Open Source IP Multimedia Subsystem Core and Testbed Exploration Areas

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Agenda

• IMS as Basis for NGN Implementation
• The Challenge of getting IMS acceptance in the Market
• The Role of Open IMS Testbeds to stimulate IMS Technology adoption
• The FOKUS Open IMS Playground stimulating IMS platform evaluation and IMS Applications Development
• The Open Source IMS (OSIMS) Core as toolkit to develop own NGN testbeds
• Case Study: OSIMS Enabling an NGN testbed at the University of Cape Town
• Exploration Areas with IMS Testbed
• Summary
Evolution towards Converged Networks

Seamless Services – The Network doesn’t Matter

- Network diversity and network innovation pace has lead to network abstraction based on IP as common denominator
- Connectivity Services versus Multimedia Services
- Users are interested in services – thus End Systems and Service Platforms matter
**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
- Builds on existing IETF and telco SDP standards
- Provides better security, Service based QoS, flexible charging and single sign on compared to the “standard” open internet

**IMS Core Infrastructure Functionality**

- Implementing generic functionality in the infrastructure is most economical!!

- Multiparty / Multimedia Session handling based on SIP Control
- Multimedia Content Pull & Push
- Messaging Support
- Conferencing and Group Com. Support
- Fixed Mobile Convergence / 3P
- Single-Sign-On User-Authentication
- High Secure Service Access and Provision
- Service based Bearer QoS
- Flexible Charging
- Legacy Network Interworking Support
- Docking Station for Service Enablers
- Docking Station for Applications
IMS is a global Standards for Converging Networks

Seamless Applications & Content (FMC & 3/4 Play)
Web 2.0

Service Enablers

CORBA / C++
OSA / Parlay
Java
JAIN
SOA
Web Services

Internet
Web Servers

Plain VoIP
SIP Servers
AAA Servers

Bear Control (QoS)

Mobile Access
Networks (GSM, GPRS)

Fixed Access
Networks (PSTN/ISDN)

Fixed and Mobile
Internet Access

Cable / TV
Networks

Web 2.0

Plain VoIP
SIP Servers
AAA Servers

Internet
Web Servers

SDP

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The scope of 3GPP should be extended to include the requirements coming from other communities. A mechanism should be put in place to ensure efficient requirements capture. 3GPP should be responsible for producing one set of IMS specifications that satisfies these requirements. It is expected that these new arrangements will be put in place during 2007.

Notes:
- IMS/Charging Architecture is not reflected on this slide = Diameter Interfaces to many entities.
**IMS Show Stopper No.1 Today – The IMS Client**

- **IMS System**
  - Applications
  - Enablers
  - Core

- **IMS Platform API** (Application Programming Interface)
  - IMS Manager
  - Enablers

- **Native Apps**
  - J2ME Apps
  - JAVA support

- **OS Abstraction Layer / HW Drivers**

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**Show Stopper No.2: IMS Development Kits**

- The SIP application server supports APIs and SDK
- Java supports easy implementation of new SIP services

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Session 6a, 10th May 2007
IMS Introduction Challenges

- IMS Integration Challenges
  - Core Network, SCE&SDP, OSS/BSS, Charging System

IMS

Applications SCE and SDP Infrastructure

OSS / BSS

Core Network Infrastructure

Charging System

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Turning IMS into Reality

1. Prototyping IMS Components – Is IMS really working or are there critical design flaws?

2. Contributing to the community – We have opened our sources and talking with everybody interested on what are NGNs

3. Help the industry design, develop, debug and test next generation communication enablers and services

4. Prototyping Use Cases – Can Service Providers really use IMS? Is IMS a benefit for them

5. Provide means of comparison between components in NGNs

The Role of Open Testbeds

- Network convergence and the new multimedia service world is a subject of huge complexity
- Required infrastructure is expensive
- The IP Multimedia System (IMS) becomes of fundamental importance for unifying the seamless multimedia applications delivery above several network types
- Operator specific or vendor specific testbeds are not sufficient for addressing this complex market, as they are limited in technology exploitation and business models and likely will not address the needs of end users adequately (technology push model)
- Learning from the internet, a huge number of application developers acting on an open infrastructure (the internet) is needed to enable successful market driven services (technology pull model)
- Thus open testbeds are key for exposing the network variety and complex service platforms to an open set of developers and to provide a
- Adequate software toolkits are of help to start working without a testbed first
- The testbed infrastructure provides the technological basis for early platform component testing and applications prototyping and thus interoperable solutions and vendor independence
IMS Testbeds as R&D Base @ FOKUS

• In November 2004 – after 2 years of development sponsored by BMBF and FOKUS – the FOKUS Open IMS Playground has been officially opened
  – www.open-ims.org
  – Technical foundation was the expertise and available software in the fields of Open Source SIP Express Router (SER) und FOKUS OSA/Parlay Gateway (OCS)
  – The Open IMS Playground is the globally pioneering open IMS Testbed und contains FOKUS own developed and industry partner IMS products

• In November 2006 the FOKUS Open Source IMS (OSIMS) Core System - the core of the IMS playground - has been officially released to the general public via the BerliOS Download site
  – 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

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Open NGN / IMS Test & Development Center

- Has been launched in 2001
- Provides all NGN layers but focus on service platform layer
- IMS Playground has been launched 2004
- Foundation for industrial and academic projects
  - Applications development support
  - Applications validation
  - Service Platform prototyping
  - Infrastructure component testing
  - Network Technologies integration

- Officially supported by

http://www.fokus.fraunhofer.de/ngni

IMS Playground @ FOKUS

- Has been launched in 2004
- Forms a globally unique state of the art IMS infrastructure featuring all major IMS components and interfaces
- Is a key infrastructure of the FOKUS NGN Service Delivery Platform test and development center
- Comprises
  - A full IMS based on own developments
  - Additional carrier grade components from industry partners
- Goals:
  - Provision of an open IMS platform and planned interconnection to Operator IMS test beds
  - Interoperability test of IMS components (S-CSCFs, Media Gateways, SIP AS, etc.)
  - Environment for development of new MM applications, application platform extensions and IMS mobility, QoS and security reasearch
- Contact: www.fokus.fraunhofer.de/ims
The FOKUS OPEN SOURCE IMS Core

- A version of the Open IMS Core (OSIMS) has been developed and was successfully tested with commercial IMS products over the last 3 years
  - provides first time implementations of core IMS components
    - Call Session Control Functions
    - Home Subscriber Server
  - offers an Open Source IMS platform to make use of the ISC interface
  - can act as a tool for IMS services proof-of-concept
  - allows to test alpha/beta versions of commercial IMS products
  - does not intend to compete with carrier grade developments but wants to create an Open IMS community and to accelerates IMS adoption
  - **This software is for establishing IMS testbeds only, not for implementing commercial IMS systems!**
  - **Note:** Users have to check potential IMS patents and standards licenses!
**OSIMS – Components & Licensing**

- **a Home Subscriber Server**
  - GNU General Public License v.2
- **3GPP compliant IMS Call Session Control Functions (CSCFs)**
  - GNU General Public License v.2
- **a SIP2IMS gateway**
  - GNU General Public License v.2

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**Specification Guidelines for OSIMS**

- **IETF RFCs (selection)**
  - SIP: Session Initiation Protocol – RFC 3261
  - Hypertext Transfer Protocol (HTTP) Digest Authentication Using Authentication and Key Agreement (AKA) - RFC 3310
  - SIP Private Header Extensions - RFC3455
  - Diameter Base Protocol – RFC 3588
  - SIP Event Package for Registration - RFC3680
- **3GPP IMS Release 6 Specifications (selection)**
  - TS 23.228 – IMS Stage 2 (Rel.6)
  - TS 24.229 - IP Multimedia Call Control Protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage3 (Rel.6)
  - TS 29.228 – Cx and Dx Interfaces, Signalling flows and message contents (Rel.6)
  - TS 33.102 - 3G Security; Security architecture (Rel. 6)
  - TS 33.203 - Access security for IP-based services (Rel.6)
**Call Session Control Functions**

- **CSCF** = SIP proxy to route and process the SIP signaling
  - **Proxy-CSCF**
    - outbound proxy for User Endpoints – entry point in the IMS network
    - keep local registrar and firewall the core network
    - add important network/charging/etc information to the messages
    - bridge between access network (visited network) and user’s home network
  - **Interrogating-CSCF**
    - entry point in the Home Network
    - originating/terminating party assigned Serving-CSCF retrieval
    - stateless forwarding of messages
  - **Serving-CSCF**
    - local registrar for served users
    - authenticate the users
    - subscription server for registration status events
    - evaluate Initial Filter Criteria and route messages accordingly to Application Servers for service processing

**SIP2IMS & Home Subscriber Server**

- **Home Subscriber Server**
  - evolution of a Home Location Register to the all-IP core network
  - stores user profile, provisioning data
  - keeps registration status
  - keeps location information

- **SIP2IMS Gateway**
  - allows transformation of IETF SIP messages to IMS conformant messages
  - translates MD5 authentication to IMS AKA authentication
  - enables developers to access core elements and to trial multimedia services by using a non-IMS VoIP client (e.g. Eyebeam, SJphone, Kphone)
Elements around the Open IMS Core

- Functionality of the Open IMS Core can be verified with additional components
  - IMS UE / OpenIC
    - must be capable of performing IMS AKA registration
    - IMS specific SIP behaviour e.g. subscription to own registration event
  - SIP client
    - uses IETF SIP protocols without IMS extensions (e.g. Kphone, eyebeam)
    - attaches to IMS Core via SIP2IMS Gateway
  - Application Servers
    - tested Service platforms for the Open IMS Playground
      - SIPSEE (SIP AS)
      - Open Communication Server (Parlay Gateway)
      - Open Communication Server X (Parlay X Gateway)

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Getting started with IMS – An IMS Testbed

- Operators and vendors are challenged strongly by the ongoing convergence (VoIP, FMC, Triple Play, Internet multimedia / web 2.0)
- IMS is a complicated subject due to convergence domains
- Success of IMS will depend strongly on open / interoperably solutions and many niche market services
- Instead of deciding for one or two vendors and/or integrators the establishment of a local IMS/NGN testbed enables all players to gain early insight into the IMS
- Currently many international testbeds are under development
- Testbeds and related tools allow to engage all players of the emerging convergence ecosystem at an early stage to develop many and really demanded services
- Universities could be part of this approach to educate staff as soon as possible

Distributing the IMS Playground

- Since its opening in 2004, there has been huge interest in the IMS Playground concept
- Many operators, integrators, and vendors around the world have used the IMS playground facilities (infrastructure and staff expertise)
- As this demand is increasing, FOKUS has decided to distribute the Open Source IMS core system for free, allowing operators, integrators, vendors as well as research organisations and universities to setup their own IMS testbed
- Open Source Core can be enhanced by local partner components and own developments
- Optionally, FOKUS add on components and professional services allow for fast testbed set up
**FOKUS Open IMS Playground Concept**

1. **Free Download**
   - NGN Open Testbeds
   - FOKUS IMS Components
   - Industry IMS Components

2. **Cooperation**
   - Universities & R&D Centers
   - Operators & Vendors
   - Remote Testbeds
   - Local Operator–specific Testbeds at FOKUS

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Joint Testbed Cooperation Enabling:

- University of Cape Town and other Locations in Africa are making use of the OSIMS to setup their own IMS Testbeds.
- Benefits and challenges include:
  - The testbeds serve as local proxies to other regional universities and industry to enable co-laborative research;
  - UCT plans experiments on QoS, mobility, security and cross layer design;
  - Unique opportunities to bring together different players in the emerging NGN / IMS space;
  - Developing countries that lack existing infrastructures have the advantage to leap forward to the new technologies without legacy to hinder them;
  - Developing countries are a huge market to be explored. It is expected that their results will also shed light on the ongoing global research efforts of IMS.

OSIMS at University of Cape Town

- At UCT, a testbed has been set up, and several students are conducting thesis research using the OSIMS.
- QoS with a WLAN network to access an IMS core network. (another paper at this conference)
- End-to-end QoS with IMS overlying heterogeneous networks.

Envisaged Implementation using OSIMS
OSIMS at University of Cape Town

- A generic cross-layer signalling protocol is being studied and the implementation is envisaged to run through OSIMS. Main objectives are:
  - Ensure the enforcement of QoS based on SIP signalling;
  - Add more intelligence in resource provisioning by IMS modules due to increased information on the bearer networks.

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**Exploration Areas with IMS Testbed**

- **Diverse Networks**
  - Yet most areas in the sub-Saharan Africa are remote from the international optical core networks. Wireless technologies have become the faster and less expensive solution.

- **Different Charging Models**
  - The effects and the requirements on the performance of the network with different charging models (pre- and postpaid models) with different services need to be thoroughly tested.

- **Different kinds of Services**
  - There are many rural areas and disadvantaged areas. High-speed communication is needed as an investment to enable people to perform essential life functions, job functions, and business functions.

- **Diverse Languages and Cultures**
  - There are many different African languages. At least 10 of them are needed to serve the needs of most people. Efficient and low-cost solutions for the applications are needed to cater for the different African languages.

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**What is Panlab**

- A project (SSA) funded by the European Commission under FP6
- ... and which enables and facilitates the Pan-European laboratory vision

**Vision for Pan-European Laboratory**

- Identify the long-term ICT industry requirements for end-to-end testing and present a plan and roadmap for how to satisfy such requirements in the long-term
- Based on the concept of federation of distributed test laboratories and testbeds that are interconnected and providing access to required platforms, networks and services for broad interoperability testing

- Provision of testing facilities for the big picture
Pan-European Laboratory and PANLAB Project

Supply long-term IST industry needs for testing NGN technologies and services

Pan-European Laboratory

- Activities

Mission

Accepted legal, economical, organizational and operational framework

- Activities

Results

Project PANLAB

- Long-term vision of the IST industry
- Roadmap for long-term Pan-European Laboratory
- Potential participants and customers
- Requirements of stockholders
- Collaboration rules and mechanism
- Requirements for tools (?)

Results

- Activities

Acceptance of legal, economical, organizational and operational framework

Activities

Mission

Project PANLAB

Results

Building Pan-European Laboratory

What? Areas

Define main activities areas for Pan-European Laboratory

How? Mechanisms

Develop mechanisms to enable Pan-European Laboratory activities

Who? Partners

Specify major participants of the Pan-European Laboratory activities
Building Pan-European Laboratory

What? Areas

Define main activities areas for Pan-European Laboratory based on detailed analysis of IST projects

How? Mechanisms

Develop and verify mechanisms to enable Pan-European Laboratory activities
- Legal framework
- Organization tools (management and collaboration)
- Technical infrastructure
- Economical aspects (?)

Who? Partners

Specify major participants of the Pan-European Laboratory activities
- “Executives”
- Customers

FIRE Strategy

- Experimentally-driven long-term research, including an important testbed dimension
  - starting from the running FET SAC projects, to include the new IPs which will be selected in call 2

How to build large-scale testing environments?

- Creating a European Laboratory for testing potentially disruptive internet concepts
  - building on ONELAB and on the advanced testbeds parts of SAC projects
- Federating existing and planned testbeds for emerging technologies
  - exploiting synergies between pre-commercial technologies and services testbeds (possibly including LivingLabs) in line with the framework provided by PANLAB
Panlab within the FIRE Initiative Context

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**Summary**
**Summary**

- IMS is the next big thing in telecommunications after VoIP
- Open source software is getting popular in the telecommunications field
- The FOKUS Open Source IMS Core (OSIMS) forms the heart of the globally recognised Open IMS Playground at FOKUS
- The FOKUS IMS Paýground also provides the foundation for the European Panlab Project ➔ http://www.panlab.net
- You can start your own testbed by downloading the OSIMS core today from www.openimscore.org
- For more information visit www.fokus.fraunhofer.de/ims

**NGN Testbeds stimulate the Market**

*Academic and Industry R&D Projects for Applications and Service Platforms (Proofs of Concept Validation, Interworking, Benchmarking, etc.)*
Any Questions?

About the Speaker

Prof. Dr. Ing. habil Thomas Magedanz

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 (Architektur 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. Prof. Magedanz is one of the founding members of FOKUS (1988) and member of the management team. Furthermore he is principal consultant of Direct Link Consult e.V., a FOKUS Consulting spin off focussing on professional services, strategic studies and technology coaching.

Prof. Magedanz is a globally recognised technology expert, based on his 18 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.

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