The Role of Open Standard Platforms for enabling UNIFIEd international education, research & collaboration

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Thomas Magedanz (PhD) is professor in the electrical engineering and computer sciences faculty at the Technical University of Berlin, Germany, leading the chair for next generation networks (Architekturen der Vermittlungsknoten – AV) supervising Master and PhD Students.

In addition, he is director of the “NGNI” division at the Fraunhofer Institute FOKUS, which also provides the national NGN/IMS test and development centre in Germany.

Since 2006 he is also extraordinary professor at the University of Cape Town in South Africa.

Prof. Magedanz is a globally recognised technology expert, based on his 20 years of practical experiences gained by managing various research and development projects in the various fields of today’s convergence landscape (namely IT, telecoms, internet and entertainment).

He acts often as invited tutorial speaker at major telecom conferences and workshops around the world.

Prof. Magedanz is senior member of the IEEE, editorial board member of several journals, and the author of more than 200 technical papers/articles. He is the author of two books on IN standards and IN evolution.
Agenda

- UNIFI Motivation
- UNIFI Overview
- Future Internet
- Smart Cities as Drivers
- Towards Common Smart City ICT Platforms based on Standards
- Example: TUB/FOKUS SC Testbeds and Toolkits
- Summary
DAAD UNIFI Motivation

- Academia and Industry needs talented Engineers for mastering the future Challenges in emerging Smart Cities
- Smart Cities are a hot topic of global relevance and competition
- Smart Cities lead to the ultimate convergence of existing ICT infrastructures and applications
- Smart Cities are considered today as the most important show case for Future Internet research, bringing together the network of the future, the internet of things and the internet of services
- Next Generation Network evolution toward Future Internet is a key foundation for the efficient and rapid realisation of open SC Service Platforms enabling Smart City Applications Prototyping
- UNIFI aims to setup a global / interconnect nucleus of expertise based on a harmonised and extensible set of Lectures, testbed infrastructures and workshops
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UNIFI Mission

- **UNIFI** – **UNI**versities for **Future** Internet
- **UNIFI** is an initiative of the Chair of Next Generation Networks (AV) at the Technische Universität Berlin aiming at building sustainable teaching and research infrastructures in the areas of Future Internet through global collaboration among academic institutions.
- The initiative intends to reach its goals via enablement and empowerment of all stakeholders of academia:
  - the creation and development of high quality curricula, integration and exchange of teaching personnel, students, postgraduates and researchers among the partner universities
  - the creation of Competence Centers for a sustainable development and bundling of local expertise
  - the creation and development of an open, general purpose, and sustainable large-scale shared Next Generation Networks Infrastructures & Future Internet Technology Experimentation and Research Facility via federation of interoperable local testbeds.
  - the creation and operation of an International Multilateral Academic Network as a communication hub and motor for intercultural understanding in the international FI academic community

www.daad-unifi.org
DAAD Project University Future Internet

Unifying Education and Testbeds around the Globe

TU Berlin
Chair for Next Generation Networks (AV)

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www.daad-unifi.org

University of Cape Town
www.uct.ac.za

Universidad de Chile
www.uchile.cl

Hanoi University of Science and Technology
en.hustech.edu.vn

Chulalongkorn University
www.chula.ac.th

www.av-tu-berlin.de
DAAD Project University Future Internet

*Unifying Education and Testbeds around the Globe*

- **Joint R&D Projects**
  - R&D
  - Joint R&D

- **Awareness Creation**
  - Workshops
  - Workshops

- **Unified Lectures**
  - Lectures
  - Lectures

- **Federated Testbeds**
  - Testbeds
  - Testbeds

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[www.daad-unifi.org](http://www.daad-unifi.org)
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From NGN/SDP toward the Future Internet / Smart Cities - A déjà vu ?

**Main Idea:**

A Converged Platform provides reusable capabilities (Enablers) for multiple applications hiding the details of underlying technologies.
Dimensions of the Future Internet

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

- **Infrastructure Foundation:**
  - Network infrastructure / substrate that supports the pillars
  - Shall support capacity requirements of Future Internet
Worldwide Future Internet Research Activities

Large Scale Experimental Facilities

Research Initiatives

Previous activities

Internat
Asia
US
EU
German

Autonomic Computing
Autonomic Communication

PlanetLab
GENI

PANLab
Onelab

Onelab2

P- II

G-Lab
G-Lab Phase 2

FIPPP
OpenLabs

FIRE
FIA
FI (FP7)

FIF
NWGN/AKARI
FIND

ACF
ACCA
SAC (FP6)

FIND

2001
2008
2012

with FOKUS and TUB contribution
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
The FI-WARE Project - the Common Core for all FI PPP Projects

defining Enablers & Service Delivery Platform for Usage Area Projects

Working together to make it possible:

- New services for everybody
- Smart applications
- Innovative business models

Providing the Technology Foundation

- Standard interfaces.
- Open to other actors (SMEs)
- Scalable and demand oriented (cloud)

FI-Ware objective: create a solid basis for the Internet of the Future
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 (IoT): 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.
Bidirectional relationship between the FI and Smart Cities:

- FI can offer solutions to many challenges that Smart Cities face;
- on the other direction, Smart Cities can provide an excellent experimental environment for the development, experimentation and testing of common FI service enablers required to achieve ‘smartness’ in a variety of application domains.
World Urbanization Prospects, the 2009 Revision
United Nations, Department of Economic and Social Affairs, Population Division

Urban Agglomerations in 2009  (proportion urban of the world: 50.1%)

Urban and rural population by development regions  (in mill.)

Total population by city size class (in millions)

Distribution of the world urban and rural population by major area
Smart City = Many Applications based on Integration of Systems
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.

Common SC Service (ICT) Platform

Federation & Integration of different fixed and mobile Network Technologies to interconnect different machines (sensors, actuators) and people and for providing applications seamless.

Enablement of "Smarter Applications" by allowing these to make use of common / open data and common service capabilities provided by a Smart City service platform.
Open Network APIs: Import and Export of „Services Enablers“

Web 2.0 World Players and Services
(Google Maps, YouTube, RSS Feeds, etc.)

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

Import
of
Web APIs

Export
of Telco Enablers

Service Brokering

Telco Enablers provided by SDPs
(Calls, Messaging, QoS, Charging, Identity Mgt., Security)

Network Abstraction

Fixed Network
Mobile Network
NGN

- Resell available capabilities
- Enable value added services
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Standards as Foundation for sustainable Education and Research

- Standards represent the global state of the art in technology and the foundation for interoperability of prototyping and later products.
- Standards are a solid foundation to start own research as well are a good target for disseminating own research results in a sustainable way.
- Standards are under evolution and thus subject of continued research.
- Standards are getting complex as an increasing number of standards relates to each other (Complexity vs. Convergence).
- Access to standard equipment/platforms is often expensive and limited.
- Testbeds are typically used to provide convenient access to standard platforms for concept validation and rapid prototyping.
- Open Source tools and open testbeds realising standards are gaining momentum in international research see European FIRE initiative as an example.
Smart City Enablement = NGN2FI Evolution

Information Technologies
(Service Oriented Architectures & Cloud Computing)

Smart Cities

VoIP and Instant Messaging

Fixed and Mobile Telecommunications

3/4 Play

IPTV

Next Generation Network

Telecommunications

Cable Networks

EPC

Future Internet

Revolution

Evolution

Clouds

Internet of Services

Internet of Things

Network Virtualization

Self Organising Networks

OTT

IMS

MTC

SDP

PES

RCS

FMC

3/4 Play

IPTV

Fixed and Mobile Telecommunications

VoIP and Instant Messaging

Cable Networks

EPC

Future Internet
Evolution of Telecommunication Platforms toward Smart City ICT Platforms

Standards will play a key role in order to achieve interoperability
The Smart Cities Value Chain

Source: Accenture
The SC Value Chain and UNIFI Positioning

**R&D Challenges**
The Challenge of Testbeds and their potential Federation
Different Application and Testbed Scopes

- Innovative multimedia applications
  - eHealth, eGovernment, e/mCommerce, interactive TV, web 2.0, telco2.0, etc.
- Service delivery platforms
  - IP Multimedia System, P2P systems, broadcasting systems, etc.
- Network technologies
  - 3G beyond, Wimax, LTE, Fixed Broadband, etc.
- Sometimes also beta test user communities
- Sometimes mixture of all above domains
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Our toolkits for ICT for Smart Cities

- Open SOA Telco Playground provides a SOA based NGN Service Delivery Platform (SDP) for hosting an open number of service enablers to be used by SC applications
- FOKUS Broker allows for controlled exposure of service enablers for dynamic policy based service and data composition
- OpenIMS Core is a proven NGN platform for rich communication services
- OpenEPC is a globally recognised QoS and seamless mobility platform for all mobile networks, incl. LTE
- OpenMTC is an M2M service platform optimized for new types of M2M communications
Fraunhofer Testbeds / Playgrounds

OSTP
- FOKUSBroker
- myMONSTER TCS
- FOKUS CloudBroker

FUSECO
- IMS
- OpenMTC
- OpenEPC

TU Berlin
Chair for Next Generation Networks (AV)
Fraunhofer Testbeds / Playgrounds
www.opensoaplayground.org
www.FUSECO-Playground.org
Exploring Services Composition - Open SOA Telco Playground
Enabling seamless Services across different Networks and Service Domains

www.opensoaplayground.org
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: FUSECO-playground.org
The FOKUS OpenEPC Platform

- In future mobile broadband communications multi-access network support (incl. fixed & cable) and multi application domain support (OTT, IMS, P2P, M2M, Cloud etc.) will become key for service delivery
- Based on the success of the Open IMS Core, Fraunhofer FOKUS has developed a **NON-OPEN SOURCE** EPC platform, enabling academia and industry to
  - integrate various network technologies and
  - integrate various application platforms into 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 implemented features are based on 3GPP specifications:
  - adaptable to different deployments
  - extensible to specific research needs
  - configurable
  - high performance

For more see: [www.OpenEPC.net](http://www.OpenEPC.net)
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.opensoaplayground.org/tcs*
The new 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 services into 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 in 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
Commercial FOKUS NGN/IMS/EPC/SOA Testbed Deployments around the world
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Unifying Education and Testbeds around the Globe

Joint R&D Projects

Awareness Creation
Workshops

Unified Lectures
Lectures

Federated Testbeds
Testbeds

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3nd FOKUS Future Seamless Communication Forum (FFF)
Berlin, Germany, November 15-16, 2012

- Theme: "Convergence of Human-to-Human and Machine-to-Machine Communications within Emerging Open Smart City ICT Infrastructures – Using Open APIs, RCS, IMS, MTC, EPC, and LTE as Enablers for Emerging Future Internet Application Domains”

- FUSECO FORUM is the successor of the famous FOKUS IMS Workshop series
  - FFF 2010 attracted 150 experts from 21 nations
  - FFF 2011 was attended by around 200 experts from 30 nations

- See www.fuseco-forum.org/2012 for details
Questions

[Diagram showing a flowchart with decision points for questions and answers, leading to actions such as thank audience, leave, or state that time has run out.]
Key Academic Conferences supported by NGNI/AV

- Future Seamless Communications Forum
  - www.fuseco-forum.org
- GI/KUVS Next Generation Service Delivery Platform Expert Talk series
  - www.KUVS-NGSDP.org
- IEEE Open NGN and IMS Testbed (ONIT) Workshop series
  - www.onit-ws.org
- ICST Tridentcom Testbed conference series
  - www.tridentcom.org
- DAAD University Future Internet (UNIFI) Workshops
  - www.daad-unifi.org
Useful Links

- Fraunhofer FOKUS NGNI Competence Center: www.fokus.fraunhofer.de/go/ngni
- TU Berlin Chair for Next Generation Networks: www.av.tu-berlin.de
- Open IMS Core Project: www.openimscore.org
- Open IMS Playground: www.open-ims.org
- Open SOA Telco Playground: www.opensoaplayground.org
- Open EPC Project: www.openEPC.net
- Open MTC Project: www.open-mtc.org
- Future Seamless Communication Playground: www.fuseco-playground.org
- NGN to Future Internet evolution Lab: www.ngn2fi.org
- Future Internet testbed tool Teagle: www.fire-teagle.org