

Improving Service Utility and Delivery for Next Generation Networks

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NEC Europe Laboratories

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 - NW Div.:** Heidelberg (D) & Acton (UK)
 - IT Div.:** Bonn/St. Augustin (D)
- ~ 110 staff working on network and IT research & development
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 - ✓ Network & Service Management
 - ✓ Security, Privacy & Performance
 - ✓ Distributed Services and Service Platforms
 - ✓ High-Performance & Grid Computing
 - ✓ Parallel Processing
- <http://www.netlab.nec.de>
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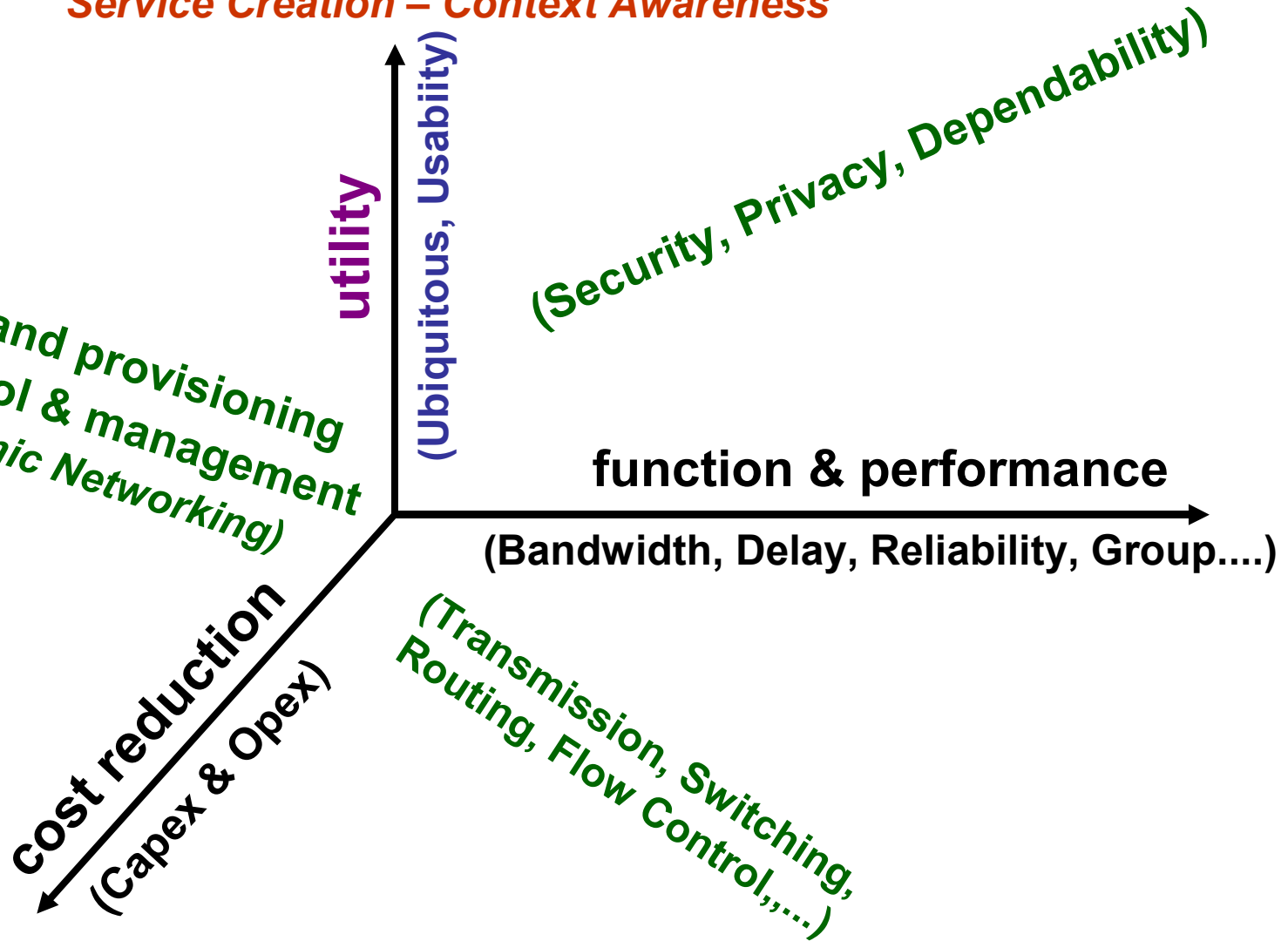
Communication in the 23rd Century



- **it's high function**
 - multimedia
 - group
 - faster than light (??)
- **it's ubiquitous**
 - available anywhere I want
 - p2p, p2m, m2m
- **it's usable**
 - wearable
 - no wires restricting our moves
 - voice activated
 - Transparent (unseen)
- **it's adaptive**
 - heterogeneous devices
 - heterogeneous networks
 - automatically adapts
 - IT and networks merge and disappear
-

Research Dimensions

services and applications
Service Creation – Context Awareness



Key Communication Trends

Near Term Trends

- from circuit switching to packet switching
 - POTS → POTS + Internet → **Internet with VoIP and IPTV**
 - 3G + GPRS → 3G + GPRS + IMS → **3G All-IP**

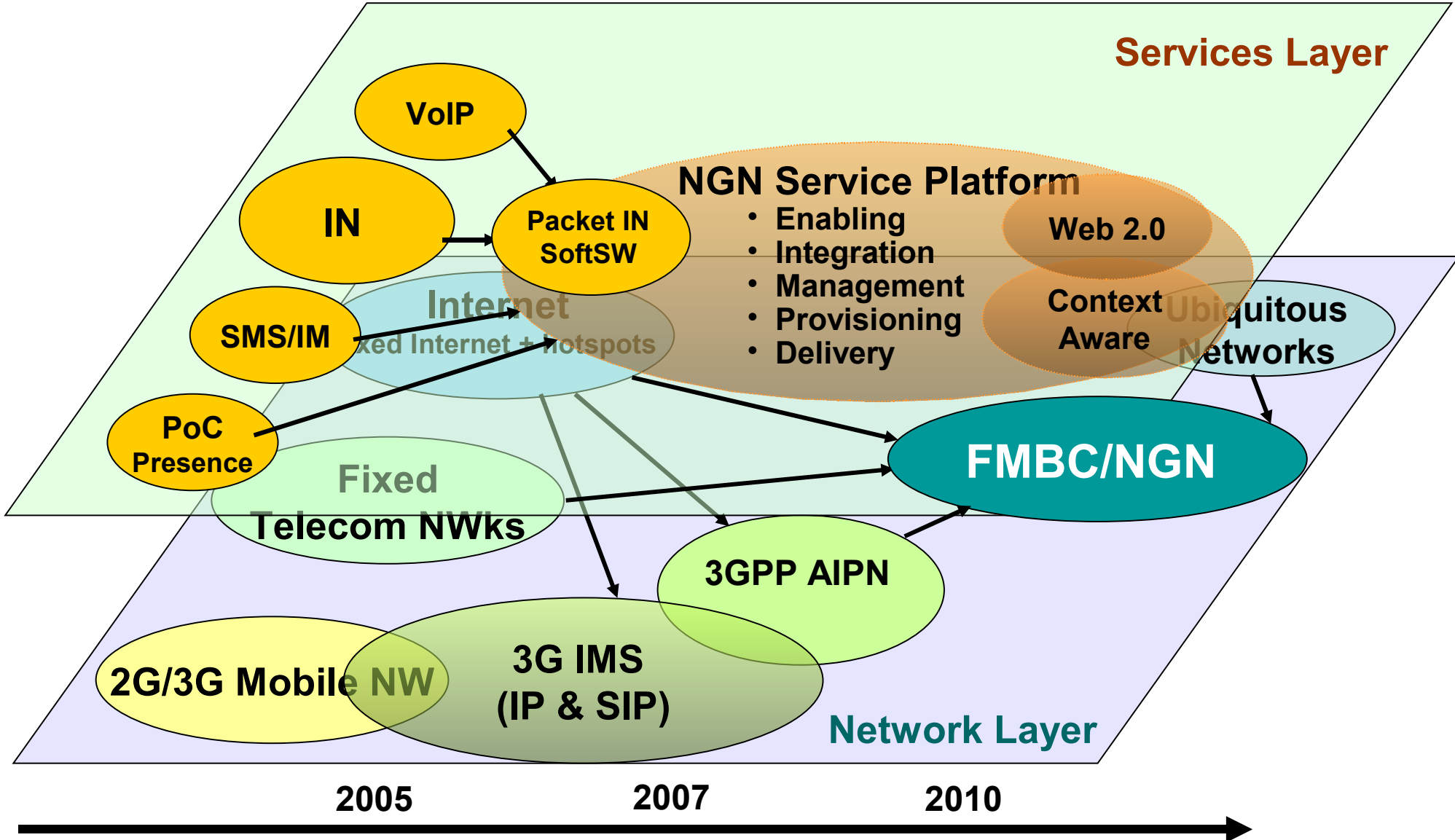
Mid Term Trends

- **from homogeneous to heterogeneous** networks
 - seamless integration of 3G and 802.11, 802.16....
 - always best connected paradigm
 - integrating digital broadcast and ad-hoc access (infrastructure-less)
- **fixed-mobile convergence towards a true NGN**

Longer Term Trends:

- computers and communications everywhere - towards ubiquitous and pervasive computing
 - **self-organizing/self-managing/autonomic networks**
- **rich and usable services across various networks and terminals**
 - **user-friendly, adaptive, personalized services**

Network and Services Evolution



Communications Services Key Challenges

- **Service Creation & Delivery for efficient service deployment**
 - enable a service eco-system allowing new value chains & business models
 - integrating IT and network technologies for faster service delivery
 - support the co-evolution of networks and services
- **Security and Privacy to remove service adoption barriers**
 - **Identity Management** to make **security solutions easier to use**
 - consistent authentication for network and application services
 - improved privacy control for providers and users
- **Context Awareness as a means to increase service utility**
 - provide the right services at the right time in the right form
 - service enabler providing personalized, user-centric services
- **Ubiquitous networks**
 - **Impact of ubiquitous on services** – local connectivity, sensors providing context information
 - Challenges for ubiquitous networks
 - autonomic networking
 - security and privacy in ubiquitous networks

Service Creation and Delivery

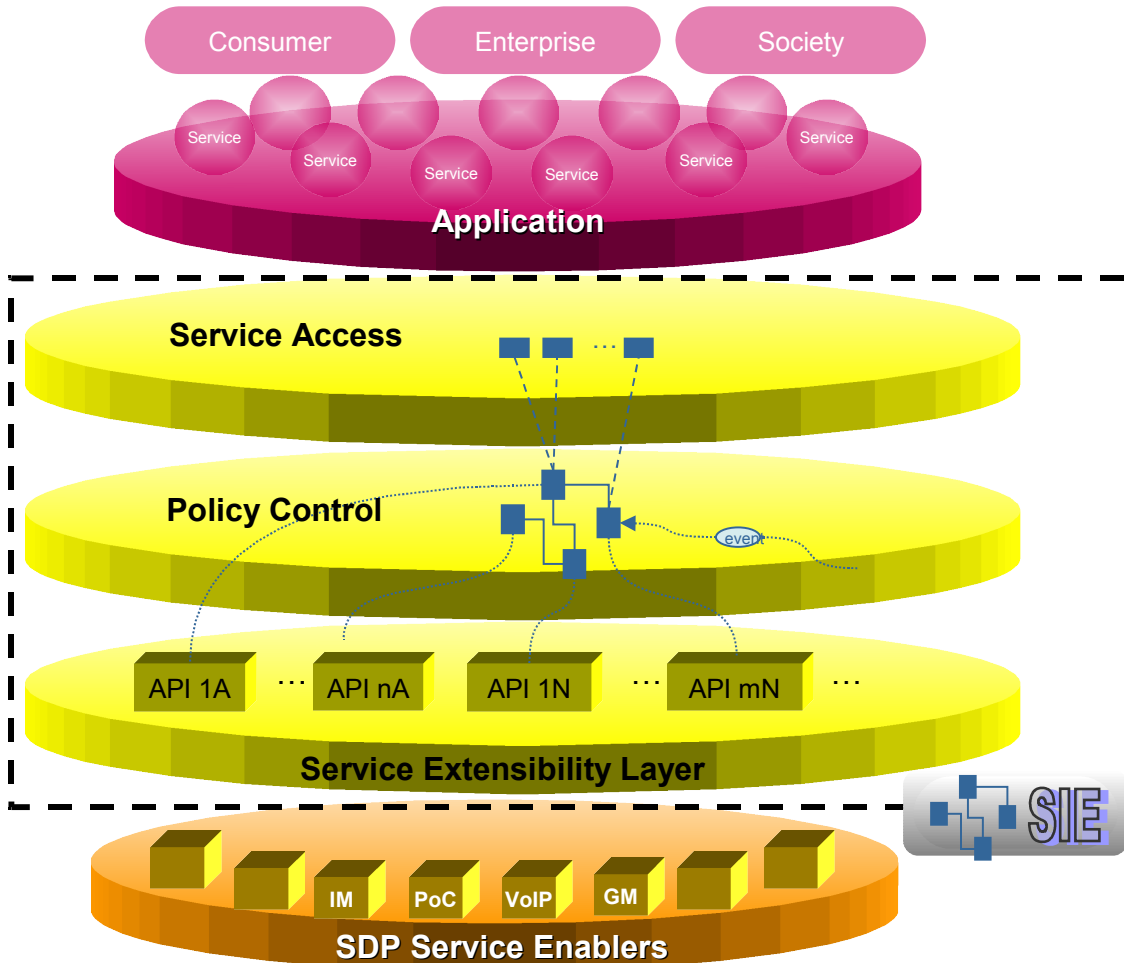
⇒ EU FP6 SPICE
and NEC's SIE Project

Service Delivery Technologies

Enabling Rich Service Worlds

Service Delivery Platforms:

- **Orchestration:** combination of basic services to form more complex advanced services
- **Controlled access** to resources for internal and 3rd party application developers



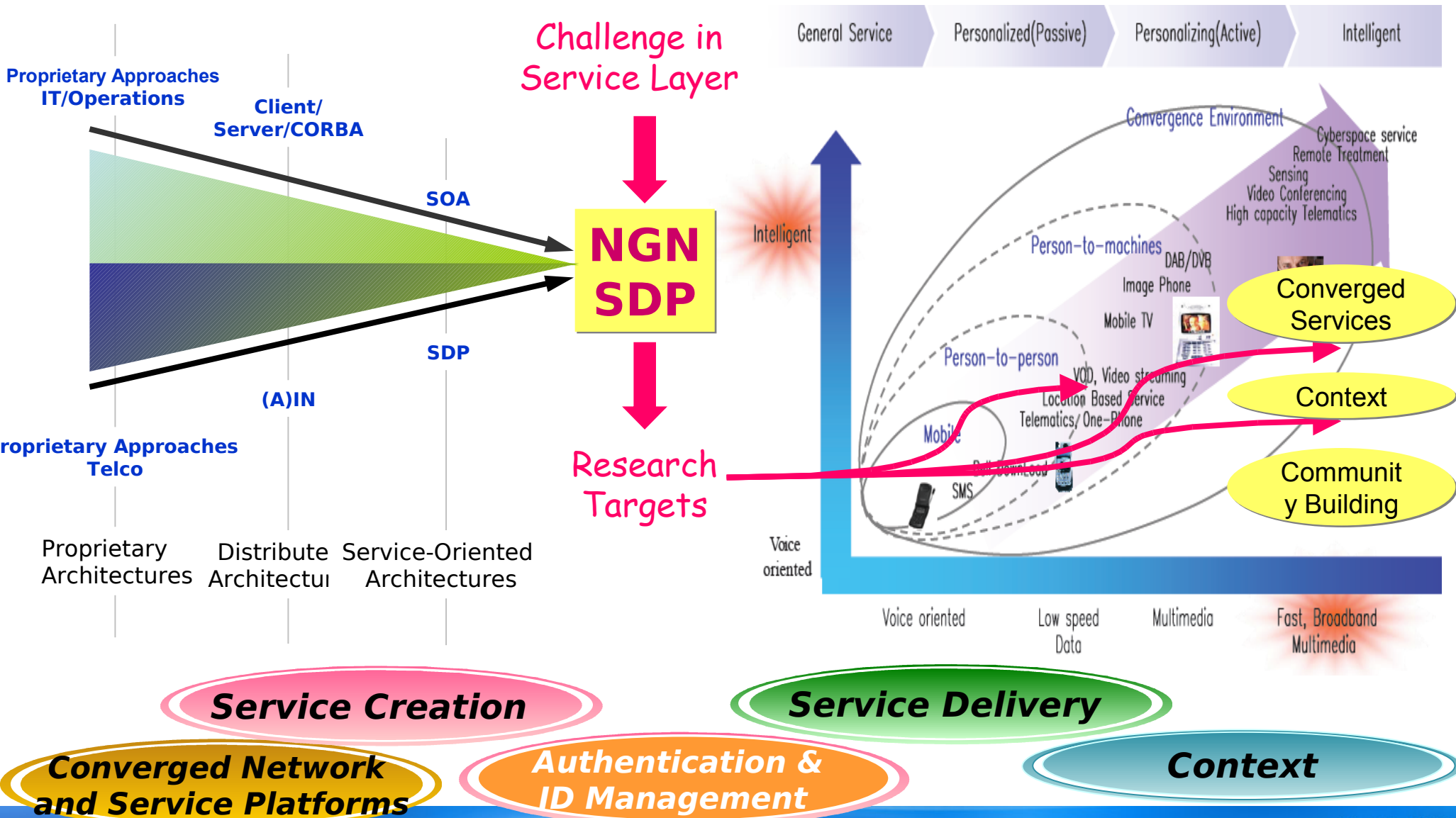
- combining **IT and Networking technologies**
- **rich set of service enablers**
- **integration technologies**
 - Federated Identity
 - Profile Management
 - Policy Management
 - Common OSS/BSS
- **Service-Oriented Architectures**

State-of-the-art technology:

- **Service-Oriented Architectures**
- OMA Service Enablers for IMS
- New Execution Environments: BPEL, JSLEE, OMA OSE

Service Delivery and Value-added Services

Goals and Activities



Challenges in Service Delivery

Advanced software technologies for efficiency, scalability, reusability

- Model-driven architectures
- Flexible composition architectures build on SOA
- Integration of different technologies (converging SIP-based and web-services)

Incorporate Web 2.0 Paradigm

- User generated services - harnessing collective intelligence
- Creation of web content via mixing („mashing“) of content of websites
- Personal publishing via social networks, and content self-creation („folksonomy“)

Business Logic Control Layer

- Telco become broker and mediator - based on semantic service descriptions
- Business logic execution engines

Services integrating Ubiquitous Networks

- Local environment: home, car, hotel, ...
- Combine private capabilities with operator-based services
 - operator-assisted ubiquitous networking
 - multi-modal services

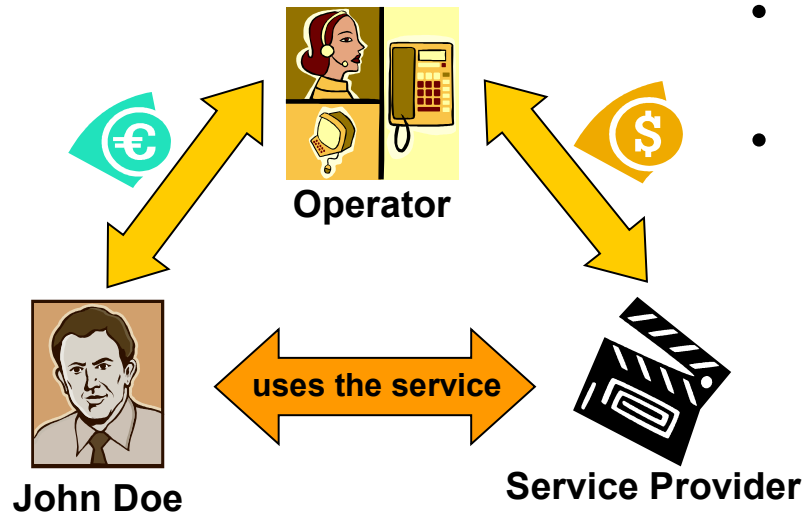
Security and Privacy

⇒ EU FP6 Projects

Daidalos, MagnetBeyond, UbiSec&Sense

Virtual Identities Enhance Service Utility

- Growing **numbers** of communications services
→ burden users with increasingly complex authentication effort
- Users want a **limited** number of operators
→ enabling universal access to everything – ideally “single sign-on”
- **Identity solutions** need to support **multiple (virtual) identities** for several **profiles, roles** and **contexts**, the **maintenance** of these identities, respecting **privacy**, and all available **services, networks, content**, ... wherever the user may be. (FP6 Daidalos)



- The trusted operator becomes a **proxy** for billing which is a business in itself.
- Improved Security through **VIDs** acting as pseudonyms
 - the service provider delivers without knowing the user.
 - the trusted operator (e.g. operator or bank) knows the user but not the service

Challenges in Identity Management

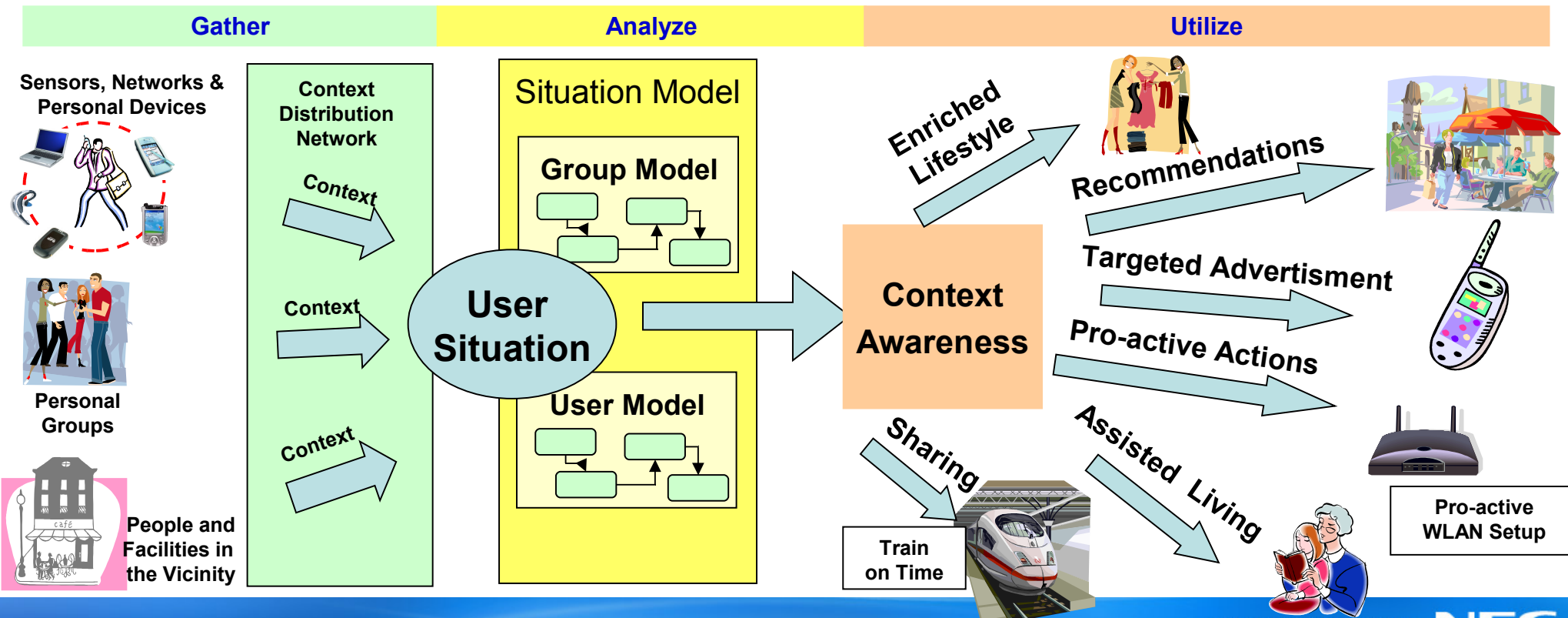
- **Identity driven mobility:** Full top-down identity-based mobility
 - beyond integration of identity in known protocols
 - including multiple devices tied to a virtual identity for a single session
- Context and Personalization: Interfaces between the user and his data with **maximum privacy and minimum leakage**
 - Seamless tracking of user context
 - Minimal user interaction with **improved learning mechanisms**
 - Context **obfuscation:** Access control mechanisms on context data respecting user privacy needs/preferences
- **Name resolution:** Secure resolution of names into multiple identities subject to access control
- Cryptographic primitives:
New set of targeted cryptographic primitives supporting the use of different (multiple) identities and name resolution

Context Awareness

⇒ EU FP6 Projects
MobiLife & SPICE

Context Utilization - Status Quo

- **determining context for users, groups, location, history based on mobile & ubiquitous network and web technologies**
 - context agent for sensing and communicating information from mobile devices
 - processing framework for dynamically provide new context processing function
- **large scale context distribution network**
 - connect many sources of context with context processing engines and service enablers to utilize context information
 - context exchange protocol (CSIP) and broker (index servers) for efficient access



Challenges in Context Awareness Technologies

Gather

- **Instrumenting the World**
 - sensors
 - networks & IT system
 - application extraction
 - user provided
- **From Measurement to Semantic Context**
 - semantic abstraction
 - adaptive gathering

Analyze

Flexible Analysis Engines

- filtering, aggregation
- data mining, reasoning,
- offline/online machine learning & prediction

Creation Environment

- creation process & refinement of processing
- simulation & testing

Utilize

Generic Enablers

- information selection
- **proactive, attentive services**

Social Networking

- group support
- multi-modality
- harnessing collective intelligence of users

Context Representat ion

IETF Presence Data Interchange Format (PDIF) vs. W3C RDF
Semantic representations/ontologies

Quality of context – Reputation of Context Provider

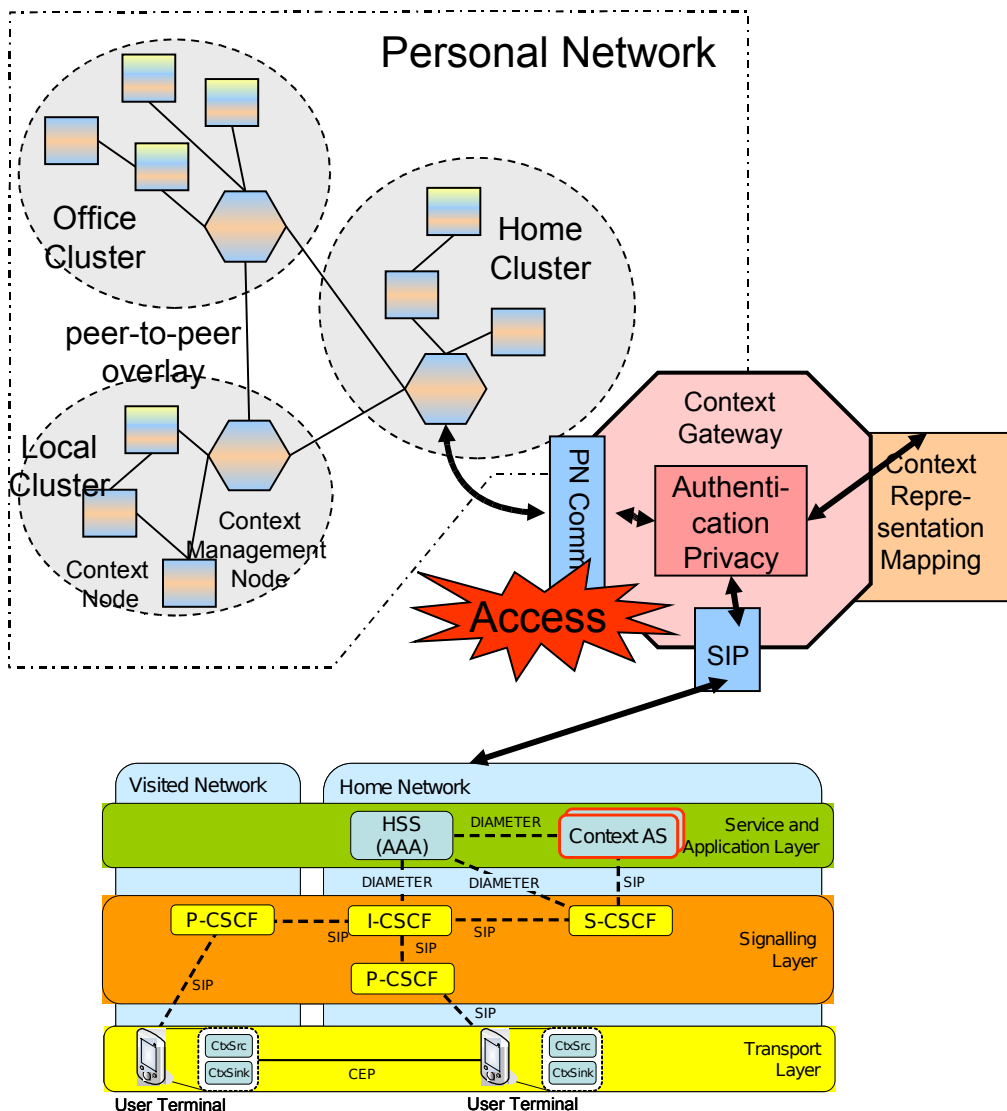
Context C ommunicat ion P latfor m

Scaleable, privacy-enhanced Context Exchange, IMS Integration
Context Exchange protocols

Discovery of Context Sources, Inter and Intra-Domain Exchange

Buildt-in Privacy Protection of Context Information is Key to Acceptance

Integrated Context Architecture



- **Personal Network**

- Context originates near user
- Ad-hoc networks
- Decentralized, self-organizing context management
- User-owned and controlled management

- **Gateway**

- critical role for privacy protection
- privacy rule based filtering

- **Context Delivery as IMS Service**

- using IMS as base platform with the OMA OSE model
- Discovery & Management
- Enabler for sharing context between millions of users
- Enabler for offering 3rd party context services

Conclusions

- The trend towards ubiquitous networks diversifies (complicates) total network complexity
- It emphasizes the need for **usability, simplicity, consistency and machine aid at the service layer** for users and service providers
- Users don't want to manage a „technology zoo“ – but look for a **usable, dependable, consistent, rich service portfolio**
- **Reducing complexity for users and service providers** is the key challenge for the future.
 - **hiding** increasing **infrastructure complexity** from the user
 - enhanced **security and privacy to build user's trust**
 - „**intelligent user support**“ enhancing usability
 - **rich and flexible service eco-system** enabling new value chains and business models
 - there is no one killer application
 - but we need to provide ever new services in a fast and efficient manner