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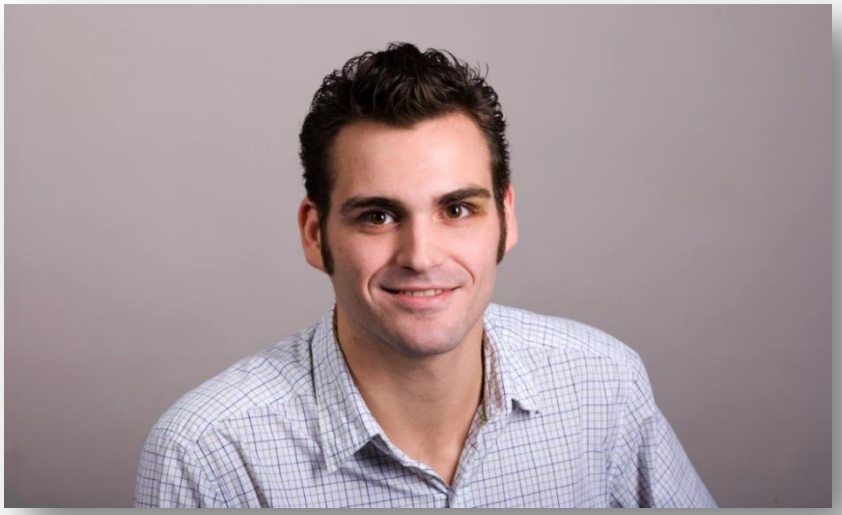

Lajos Lange received his Diploma degree as an Engineer for Multimedia Engineering at the University of Wismar, Germany. During his studies he specialized his skills in the areas of communication and network technologies. In cooperation with the Telekom Laboratories in Berlin, he invented the resource saving protocol TinySIP in regard to a Wireless Sensor Network environment. Since August 2007 he is a researcher at the Fraunhofer Institute FOKUS in the competence center NGNI. He is working on his PhD in the fields of NGN-IMS, Internet technologies and Services Oriented Architectures. In more detail, in the provisioning, composition, evolution of services as well as in the abstraction of services in open API's.

Policy Managed Context Access for Future Internet Service Platforms

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Lajos Lange,
Thomas Magedanz,
Daniel Nehls

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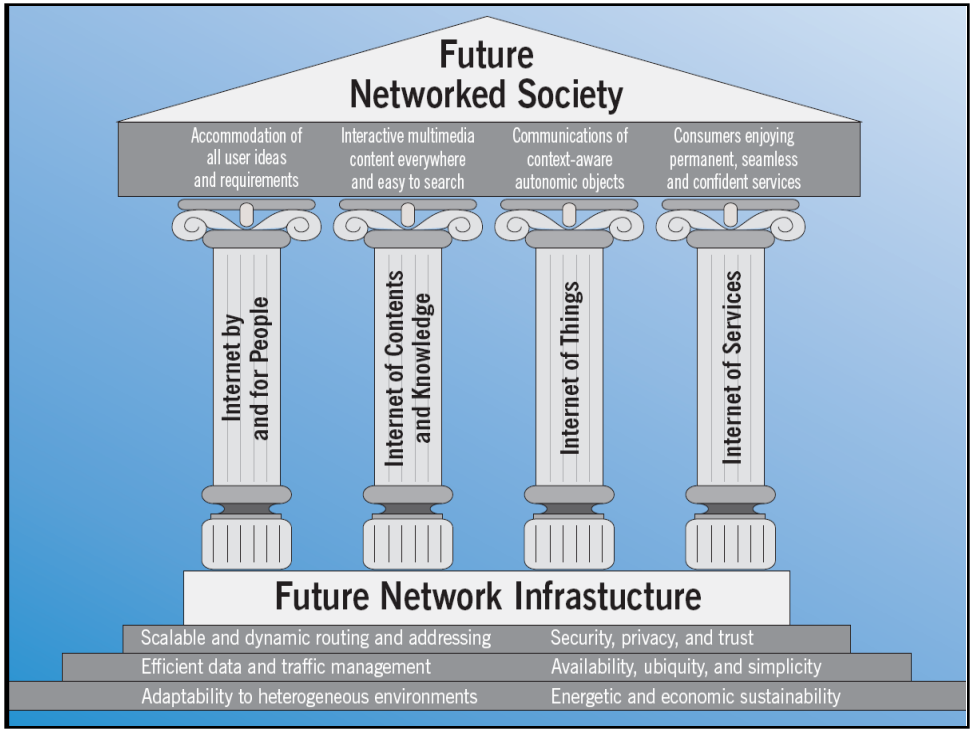
Agenda

- Future Internet Services: Challenges and Opportunities
- Open Future Internet Platforms Interconnecting IoS and IoT
- Scenario
- Conclusion & Future Work

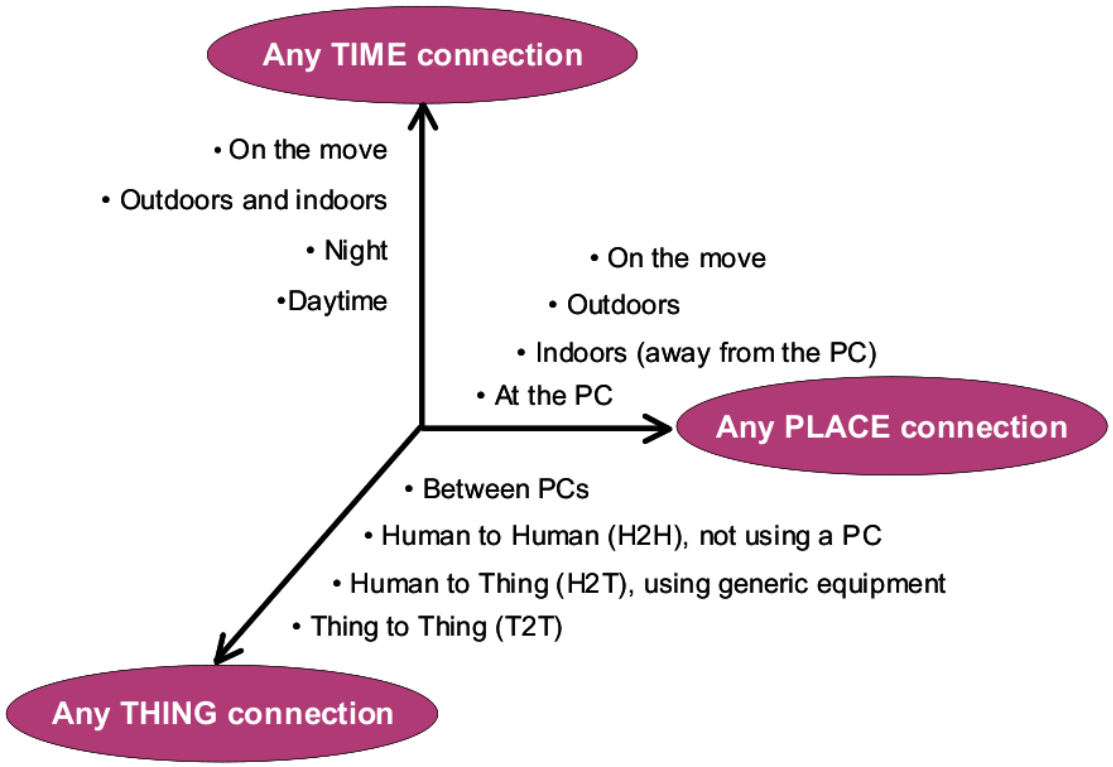
Dimensions of the Future Internet

- Future Internet Pillars
  - Internet by and for People
  - 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



Future Internet, The Cross-ETP Vision Document, Version 1.0, 2009

Internet of Things (IoT) – A Definition

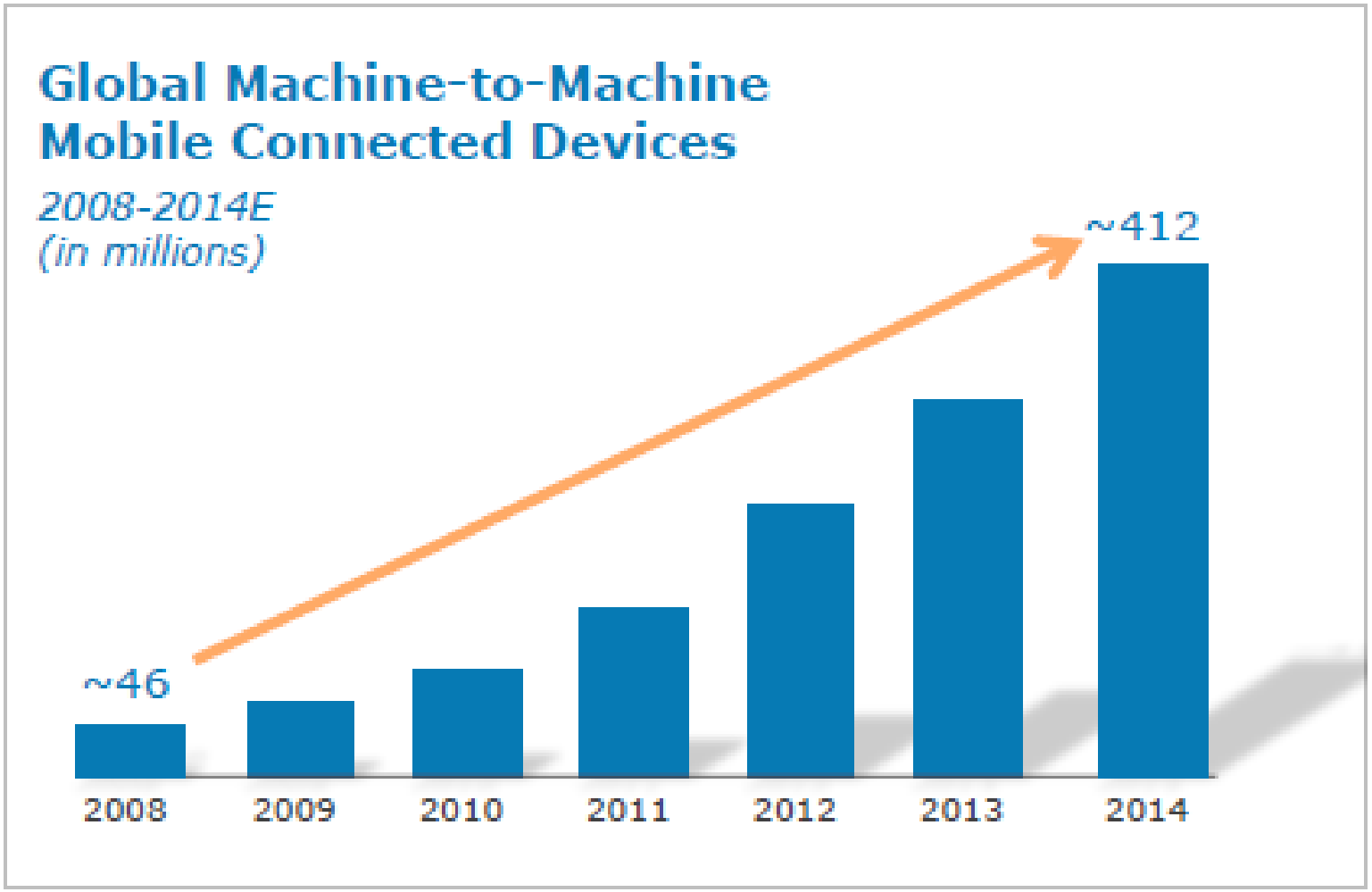


***Source*: ITU adapted from Nomura Research Institute**

"... embedding short-range mobile transceivers into a wide array of additional gadgets and everyday items, enabling new forms of communication between people and things, and between things themselves. A new dimension has been added to the world of information and communication technologies (ICTs): from anytime, any place connectivity for anyone, we will now have connectivity for anything."

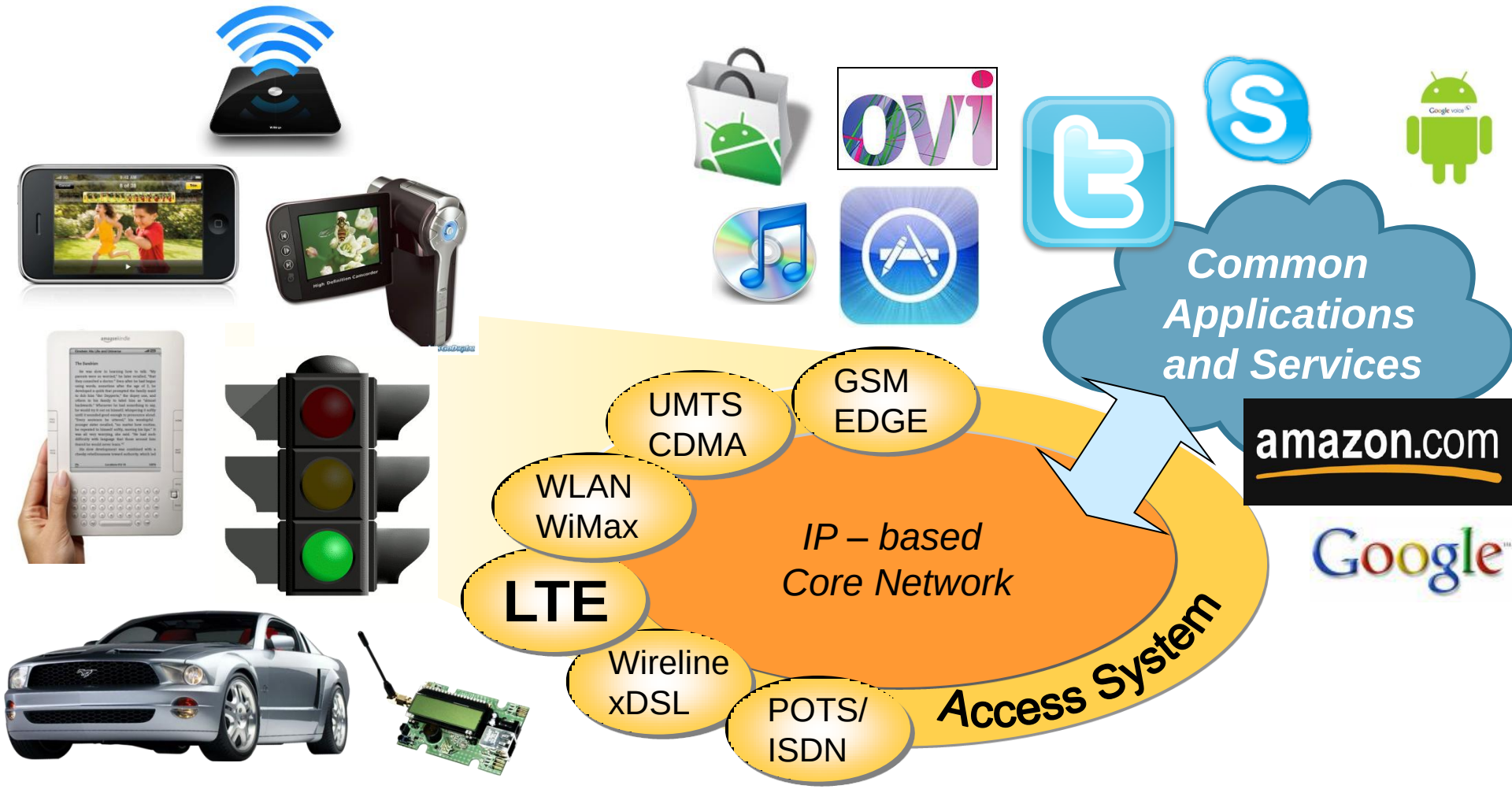
From "ITU Internet Reports 2005: The Internet of Things – Executive Summary"

M2M Communications is coming

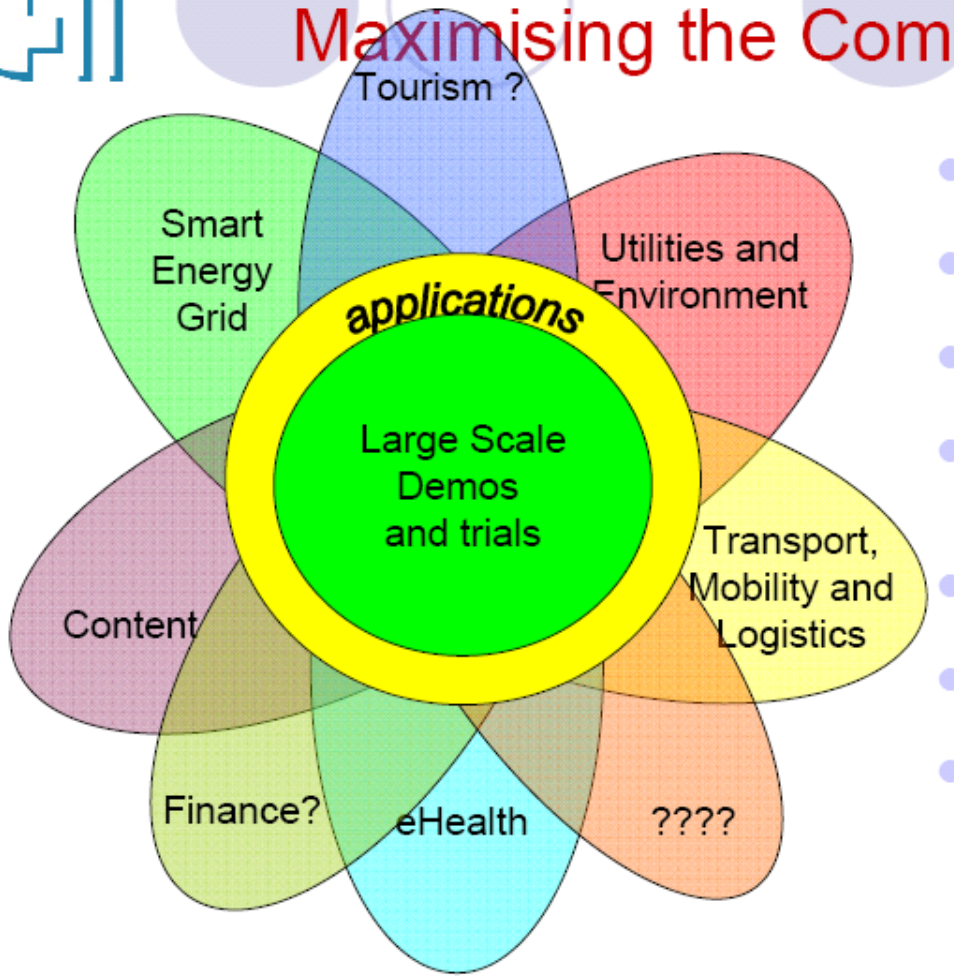


Source: Juniper Research, 2010

Highest Diversity of Things and Services



The Notion of Enablers within the European Future Internet Initiative

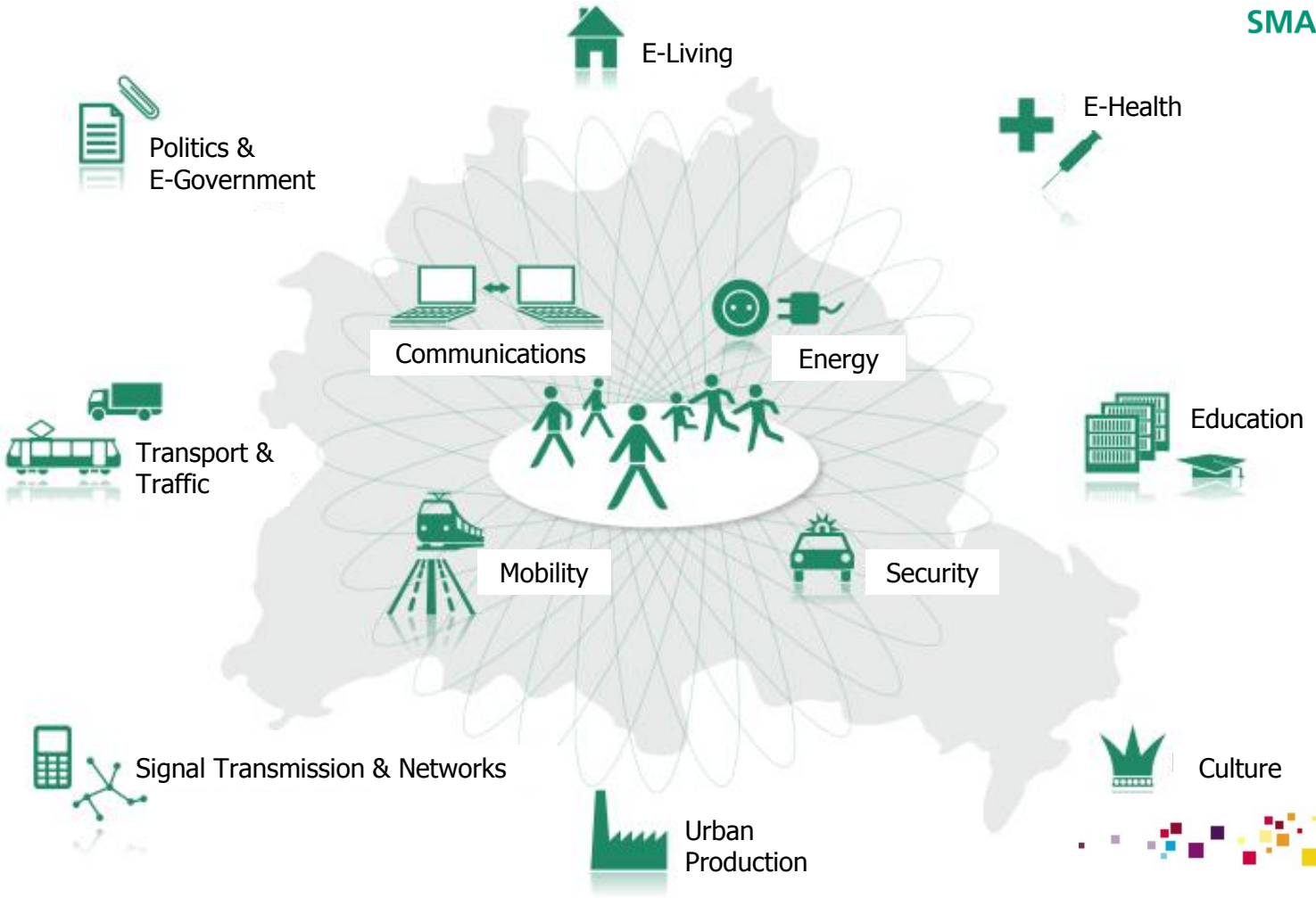


- Examine the basic enablers in each area
- Determine the common enablers
- Determine the enhanced enablers
- Work out how to provide a core platform that supports the enablers
- Build it and show the world
- Use it in large scale trials and tests
- Use existing advanced infrastructures to test future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

Future Internet … to make our cities smart

Open Platforms Are Needed

Fraunhofer SMART CITIES



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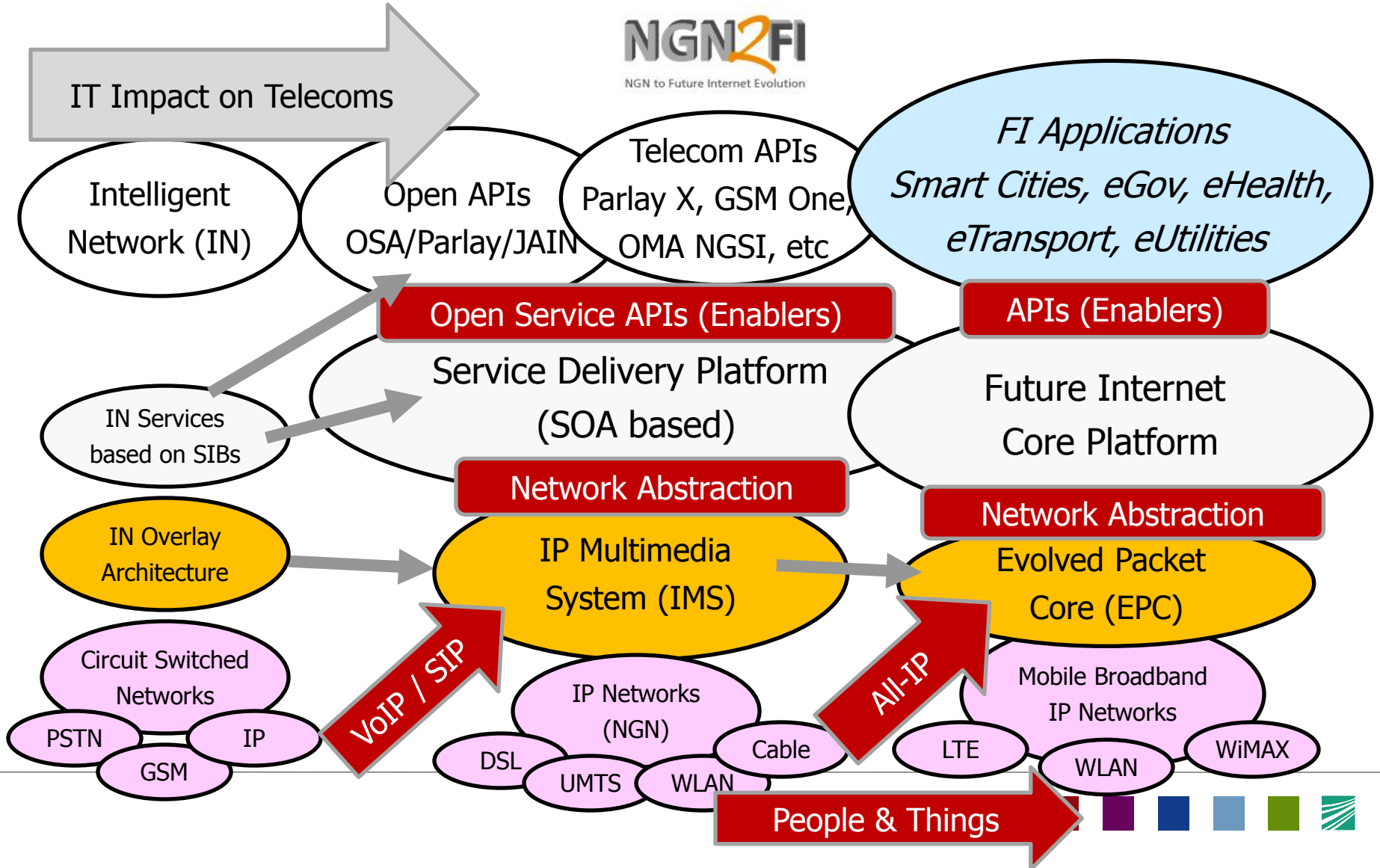
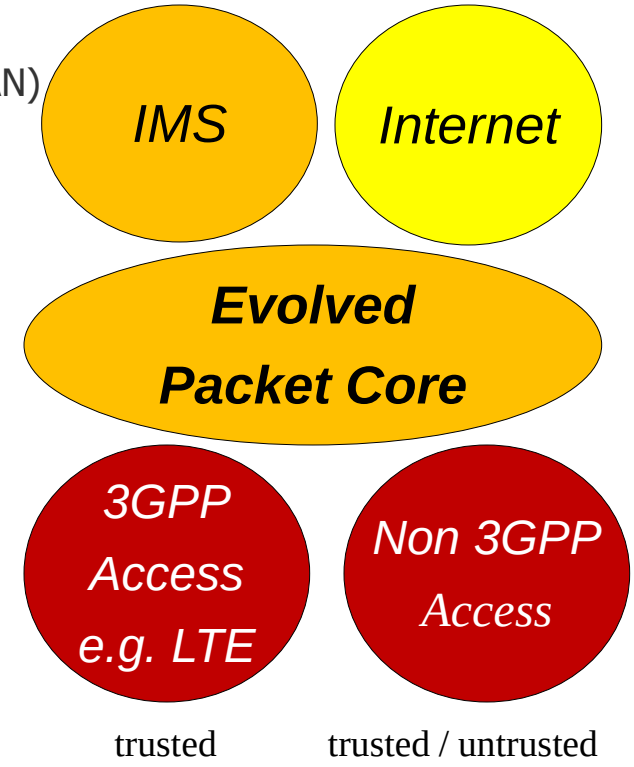
Evolution of Telecommunication Platforms toward Future Internet

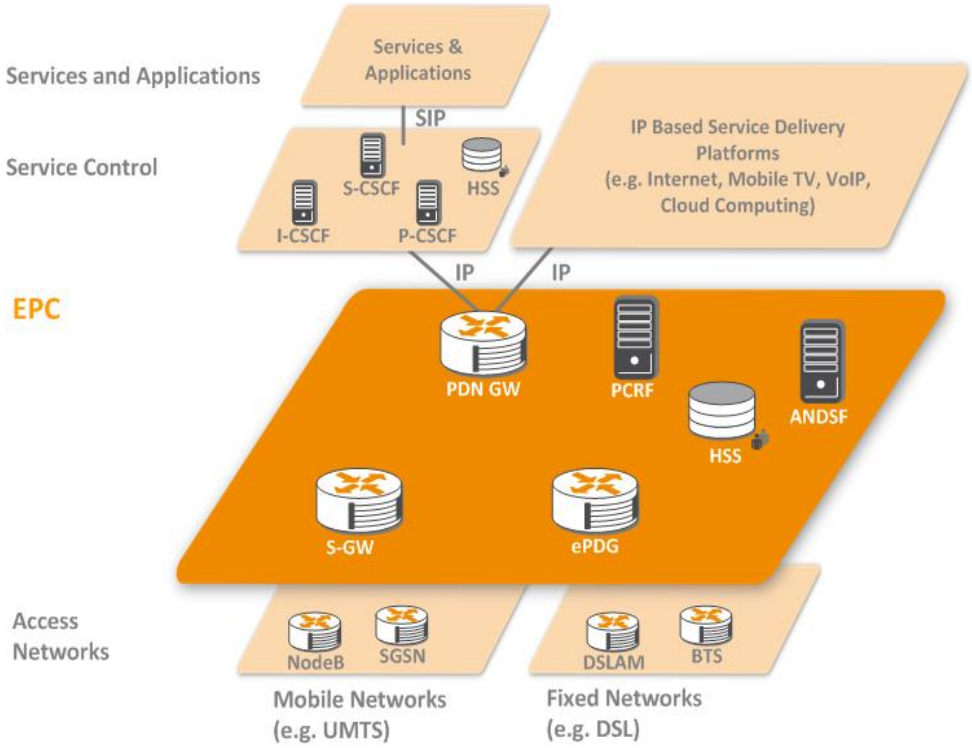


Evolved Packet Core (EPC)

- EPC is part of the 3GPP Evolved Packet System (EPS)
- The EPC is a multi-access core network based on the Internet Protocol (IP) one common packet core network for both
  - trusted networks including
    - 3GPP Access (LTE-E-UTRAN, UMTS-UTRAN, GPRS-GERAN)
    - Non 3GPP Access (WIMAX, CDMA2000/HRPD)
  - and untrusted networks including
    - Non-3GPP Access (WLAN)
- EPC provides connection to IP service domains
  - IMS
  - Internet (or others, e.g. P2P etc.)
- Important EPC functions include:
  - NAS and security (AAA)
  - mobility and connectivity management
  - policy QoS control and charging (PCC)



EPC Architecture and Capabilities



- Separation of core network functionality from service control
  - Mobility and QoS Management
- Decoupling of service provisioning from connectivity functionality
  - Novel service platforms can be easily deployed
- Generalized mobility support at EPC level
  - All-IP mobility support
  - Transparent to applications
- Complete convergence at core network level
  - All-IP services are sustained transparently
- Docking networks directly in the EPC
  - No implications on the service delivery platforms
- No dependencies on service signaling protocols
  - All protocols that are enabled over IP

Evolved Packet Core Principles

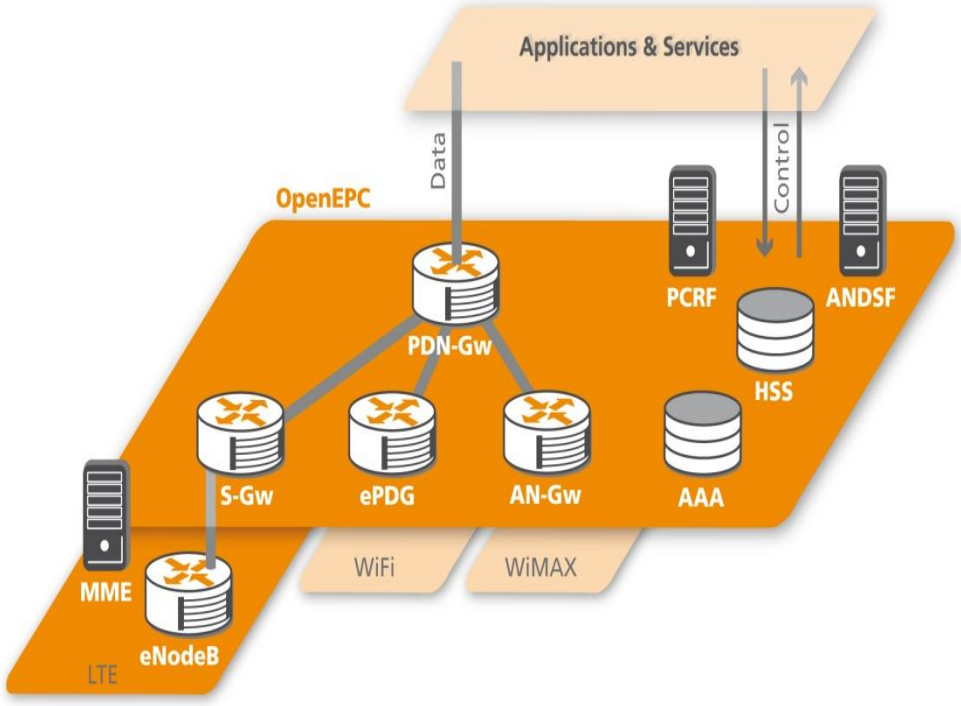
- EPC is designed to be a packet switched only system
  - IMS fulfills the role of a multimedia service platform
- EPC is a flatter architecture in comparison with 3GPP GPRS Core
  - Reduction of nodes in user plane path
  - GTP remains main protocol for 3GPP accesses
- EPC enables interworking with non-3GPP accesses (WLAN, WiMAX, CDMA2000, …) transparent to the services
  - IP Mobility between 3GPP accesses and non-3GPP accesses based on PMIPv6 (Proxy Mobile IPv6) or DSMIPv6 (Dual-Stack Mobile IPv6)

OpenEPC Rel. 2

Features, Functionality and Components

- Rel. 2 highlights the introduction of LTE specific Access Network Elements.
  - evolved NodeB (**eNodeB**)
  - Mobility Management Entity (**MME**)
  - GTP-C/U, S1-C/U, S6a/d, S11, S1AP

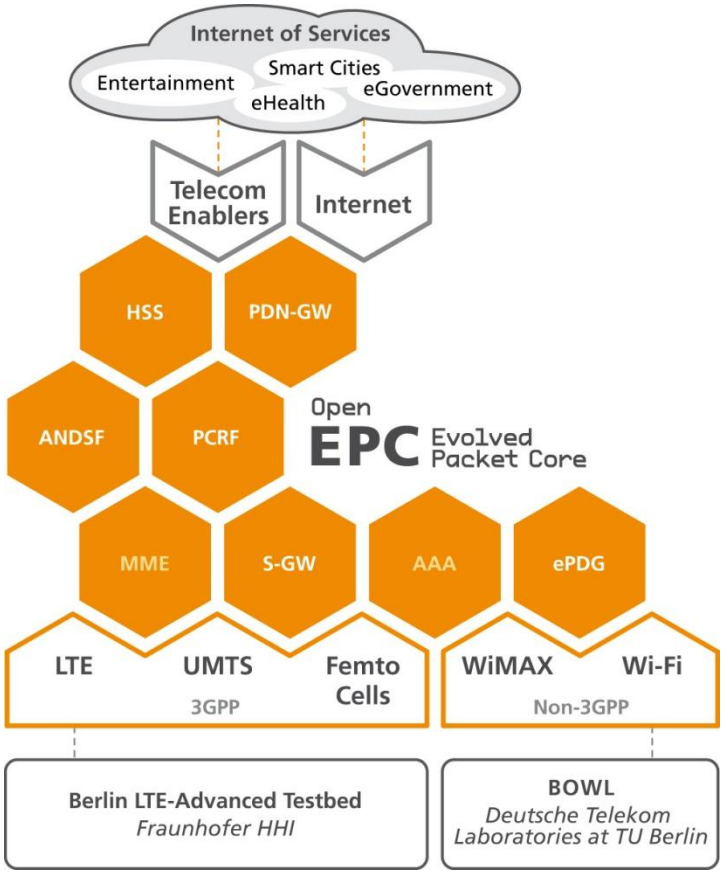
- New Features
  - Improved Provisioning and Application Development Support
  - Truly Seamless Handovers (Zero Packet Loss)
  - Lower Latency Attachments
  - IP-Flows Live Monitoring (See what's going on in your Testbed)



Related Testbed

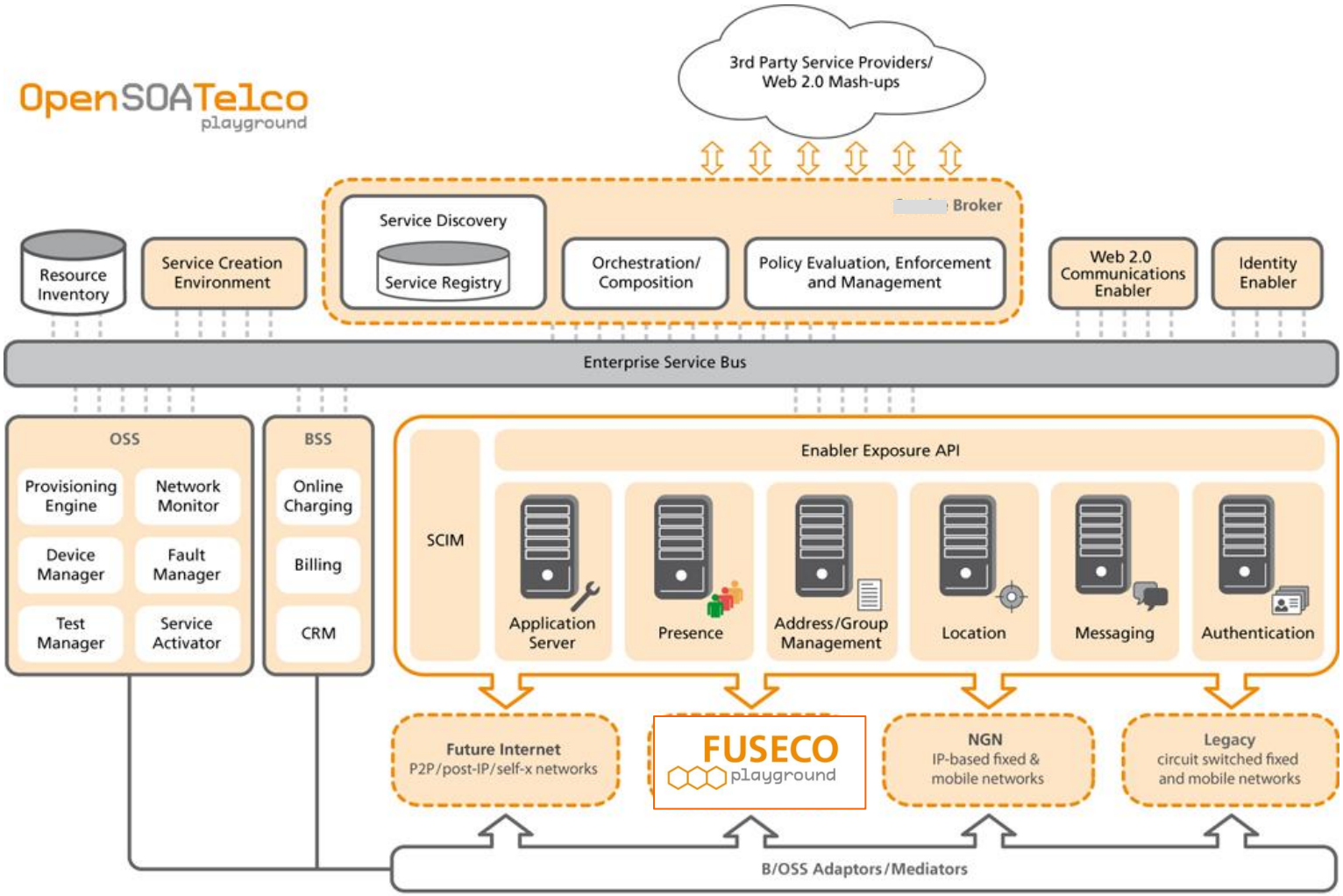
Future Seamless Communications (FUSECO) Playground

- State of the art testbed infrastructure as a cooperation of Berlin's Next Generation Mobile Network expertise for
  - **EPC** from Fraunhofer FOKUS
  - **LTE-Advanced** at the Fraunhofer HHI
  - **WLAN** Networks at the Berlin Open Wireless Network from the Dt. Telekom Labs @ TU Berlin
- 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: **www.fuseco-playground.org**

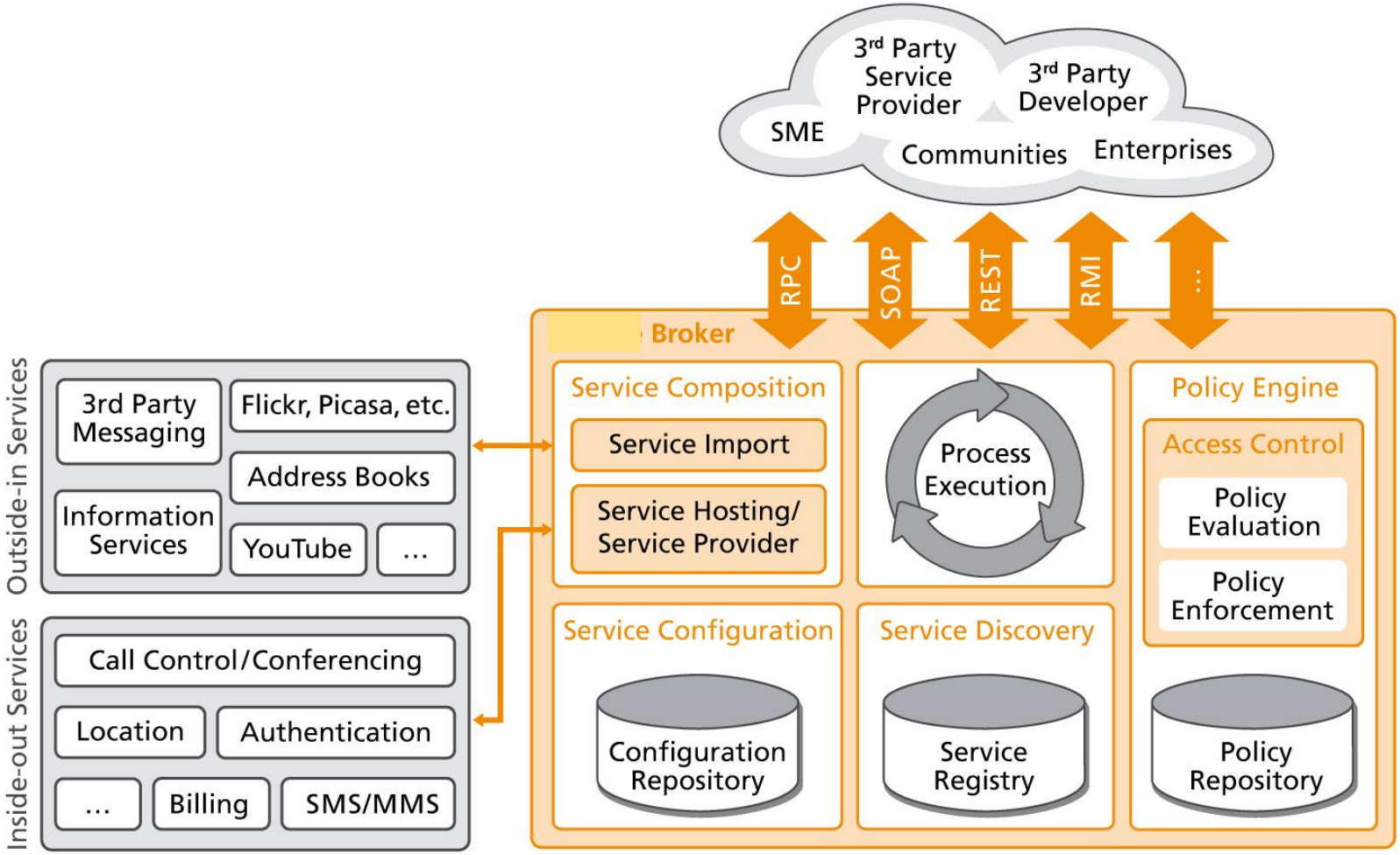


FOKUS Open SOA Telco Playground

Enabling seamless Services across Networks and Service Domains

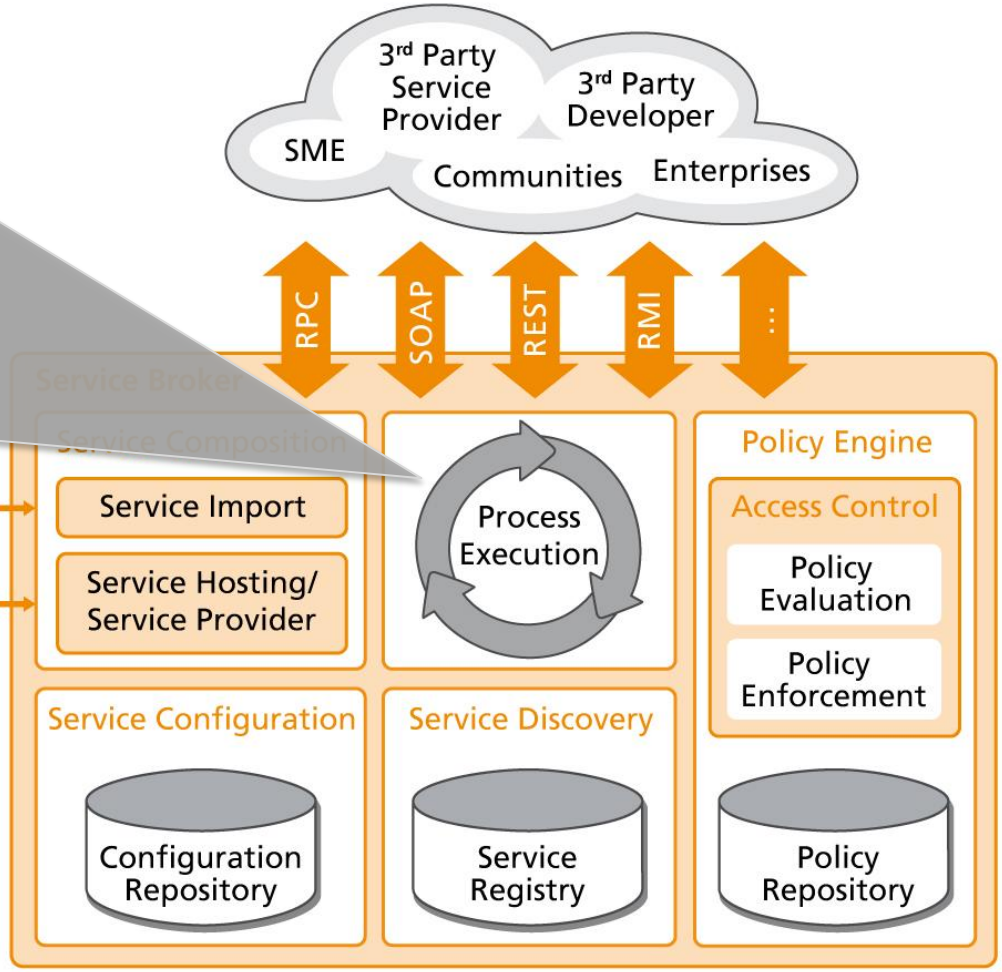


NGN Broker
Architecture



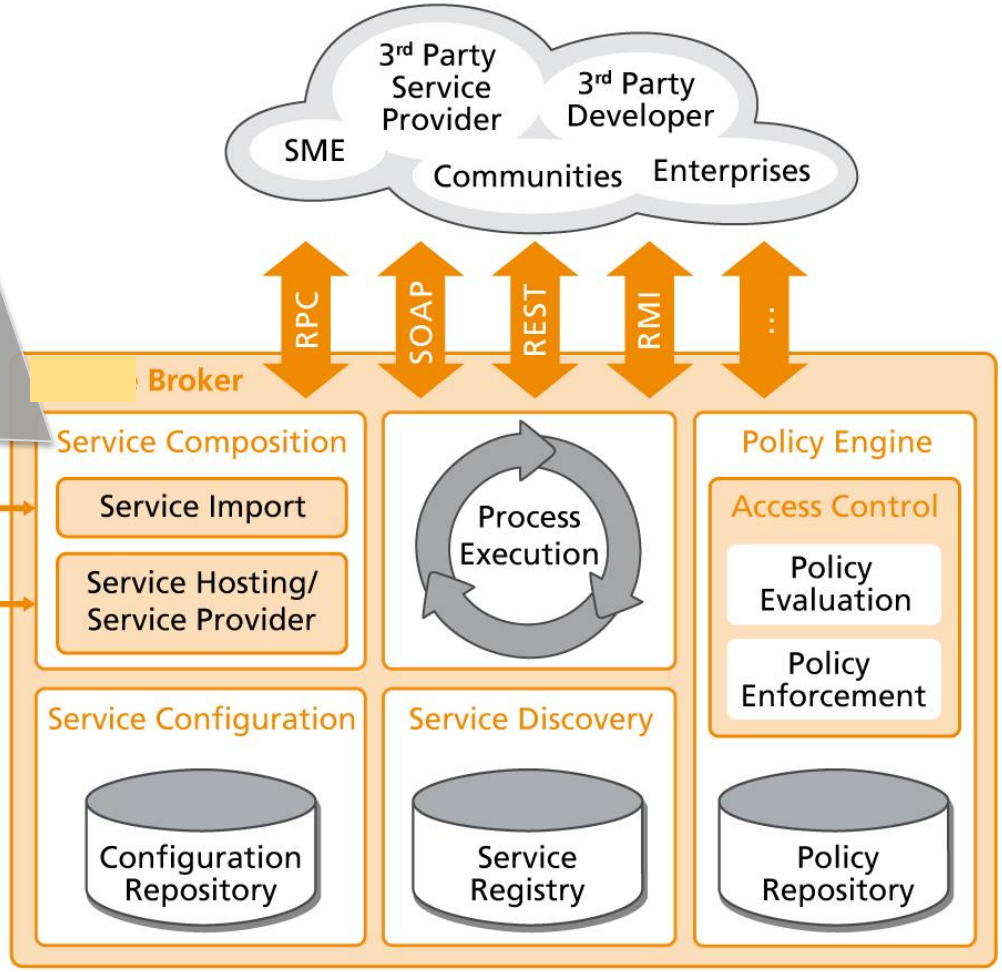
NGN Broker
Architecture

Services created by internal or external software developers have to run on a flexible platform that is able to **manage the life cycle** of components that includes the **relationships between software components as well as versioning mechanisms**. The Open Service Gateway initiative (**OSGi**) has been identified as a perfect standard based framework that handles the mentioned requirements of an execution environment.



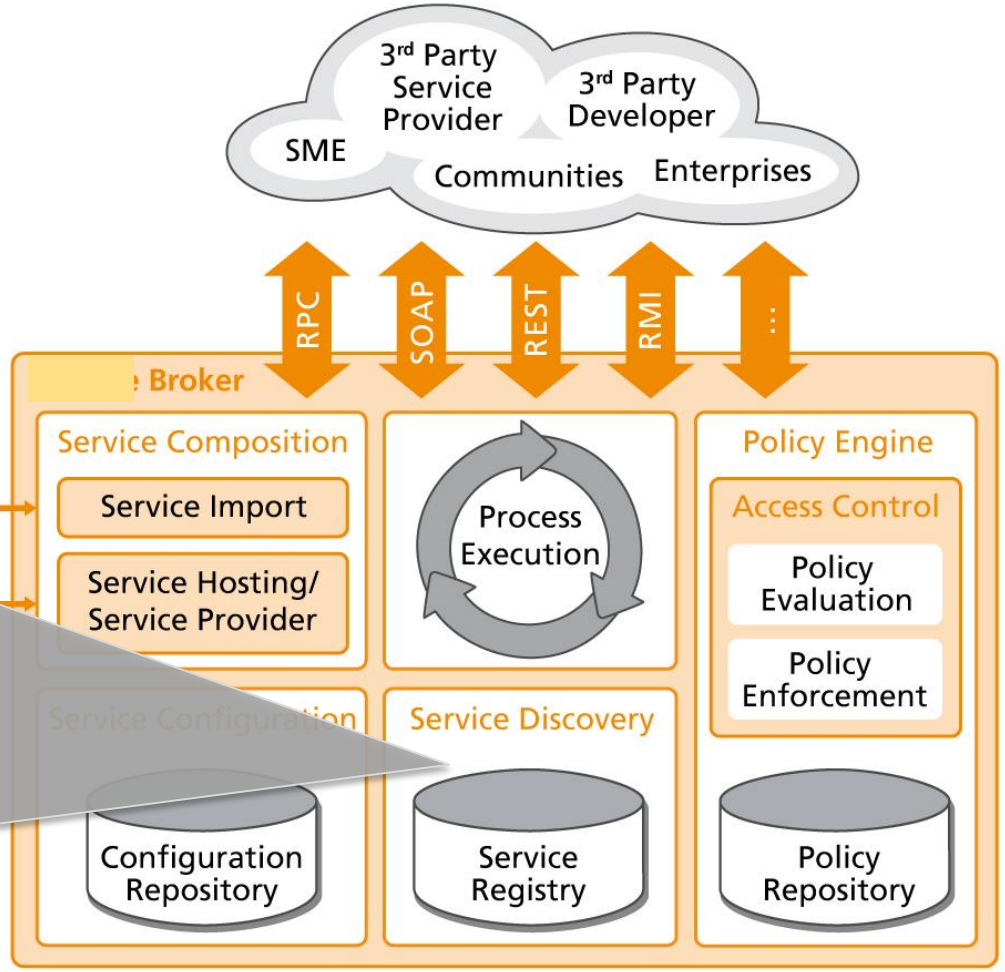
NGN Broker
Architecture

• Service Hosting / Provider:
exposes the domain typical assets of the underlying network infrastructure via various service endpoints as services.
• Service Import:
Allows integrating services from external service providers by simply linking the service endpoints (WSDL, WADL, etc.) to the service registry.
• Service Composition:
abstracts their business rules and service execution sequence logic from services, promoting agility and reusability on its highest grade.

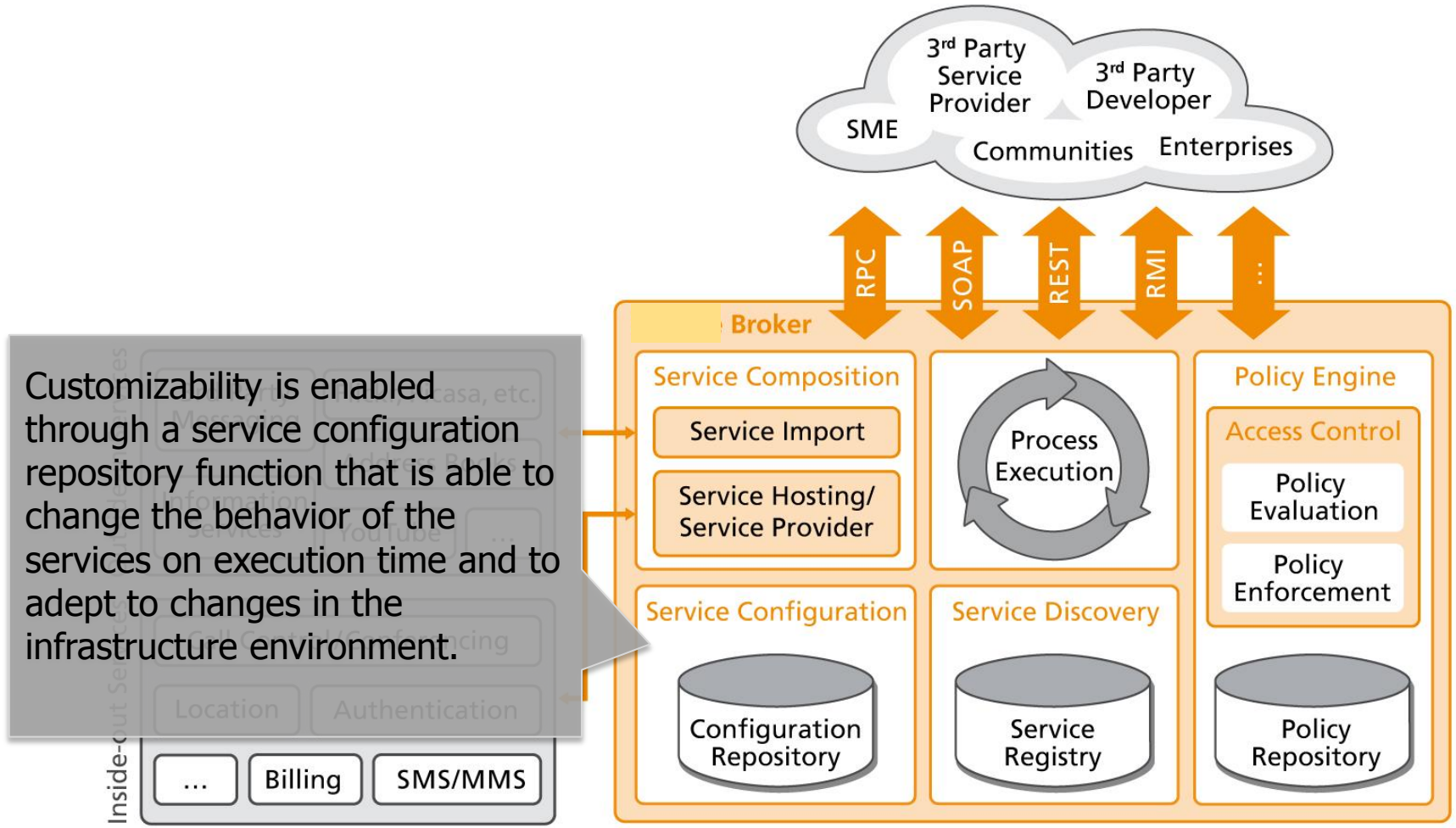


NGN Broker
Architecture

- A simple integration of external service needs a mature service describing standard technology
- It is the fundament for a service discovery function.
  - WADL and WSDL are W3C defined standards describing the operational and technical parts of a services.
  - USDL is another very young description language that tries to combine next to operational and technical descriptions also the business related information.



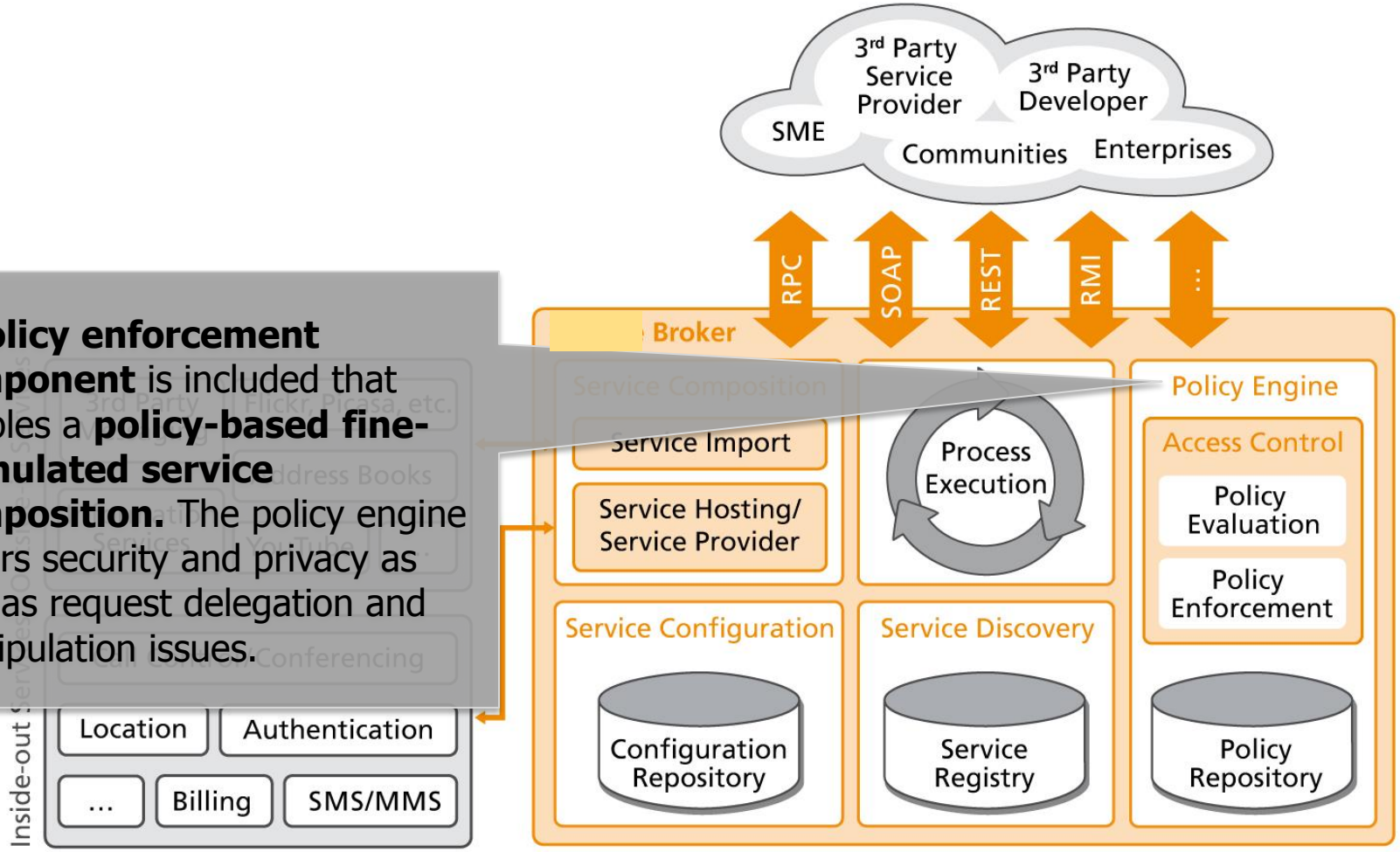
NGN Broker
Architecture



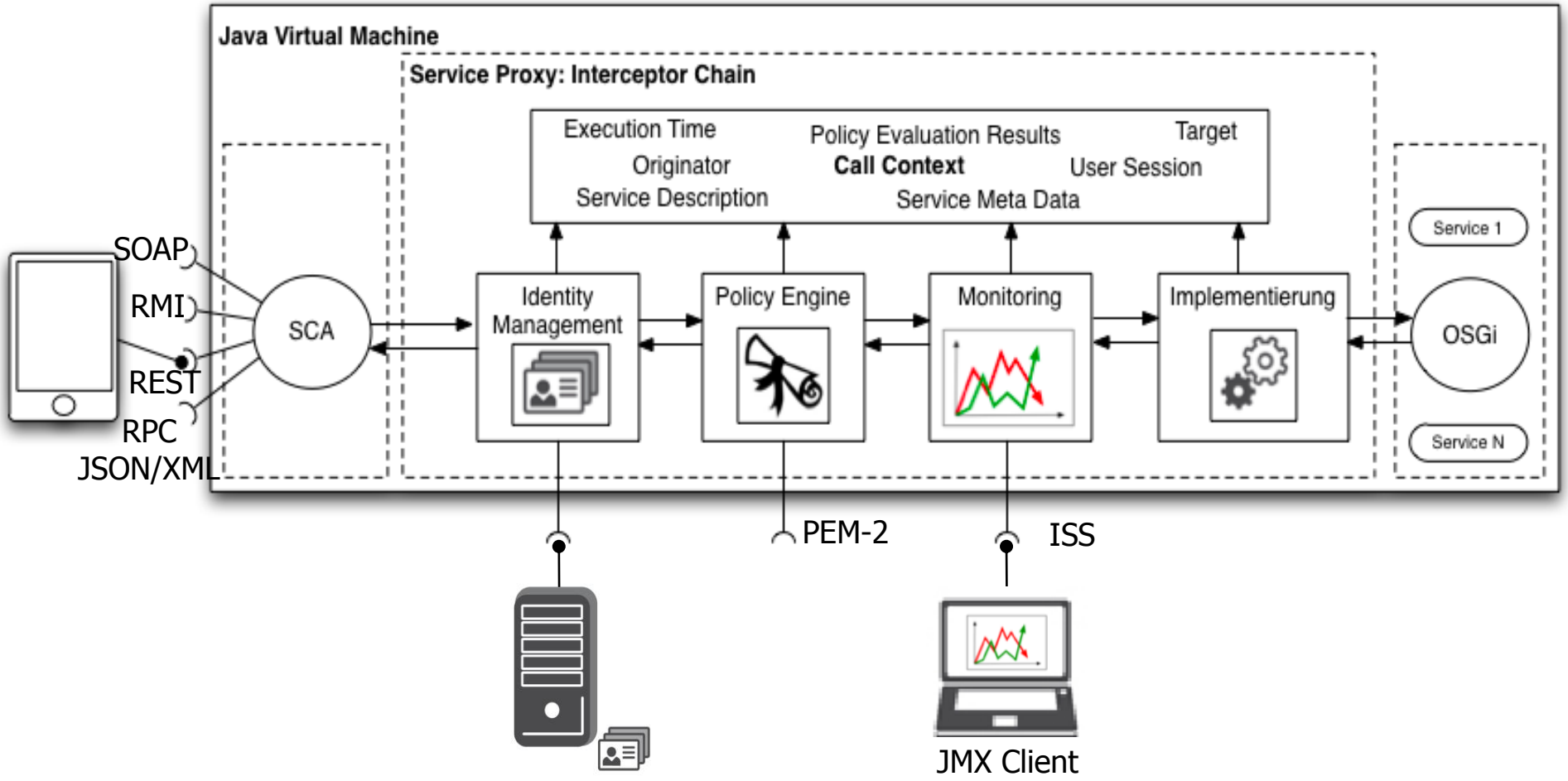
Customizability is enabled through a service configuration repository function that is able to change the behavior of the services on execution time and to adept to changes in the infrastructure environment.

NGN Broker
Architecture

A **policy enforcement component** is included that enables a **policy-based fine-granulated service composition.** The policy engine covers security and privacy as well as request delegation and manipulation issues.



The Interceptor Chain
Policy Evaluation



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Tesbed at FOKUS comprising variety of sensor nodes supporting the Internet of Things

MicaZ/Crossbow
(IEEE 802.15.4,RFID)

USB-Stick/Integration
(ZigBee)

Home Control/Conrad
(ISM 433MHz)

ESB Mote/Scatterweb
(ISM 868MHz)

IMote/Intel
(Bluetooth)

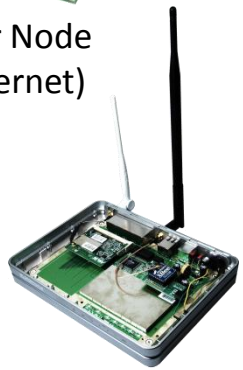
Atmel
(IEEE 802.15.4
6LoWPAN)

FOKUS Sensor Node
(868MHz,Ethernet)

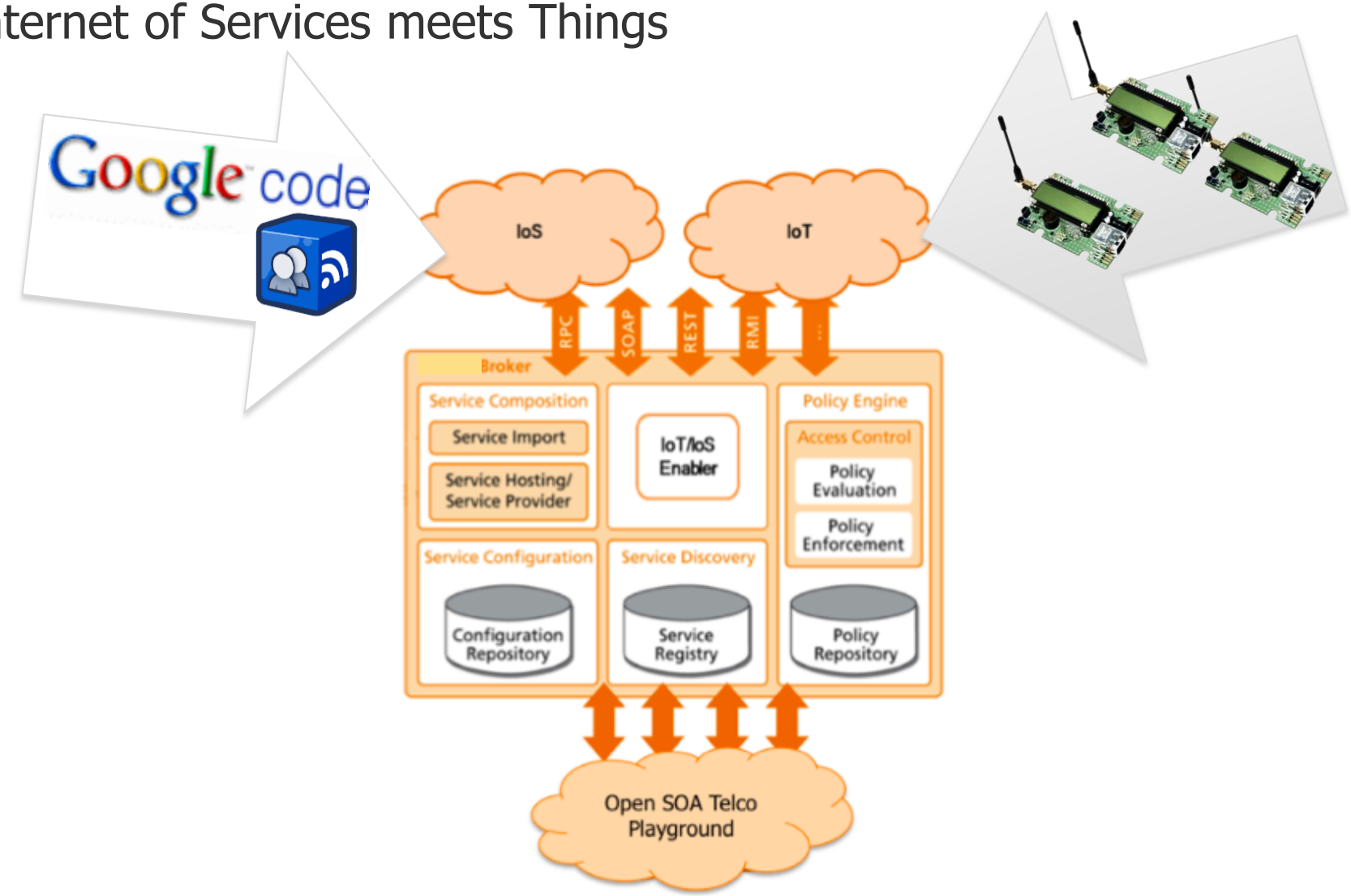
Tmote/MoteIV
(IEEE 802.15.4)

Zebra/senTec GmbH
(IEEE 802.15.4/ZigBee)

Sensor/RFID Gateway
(WLAN,RFID,802.15.4)

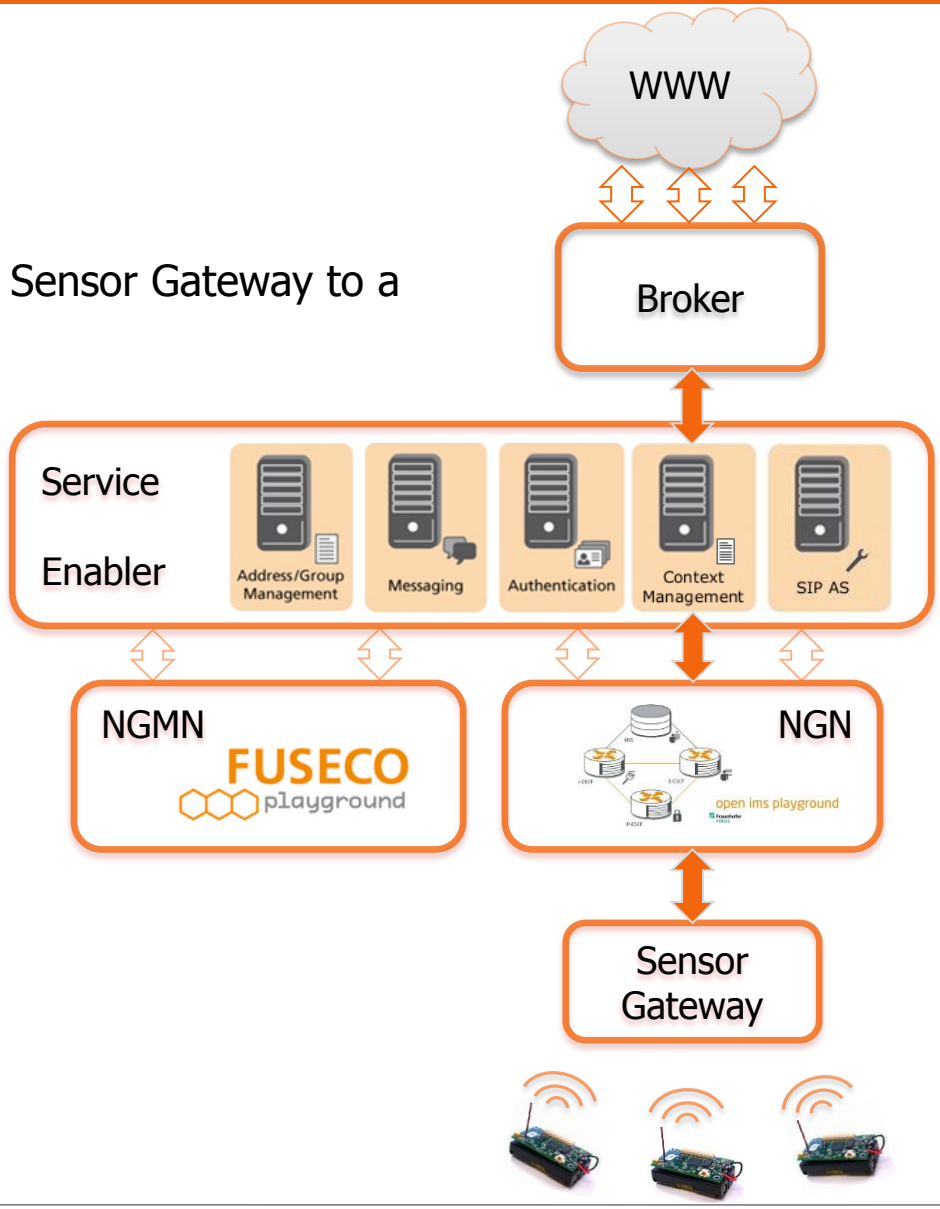


Internet of Services meets Things



IoT Services

- Sensor Information are published by a Sensor Gateway to a Context Management Server via SIP
- Sensor data can be enhanced with other context information like location or presence information
- Broker subscribes to enriched sensor information and provides it as a service



Scenario

Active Electronic Device Reminder

- Combining sensor information with location information
- Power plugs with sensors publish the status (on/off) of devices to the Context Management Server
- Person publishes its location with its IMS client to the Context Management Server
- If a person leaves its home area and electronic devices are still turned on, it gets notified and can chose to turn them off with its IMS client

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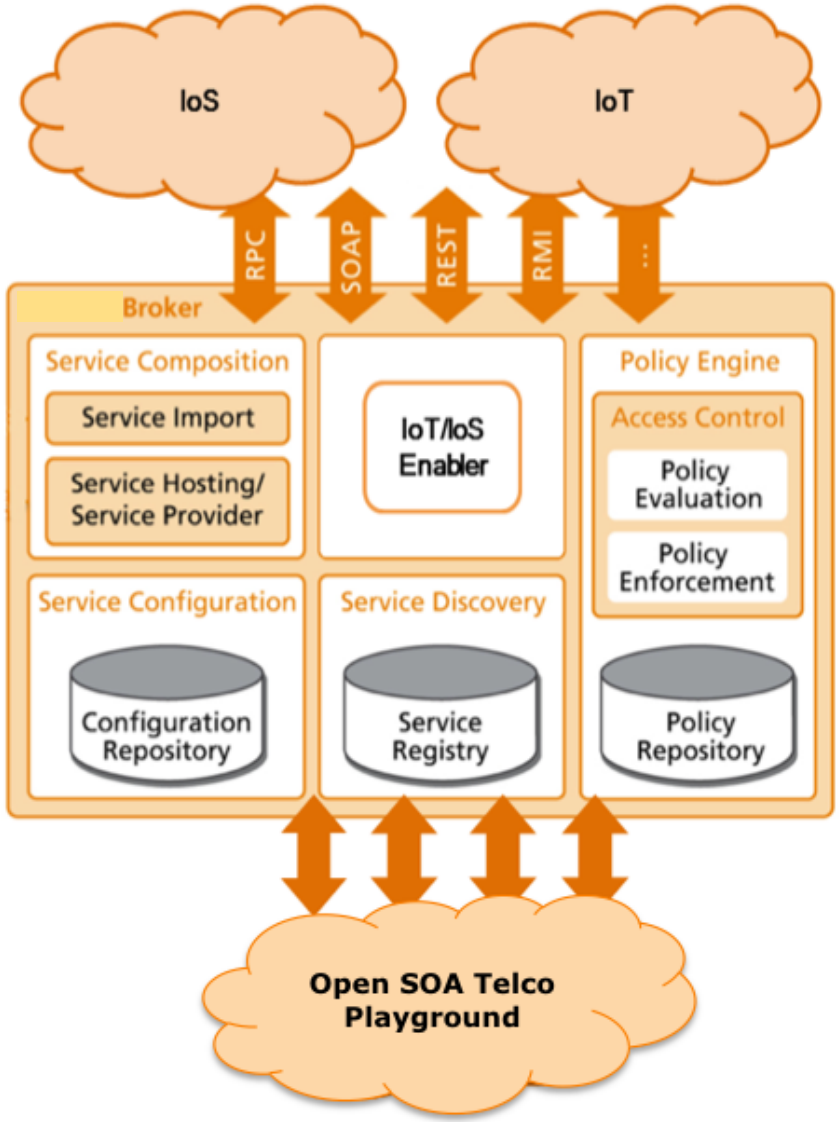
Internet of Services meets Things

- NGNI IoS/IoT R&D Topics:
  - Simple provisioning procedures
  - Efficient inter/intra-communication
  - Semantic Discovery
  - Clustering and distributed computing
  - Service/Device Monitoring
  - User and service data aggregation approaches
  - Policy based privacy / access control



Any Questions?

شكراً على حُسن إصغائكم

Muchas Gracias

谢谢

Merci Beaucoup

Fraunhofer FOKUS

Vielen Dank

有難う

Thank You

Terima Kasih

Hartelijk Dank

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