the world
- Use it in large scale trials and tests
- Use existing advanced infrastructures to test future Internet function

EU FI PPP
Facts

FACTS & FIGURES

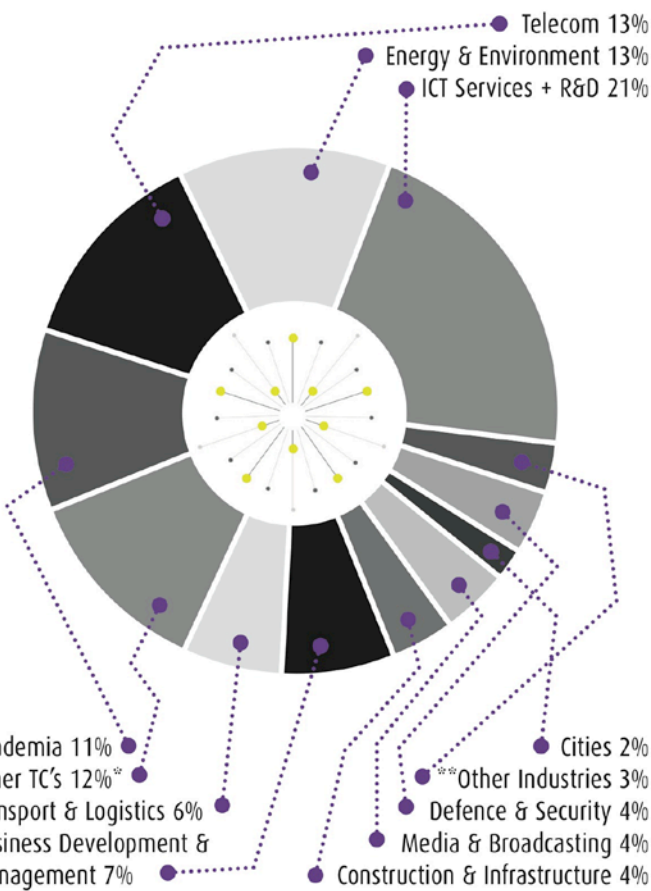
2x € 300 million

INVESTMENT BY THE EUROPEAN COMMISSION &
PROGRAMME PARTICIPANTS

158 68% 18
PARTNER ORGANIZATIONS AND COMPANIES INDUSTRY SHARE IN THE PROGRAMME ACADEMIC INSTITUTIONS

23

COUNTRIES REPRESENTED (2 FROM OUTSIDE EUROPE)



INDUSTRIES REPRESENTED IN THE FI PPP PROGRAMME

* Other Technology Companies, such as artificial intelligence, marine, aerial and satellite R&D, or automobile and other hardware manufacturing. ** E.g. Banks, retail stores, agriculture and food producing industries. Note: Figures are based on the number of participating organisations and approximate, since there are stakeholders with notable overlap in industries.



FI-WARE: Collaborating with Usage Area Projects



Envirofi:
environmental data
in the public domain



Finest:
increasing efficiency
in international
logistics value-chains

Safety: Making cities
saber



SmartAgriFood: Making
the food value chain
smarter



Instant Mobility:
using FI in personal
mobility



Finseny:
Reaping the
benefits of
electricity
management at
community level



Fi-content:
networked media
including gaming



Outsmart:
making public
infrastructure in
urban areas more
intelligent and
efficient



FI-Ware

FI-PPP Use Case Projects Sites



Future Internet vs. Smart Cities

- Future Internet is “a socio-technical system comprising Internet-accessible information and services, coupled to the physical environment and human behavior, and supporting smart applications of societal importance”
- FI can transform a Smart City into an open innovation platform supporting vertical domain of business applications built upon horizontal enabling technologies.
- FI pillars for a Smart City environment:
 - The Internet of Things (IoS): defined as a global network infrastructure based on standard and interoperable communication protocols where physical and virtual “things” are seamlessly integrated into the information network
 - The Internet of Services (IoS): flexible, open and standardized enablers that facilitate the harmonization of various applications into interoperable services as well as the use of semantics for the understanding, combination and processing of data and information from different service providers, sources and formats.
 - The Internet of People (IoP): envisaged as people becoming part of ubiquitous intelligent networks having the potential to seamlessly connect, interact and exchange information about themselves and their social context and environment.



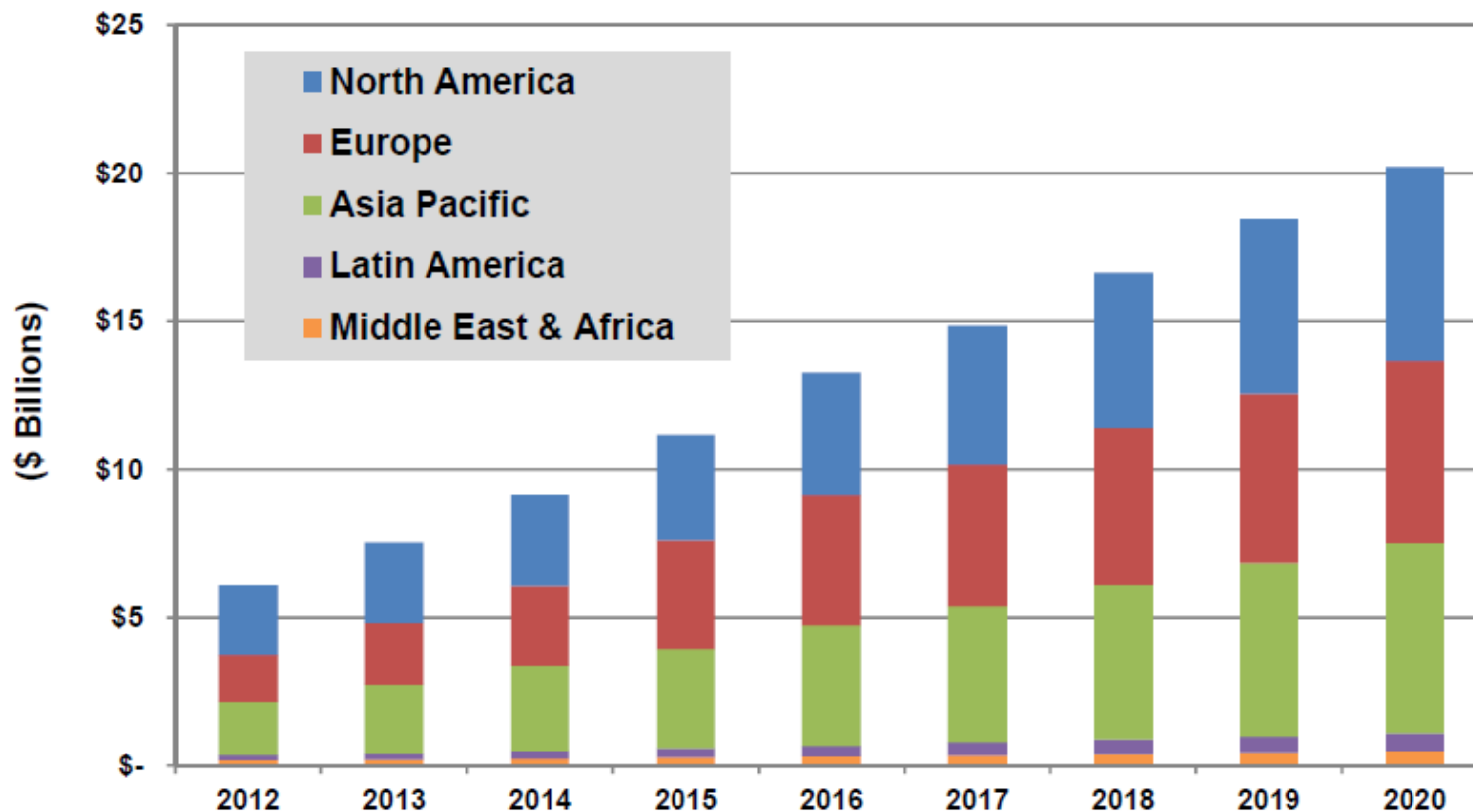
Smart Cities

- The Smart City can be defined as the integration of technology into a strategic approach to sustainability, citizen well-being, and economic development. Any adequate model for the smart city must be multi-dimensional, encompassing different aspects of “smartness” and stressing the importance of integration and interaction across multiple domains.
- “Smart Cities” are environments of open and user driven innovation for experimenting and validating Future Internet-enabled services.
- Smart Cities Technology links to FI, the Internet of Things, and M2M.

As cities are defined as ‘systems of systems’, there is no **one** Smart Cities market:
-There are Smart Cities segments, ecosystems, and subsystems



Smart City Technology Annual Revenue by Region, World Markets: 2012-2020



(Source: Pike Research)

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Smart City Vision – Information and Communication is Key

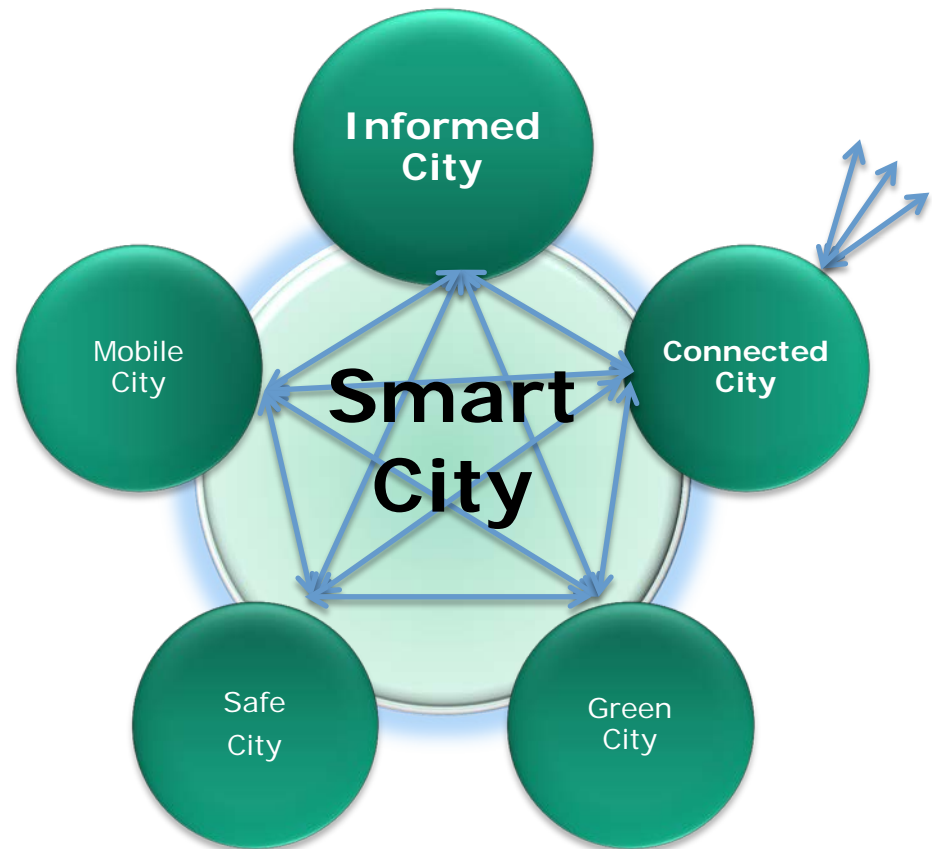
- City as **service provider**

for citizens, enterprises,
institutions, and tourists

- Smartness via

**Always Best Informed
and Inter-Connected
Urban Actors** (Machines,
Systems and People)

Information at any need,
at any place, at any
device, at any time, at any
preference

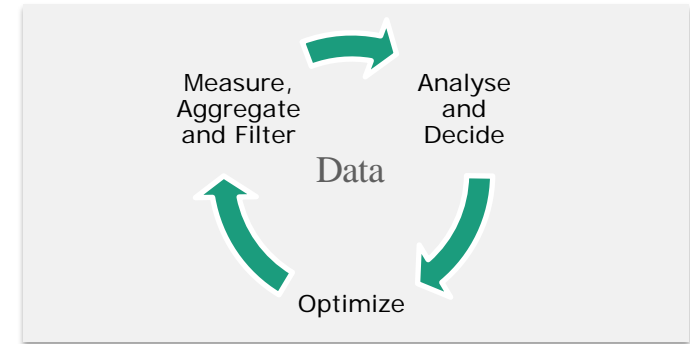
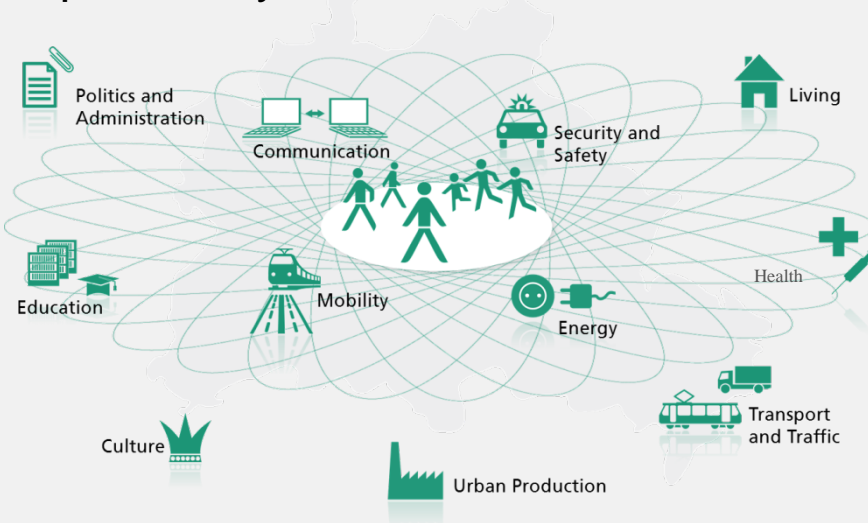


Smart Cities require a common service and network Infrastructure

City is a system of systems



Effectivity and efficiency results from optimized integration / federation of separated systems

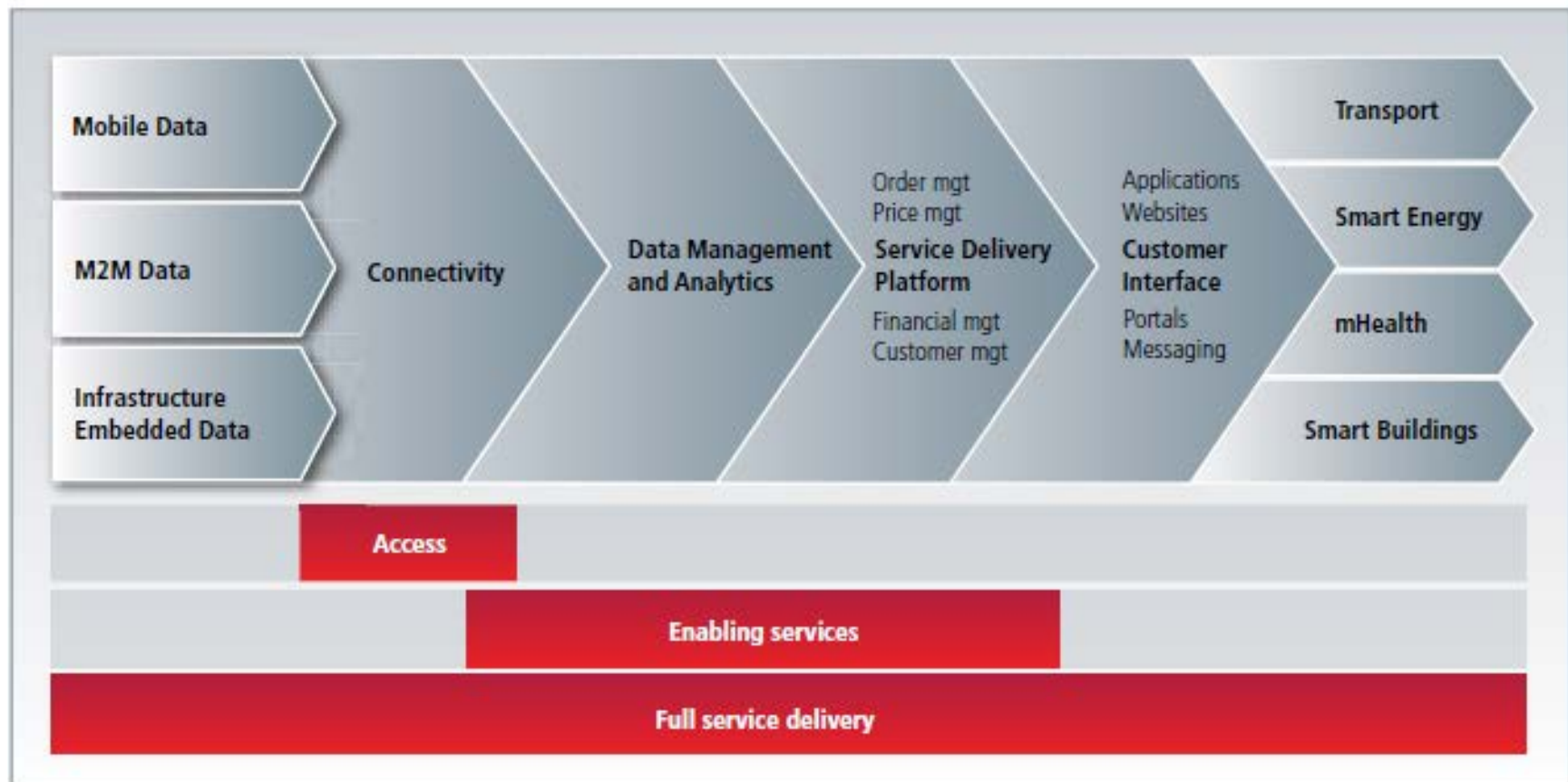


**as Enabler and Integrator for
ICT-based Solutions**

- FOKUS Smart Cities Portal, Sept. 2011
- acatech Position Paper: „Smart Cities“, Jan. 2011.
- Münchener Kreis Smart Cities Conference in Berlin, July 2010



The Smart Cities Value Chain

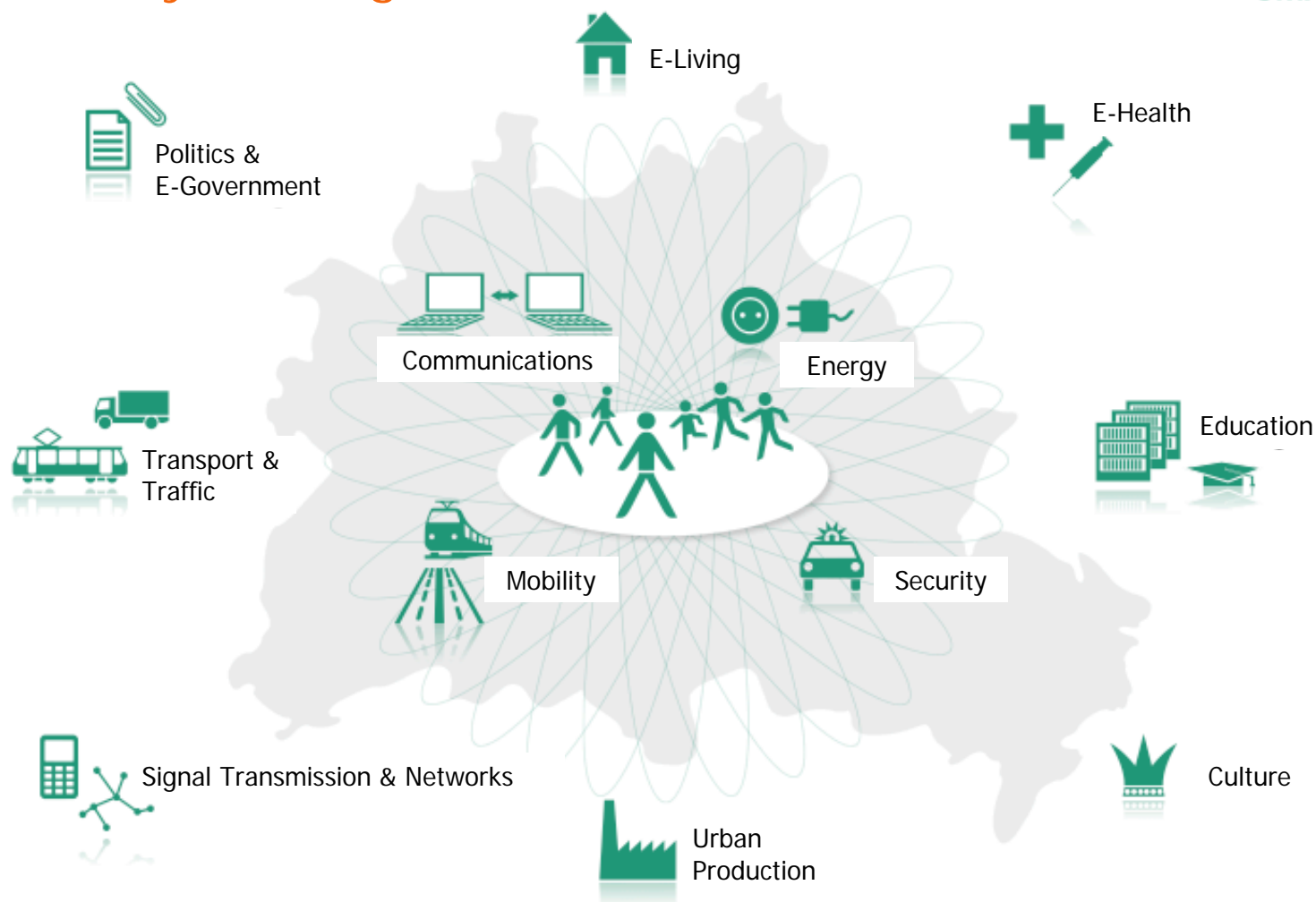


Source: Accenture



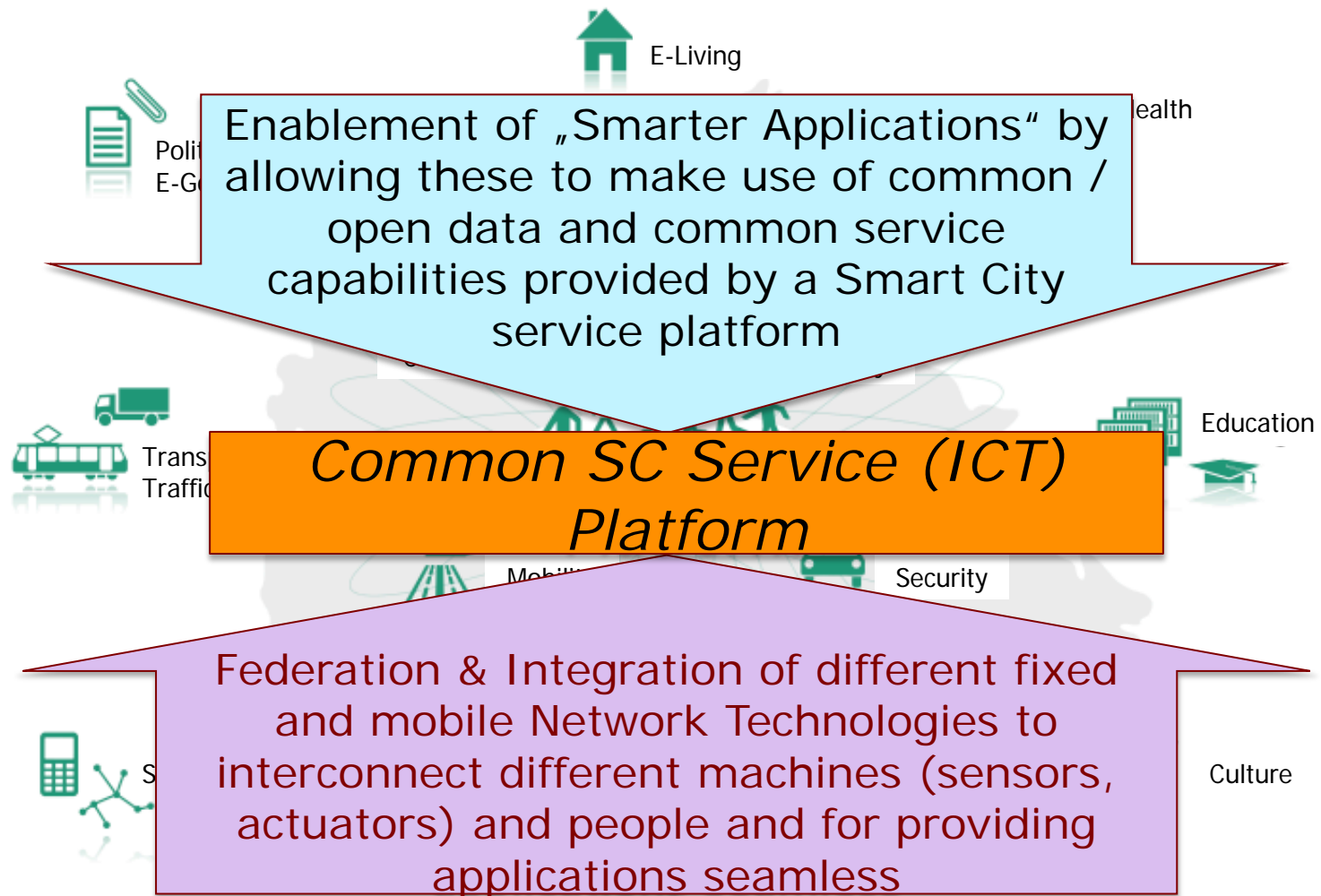
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A Smart City relies on Integration & Federation of Systems

Convergence will lead to a Common SC Service (ICT) Platform



Functional Requirements for a Smart City Platform

Communication Enablers & Sectors

Enabling Services		Business / Collaborat ion	Leisure time communicati on	E-Health	Utilities	Facility Management	E-Energy	Logistics
Machine-2- machine	Retrieve data			X	X	X	X	X
	Control devices			X	X	X	X	X
	Send data			X	X	X	X	X
Human-2-human	A/V Call	X	X	X	X	X		
	A/V conference	X		X	X	X		
	Messaging / File transfer	X	X	X	X	X		
	Presence	X	X			X		X
	Location	X	X	X	X	X	X	X
	Address Book	X				X		
Overarching enablers	QoS	X	X	X	X	X		
	Device/ent ity mgmt	X	X	X	X	X	X	X
	Security	X	X	X	X	X	X	X

Example Use Case: In-Depth Analysis Facility Management

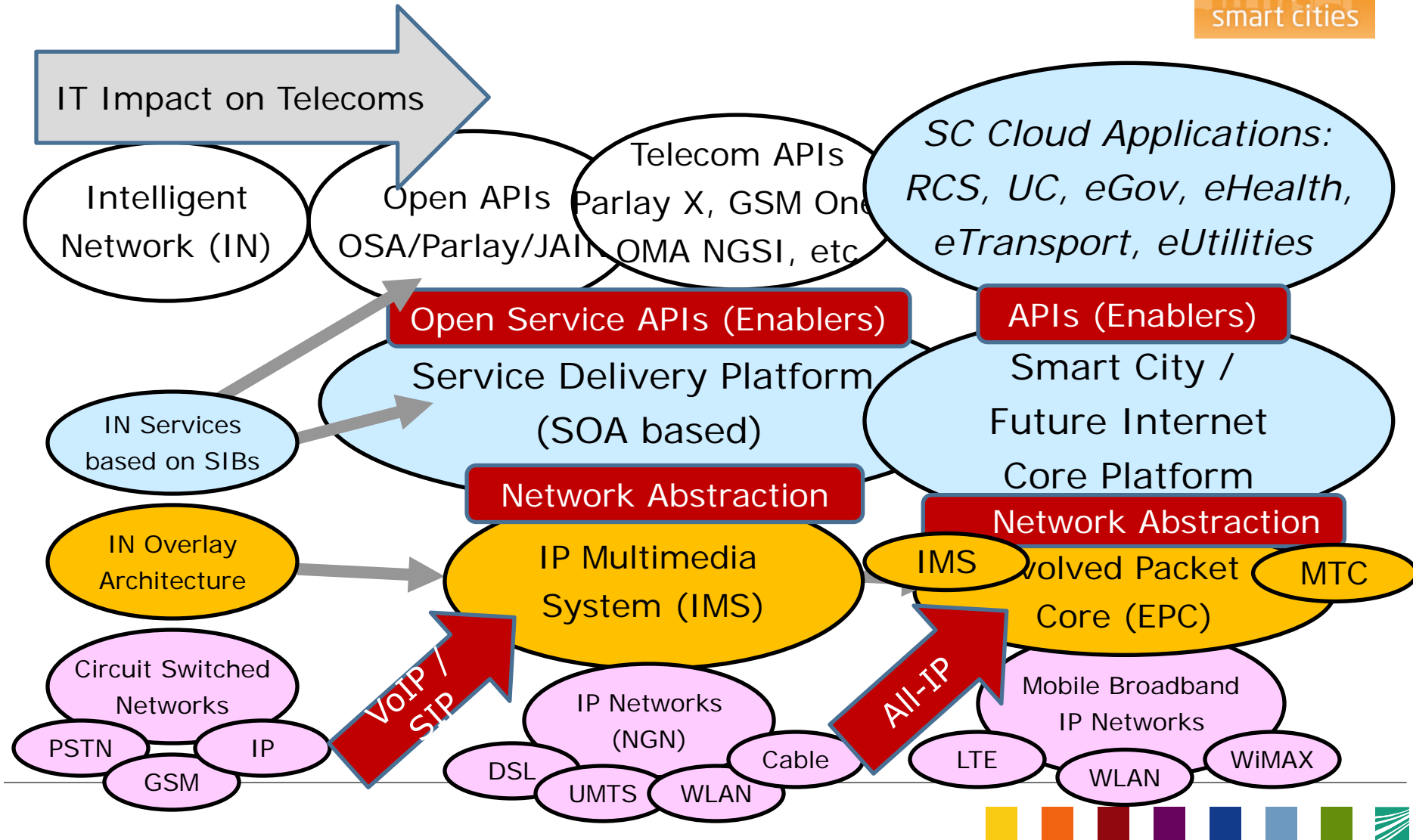
Facility Management		Video surveillance	Utility Metering	Condition monitoring (temp., humidity, etc.)	Automation (light, air conditioning, etc.)	Alarm system monitoring
Machine-2-machine	Retrieve data	X	X	X	X	X
	Control devices				X	X
	Send data				X	X
Human-2-human	A/V Call	X				X
	A/V conference					X
	Messaging / File transfer		X			
	Presence	X				X
	Location	X	X	X	X	X
	Address Book	X		X		
Overarching enablers	QoS	X		X	X	X
	Device/entity mgmt	X	X		X	X
	Security	X	X	X	X	X



Agenda

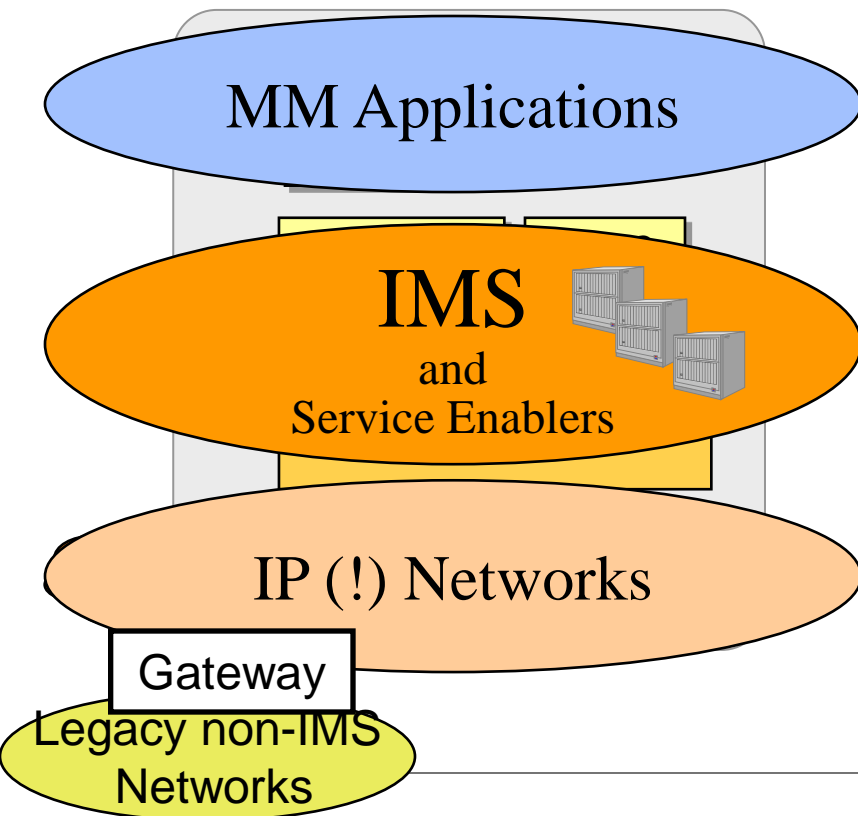
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Evolution of Telecommunication Platforms toward Smart Communications



IMS Architecture Principles

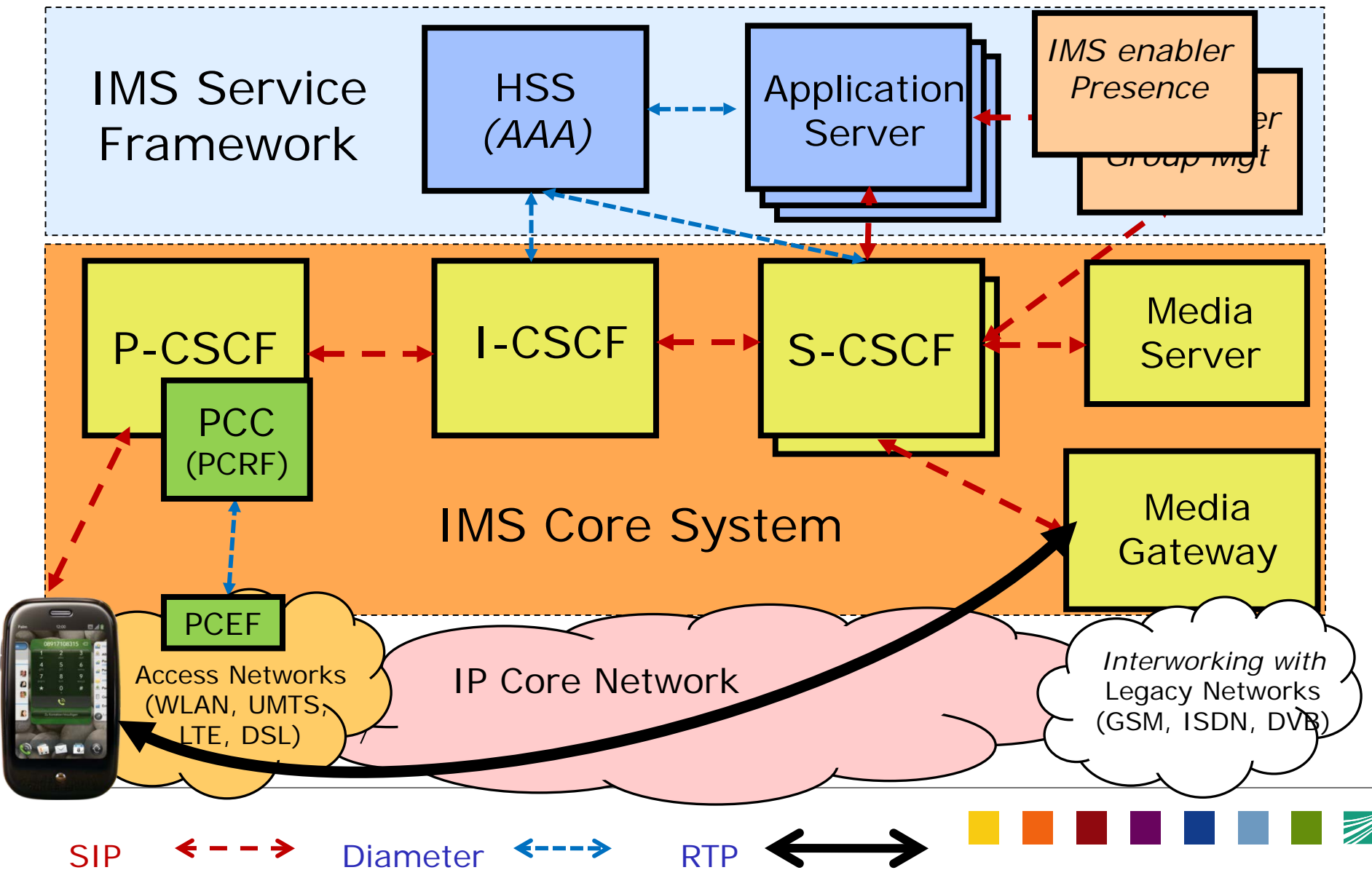
- IMS does NOT standardise specific services, but enablers
- BUT supports inherently multimedia over IP, VoIP, IM, presence (SIP)
- IMS enables the flexibility in providing IP-based applications !!



- Horizontal Architecture defining a "docking station" for applications
- Defines service enabler capabilities
- Build on existing IETF and telco SDP standards
- Provides compared to standard internet
- Better security, Service based QoS, flexible charging and single sign on



3GPP IMS Architecture: IMS Core and Application Layer



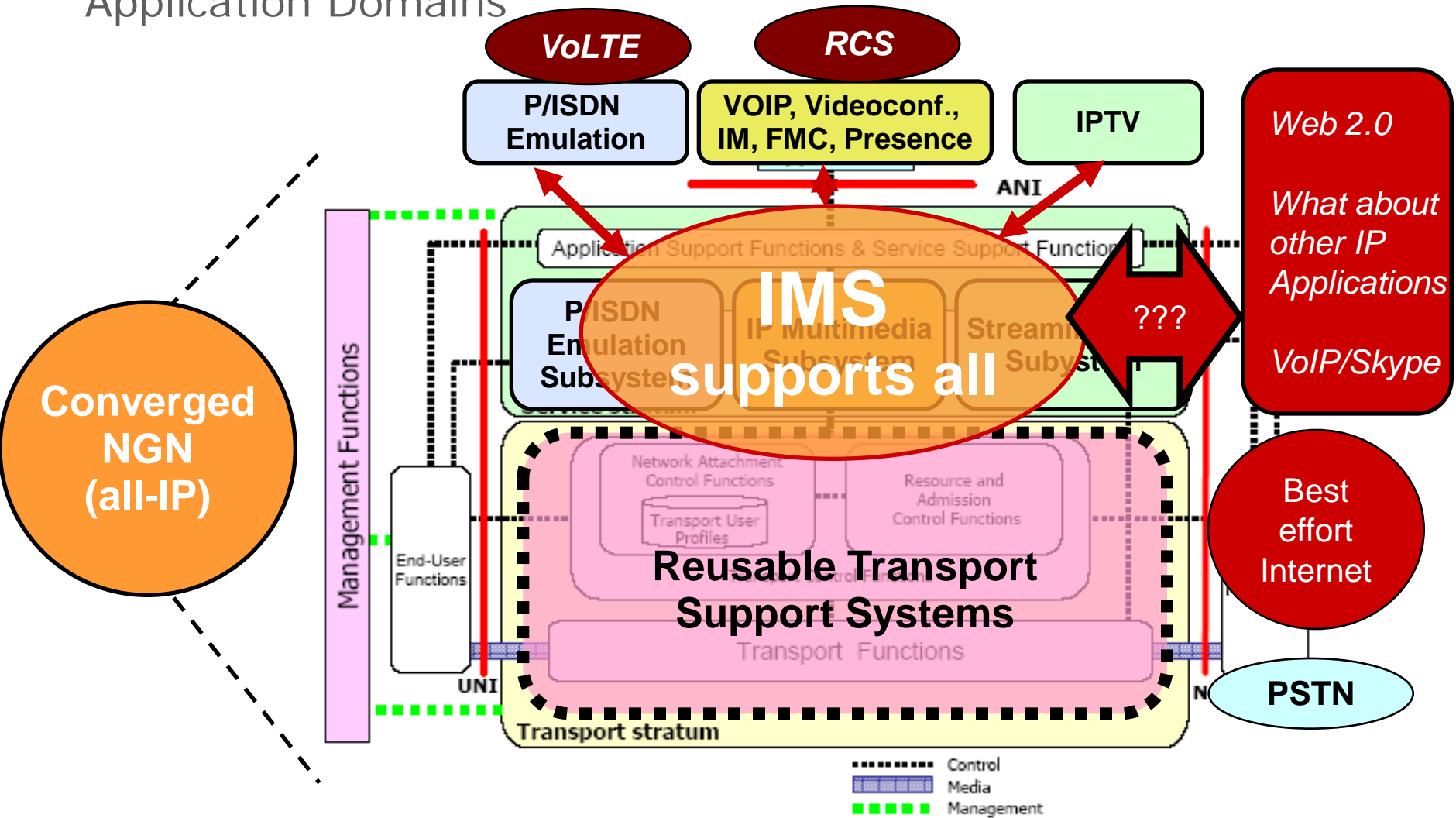
IMS Road Map

IMS Deployment Roadmap								
2005	2006	2007	2008	2009	2010	2011	2012	2013-2014
IMS Reaches Trial Stage The bulk of HSS, CSCF, BGCF, PSTN gateways, and application server (mainly voice app server) equipment move from lab testing to field trials, some moving to services by the end of 2007			IMS Networks Emerge IMS deployments consist of an HSS and a CSCF to support fixed-line VoIP services deployed by both large incumbents expanding out of their home turf, and mobile operators jumping into the fixed line business			IMS Deployments Ramp Up Large fixed-line incumbents continue to migrate their infrastructure from PSTN to TISPAN. Mobile operators begin to deploy IMS with the adoption of RCS in 2010 and the migration of their mobile infrastructure to LTE, with massive IMS deployments expected in 2012.		

Source: Infonetics

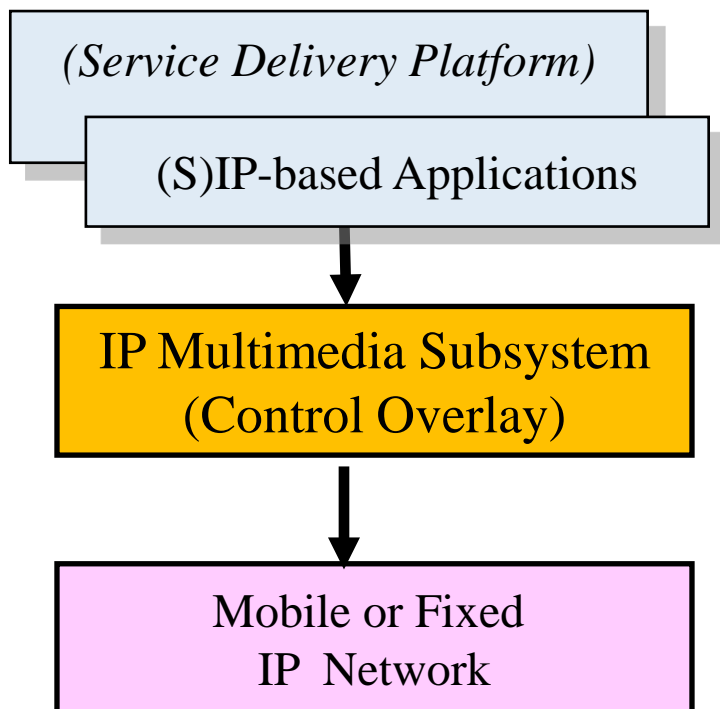
Industry expects IMS deployment to ramp up, driven by PSTN migration from fixed line operators and migration to LTE together with RCS adoption from operators

IMS is the common control platform within the NGN for many Application Domains

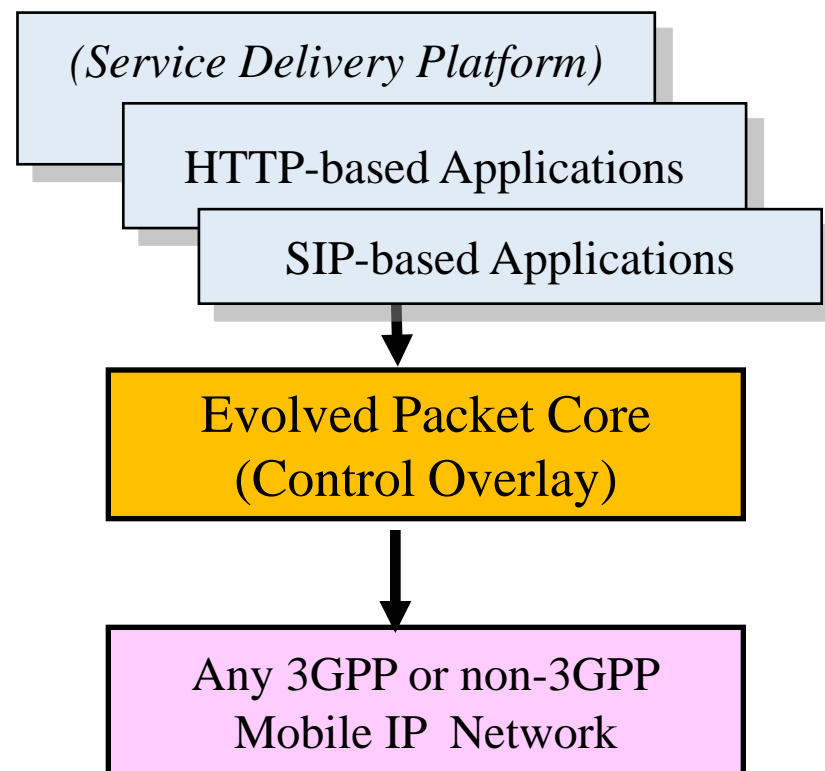


IMS Concept Evolution toward EPC

Main Idea: Common Control Overlay Architecture abstracts from underlying IP network technology and provides common platform capabilities for any IP-based Applications / Services



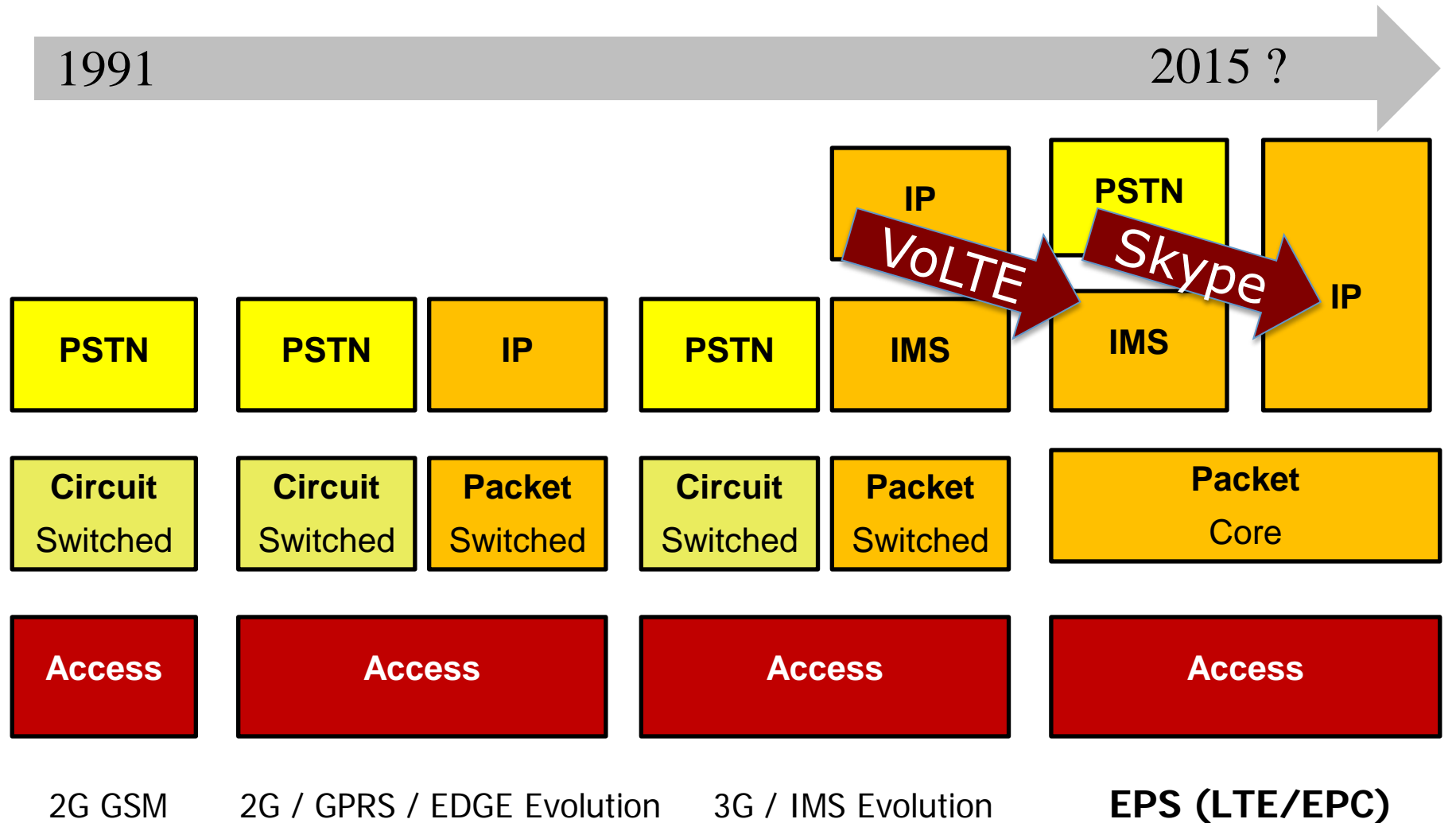
Packet Switched Telco Domain (NGN)



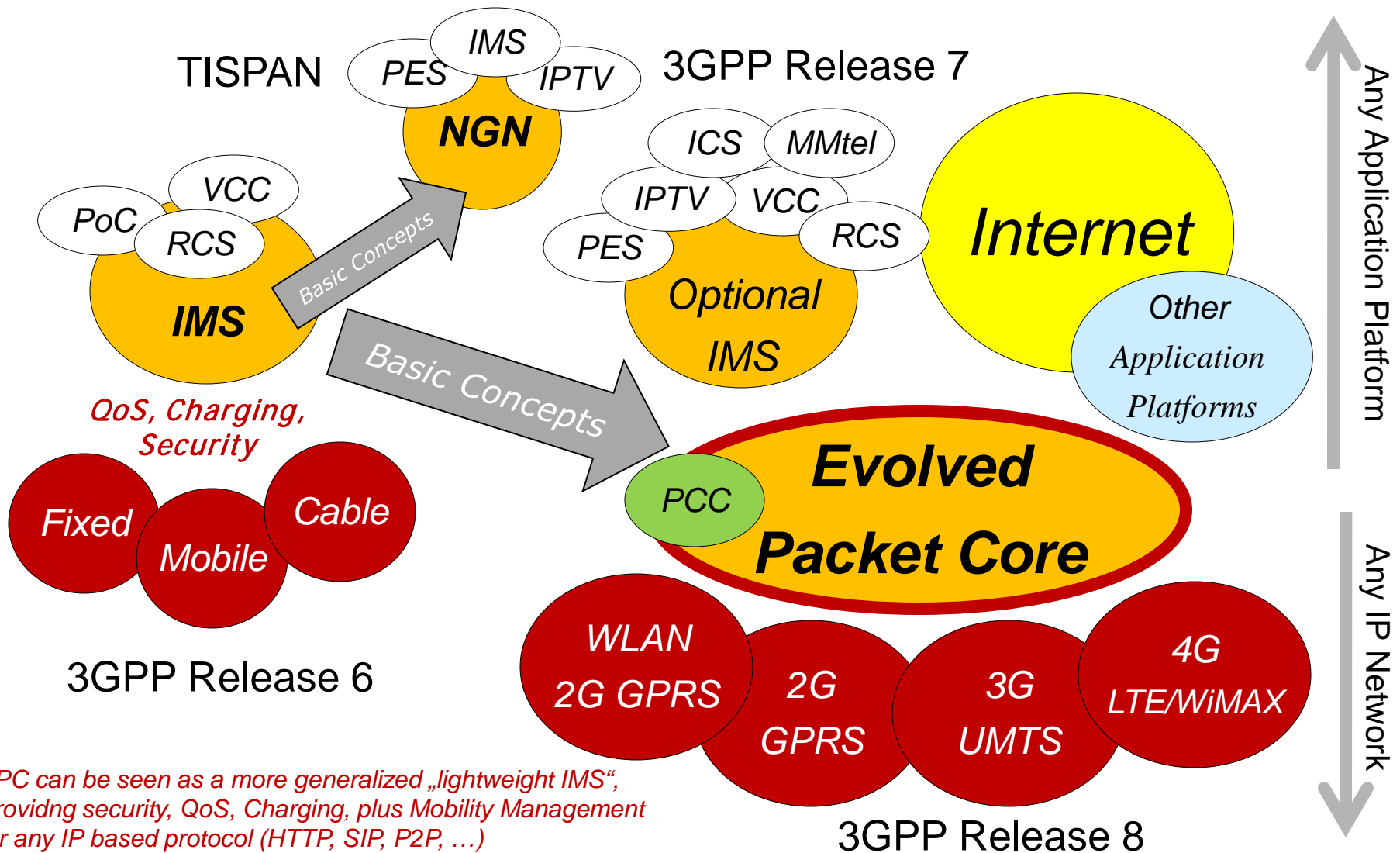
Mobile Packet Switched Telco Domain



Mobile Network Architecture Evolution

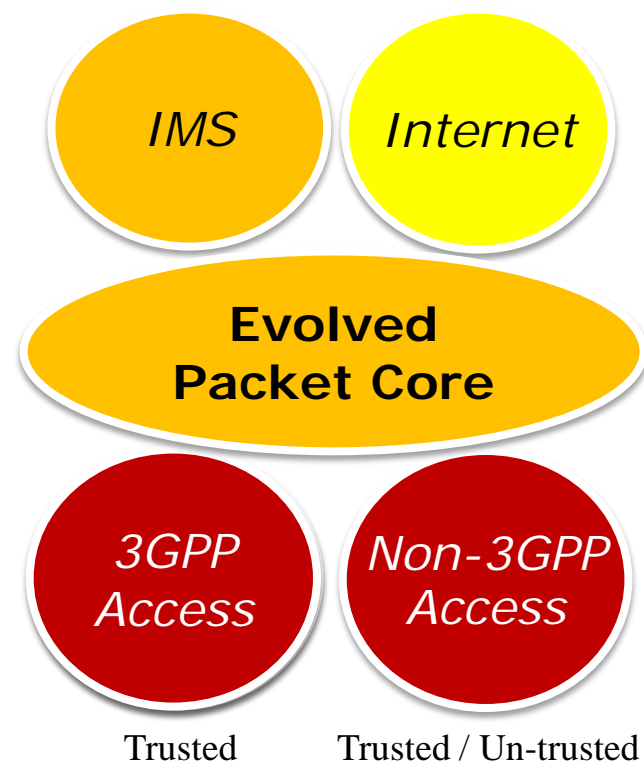


Concept Reuse: From IMS for NGN to EPC for all-IP

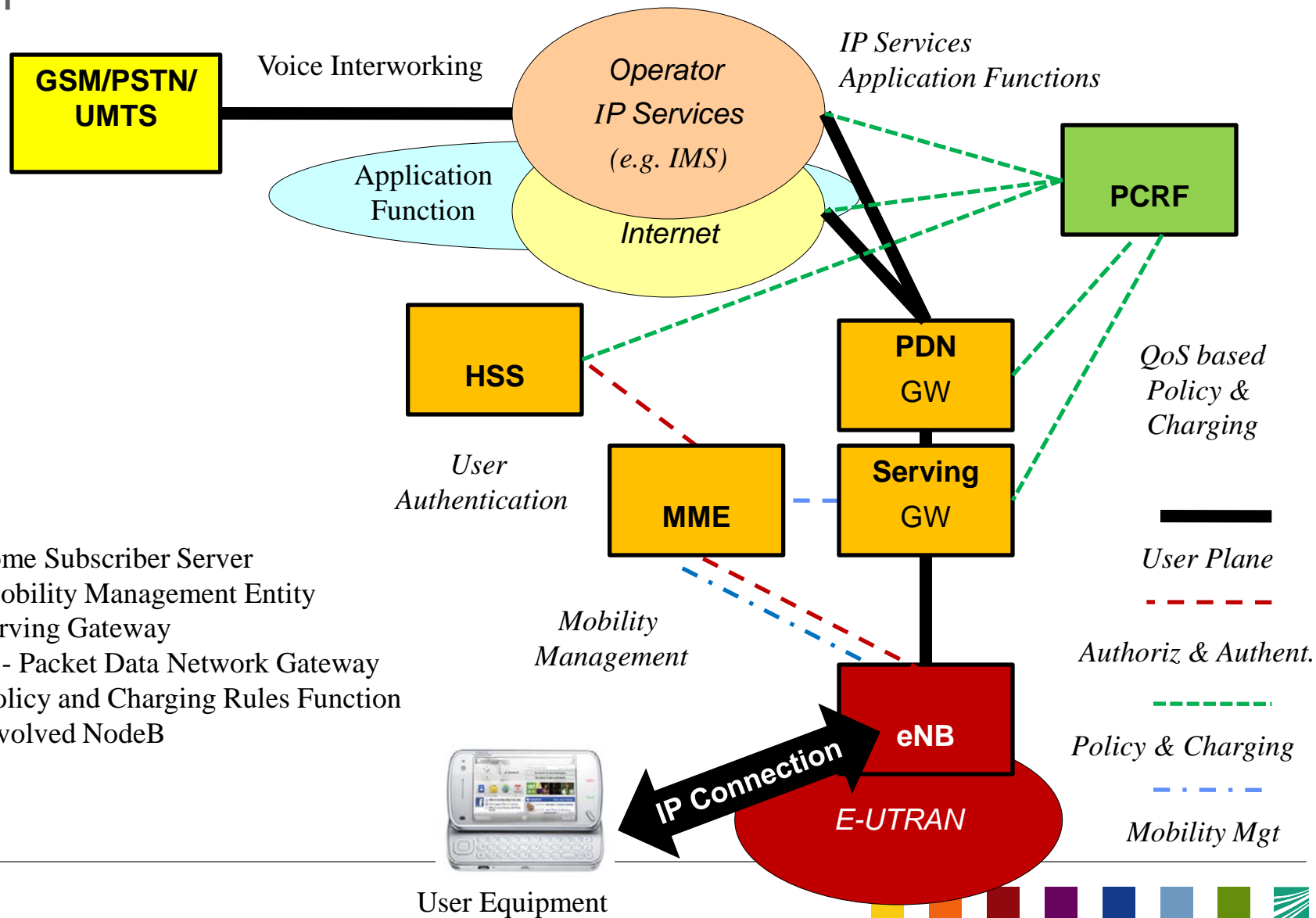


3GPP Evolved Packet Core (EPC)

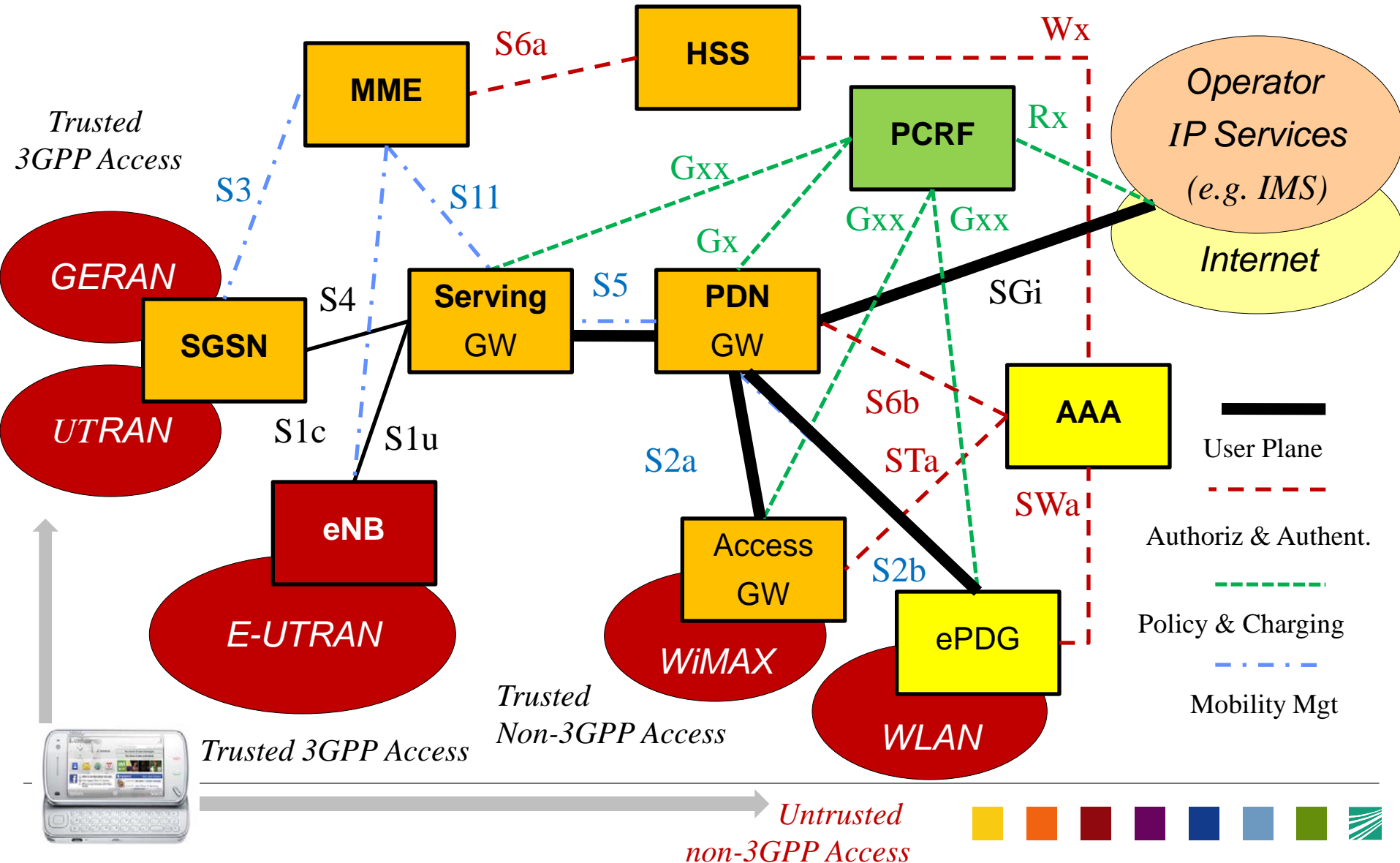
- The EPC is a multi-access core network architecture based on the Internet Protocol (IP) common for:
 - 3GPP access networks (LTE-A, LTE, HSPA+, UMTS, GPRS)
 - Non-3GPP access networks
 - Trusted networks (cdma2000, WiMAX)
 - Un-trusted networks (WiFi)
- EPC provides **connectivity** to IP service domains
 - IMS
 - Internet or other (M2M, Cloud, P2P etc.)
- The enhanced IP connectivity features include:
 - Authentication and authorization
 - Secure communication
 - Transparent mobility management
 - Connectivity management support
 - Policy based QoS and charging



Simplified EPC Architecture



Full EPC Architecture

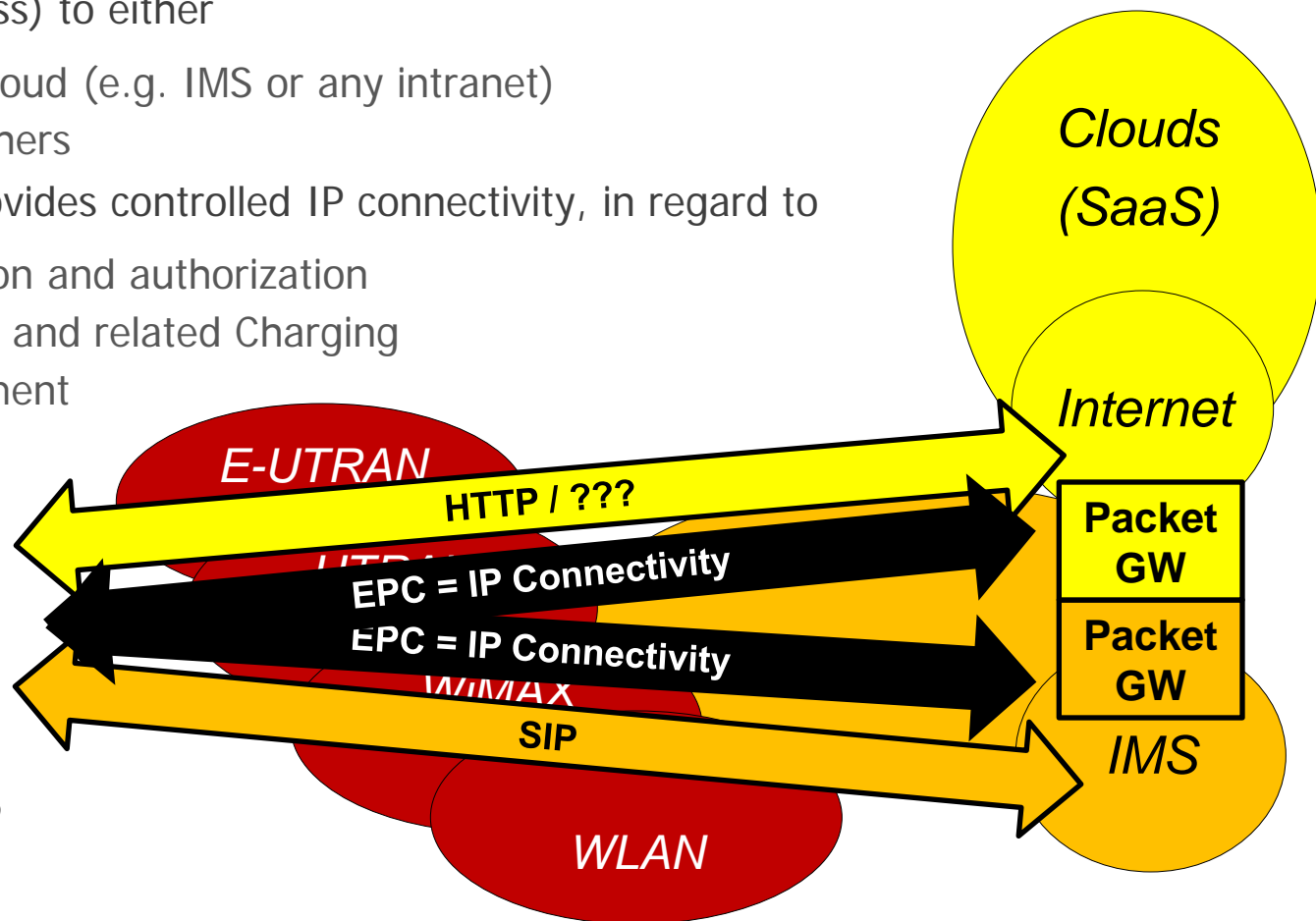


EPC Capabilities = Seamless IP Connectivity (= ABC)

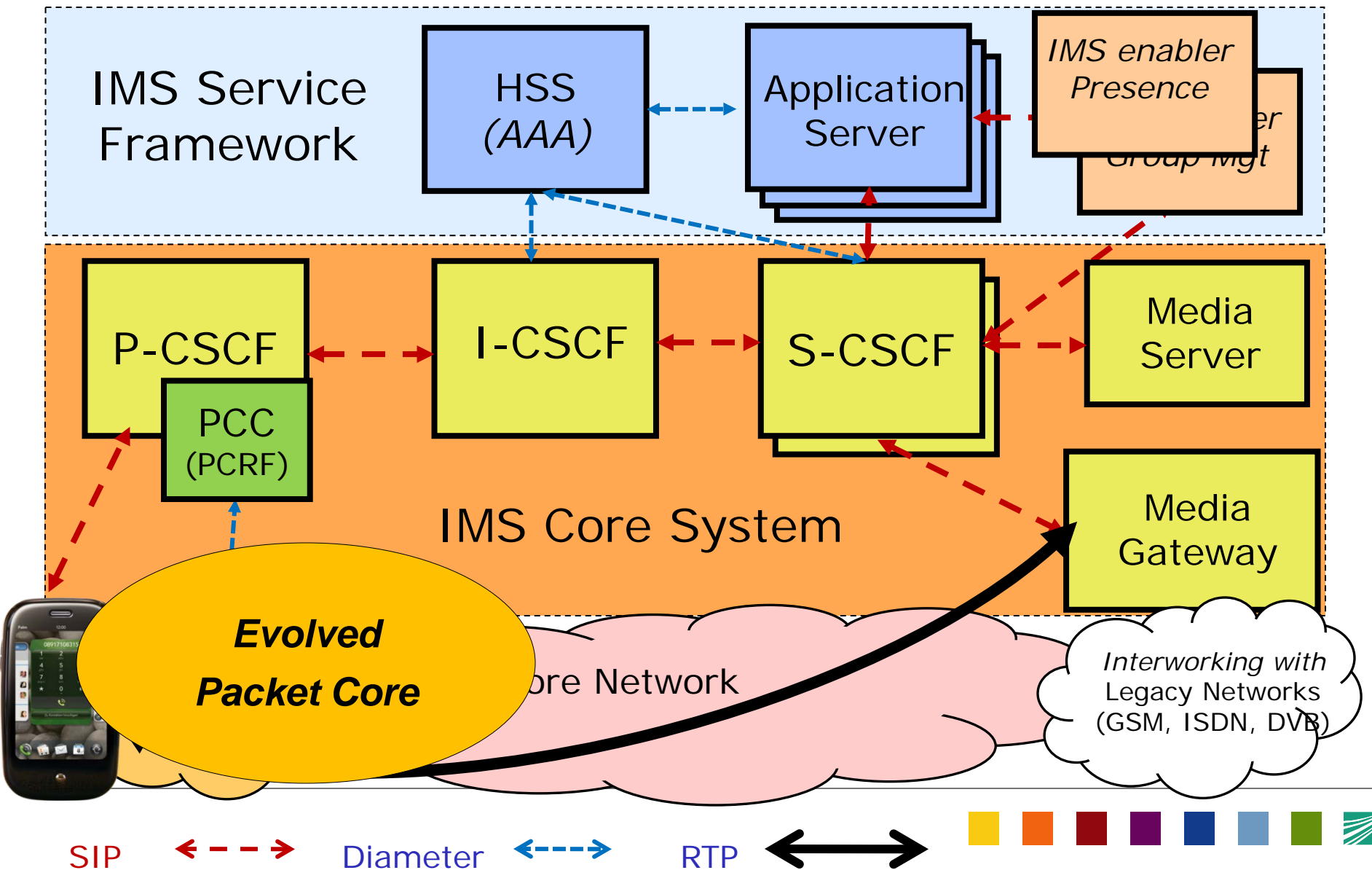
- The EPC allows multiple access networks to be connected in a controlled way (secure, QoS, seamless) to either
 - the operator IP cloud (e.g. IMS or any intranet)
 - the internet or others
- Note that the EPC provides controlled IP connectivity, in regard to
 - User authentication and authorization
 - Quality of Service and related Charging
 - Mobility Management



User Equipment
may be connected to
several IP service
domains in parallel



3GPP IMS Architecture: IMS Core and Application Layer



Automotive



Security



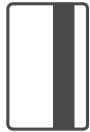
Tracking & Tracing



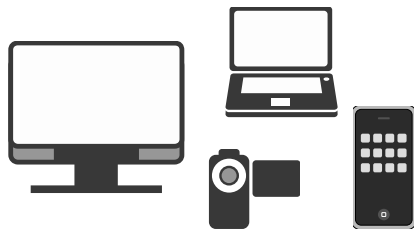
Healthcare



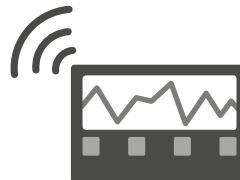
Payment



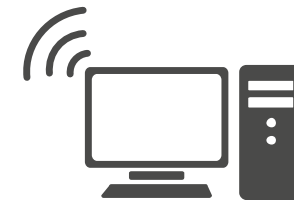
M2M Segments



Consumer Electronics



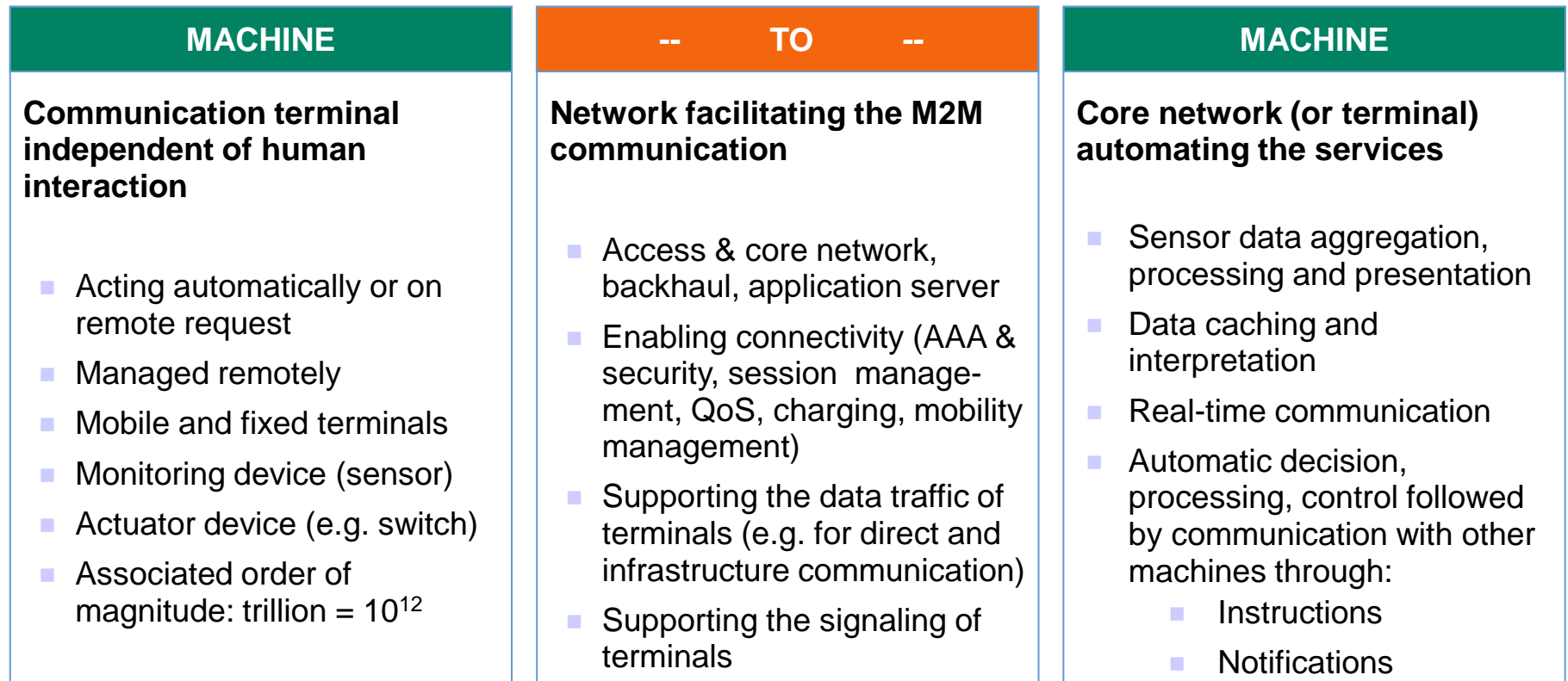
Metering



Remote Maintenance
and Control



M2M – What is this communication about ...



MTC Standard Landscape

- MTC standards address in general only one part of the M2M communication
- ETSI, OMA & 3GPP standards together develop a complete network oriented M2M communication architecture
- oneM2M is about to take off

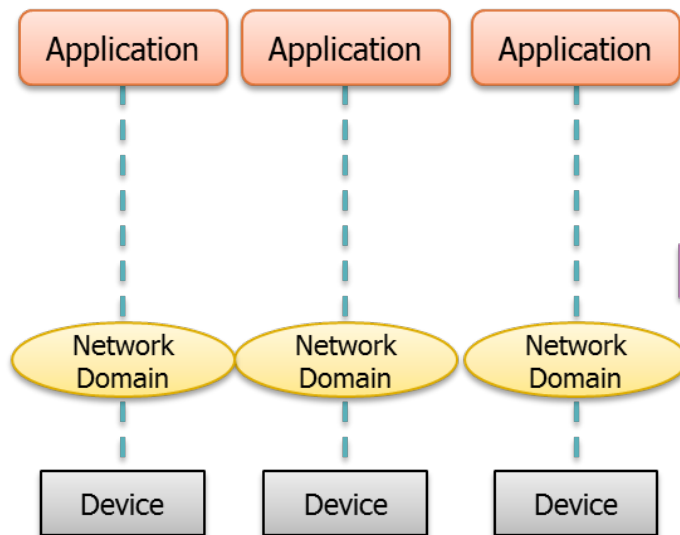
NEW:



M2M Services & Applications

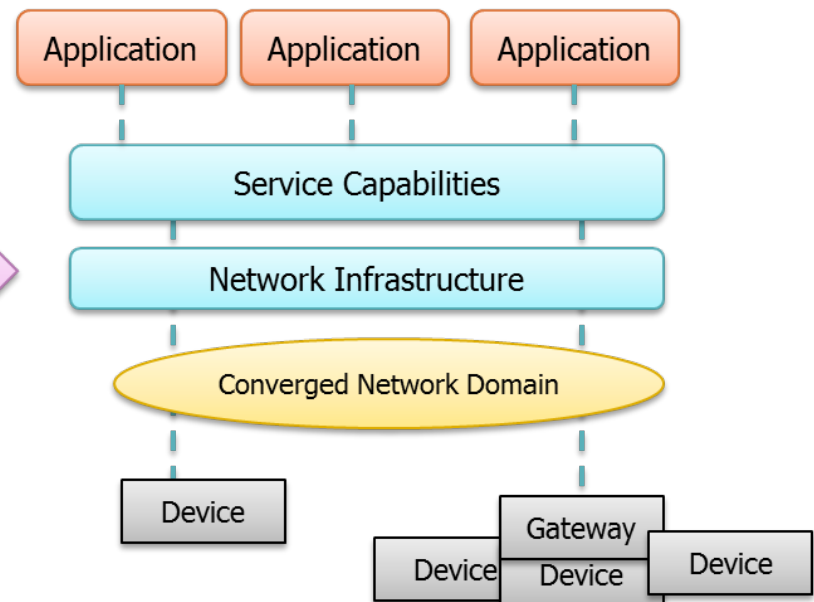
■ Today

- SMS based.
- Vertical isolated systems.
- INTRANet of Things



■ Future

- Global horizontal approach.
- INTERNet of Things.

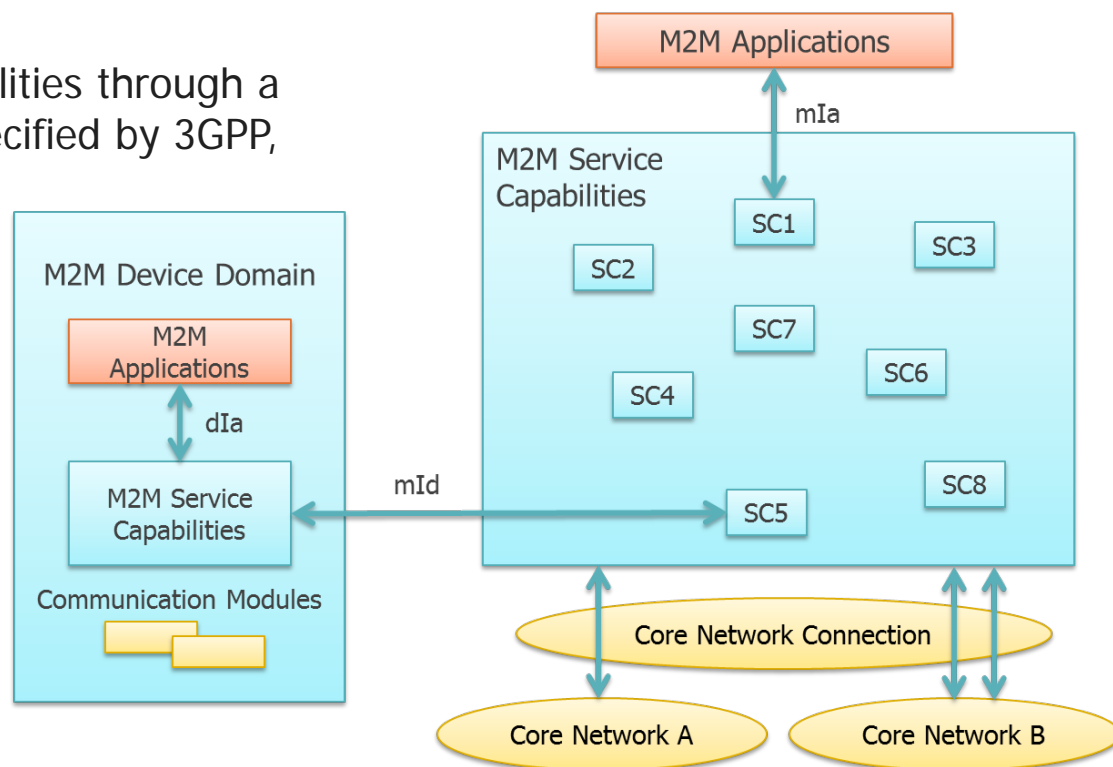


Functional Architecture Framework

- **Service Capabilities (SC):** provide functions that are shared between different M2M applications

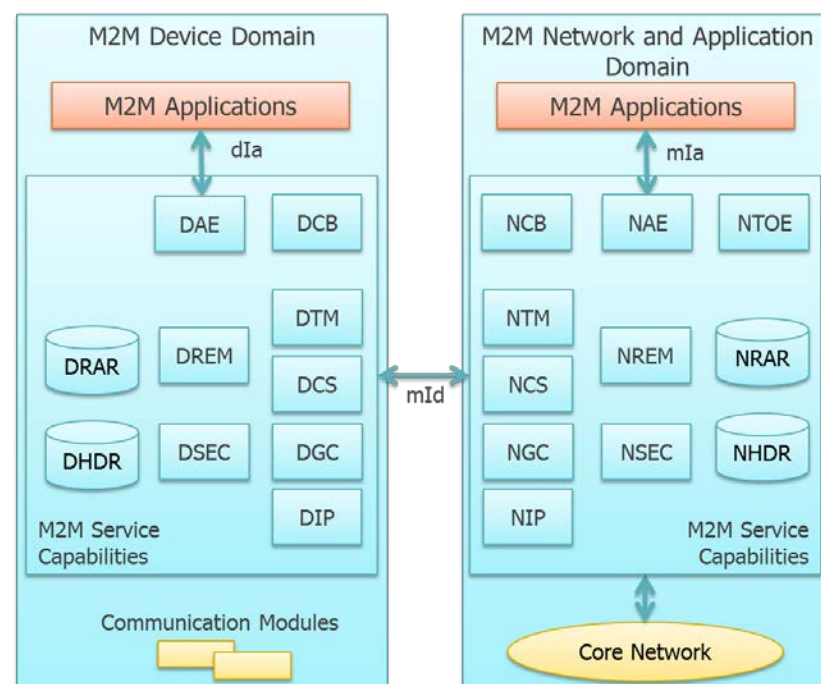
- Can use core network capabilities through a set of exposed interfaces specified by 3GPP, TISPAN, 3GPP2
- SC can involve other SCs (to be further studied)
- SC can interface with CNs

- Three interfaces are defined:
 - dIa, mIa, mId



Service Capabilities

1. Application Enablement (xAE);
2. Generic Communication (xGC);
3. Reachability, Addressing and Repository (xRAR);
4. Communication Selection (xCS);
5. Remote Entity Management (xREM);
6. SECurity (xSEC);
7. History and Data Retention (xHDR);
8. Transaction Management (xTM);
9. Telco Operator Exposure (xTOE);
10. Interworking Proxy (xIP).
11. Compensation Broker (xCB);



where x stands for: N for Network, G for Gateway, D for Device

oneM2M – New Global Organization for M2M Standardisation

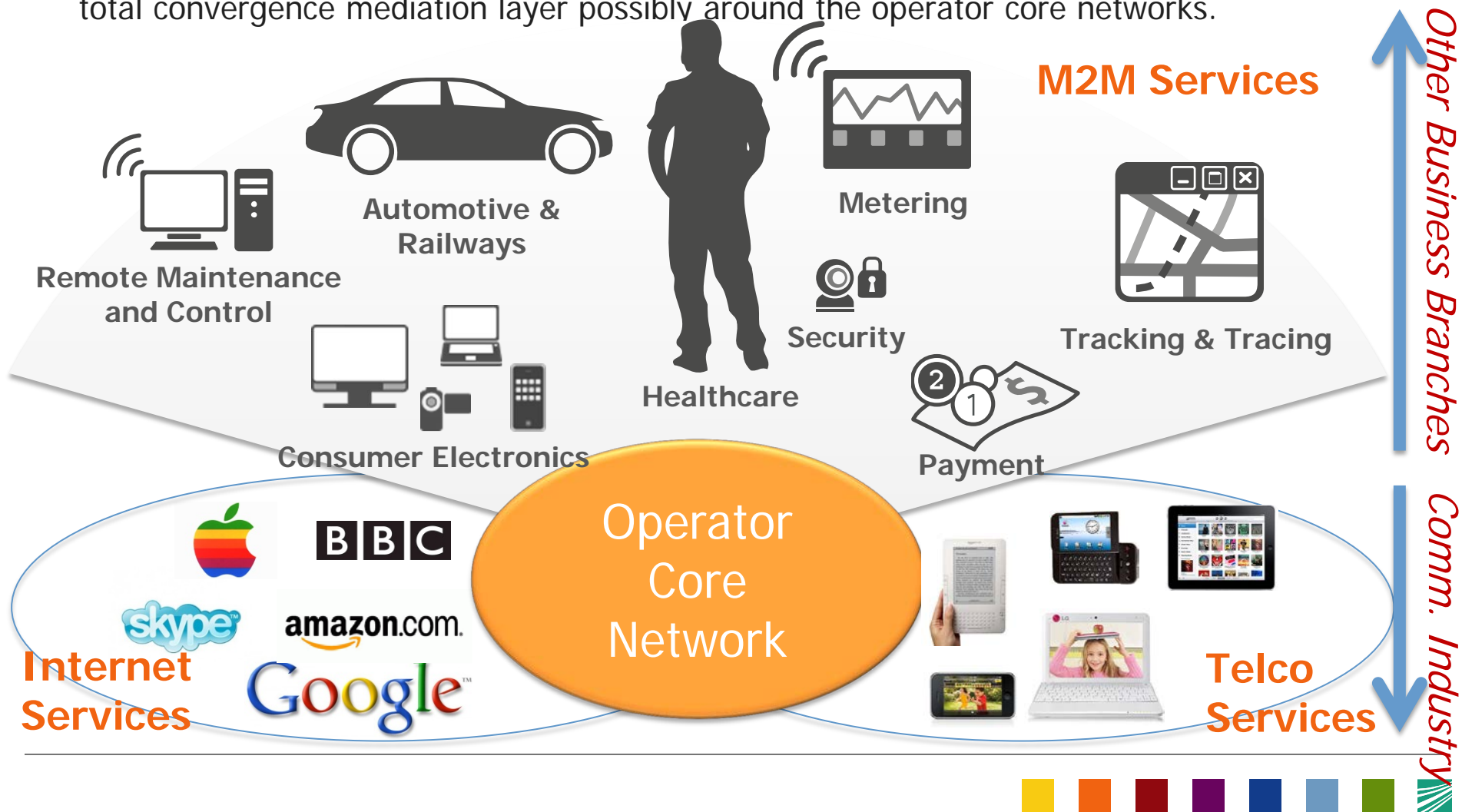
- oneM2M will develop technical specifications
 - for a common M2M Service Layer
 - to ensure the global functionality of M2M
- Allow a range of industries to take advantage of M2M technology
- Connect the myriad of devices in the field with M2M application servers worldwide
- Attract and actively involve organizations from M2M-related business domains such as: telematics and intelligent transportation, healthcare, utilities, industrial automation, smart homes, etc.

www.onem2m.org



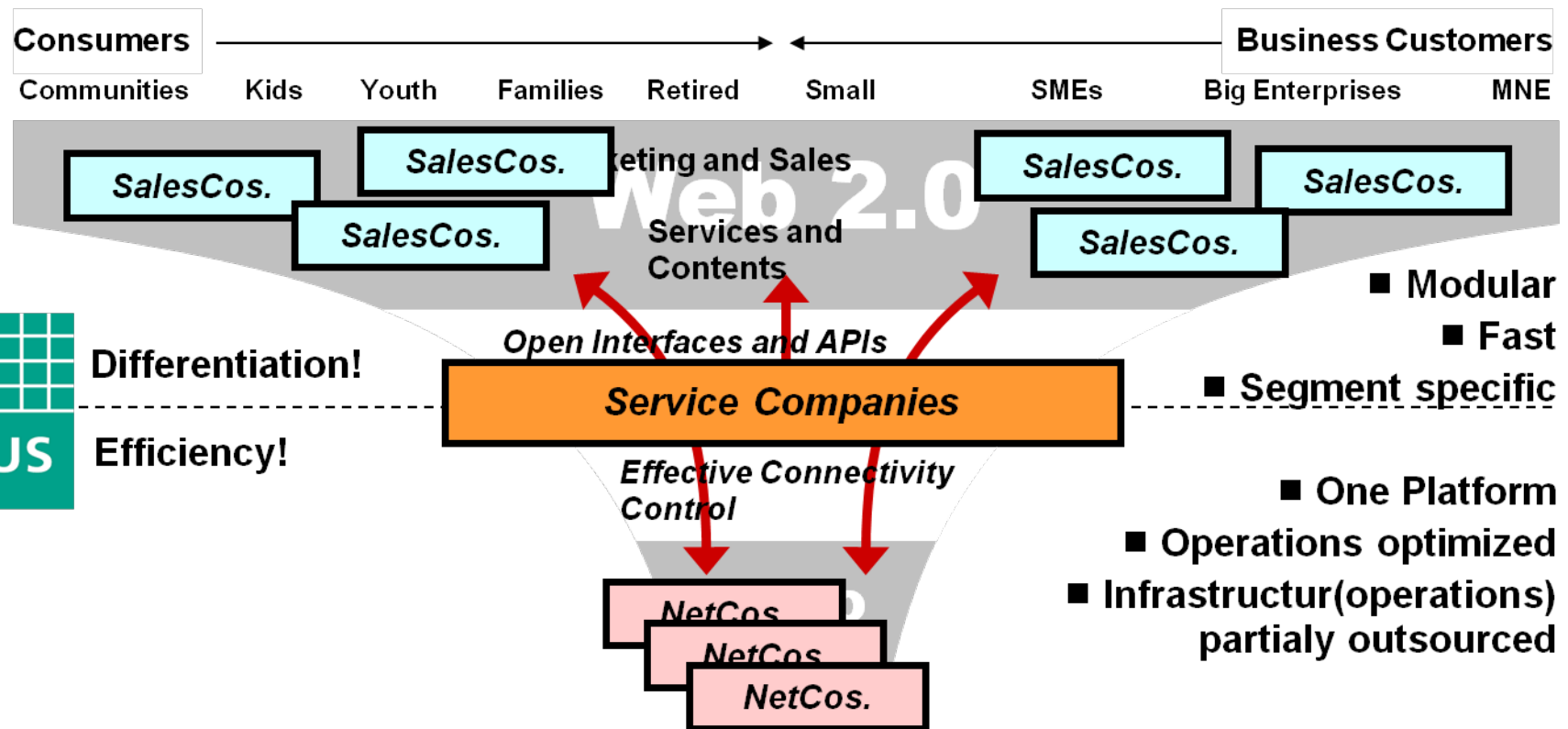
M2M – Total Convergence of Communication

The telecommunication industry and other business branches are currently merging into a total convergence mediation layer possibly around the operator core networks.

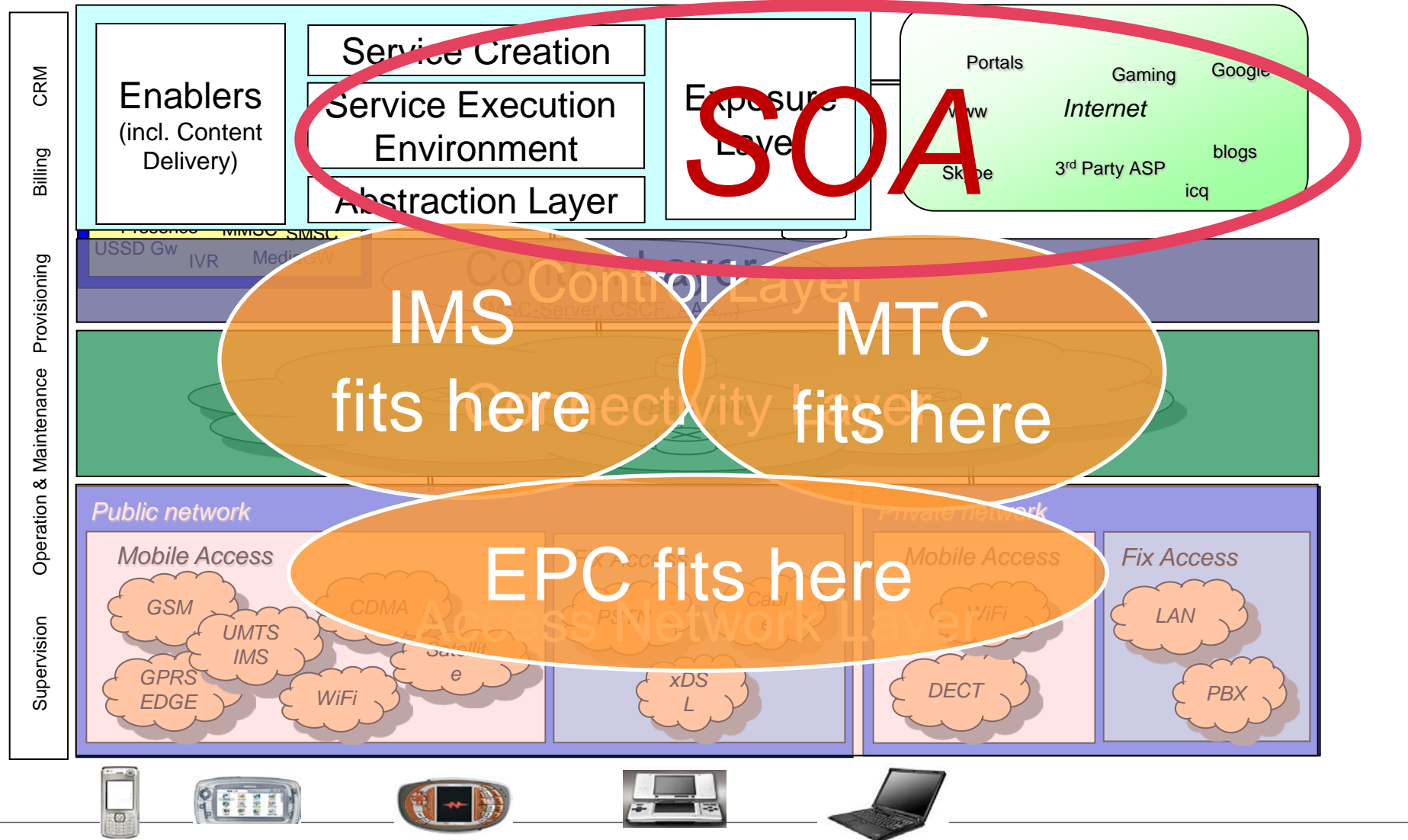


Increasing Service Diversity requires Abstractions & Partnering

Strategy of the broadening „T(elecoms)“: Broad top, sleek bottom



IMS, MTC and EPC Positioning within an SDP Environment



Towards APIs / Enablers in the Smart City (SC) Context ...

SC Application Providers and Services

(Universal Coms, eLogistics, eUtilities, eEnergy, eHealth, eGov...)

- Re-use what is publicly available
- Create recognised user interfaces

*Import
of
SC APIs*

*Export
Of SC
Enablers*

- Resell available capabilities
- Enable value added services

Service Brokering

SC Enablers provided by SC Core Platform

(RCS, information access, QoS, Charging, Identity Mgt., Security, M2M)

Network Abstraction

IMS + MTC + Evolved Packet Core

Sensor
Networks

Mobile IP
Network

Fixed IP
Network



Agenda

- Smart Cities as Future Internet Show Case
- Smart City communication infrastructures requirements
- *The Role of IP Multimedia Subsystem, Machine Type Communication, Evolved Packet Core and related Open APIs within emerging Smart City SDPs*
- FOKUS Toolkits and practical examples
- Summary
- Q&A



Smart City ICT

Tools & Testbeds



osims



open mtc



open epc



Smart Communications
Playground



FUSECO



FUTURE SEAMLESS COMMUNICATION

Research Agenda of Fraunhofer: Smart City Vision

Environment

Cities that produce
almost no more CO₂-Emissions.

Energy

Cities that are greatly
energy-efficient.

Resources

Cities that are profoundly
resource-efficient.

Quality of life

Cities that provide the
best life quality for all
residents.



»**Morgenstadt**«



Fraunhofer

Society

Cities that **represent a**
post-fossil society.

Smart City

Cities that **intelligently**
interlink all its potentials
and city systems.

Climate Change

Cities that can easily
adapt to the **effects of**
climate change.

E-Mobility

Cities that offer a **medium**
for the **change towards**
electromobility.

Quelle: www.big.dk

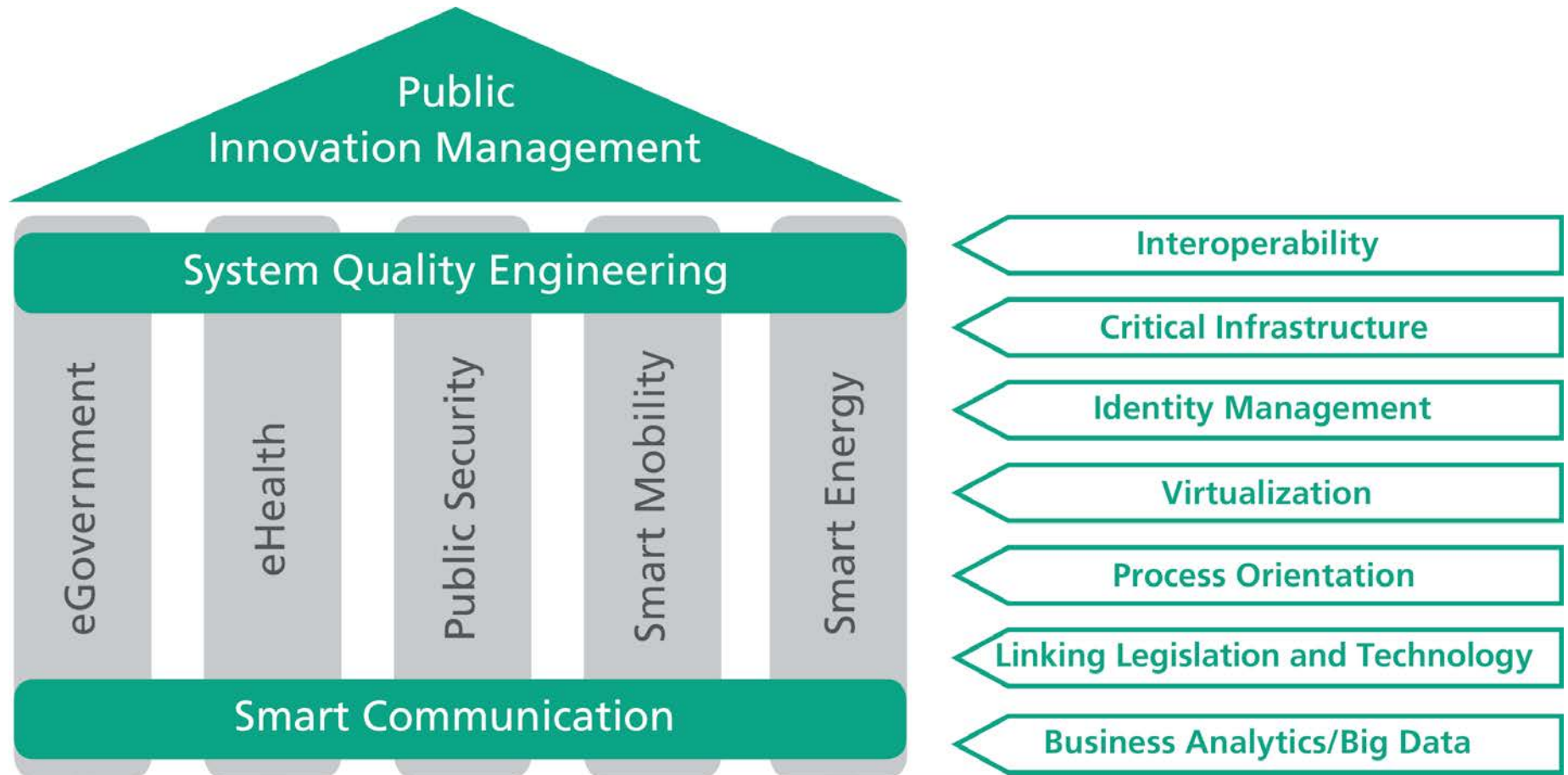
About the Fraunhofer Gesellschaft



The Fraunhofer Gesellschaft is Europe's largest organization for applied research.

- Fraunhofer develops products and processes through to technical or commercial maturity
- Individual solutions are elaborated in direct contact with the customers
- The Fraunhofer Gesellschaft maintains
 - 66 self-contained Fraunhofer Institutes throughout Germany
 - with a staff of 22, 000 scientists and engineers
 - 1.9 billion Euro annual budget
- More than 70% of funding are raised through innovative development projects, license fees and contract research
- Sub-companies and representative offices all over the world

Fraunhofer FOKUS – Activity Domains



A Smart City



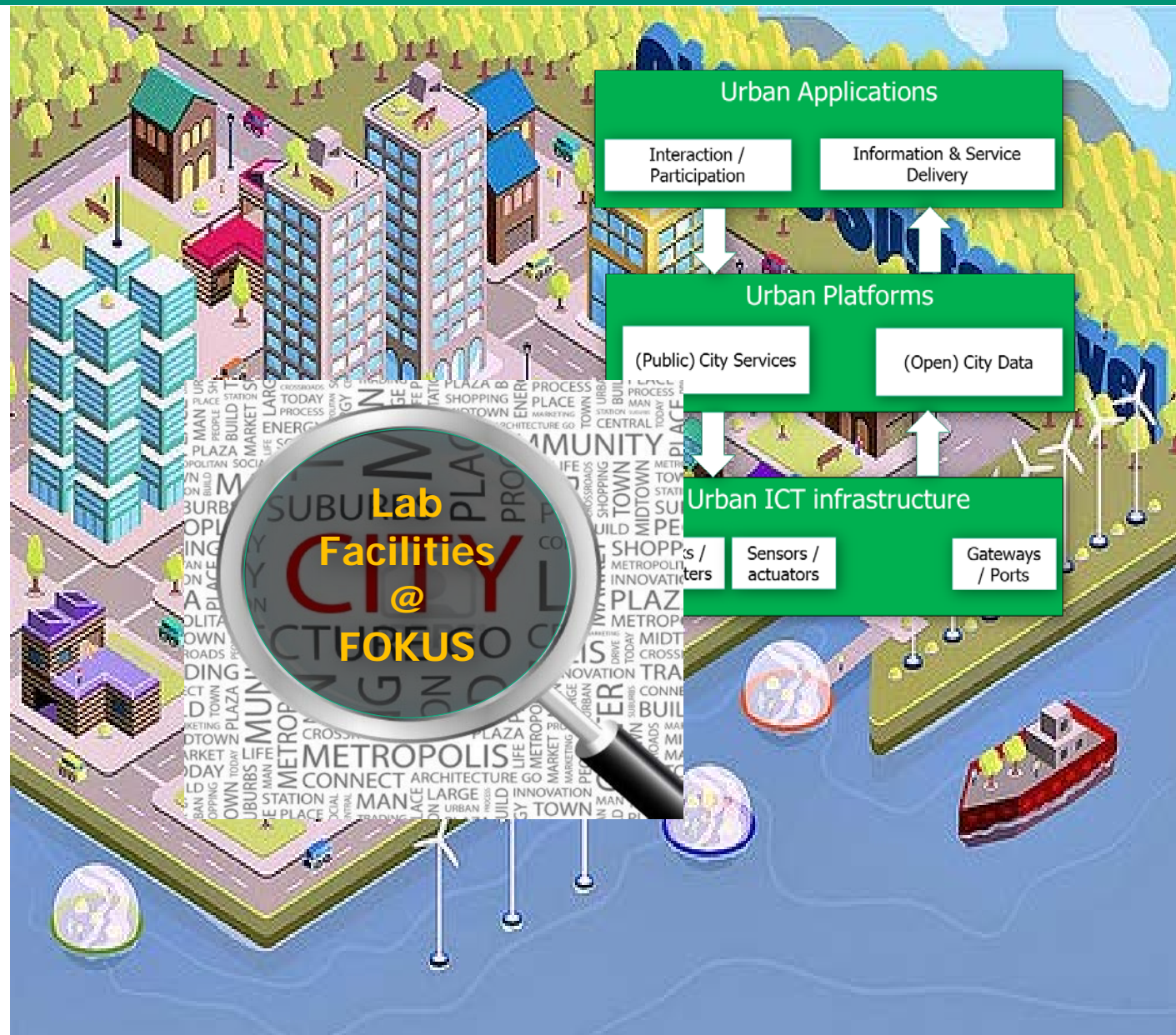
A Smart City

depends on a smart

ICT
Infra-
structure



A Smart City
depends on a
smart
ICT
Infra-structure
that is inspired
by
FOKUS
Labs



Evolution of a Smart City ICT infrastructure

A Smart City ICT infrastructure is

- a vast distributed system of systems that is
- used for providing all kind of relevant services and data
- run by multiple actors (public and private organisations)
- continuously being redesigned and improved.

Urban ICT policy

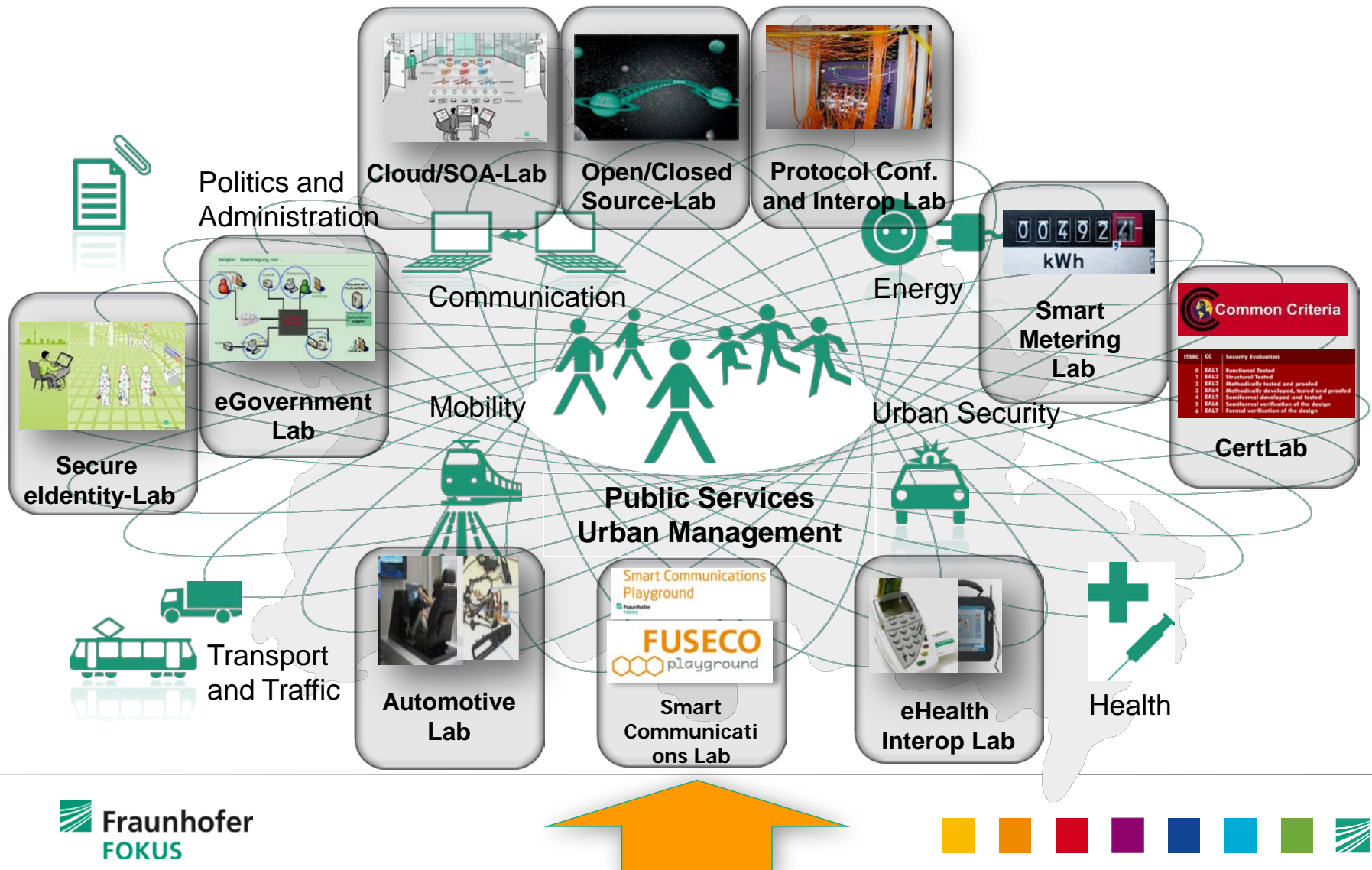


Evolution of a Smart City

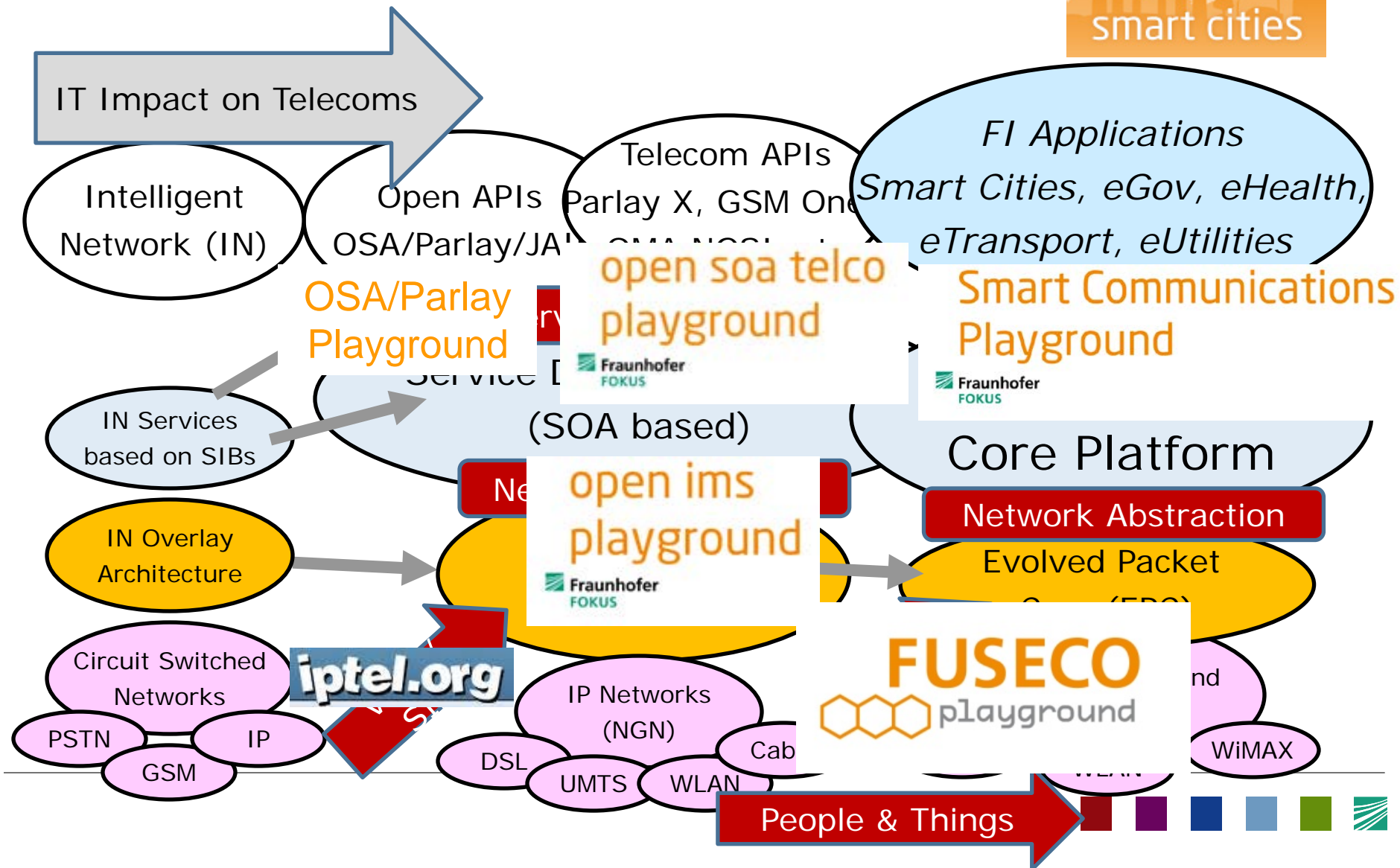


Solutions made by FOKUS

FOKUS labs on ICT in Smart Cities



Related FOKUS Testbed Evolution



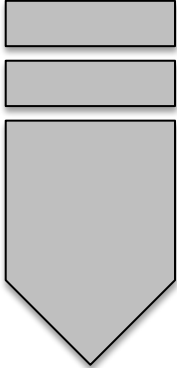
Stakeholders

Operators


Manufacturers

Application
developersResearch
institutions
and
universities

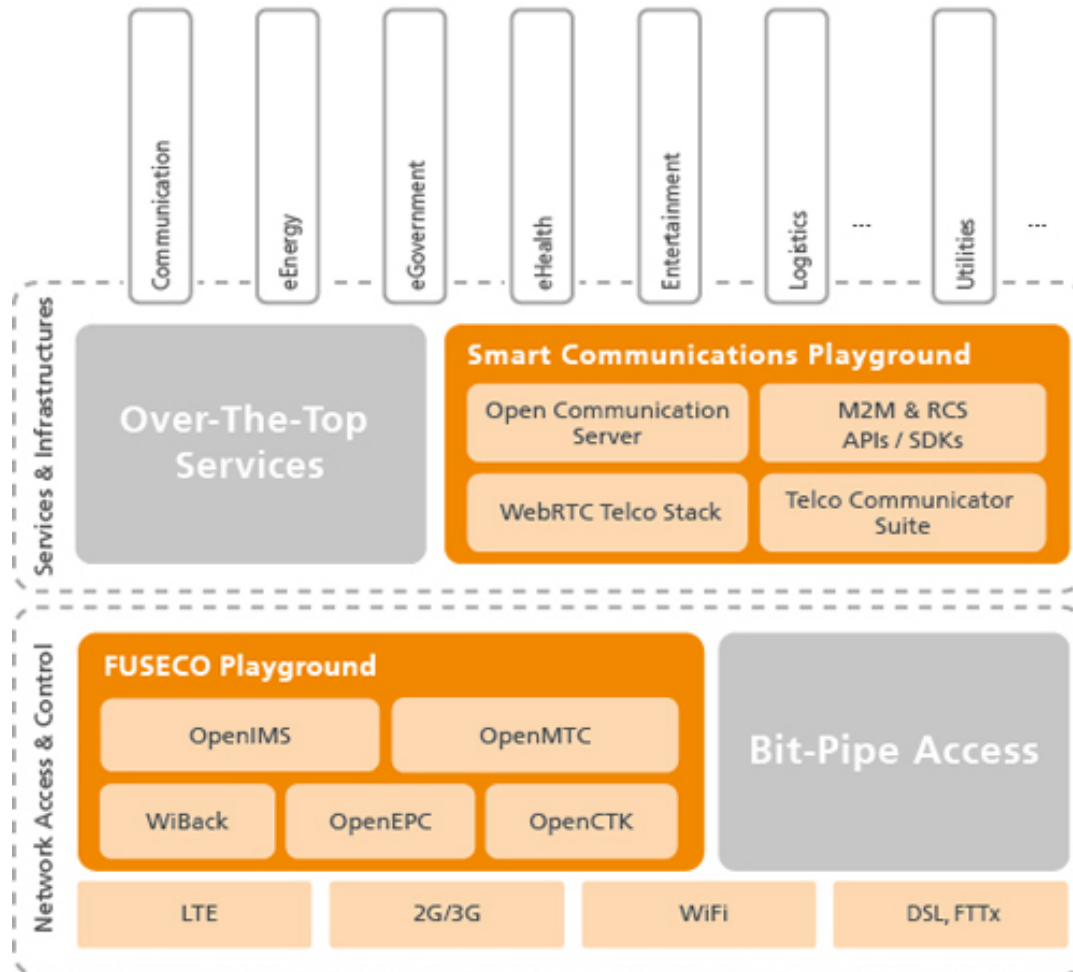
- 
- Be prepared for all-IP mass mobile broadband world
 - Validate new technologies

- 
- Validate their products against standard compliant EPC
 - Looking for the missing pieces

- 
- Validating wireless applications
 - Direct access to core functionalities

- 
- R&D on real network conditions
 - Innovating new concept and algorithms

Fraunhofer Testbeds / Playgrounds



Smart Communications Playground



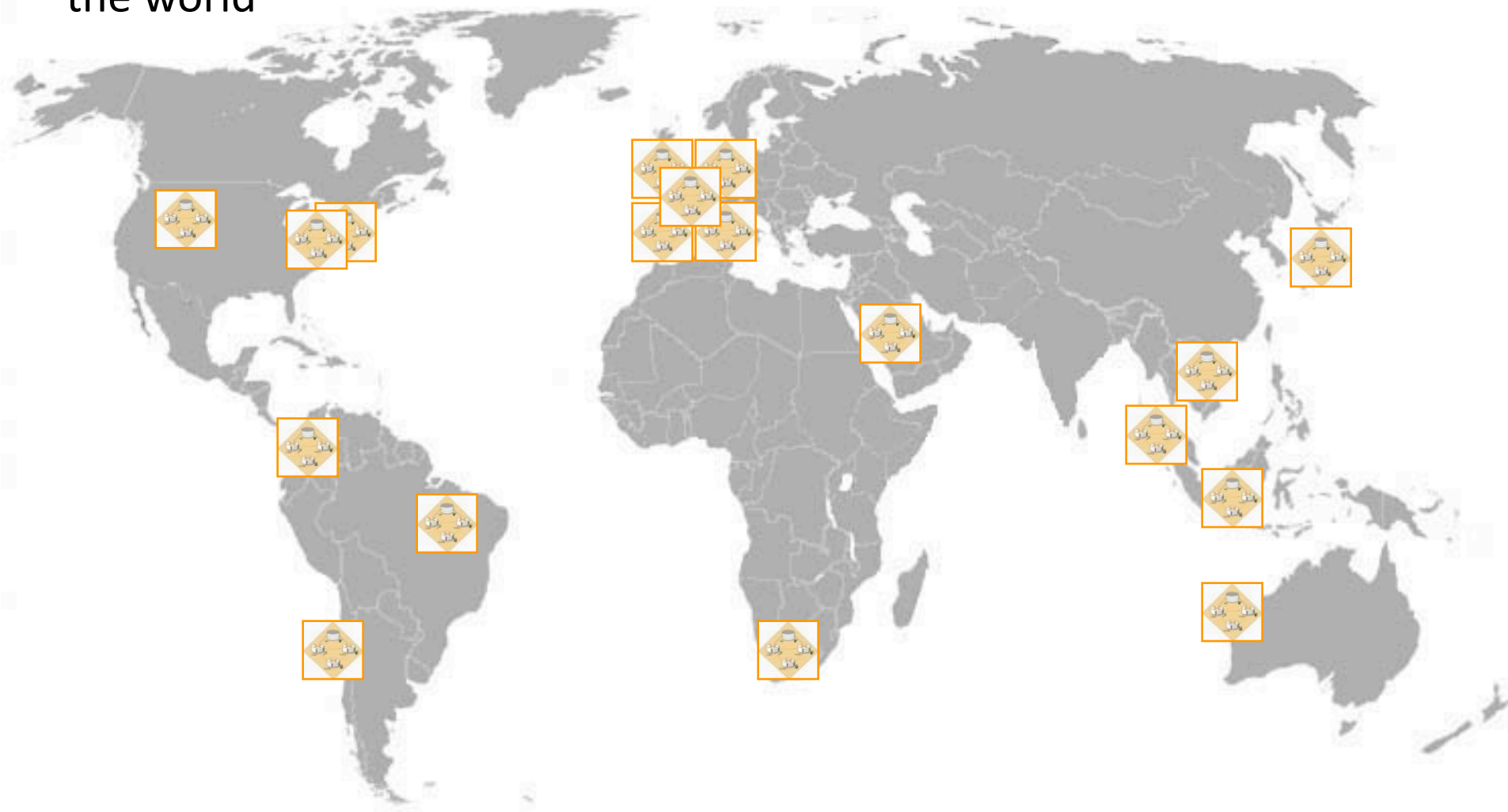
www.SC-playground.org



www.FUSECO-Playground.org



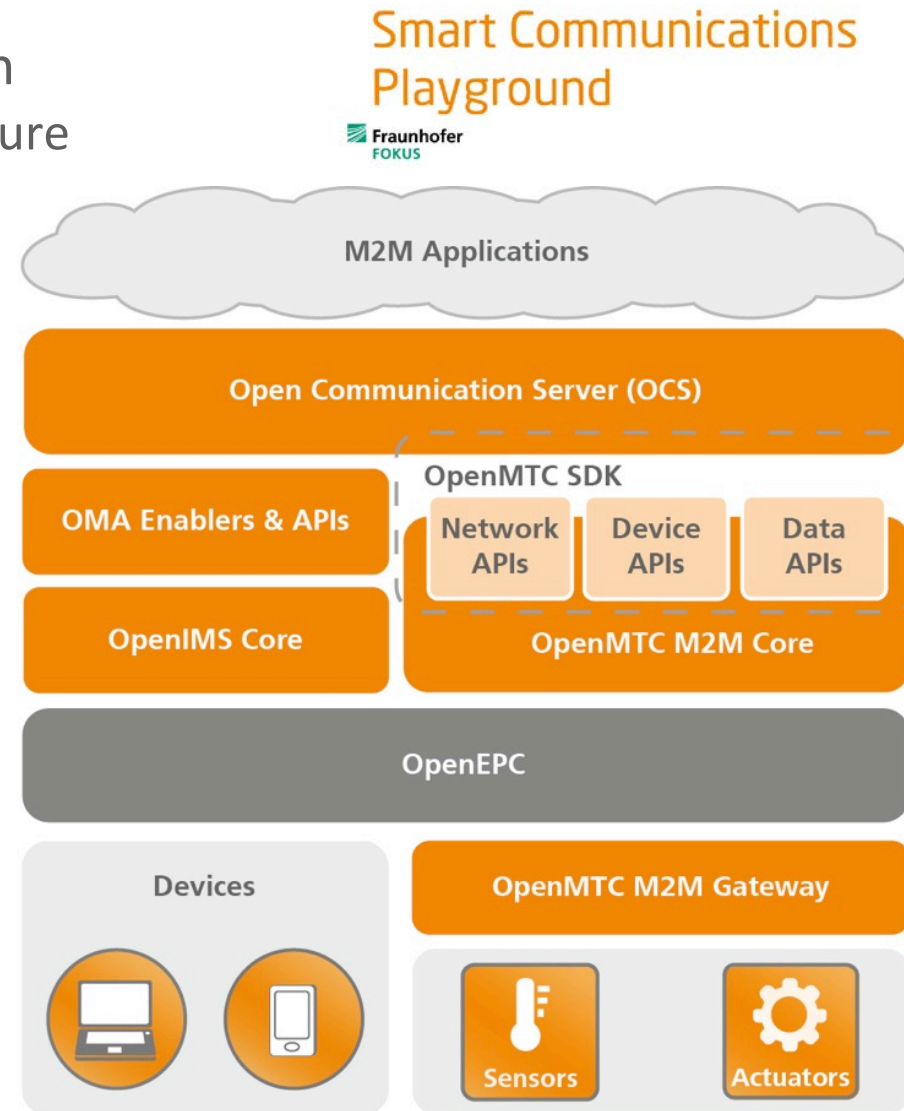
Commercial FOKUS NGN/IMS/EPC/SOA Testbed Deployments around the world



FOKUS Smart Communication Research

A Generic Smart Communication Architecture

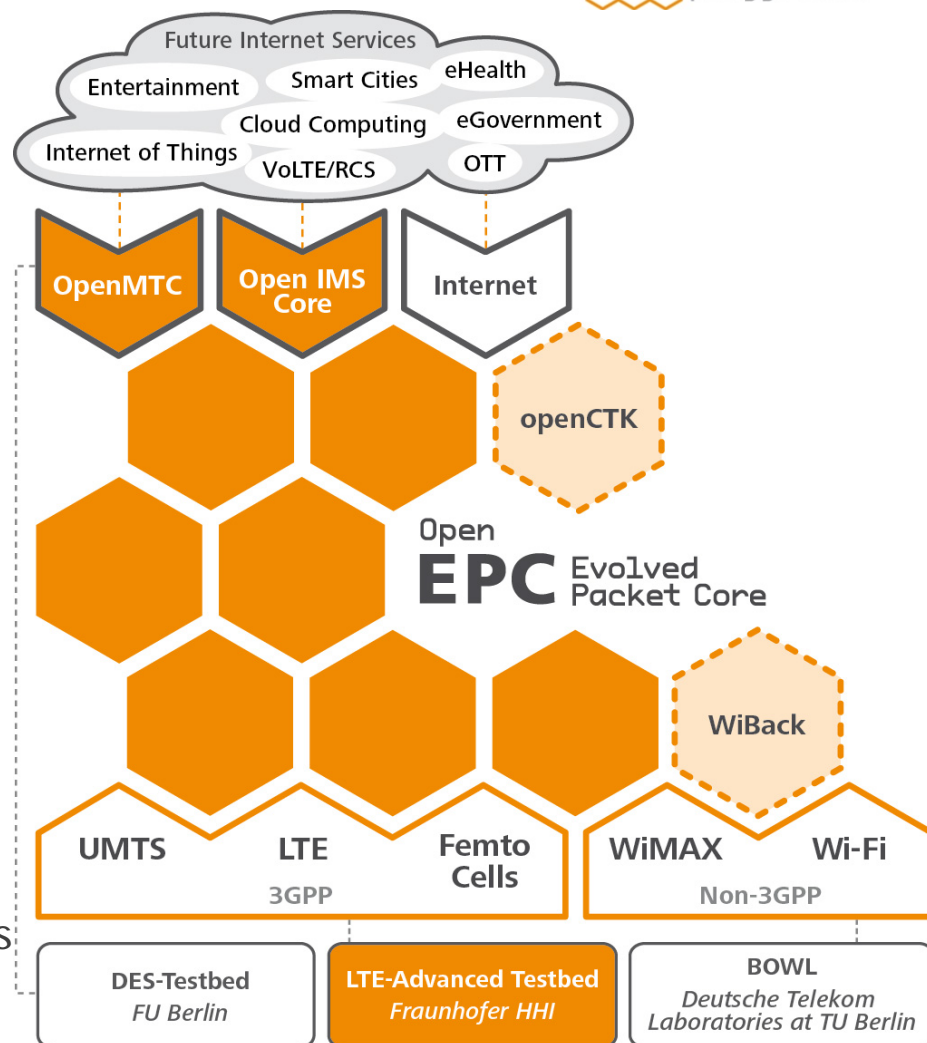
- Connecting Smart City objects across application domains
- Enabling the Internet of Things by using M2M gateways and network middleware to communicate efficiently
- Enabling multimedia communication services by integrating Telecoms APIs and platforms.
- Enable rapid application development using M2M and H2H network APIs and software development kits (SDK)
- Enable cross domain data analytics and fusion to serve the need of Smart Cities



Future Seamless Communication (FUSECO) Playground



- State of the art testbed infrastructure as a cooperation of Berlin's Next Generation Mobile Network expertise for
 - **Open IMS** for H2H communications
 - **OPenMTC** for M2M communications
 - **OpenEPC** for seamless access
 - Various access network technologies
- Enabling to prototype application support for
 - handover optimization across heterogeneous networks
 - support for Always Best Connected (ABC)
 - subscriber profile based service personalization
 - QoS provisioning and related charging
 - controlled access to IMS-based services
 - controlled access to Internet/Mobile Clouds
- More information:



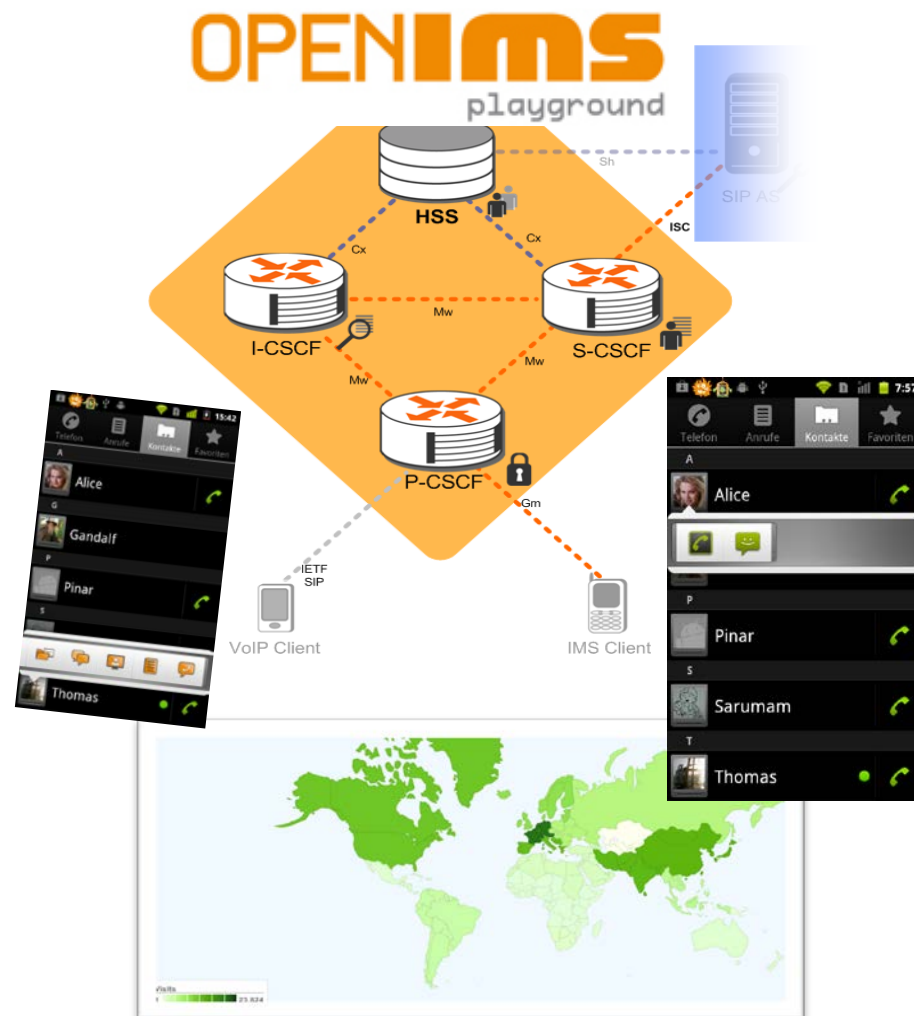
Open Source IMS Core System

- Global reference for IMS test-beds
- In November 2006 the FOKUS *Open Source IMS (OSIMS) Core System* - the core of the **Open IMS playground** - has been officially released to the general public via the BerliOS Open Source portal

www.openimscore.org

- OSIMS allows industry and academic institutions to setup own testbeds (with or without FOKUS support and components)
- Since then OSIMS has been downloaded many thousand times from all over the world

See also www.open-ims.org



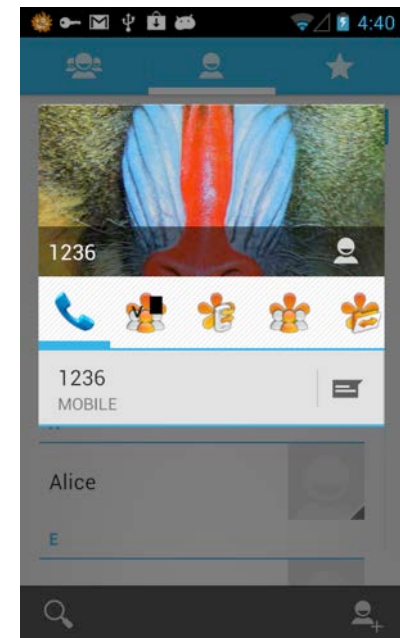
Note: IMS Client shown is MyMonster
– see www.opensoapplayground.org/tcs



Telco Communicator Suite

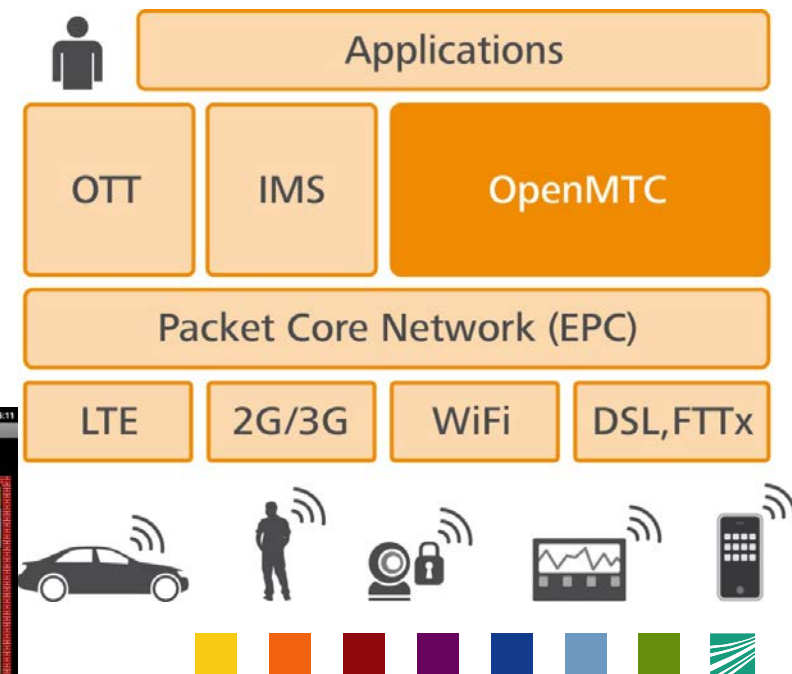
Android Communication Client

- The software stems
 - Extended RCS Stack from Orange Labs for VoLTE
 - Compliant to GSMA RCSe specification
 - Client/Server API allows easy integration with Android native application
- Supported RCS/VoLTE key features:
 - Enhanced native address book with supported service capabilities and presence info
 - Messaging
 - File Transfer
 - 1-1 chat
 - Adhoc group chat
 - Location
 - Rich Call with multimedia content sharing
 - Image Sharing
 - Video Sharing
 - Video/Audio VoIP



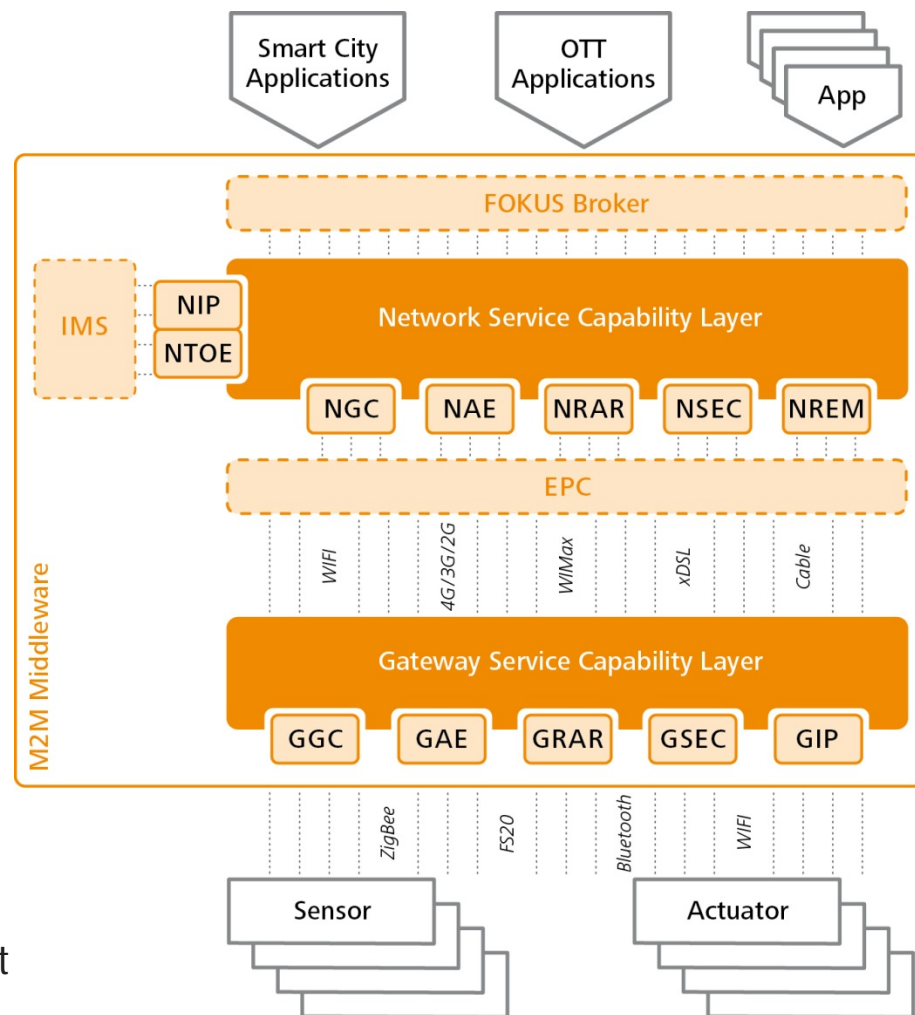
Introducing the FOKUS OpenMTC Platform

- Based on the success of the Open IMS Core and OpenEPC Fraunhofer FOKUS has developed a **NON-OPEN SOURCE** Machine Type Communication platform, enabling academia and industry to:
 - integrate various machine devices with operator networks
 - integrate various application platforms and servicesinto a single local testbed, thus lowering own development costs
- OpenMTC is an intermediary layer between multiple service platforms, the operator network, and devices
- This platform can be used to perform R&D the fields of machine type communication
- OpenMTC implemented features are aligned with ETSI M2M specifications:
 - Adaptable to different M2M scenarios (e.g. automotive)
 - Extensible to specific research needs
 - Configurable
 - Performant
- For more see www.open-MTC.org

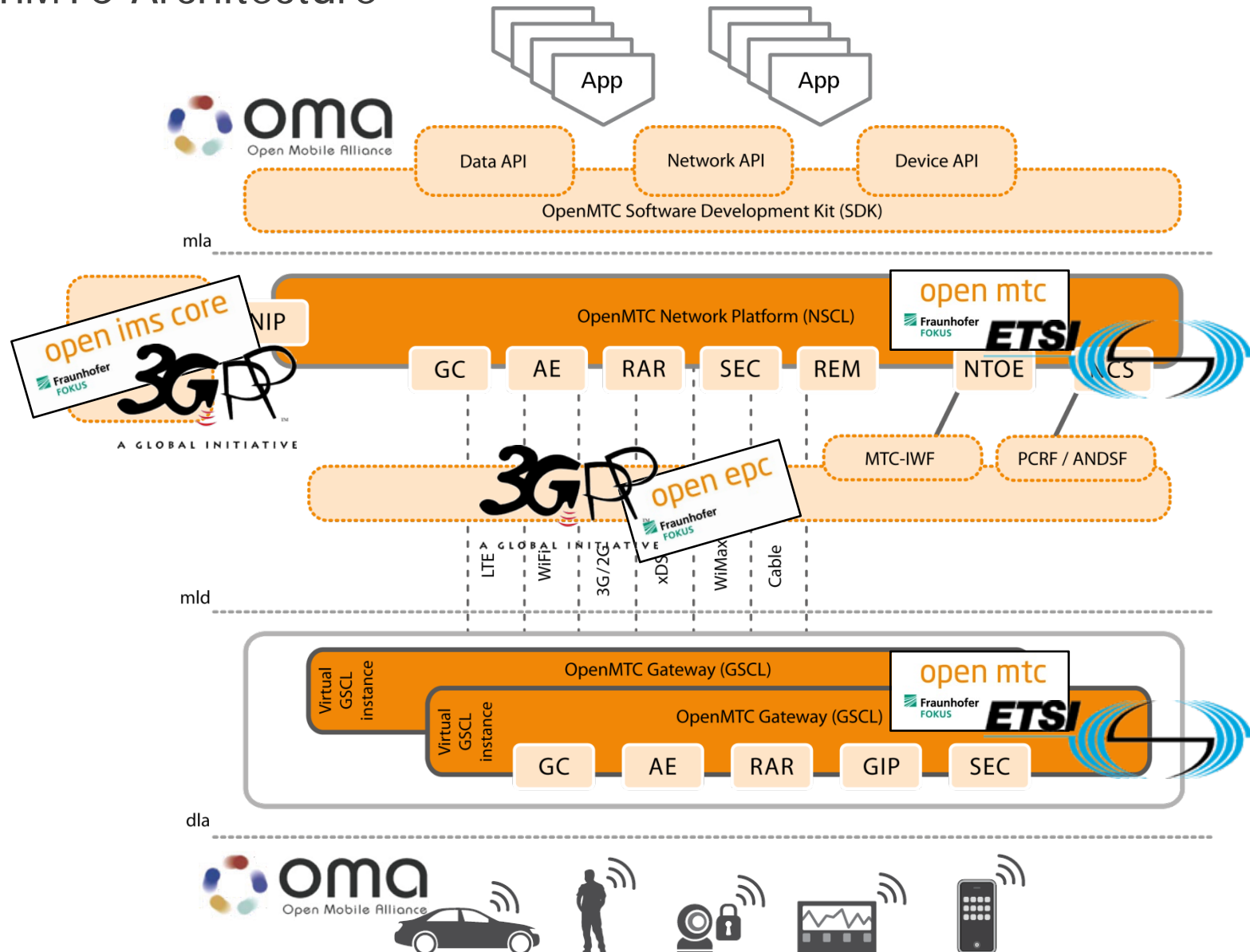


OpenMTC Architecture – Release 1

- OpenMTC consists of the two main components
 - Network Service Capability Layer (NSCL)
 - Gateway Service Capability Layer (GSCL)
- Both SCLs contain several modules
 - e.g. NGC: Network generic communication, GSEC: Gateway security, etc.
 - Some of them are optional
- OpenMTC allows interworking with
 - OpenEPC (Evolved Packet Core)
 - OpenIMS (IP Multimedia Subsystem)
 - FOKUS Service Broker
- OpenMTC supports:
 - Various sensors and actuators (e.g. ZigBee, FS20 devices)
 - Multiple Access networks (e.g. fixed, mobile, xDSL, 3G, etc.)
 - Various Applications (e.g. Smart Cities, Smart Home, etc.)

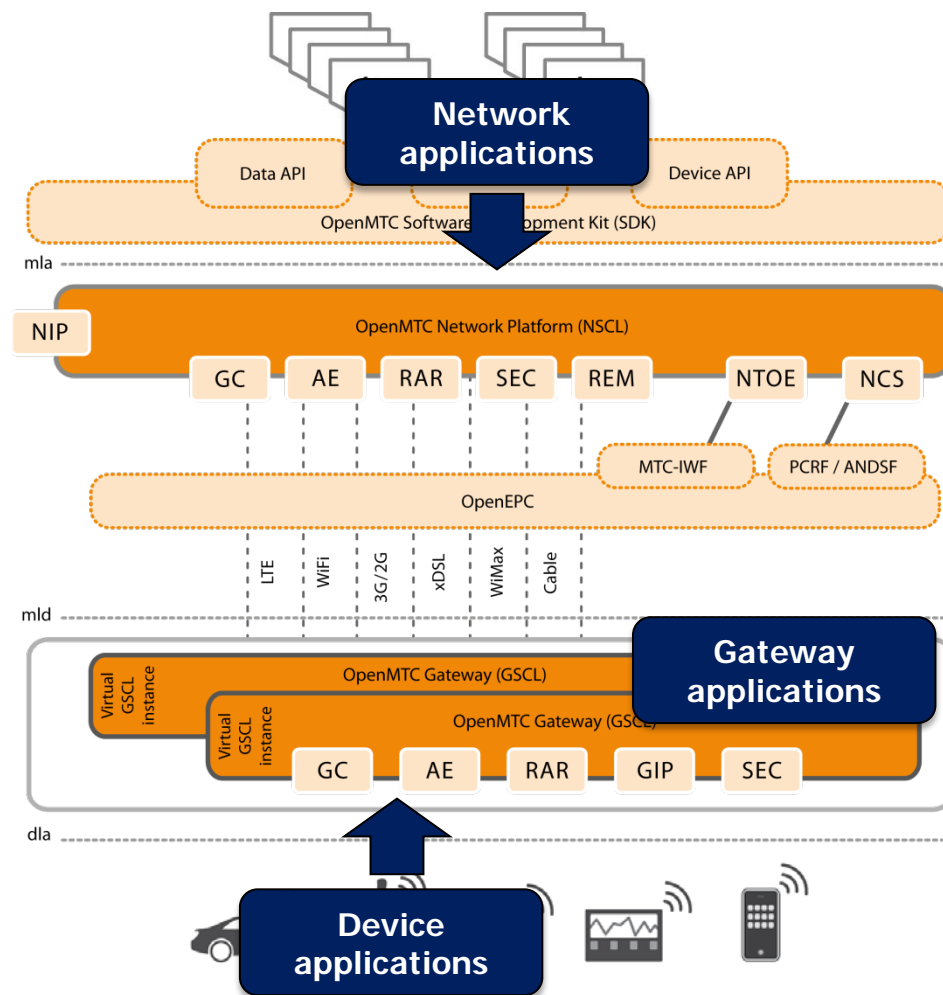


OpenMTC Architecture



OpenMTC Application Enablement

- Exposes functionalities implemented in the service layers (N/GSCL) via the reference points
 - mla
 - dla
- Single contact point for
 - Network Applications (NA)
 - Gateway Applications (GA)
 - Device Applications (DA)
- Performs routing between applications and capabilities in the N/GSCL
- Routing is defined as the mechanism by which a specific request is sent to a particular capability



Integration and Interworking on all layers

Supporting Interoperability

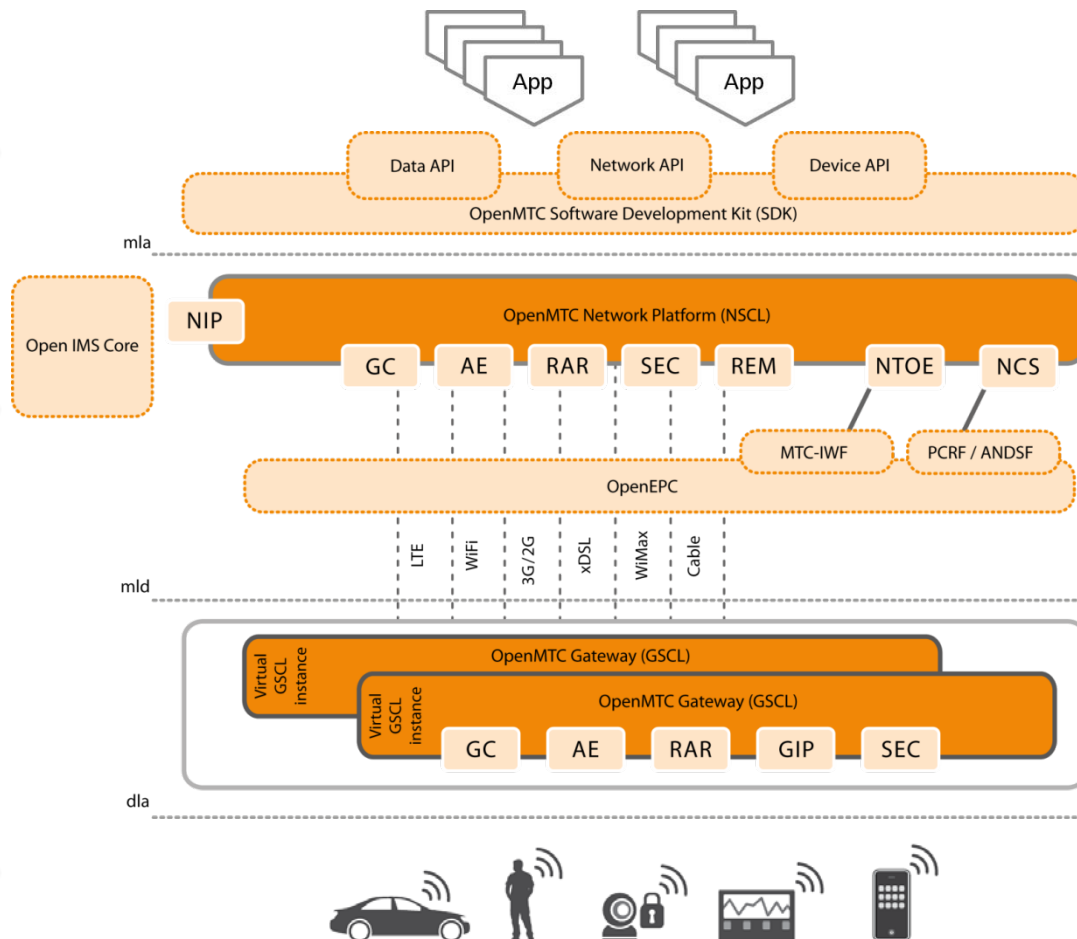
Heterogeneous Application
Integration



Heterogeneous System /
Platform Integration

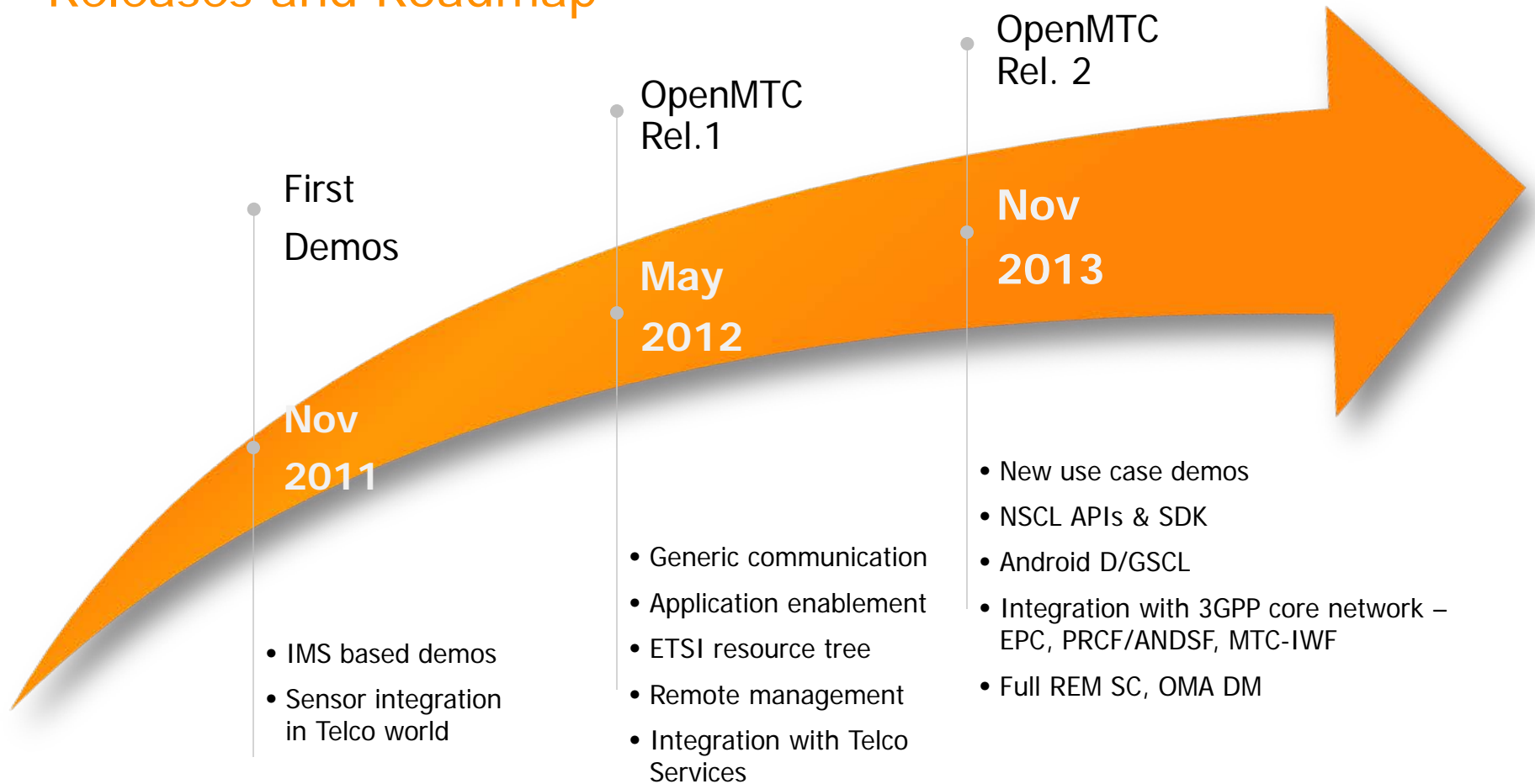


Heterogeneous Device
Integration



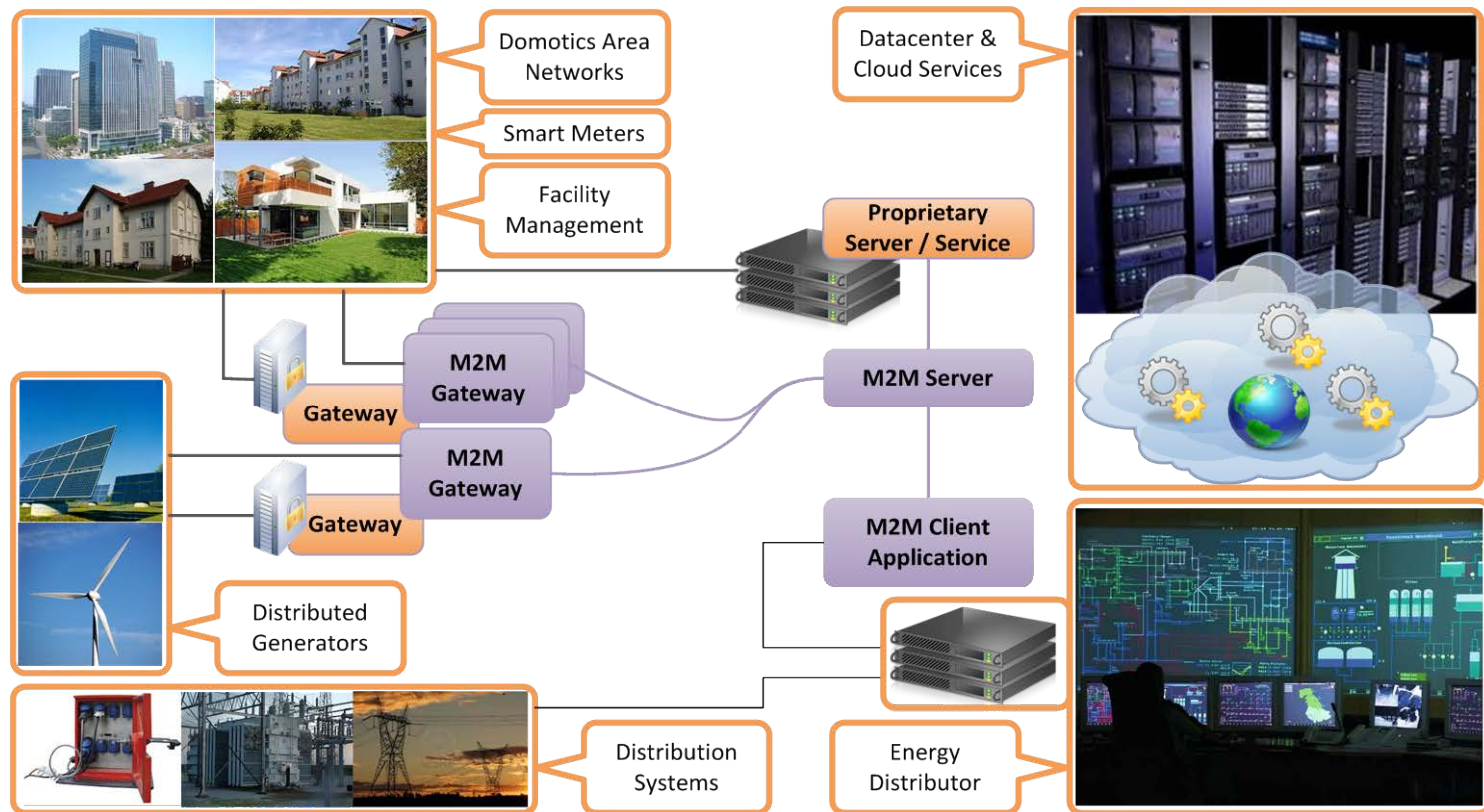
OpenMTC

Releases and Roadmap



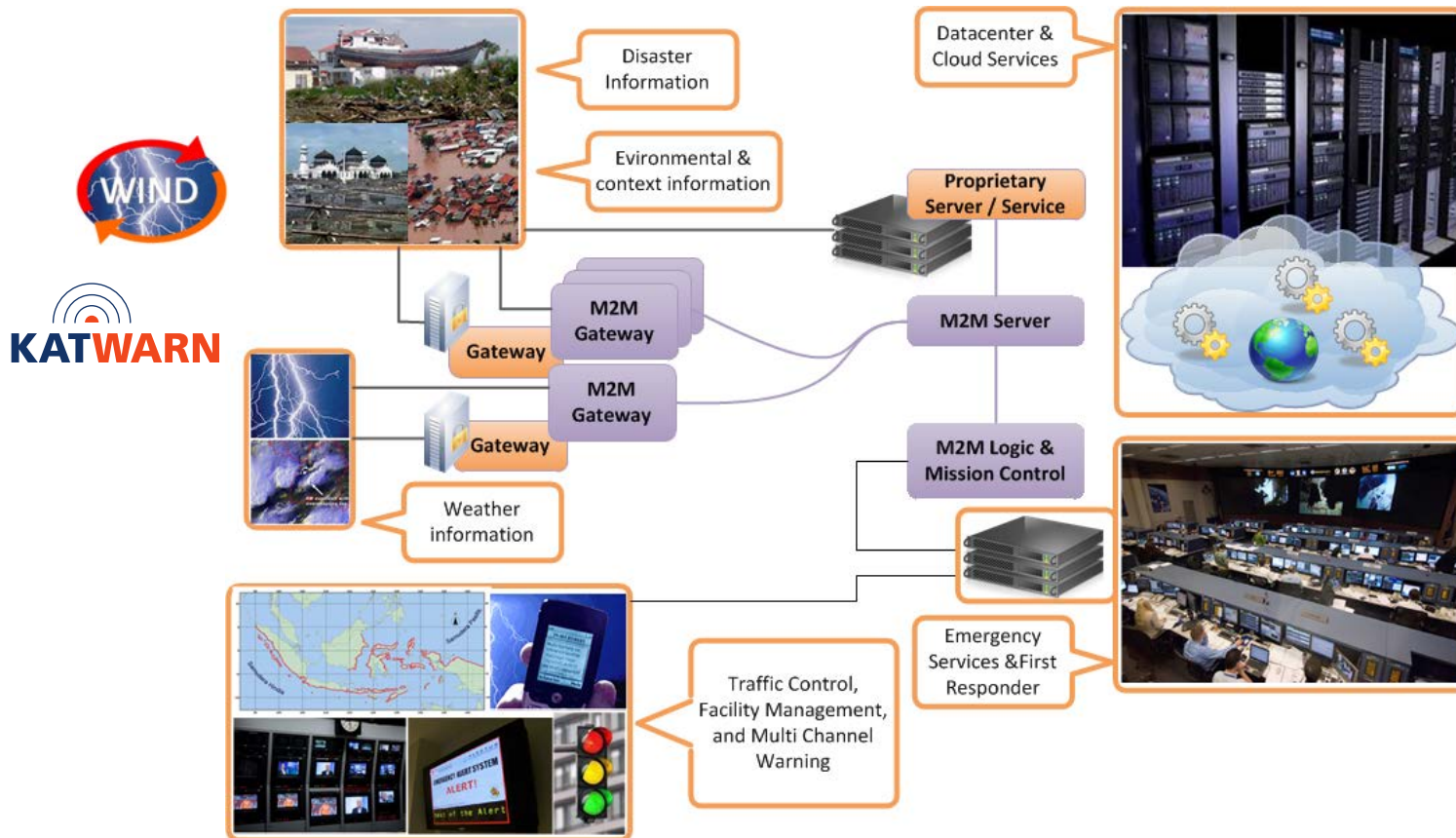
Smart City Services for Facilities and Campuses

- OpenMTC hides heterogeneity across a wider facility infrastructure (i.e. sensor and actor networks), communications (i.e. wireline or wireless, fixed or mobile), and services (i.e. M2M or proprietary) enabling data fusion and joint control.



Smart City Services for Early Warning and Emergency Management

- OpenMTC aggregates sensor information and environmental warnings, implements application logic and policies, and can automate counter-measures (e.g. multi-channel hazard warning, facility management, and traffic control) via dedicated application logic.



KATWARN – An example for cost-effective solutions

An adaptable combination of existing technologies for public alerting



Verband 
öffentlicher Versicherer

 **Fraunhofer**
FOKUS

KATWARN-App

Top iPhone Apps in Nachrichten (gratis)

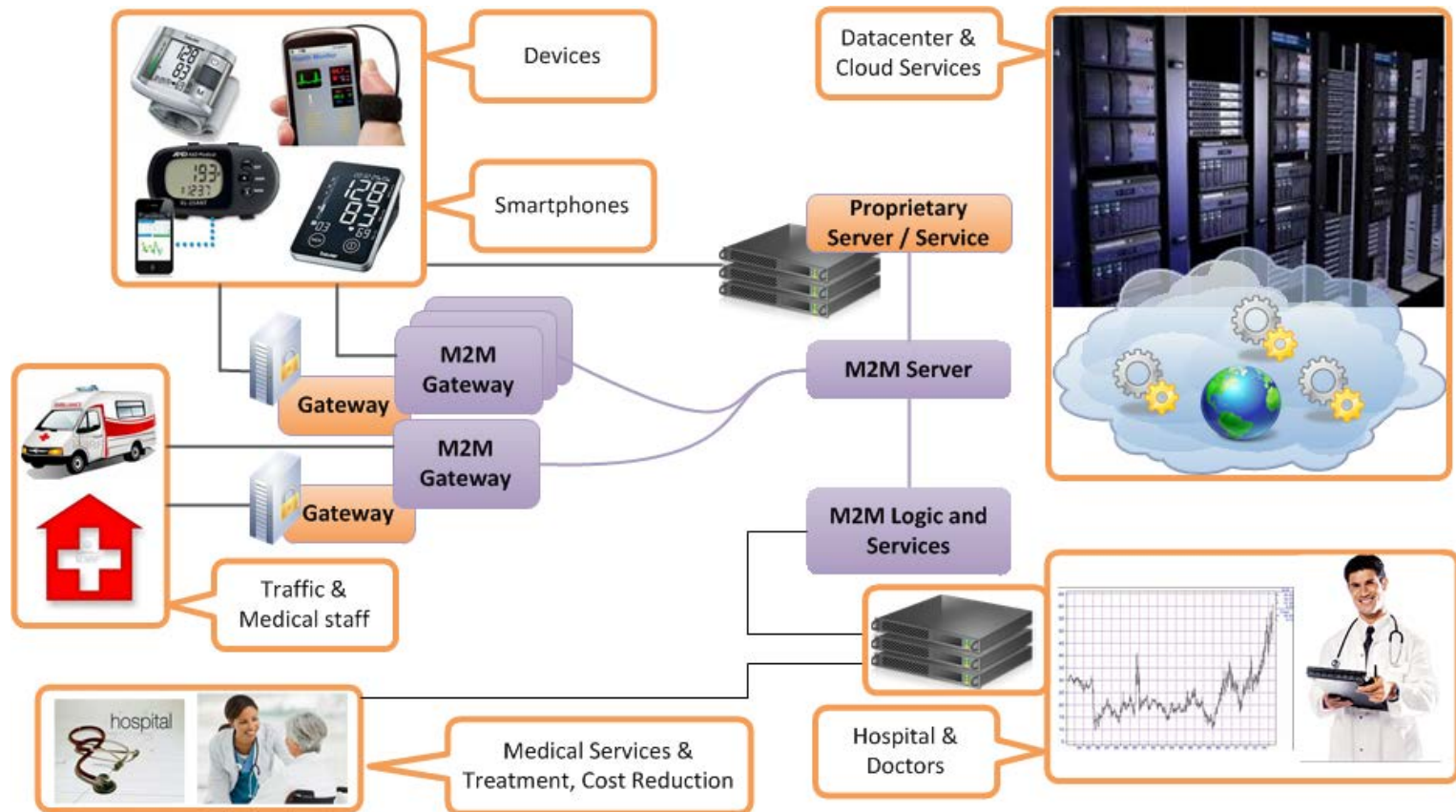
Sortieren nach: Bestseller

-  **KATWARN**
Nachrichten
Aktualisiert 13.11.2012
GRATIS
-  **SPIEGEL ONLINE**
Nachrichten
Aktualisiert 12.11.2012
GRATIS
-  **Tagesschau**
Nachrichten
Aktualisiert 10.11.2011
GRATIS
-  **Deutscher Bundestag**
Nachrichten
Aktualisiert 28.09.2012
GRATIS
-  **SPORT BILD +**
Nachrichten
Aktualisiert 10.10.2012
GRATIS
-  **FOCUS Online - Nachrichten**
Nachrichten
Aktualisiert 07.11.2012
GRATIS
-  **n-tv iPhone edition**
Nachrichten
Aktualisiert 12.11.2012
GRATIS
-  **AUTO WORLD deutsch**
Nachrichten
Aktualisiert 15.09.2012
GRATIS



Smart City Services for eHealth and Support of Elderly People

- OpenMTC supports various eHealth devices and can communicate health information to hospitals and first responders. In conjunction with traffic & location information and data about medical staff occupancy, critical time savings and cost reduction can be achieved.



FI-star as one of the Phase 2 Use Case project of FI-Ware



fi-ware

OUTSMART



FUTURE
INTERNET
PPP



Flspace
Business Collaboration

fi★star

THE FUTURE. NOW.

<https://www.fi-star.eu>

<http://fistarblog.com/>



FIcontent



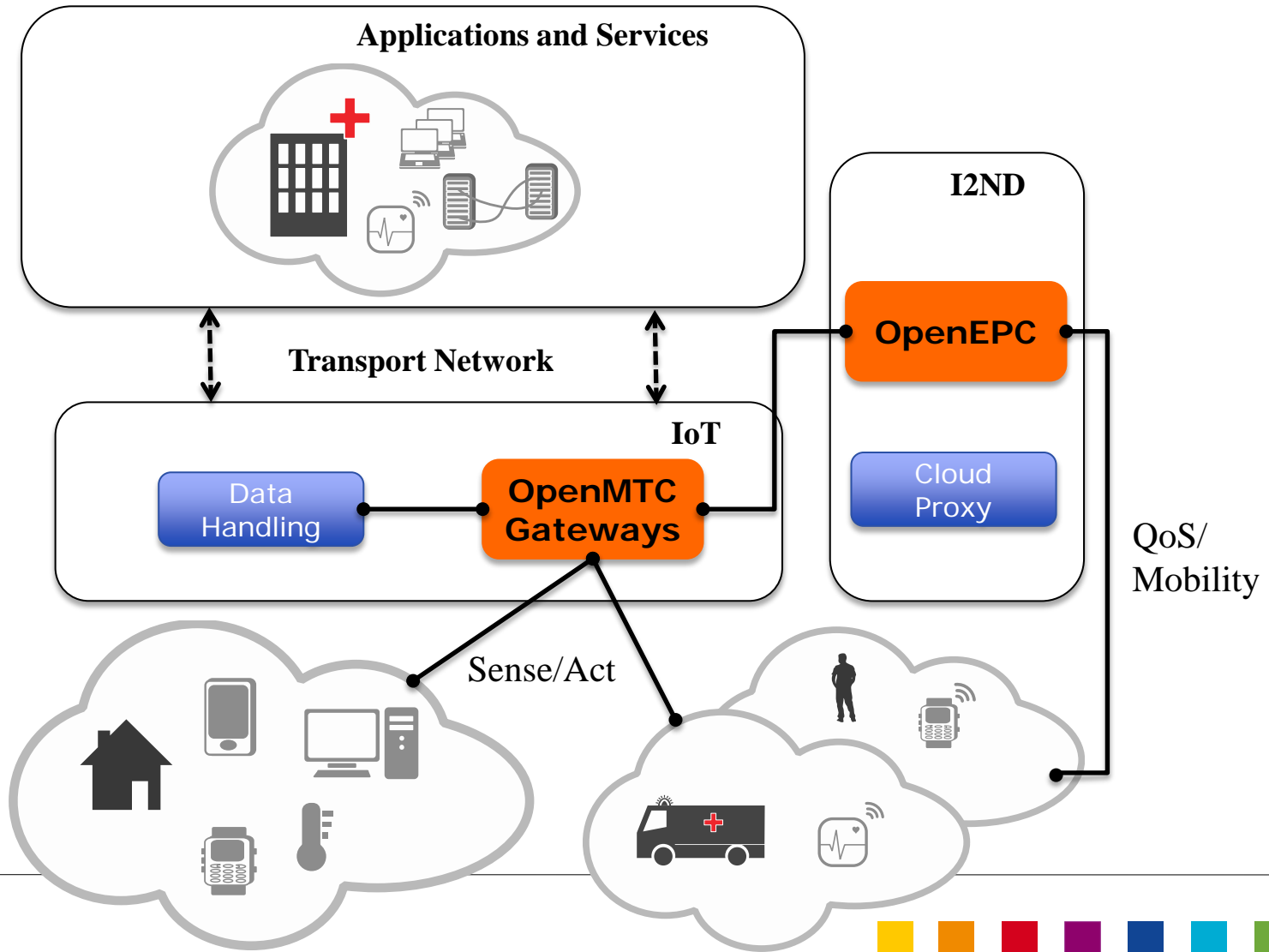
FI-Star budget and partner structure



FiStar	Budget €	EU contribution €
Total	16,830,394	13,499,000
26 partners, of which:		
Fraunhofer FOKUS	634,561	488,934
TU Berlin, AV	835,204	654,228

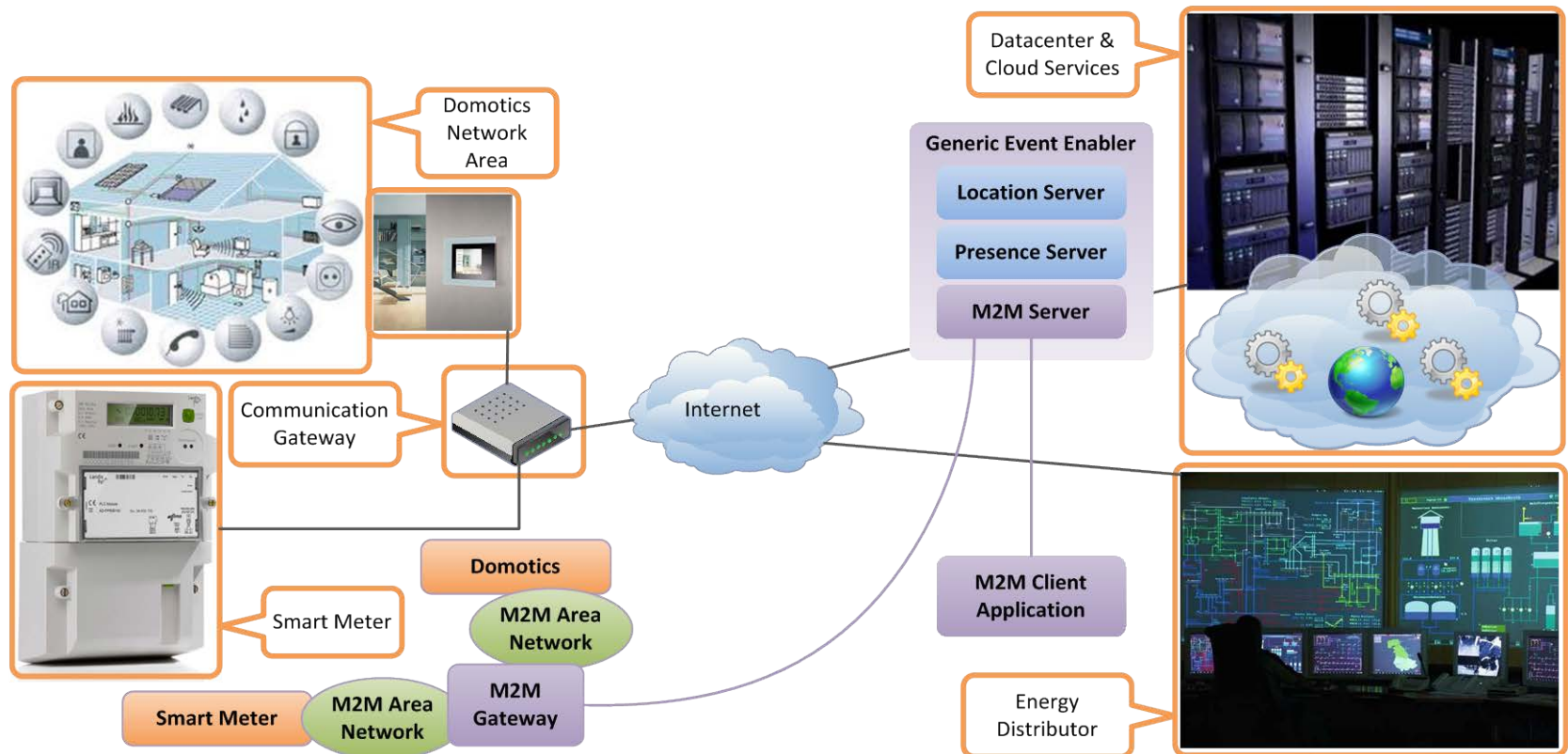


AV/FOKUS Components in FI-Star



Smart City Services for End Customer Domotics and Smart Metering

- OpenMTC provides a unified API to M2M client applications while hiding heterogeneity of end-customer premises equipment (i.e. domotics and smart meter) and the communication links between customer premises and M2M service center.



Current Research

TRESCIMO | Testbeds for Reliable Smart City Machine-to-Machine Communication

- **Context:** FP7 FIRE STREP: EU/SA collaboration
- **Motivation:** Urbanization issues in South Africa
- **Goal:** Reliable Smart City Communication Platform
- **Approach:**
 - Smart Technologies
 - CSIR: Smart Platform
 - i2CAT: Smart City Platform
 - Fraunhofer/TUB: OpenMTC / FITeagle
 - Smart Sensors
 - Eskom: Utility Load Manager
 - AirBase: Smart City Air Pollution Wireless Sensors
 - Evaluation
 - Pilots: San Vicenç dels Horts and Johannesburg
 - Testbeds: TUB and University of Cape Town
- **Web:** <http://trescimo.eu>



Approach | Main Roles



Project Management.



OpenMTC
developments.
Testbed
interconnection.



OpenMTC
developments.



Smart device
developments.
Testbed setup.



Experimentation and
evaluation.

Scenarios and
requirements.
Smart City platform
developments.



Testbed setup.



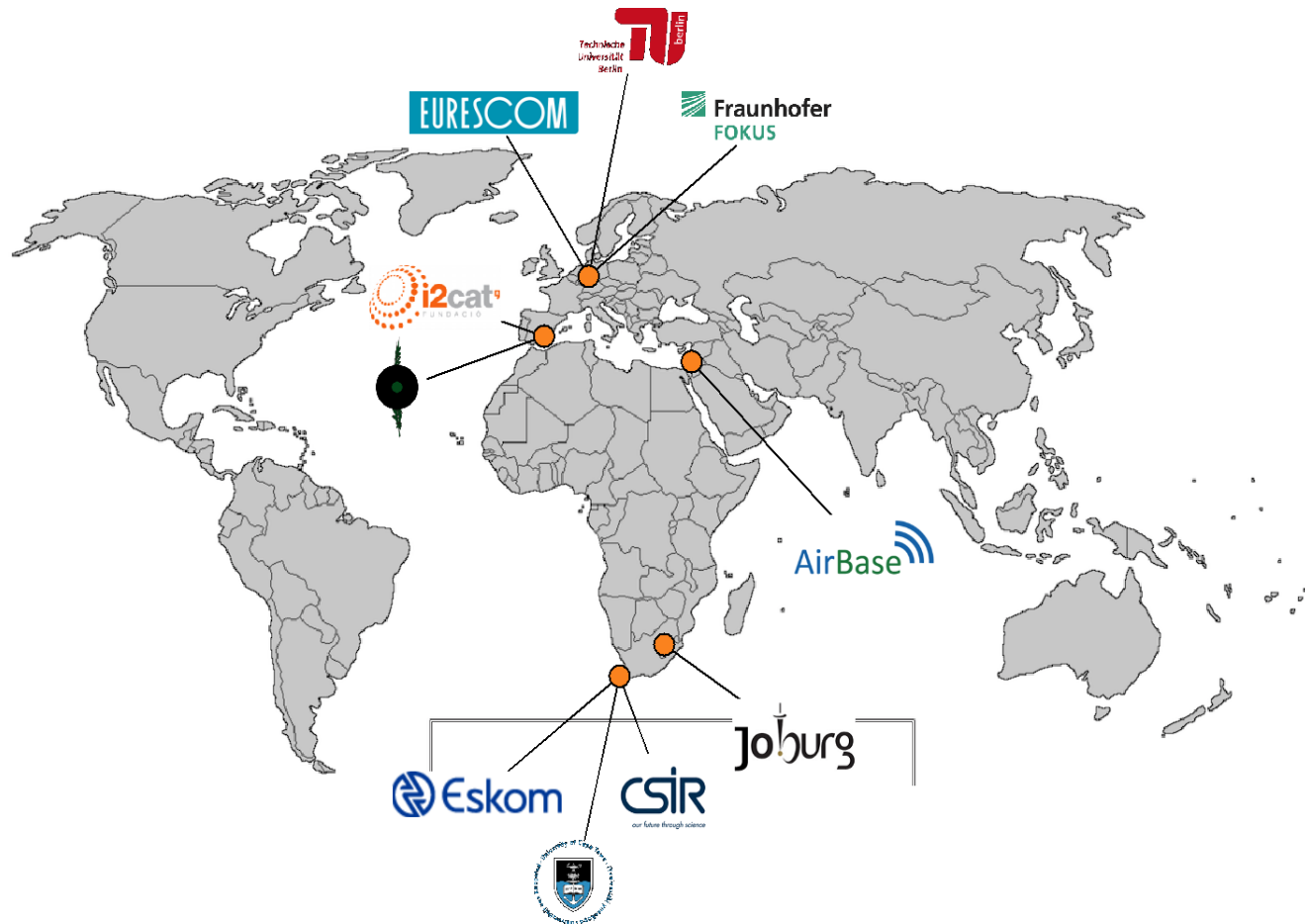
Smart device
developments.
Testbed setup.



These partners **are not** funded by the EC.



Approach | Collaboration between Europe and South Africa



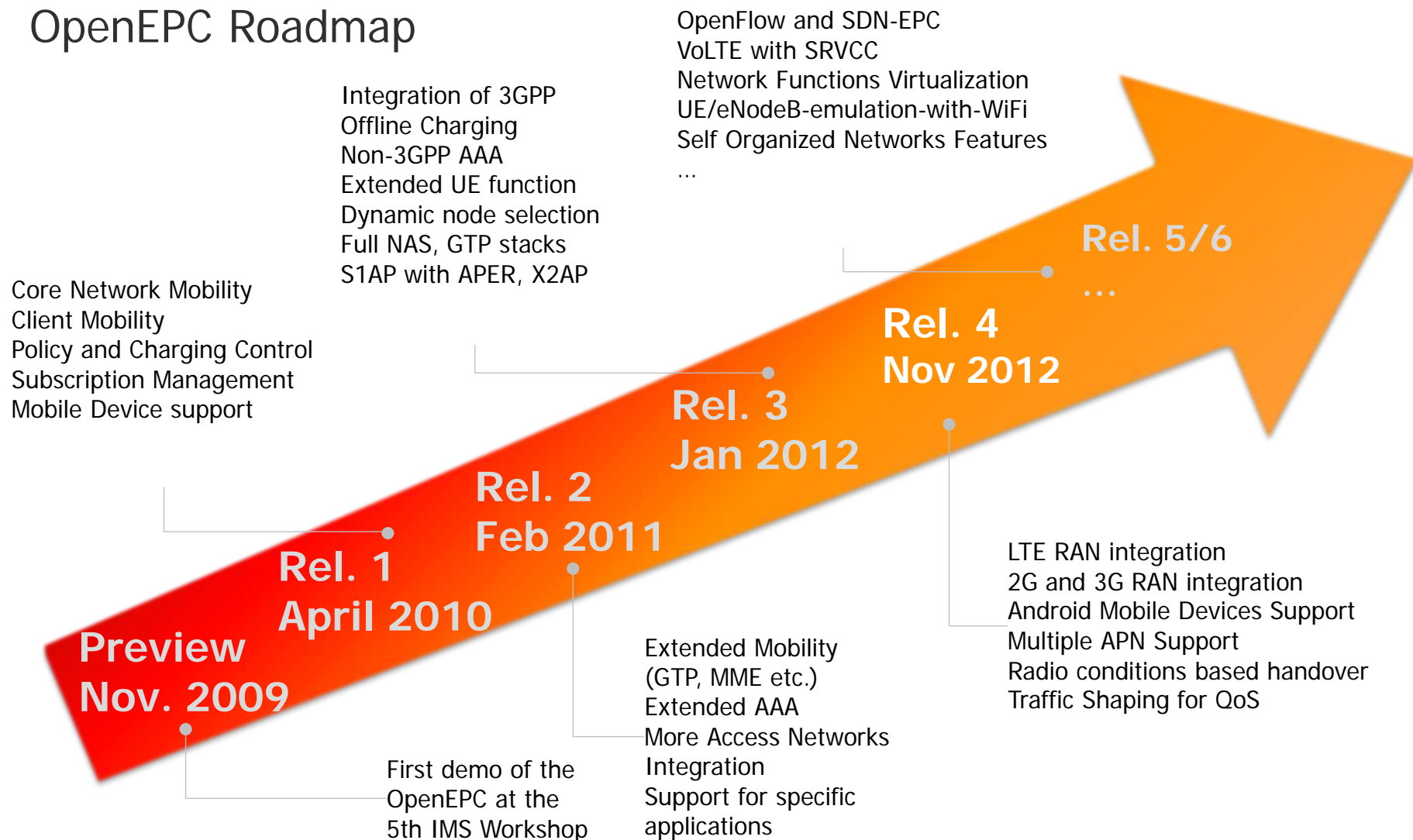
What is FOKUS OpenEPC Platform?



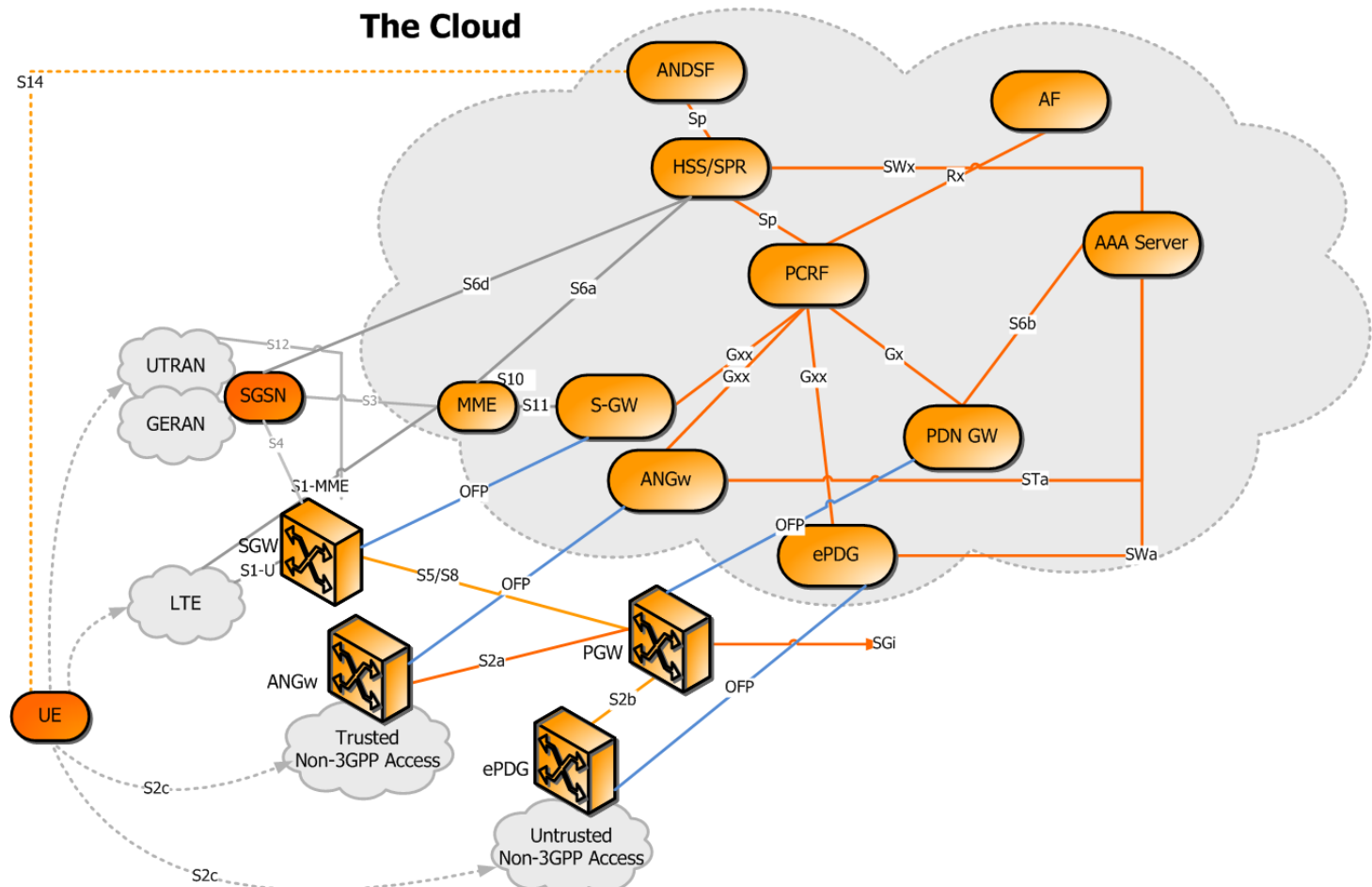
- Future massive broadband communications will be realized through multi-access support (LTE, 3G, 2G, WiFi, fixed networks ...) and multi-application domains (OTT, IMS, P2P, M2M, Cloud, ...)
- Fraunhofer FOKUS is developing the **NON-OPEN SOURCE** OpenEPC, enabling:
 - integrate various network technologies and
 - integrate various application platformsinto a single local testbed, thus lowering own development costs
- This platform can be used to perform R&D in the fields of QoS, Charging, Mobility, Security, Management, Monitoring
- OpenEPC represents a software implementation of the 3GPP EPC standard addressing academia and industry R&D:
 - Configurable to different deployments
 - Customizable to the various testbed requirements
 - Extensible to specific research needs
 - Reliable & highly performant
 - Based on 3GPP standards
- More information: www.OpenEPC.net



OpenEPC Roadmap



The Cloud



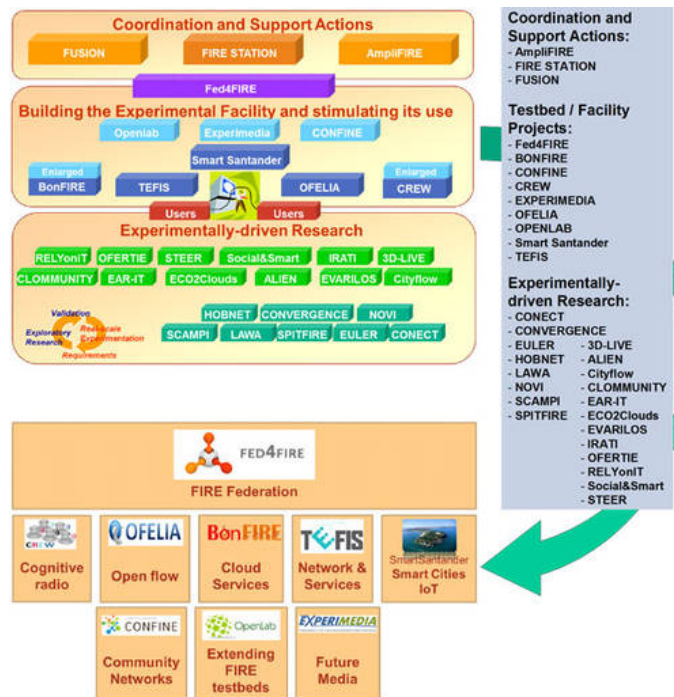
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Europe's key Initiatives for Future Internet Research and Development

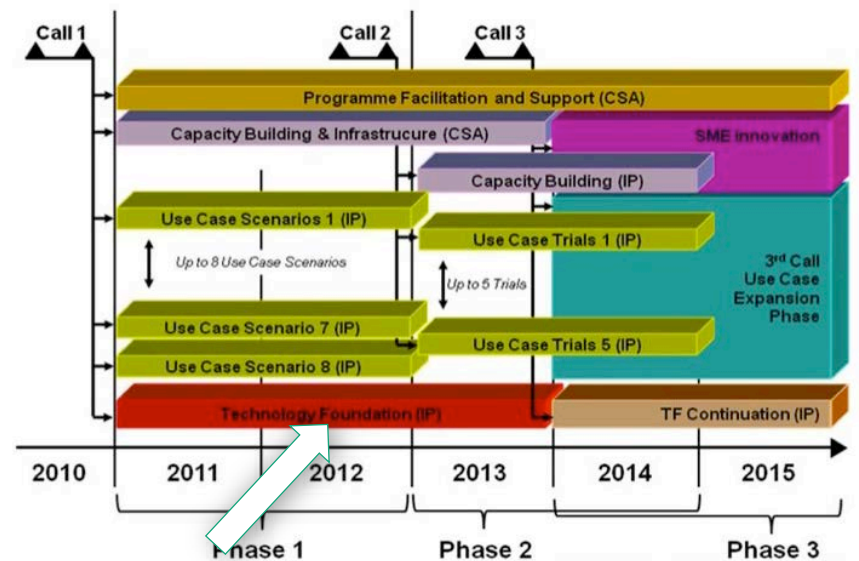
FIRE and the FI-PPP

NGNI is one of the most active contributors to:

- Europe's **Future Internet Research and Experimentation Initiative (FIRE)**
- Europe's **Future Internet Public Private Partnership Programme (FI-PPP)**



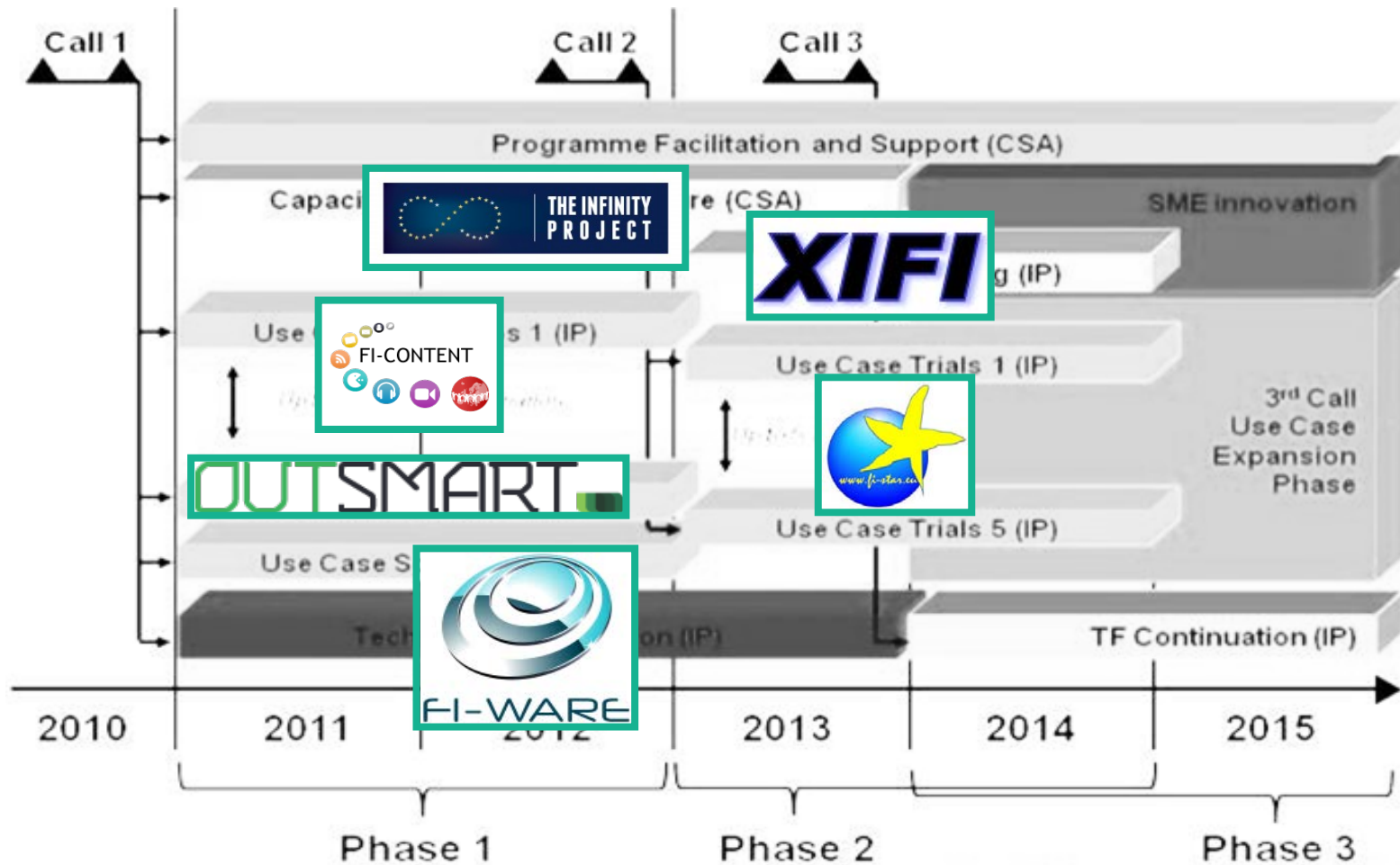
FIRE



Future Internet Core Platform

FI-PPP

Fraunhofer FOKUS' involvement in the FI-PPP



FI-WARE – a collaboration effort between operators and IT providers with good participation from Academia

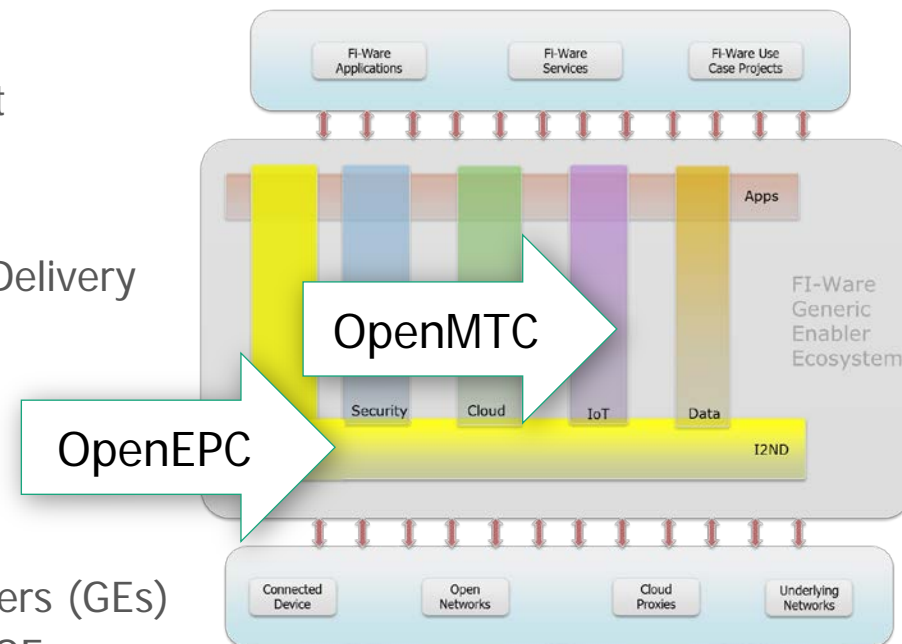
- *The FI-WARE project will introduce a generic and extendible ICT platform for Future Internet services.*
- *The platform – also referred to as the “Future Internet Core Platform” or “FI-WARE” – aims to meet the demands of key market stakeholders across many different sectors, strengthen the innovation-enabling capabilities in Europe and overall ensure the long-term success of European companies in a highly dynamic market environment.*



FI-PPP FI-WARE

FI PPP Key Platform Project makes use of OpenXXX Tools

- FI-WARE project is providing the design and the first prototypes of the European Future Internet
- Generic platform covers the following areas / topics (referred to “chapters”)
 - Data/Context Management
 - Internet of Things Service Enablement
 - Cloud Hosting
 - Security
 - Applications/Services Ecosystem and Delivery Framework
 - Interface to Networks and Devices
- FIWARE aims at
 - Identifying and defining generic enablers (GEs)
 - Providing an API specification for the GEs
 - Showing that GEs can be realized



DAAD Project University Future Internet

Unifying Education and Testbeds around the Globe



Hanoi University of Science and Technology

en.hustech.edu.vn

Universidad de Chile

www.uchile.cl



R&D
Lectures
Testbeds

R&D
Lectures
Testbeds

R&D
Lectures
Testbeds



Chulalongkorn University

www.chula.ac.th

University of Cape Town

www.uct.ac.za

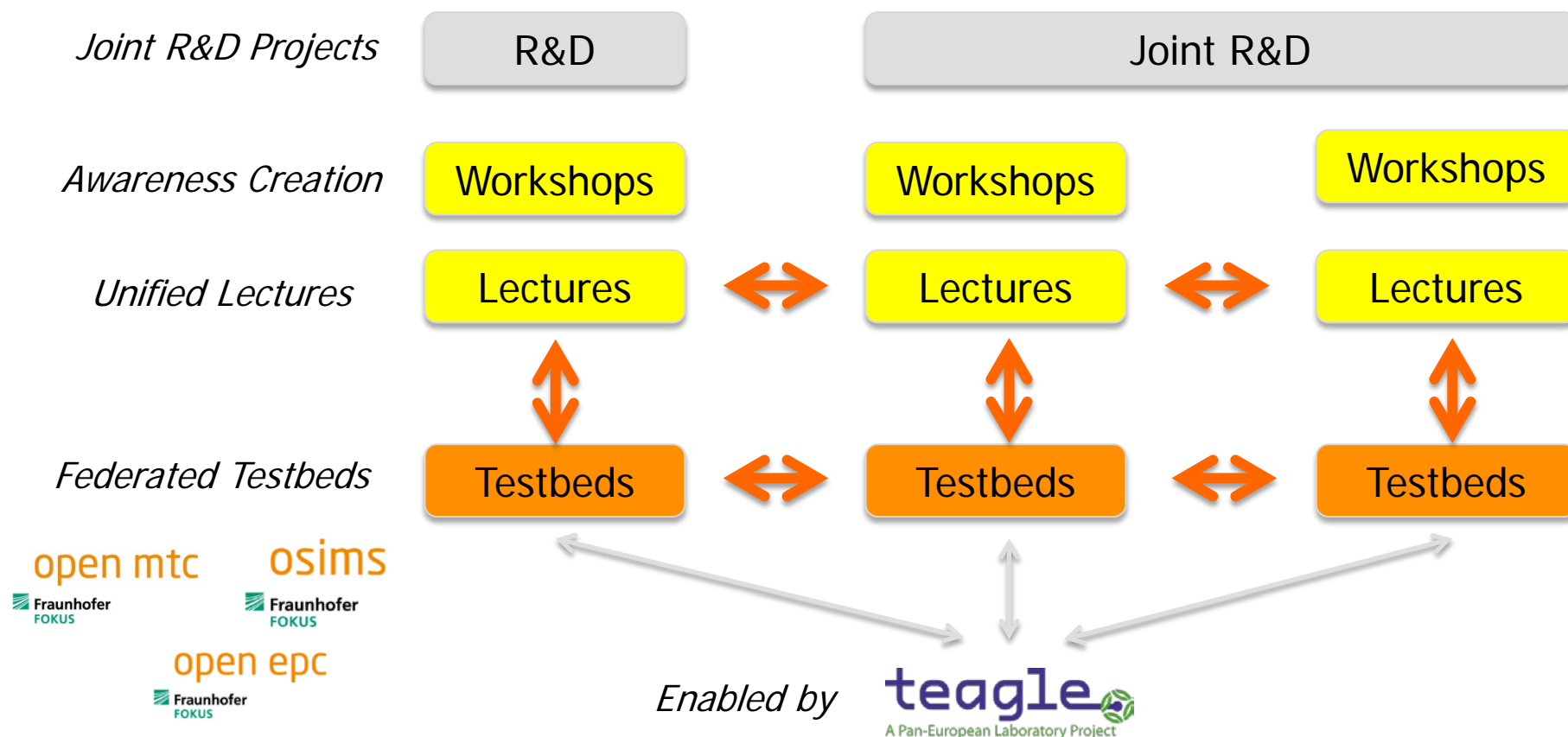


Enabled by



DAAD Project University Future Internet

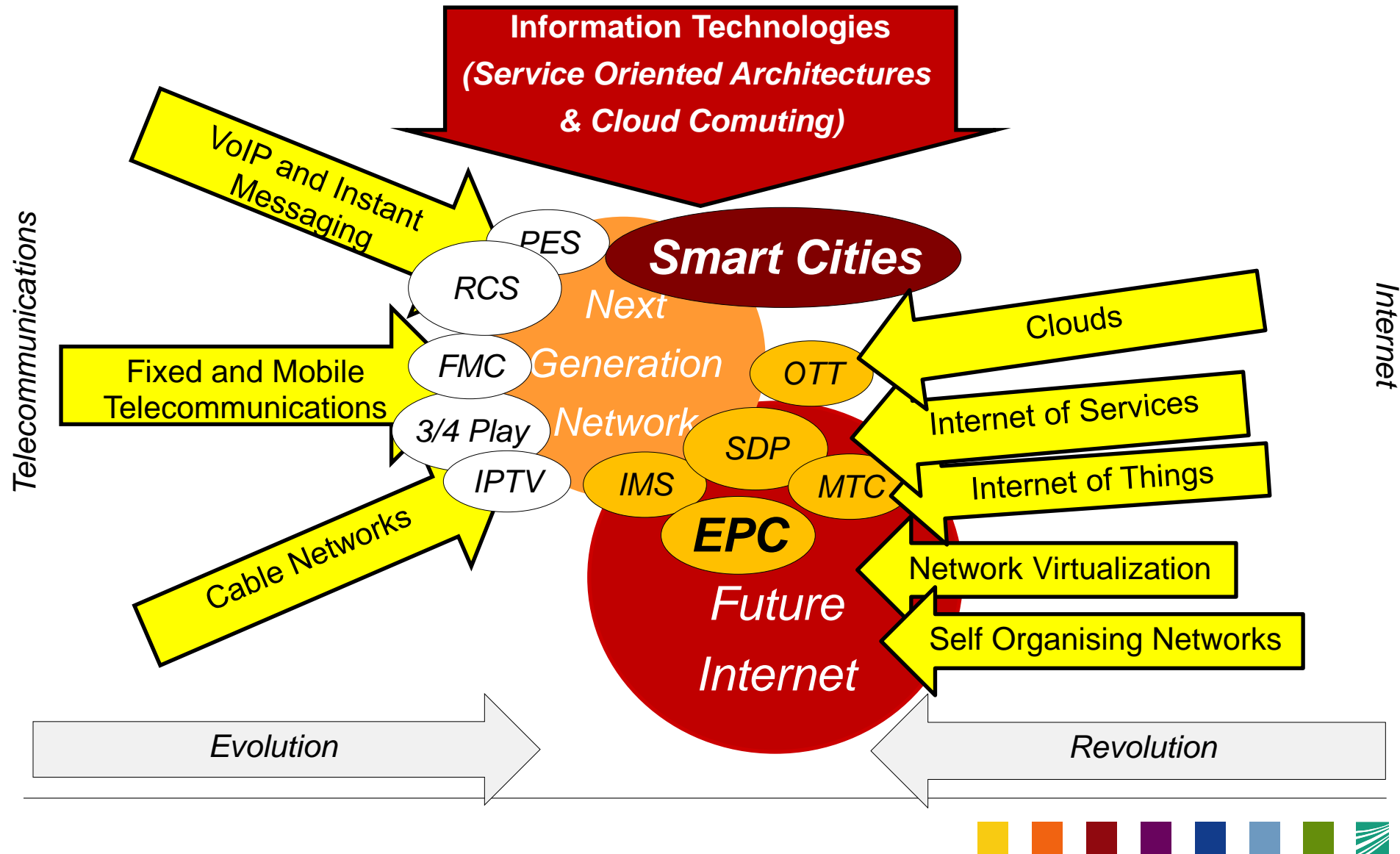
Unifying Education and Testbeds around the Globe



Agenda

- Smart Cities as Future Internet Show Case
- Smart City communication infrastructures requirements
- The Role of IP Multimedia Subsystem, Machine Type Communication, Evolved Packet Core and related Open APIs within emerging Smart City SDPs
- FOKUS Toolkits and practical examples
- Summary
- *Q&A*

NGN2FI Evolution is a Challenge



4th FOKUS „Future Seamless Communication“ Forum (FFF) Berlin, Germany, November 28-29, 2013



- **Theme: „Smart Communications Platforms for Seamless Smart City Applications – Fixed and Mobile Next Generation Networks Evolution towards virtualized network control and service platforms and Seamless Cloud-based H2H and M2M Applications“**
- FUSECO FORUM is the successor of the famous FOKUS IMS Workshop series (2004-09)
 - FFF 2010 attracted 150 experts from 21 nations
 - FFF 2011 was attended by around 200 experts from 30 nations
 - FFF 2012 was attended again by around 200 experts from 30 nations
- See **www.fuseco-forum.org**



Agenda

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Smart City ICT

Tools & Testbeds



Questions