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PROTOTYPING CONVERGENCE SERVICES FOR BROADBAND NETWORKS

JULY 2010, MOBILEWARE 2010, CHICAGO

Fraunhofer

FOKUS

Agenda

- ■ Market Trends and Forecasts

- ■ Broadband Networks

- ■ Voice Services on Broadband Networks

    - ▪ Requirements
    - ▪ A standard based approach for Voice over Broadband Networks

- ■ Prototype Implementation

    - ▪ Use case – Multimedia Telephony
    - ▪ Use case – Emergency Services
    - ▪ Use case – Session Mobility Manager

- ■ Conclusion

- ■ References

Market Trends and Forecasts

- Mobility
  - Internet usage patterns and behaviour are migrating to the mobile arena
- New Expectations
  - Subscribers have the same communication expectations whether at home or on the "go"
- User – Centric
  - Rather than technology driving user behaviour, this change is user-centric driven by us as consumers as well as business users
  - We rapidly take up new services and new ways of using them and the technology has to keep up with this
- Consumer and Business User needs
  - Similar in terms of convenience and being constantly connected, with users joggling the roles of professional and private life

The Power of Users (1)

ITunes
Over **4 billion songs**, **125 million TV** episodes and **8 million movies** have been purchased and downloaded from iTunes

Source: Apple, September 2008

Facebook
More than **400 million** active users, 50% of our active users log on to Facebook in any given day. Average user has 130 friends. People spend over **500 billion minutes per month** on Facebook
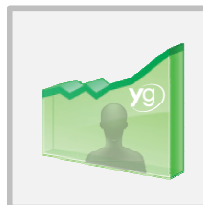
Source: Facebook, June 2010

YouTube
More than **100 million video** views are generated on YouTube **every day** – it would take over 400 years to view them all

Source: YouTube, Sept 2008

Business Today
Increased demand for connectivity will create a nearly **$1 trillion** market by 2013 alone in the US and Canada.

Source: Yankee Group, June 2010

■ Multimedia is user-centric and the evolution is driven by us as the internet goes mobile

The Power of Users (2)

	As at 31 March 2010/ For the period from 1 January 2010 to 31 March 2009	As at 31 December 2009/ For the period from 1 October 2009 to 31 December 2009
Customer Base	538.89 million	522.28 million
Net Additional Customers	16.60 million	13.92 million
Average Revenue per User per Month (ARPU) (RMB/User/Month)	70	80
*Total Voice Usage Volume (Minutes)	796.47 billion	785.04 billion
Average Minutes of Usage per User per Month (MOU) (Minutes/User/Month)	508	503
Average Revenue per Minute of Usage (RMB)	0.137	0.159
Number of Value-Added Business Users	508.44 million	463.39 million
Number of MMS Users	155.02 million	147.54 million
Number of Wireless Music Users	433.19 million	406.22 million
*SMS Usage Volume (Messages)	178.3 billion	173.5 billion
Number of Employees	148,610	145,954
Labor Productivity (Customers/Employee)	3,626	3,578

Source: China Mobile Ltd, March 2010

Full Service Broadband – a consumer proposition

Meeting user demands for convenient and cost effective broadband –
any service, any screen, anywhere

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Broadband Networks – Evolved Packet System (EPS)

- 3GPP required a network architecture able to support the characteristics of E-UTRAN

- The study point to generate such network architecture was called the "System Architecture Evolution" (SAE)

- SAE objective was:

  "to develop a framework for an evolution or migration of the 3GPP system to a higher-data-rate, lower-latency, packet-optimized system that supports, multiple RATs. The focus of this work is on the PS domain with the assumption that voice services are supported in this domain"

- The result of that study is a new simplified All-IP architecture which fulfills the requirements of NMGN: the "Evolved Packet Core" (EPC)

- Evolved Packet Core + LTE access technology (E-UTRAN) = Evolved Packet System (EPS)

- The EPS is an IP network and uses the standard routing and transport mechanisms of the underlying IP network.
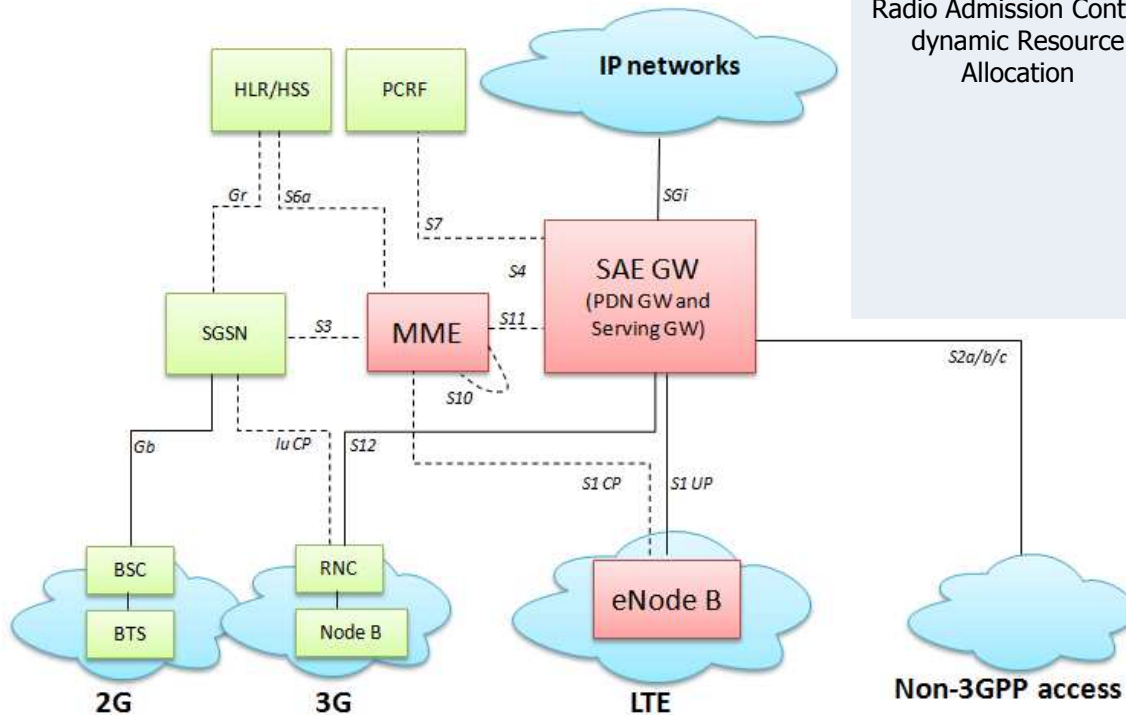
Broadband Networks – Evolved Packet Core

- EPC is an efficient standard based all IP core network architecture supporting the next generation of full service Broadband

- EPC is an important step forward for operators seeking to secure success for the long term

- Key Features

  - Everywhere coverage, always on Broadband access for fixed, nomadic and mobile users, enabling a richer variety of services and better user experience

  - Easy upgrade from existing technologies

  - Serves high capacity mobile broadband. For subscribers, excellence in mobility speed and quality is of utmost importance. EPC delivers this to any screen, anywhere.

  - Facilitates fully multi-service converged core – multiple access technologies and interworking with legacy 3GPP and 3GPP2 networks. This means that both GSM, WCDMA and CDMA networks can evolve to LTE and evolve to EPC

  - It also enables a common core network for Fixed Mobile Convergence (FMC) which reduces the cost of ownership and facilitates development towards multiservice subscriber offerings

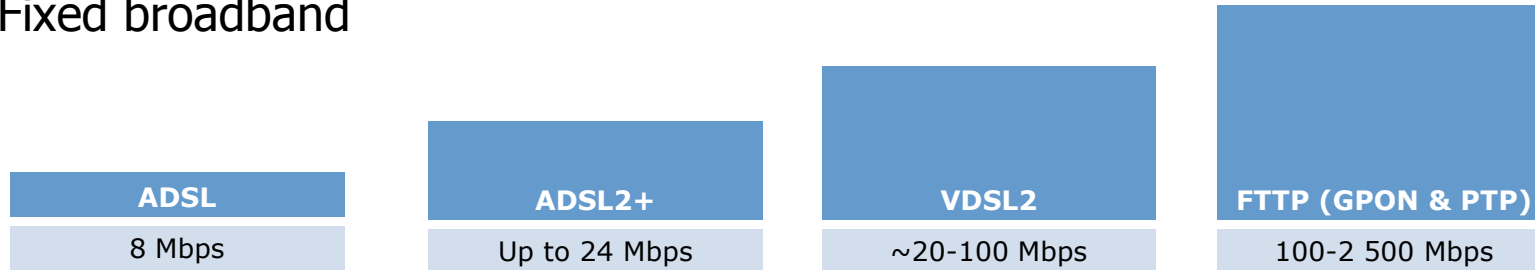# 3 GPP EPS Functional Split between LTE and EPC

Evolved Packet System		
LTE (E-UTRAN)	Evolved Packet Core (EPC)	
eNodeB (eNB) Inter Cell Radio Resource Management Continuity, Radio Admission Control, dynamic Resource Allocation	Mobility Management Entity (MME) NAS, Idle State Control, Security, EPS Bearer Control	
	Serving-Gw Mobility Anchoring for intra – 3GPP	PDN Gw IP address allocation, Packet Filtering, inter 3GPP mobility anchoring

HSS - Home Subscriber Server
MME Mobility Management Entity
SGW - Serving Gateway
PDN GW - Packet Data Network Gateway
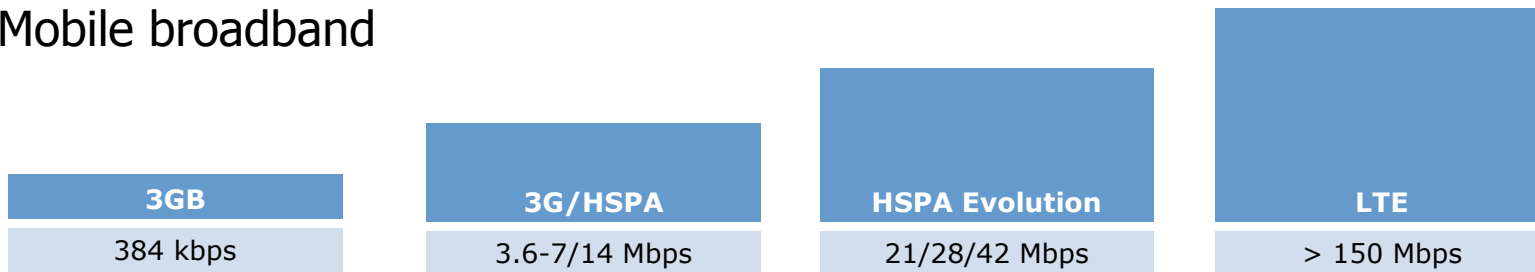PCRF - Policy and Charging Rules Function
eNB – Evolved NodeB

The Power of Technology

Fixed broadband

ADSL	ADSL2+	VDSL2	FTTP (GPON & PTP)
8 Mbps	Up to 24 Mbps	~20-100 Mbps	100-2 500 Mbps

Mobile broadband

3GB	3G/HSPA	HSPA Evolution	LTE
384 kbps	3.6-7/14 Mbps	21/28/42 Mbps	> 150 Mbps

Speed and Capacity increase

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How should legacy telephony services fit into Broadband Networks?

■ Despite the increase in data rate from services such as facebook, YouTube or ITunes, for Operators the key generating revenue services remains voice-telephony and SMS services.

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* Legacy telephony services   Source: China Mobile Ltd, March 2010

Requirements for modern voice telephony services

■ Conventional telephony communicates using the voice medium only, and connecting only two telephones per user over circuits of fixed bit rates. In contrast, modern communication services depart from the conventional telephony service in three essential aspects; multimedia, multi-point, and multi-rate

Telephony Today

Standardized Multimedia Telephony (3GPP/TISPAN)
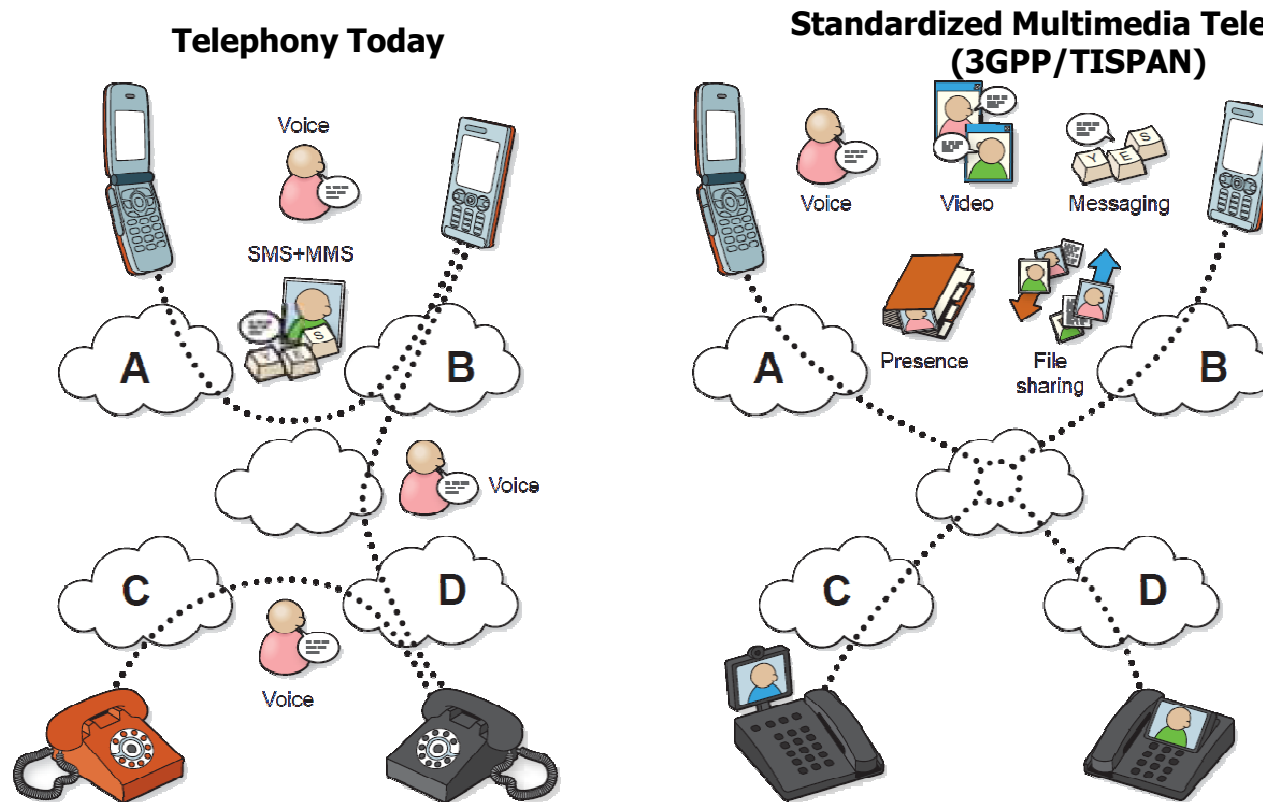
Requirements for modern voice telephony services

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Multimedia	Multi-point	Multi-rate

• Media Type: audio, still images, or full motion video or a combination of these media types.
 	
• Each medium demands different requirements on the network in terms of:
   • Bandwidth & QoS
   • Signal latency
   • Signal fidelity
	• Call Participants: setup of connection to two or more people
	
	• Direction: can be one-way or two-way communication
	
	• Control: connection may be reconfigured many times within the duration of the call
		• Flexible allocation of transmission capacity to connections
		
		• Support for a wide range of bit-rates; audio (1Kbps – 100s Kbps), video (1 Mbps – 100s Mbps)

A standard based approach for Voice over Broadband Networks

■ **Solution 1:**

Use the IP Multimedia Subsystem (IMS) mechanism specified in 3GPP Release 5 and realize voice using the MultiMedia Telephony (MMTEL) framework introduced in 3GPP Release 7.

■ **Solution 2:**

Stick to the old circuit switched way of providing voice services. The second option would be possible in the EPS network realization by that users temporarily leave the LTE network to perform the voice calls over 2G/3G network, and then return when the voice call is finished.
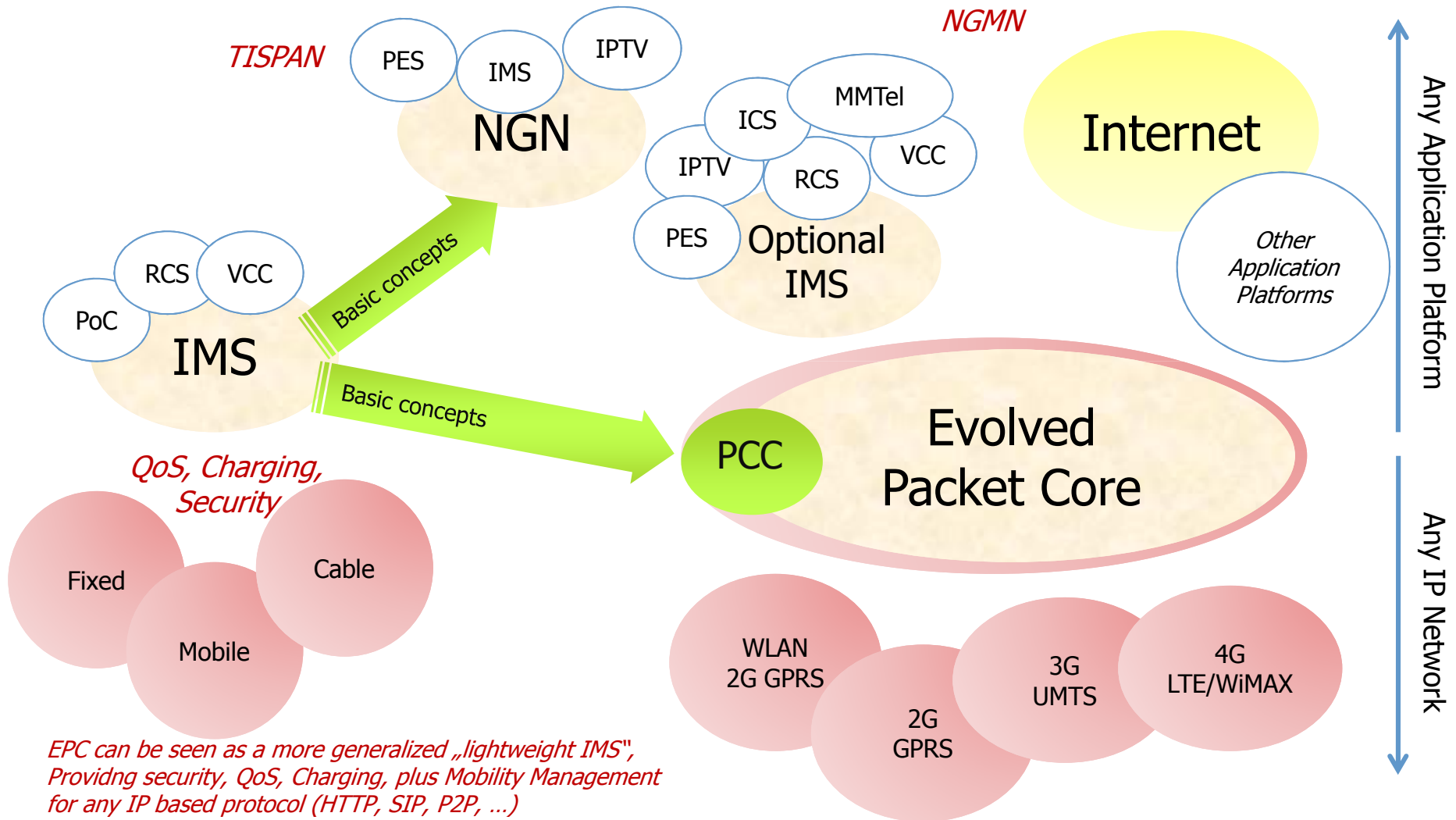
■ EPS solution to voice services based on Solution 1

Legacy voice service	Transition Solution	EPS Solution
CS voice	CS Fallback (Rel 8)	IMS VoIP (Rel 7)
Supplementary Service	CS Fallback (Rel 8)	Multimedia Telephony (Rel 7)
Emergency Calls with Location Support	CS Emergency Calls (Rel 5)	IMS Emergency Calls with Location

# Concept reuse: From IMS for NGN to EPC to mobile all-IP networks

TISPAN

NGMN

PES   IMS   IPTV

NGN

MMTel
ICS
IPTV   RCS   VCC
PES   **Optional IMS**

Internet

Other Application Platforms

RCS   VCC
PoC
IMS

Basic concepts

Basic concepts

QoS, Charging, Security

PCC

Evolved Packet Core

Fixed

Cable

Mobile

WLAN 2G GPRS

2G GPRS

3G UMTS

4G LTE/WiMAX

*EPC can be seen as a more generalized „lightweight IMS",
Providng security, QoS, Charging, plus Mobility Management
for any IP based protocol (HTTP, SIP, P2P, …)*

Any Application Platform

Any IP Network

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Prototype Objectives

- The objective of the prototype implementation is to implement the Open Voice Profile (Open Voice Initiative over IMS Profile V1.0.0) which defines a minimum mandatory set of features a User Equipment (UE) and network requires in order to implement IMS-based telephony service over EPS radio access
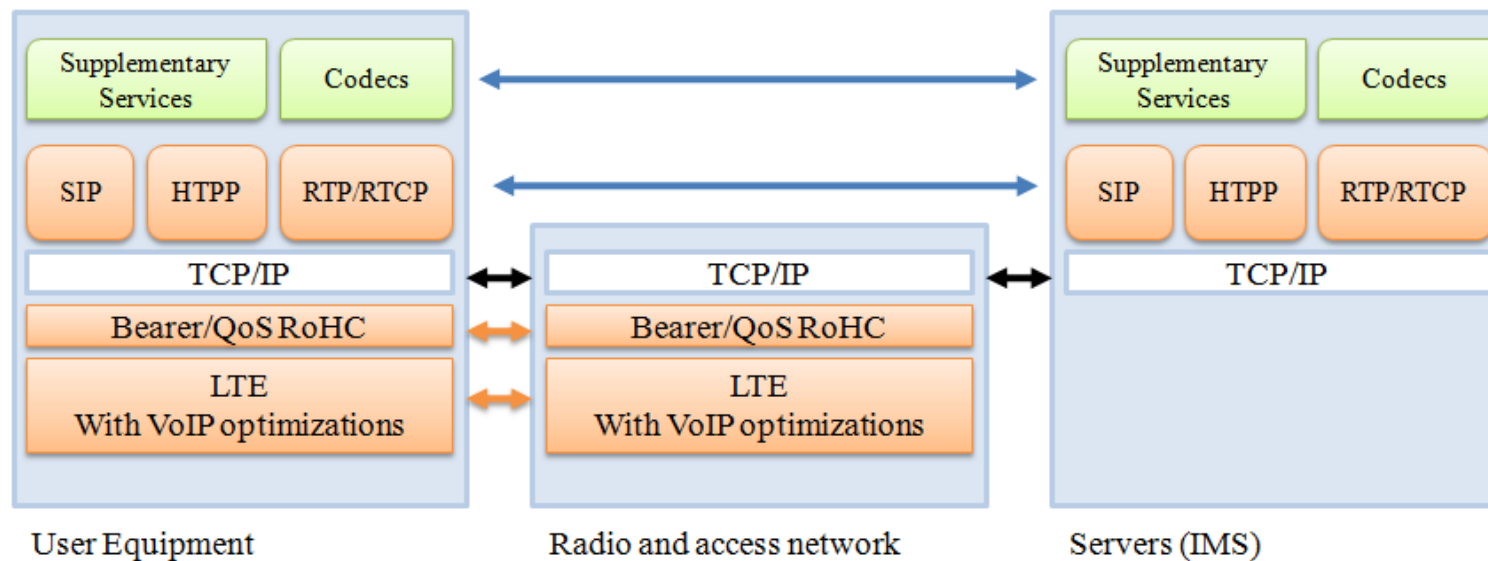
Prototype Implementation – Use Cases

MMTel

Multimedia Telephony (MMTel)
A solution for delivering multimedia telephony to broadband-connected devices. Focus is on voice and video calls with options to include messaging, video and image sharing. It is based on the 3GPP/TISPAN standard, which is the only global standard for multimedia telephony.

PSTN/ISDN Simulation service capabilities using session control over IP interfaces and Infrastructure

IMS Emergency Calls and Location Support

This is specified in 3GPP Release 9 which fulfils the last regulatory requirement seperating VoIP on IMS from CS in 3GPP networks

Session Mobility Manager
Interacts with the Mobility Managemer Entity Components (MME) of the EPC network
provide a seamless experience for the applications running on the client devices, such that operations like network attachment or handovers would be transparently handled.

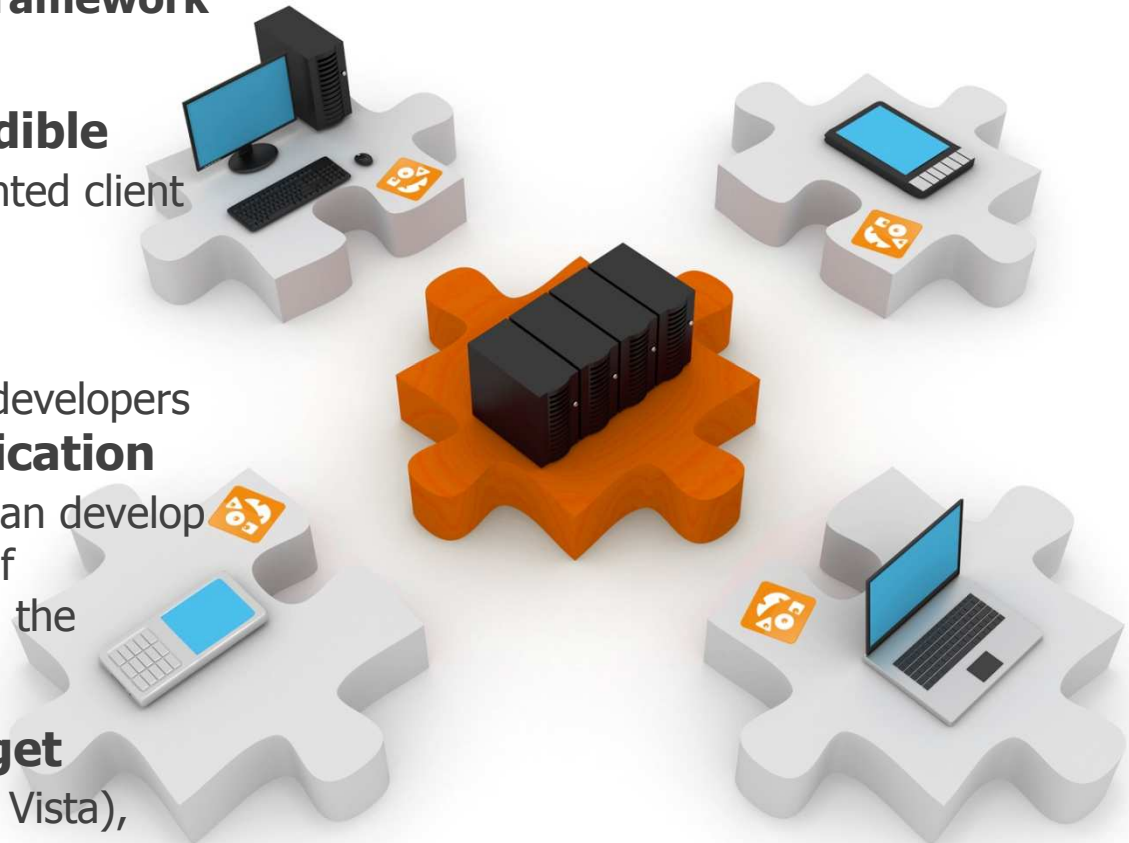■ Implementations was based on the myMONSTER TSC Framework

myMONSTER TCS

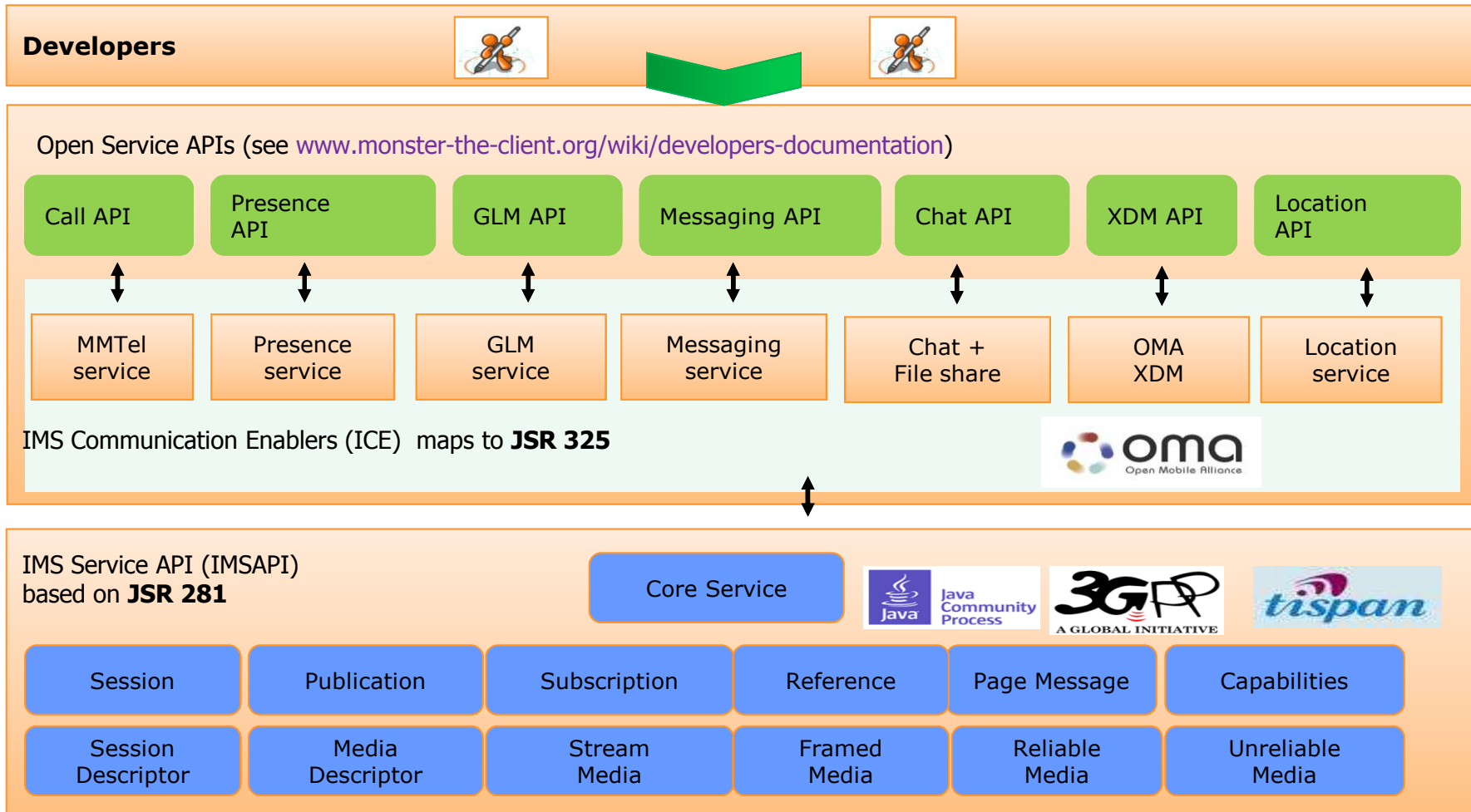- **Service enabling client framework**

- Module based in an **extendible plug-&-play** service oriented client architecture

- exposing **Service APIs** to developers with a **unified communication interface** on which they can develop and bring together a suite of integrated applications from the telecommunication domain
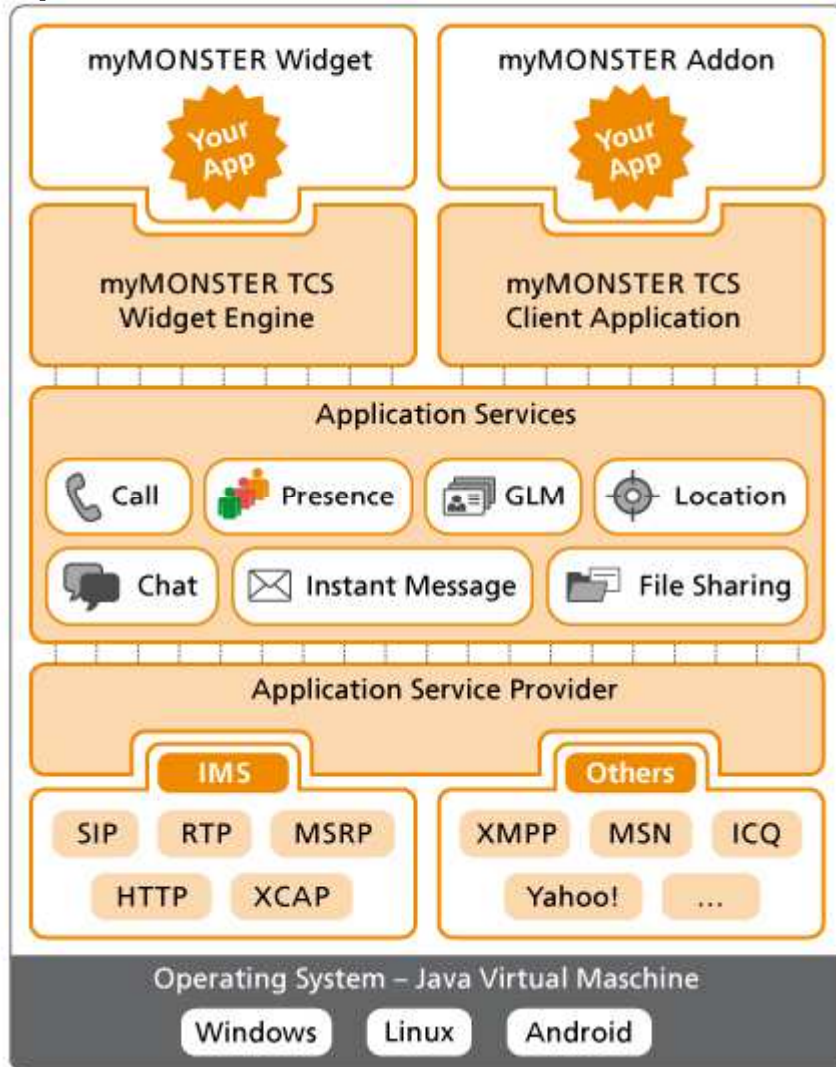
- Support for **multiple target platforms**: Windows (XP, Vista), Linux, Android, Windows Mobile

myMONSTER TCS – Software Development Toolkit

Developers

Open Service APIs (see www.monster-the-client.org/wiki/developers-documentation)

Call API	Presence API	GLM API	Messaging API	Chat API	XDM API	Location API

MMTel service	Presence service	GLM service	Messaging service	Chat + File share	OMA XDM	Location service

IMS Communication Enablers (ICE) maps to **JSR 325**

OMA
Open Mobile Alliance

IMS Service API (IMSAPI)
based on **JSR 281**

Core Service

Java Java Community Process

3GPP A GLOBAL INITIATIVE

tispan

Session	Publication	Subscription	Reference	Page Message	Capabilities

Session Descriptor	Media Descriptor	Stream Media	Framed Media	Reliable Media	Unreliable Media

myMONSTER TCS Communication Service Enablers APIs

API	Description
Call	Creating audio and video calls including call control functions like call-hold, call-resume and call-transfer (IMS VoIP).
Instant Messaging (SMS -like) and Chat	Sending instant messages in page mode using SIP and session mode messaging using MSRP (Message Session Relay Protocol) with extensions to OMA IM Specification
Presence	Publication of the presence state and getting notification of users' presence Information. Support for PIDF, RPIDF, OMA Presence
Location	Access to different device location sources such as GPS, Cell Id and static locations of UE for Location-Based Services
Network Stored Address Book	Managing groups of contacts and contact data with local and server side storage. Support for OMA service AUIDs (access-rules, deferred-list, groups, user-profile resource-lists rls-services)
File Sharing	Creating multimedia sessions for sending and receiving multiple media file types over MSRP

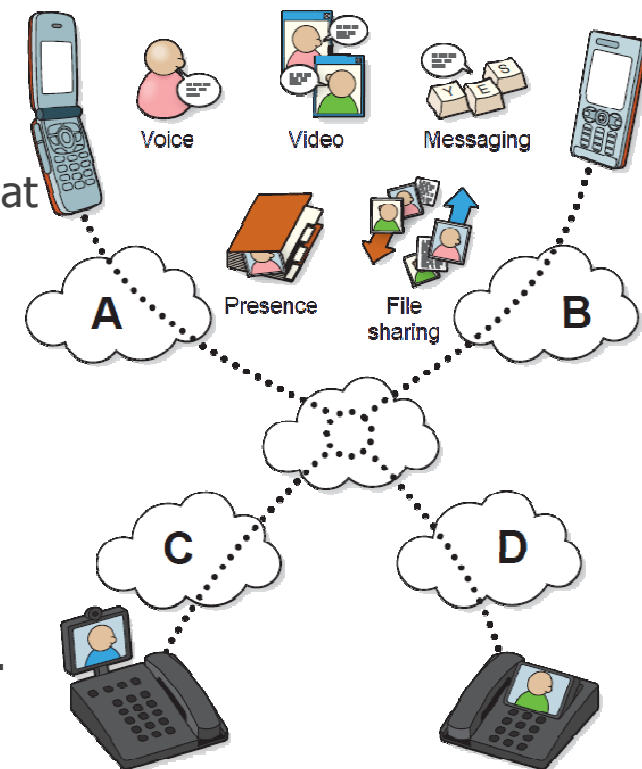# Extensions to myMONTER TCS
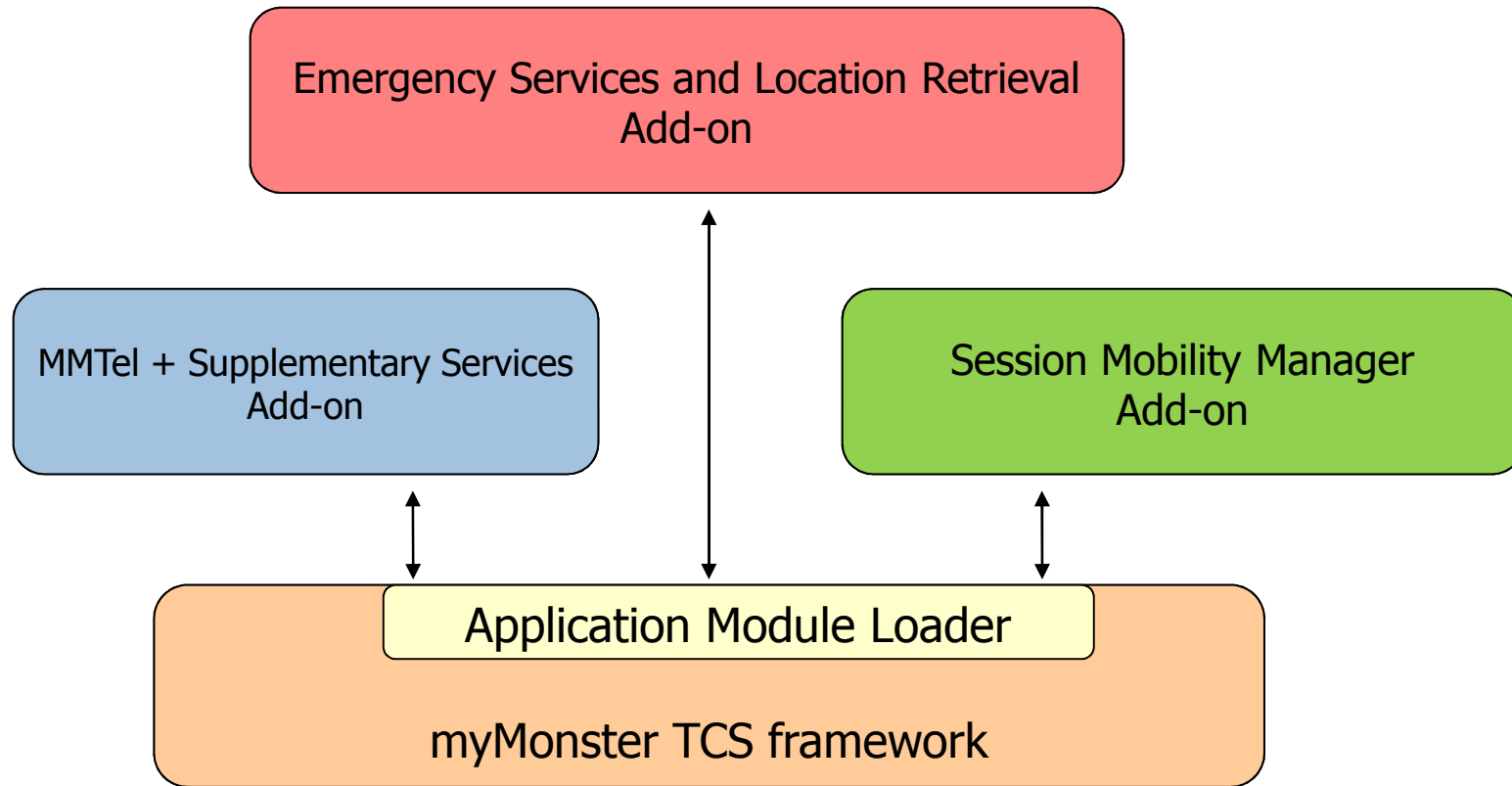
MMTel – a single session service
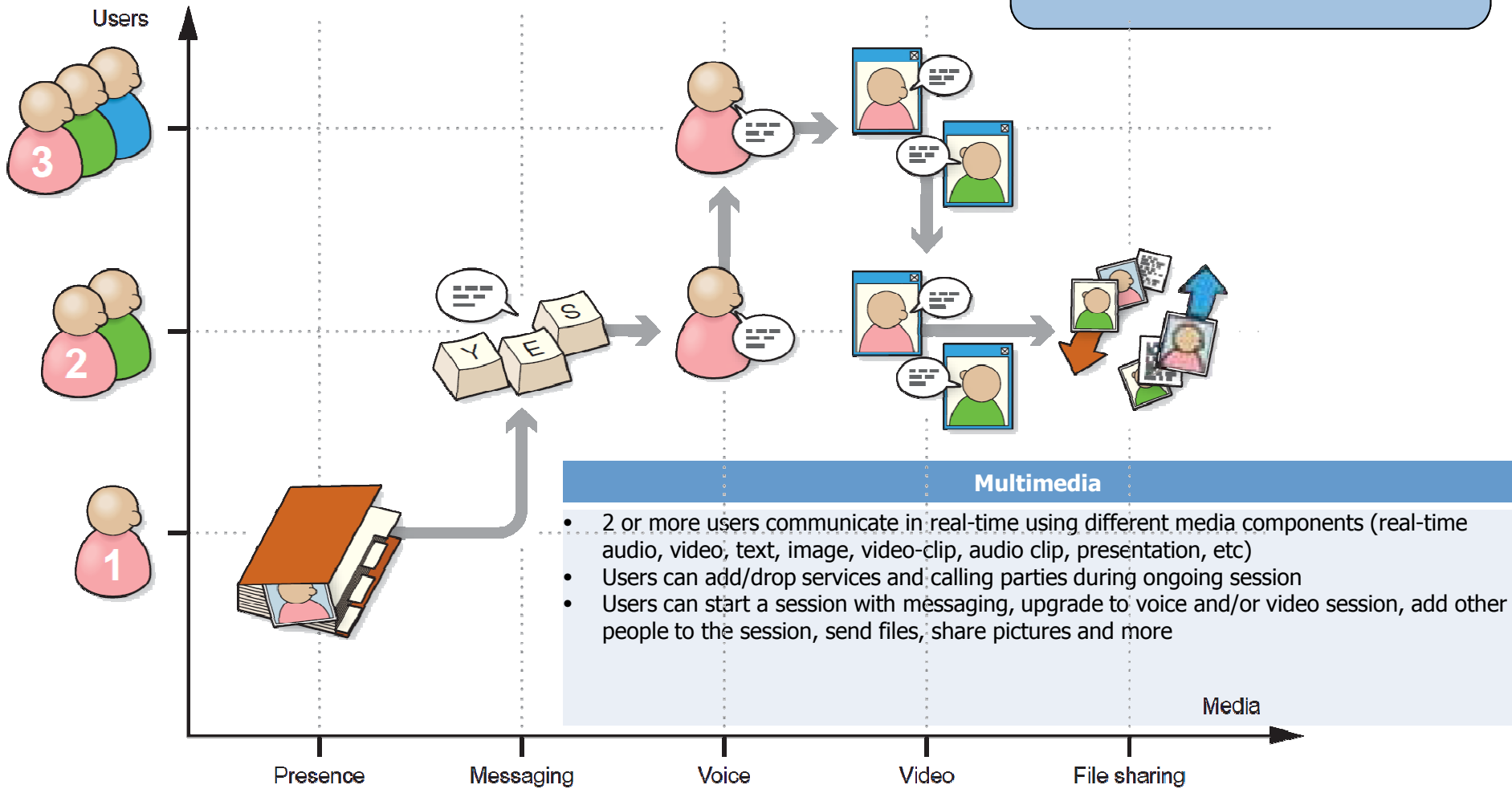
MMTel + Supplementary Services
Add-on

- A global standard based on the IP Multimedia Subsystem (IMS), offers converged, fixed and mobile real-time multimedia services that allow users to communicate using voice, video, and chat.

- The MMTel standard contains clear operator to operator interconnect specifi cations. This means that users who belong to different operators can communicate with each other using all available multimedia services.

- Mobile access is based on Internet Protocol (IP) – future proof

- MMTel operators and carriers can generate new revenue streams almost immediately – for instance, by adding new multimedia services to their offering.

- Functionality – single session control and supplementary services for fixed and mobile devices

**Standardized Multimedia Telephony
(3GPP and ETSI/TISPAN)**

Single Session Control

MMTel + Supplementary Services Add-on

Users

3

2

1

YES

Multimedia

- 2 or more users communicate in real-time using different media components (real-time audio, video, text, image, video-clip, audio clip, presentation, etc)
- Users can add/drop services and calling parties during ongoing session
- Users can start a session with messaging, upgrade to voice and/or video session, add other people to the session, send files, share pictures and more

Media

Presence   Messaging   Voice   Video   File sharing

Session Manipulation Services

MMTel + Supplementary Services Add-on

- MMTel services include supplementary services, regulatory services, and services that did not exist previously within PSTN/ISDN.

- 2 Examples

  - communication diversion of multimedia services
  - ad hoc conferencing

- Communication Diversion – part of the PSTN/ISDN call forwarding services, which supports the diversion of other multimedia according to relevant criteria such as presence, media type, time, origin and anonymous.

- Ad Hoc Conferencing - subscriber A signals to conference service which distributes a message to the B-side(s) including an accept or not accept option for the B-subscriber(s) including Conference ID and PIN. If the subscribers accepts the conference call, an MMTel call (voice/video) is set up automatically via the conference server and all the participant invited.

Supplementary Services Overview

MMTel + Supplementary Services Add-on

| Supplementary Service	Basic Function
Originating identification presentation (OIP)	Provides the terminating party with the asserted identity of the originating party.
Originating identification restriction (OIR)	Enables the originating party to withhold the information on its asserted identity from the terminating party.
Terminating identification presentation (TIP)	Provides the originating party with the asserted identity of the terminating Party.
Terminating identifi cation restriction (TIR)	Enables the terminating party to withhold the information on its asserted identity from the originating party.
Communication diversion (CDIV)	Enables a user to have communications redirected by the network to another user. Variants of conditions include: unconditional, busy, no reply, not logged in, 'defl ection' (=explicit forwarding during call setup phase).
Communication hold (HOLD)	Enables a user to suspend media within a session and resume later.
Communication barring (CB)	Allows a user to bar certain categories of outgoing and/or incoming communications
Message waiting indication (MWI)	Enables the network, on the request of a controlling user, to indicate to the receiving user that there is at least one message waiting.
Conference (CONF)	Enables a user to participate in and control simultaneous communication with multiple users.
Explicit communication transfer (ECT)	Enables a transferring party A to transform two of that party's communications (for example an active communication to party B and a communication on hold to party C) into a new communication between party B and party C.

Regulatory Services Overview

MMTel + Supplementary Services Add-on

Supplementary Service	Basic Function
Number portability	Users can keep their telephone numbers when they change operators
Legal intercept	Government authorities may intercept traffic (both signalling and the media plane) without the user's awareness
Emergency call	The IMS system applies location-based routing of emergency calls
Carrier select	Users may select a carrier by adding a prefix before the phone number
Carrier pre-select	Calls are routed via specific carrier according to information in the subscriber profile
Malicious communication identification (MCID)	A service for identifying malicious calls

MMTel and Supplementary Views on myMONSTER -TCS

Ut Interface for user configuration of supplementary service
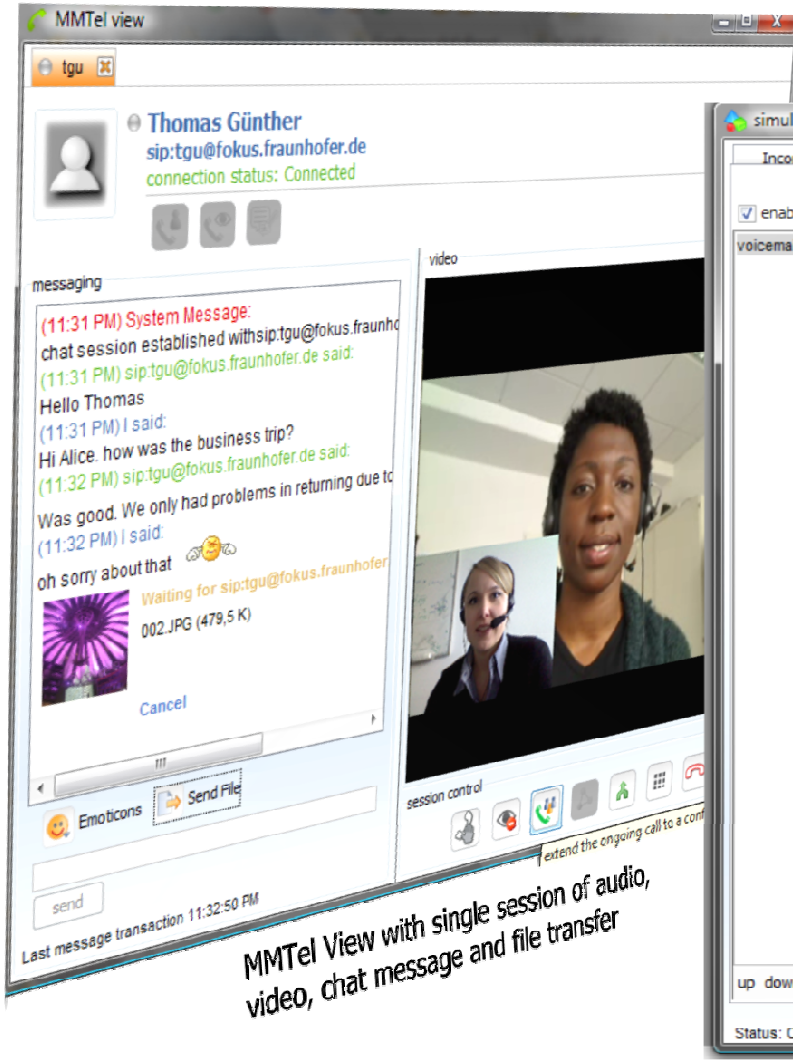
MMTel View with single session of audio, video, chat message and file transfer

myMONSTER TCS Extension
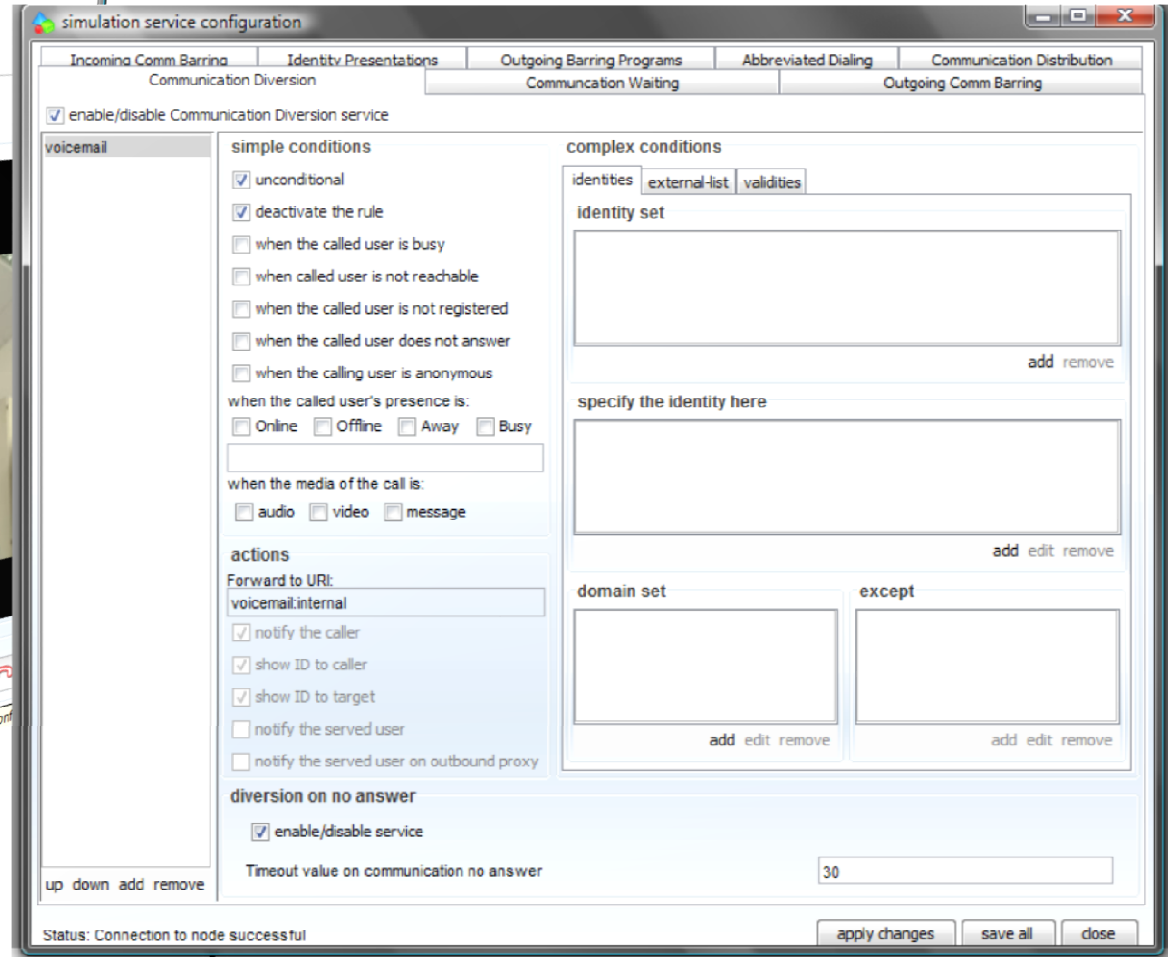
Emergency Services and Location Retrieval Add-on

- The myMONSTER emergency services extensions overcome the "problem of the caller location" within all IP networks.

- The location of the device is covered and inserted in the message flow so that the network can map the service request to the nearest PSAP

- It recognizes E-Call to emergency numbers (112) or emergency identifiers (urn:service:sos.police)

- Adds location information to the recognized E-Calls

- Shortcuts to generate E-Calls to : Police, Ambulance and Fire Brigade

- Retrieve location information from:
  - user settings/profile
 - Supl A-GPS Agent, acting as a NMEA server
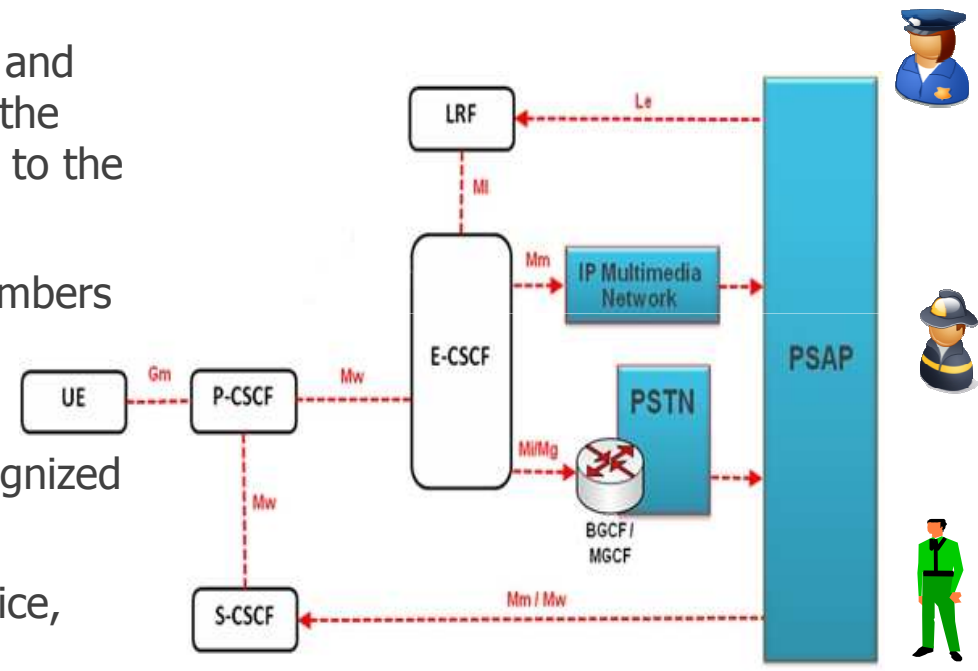
E-CSCF – Emergency Call State Control Function
LRF – Location Retrieval Function
PSAP – Public Safety Answering Point

myMONSTER TCS Extension

Emergency Services and Location Retrieval Add-on

- Extract location information from the initial INVITE request

- Show location on the map, using:

  - Civic location
  - Geodetic information (2D Point)

- Convert civic location to 2D Point, using the Geocoding API from Google
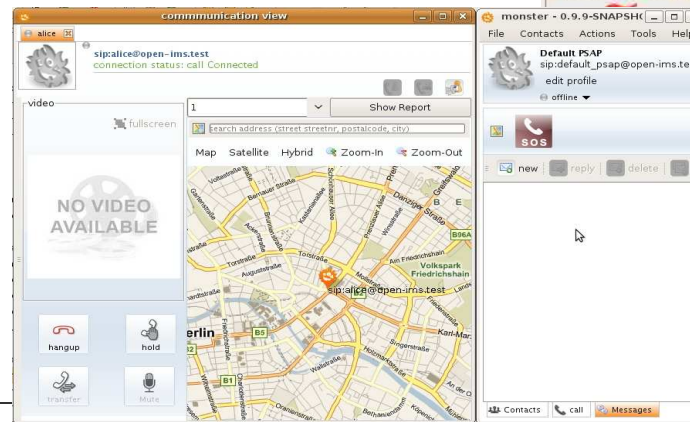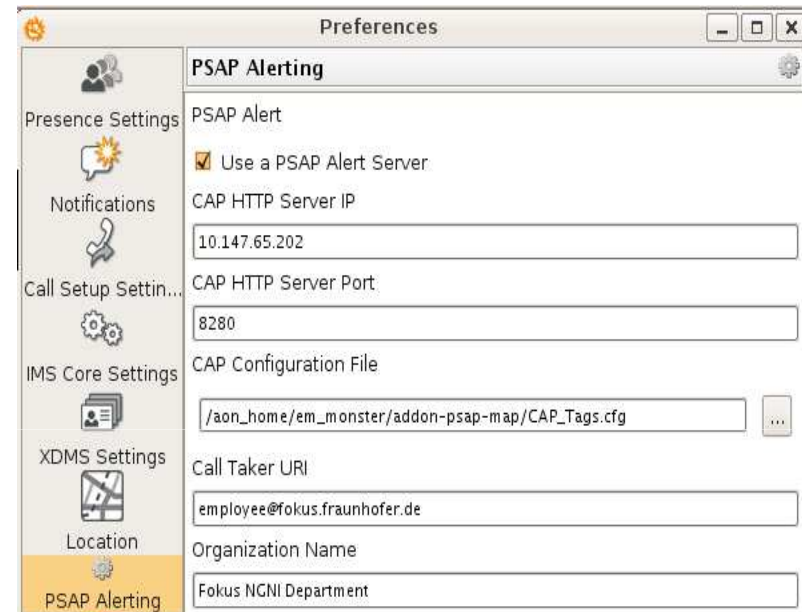
myMONSTER TCS Extension

Emergency Services and Location Retrieval Add-on

- The development of this extension is performed under the umbrella of the PEACE European Project and is geared toward operators and safety organizations that have already started the migration of their current emergency system to broadband networks.
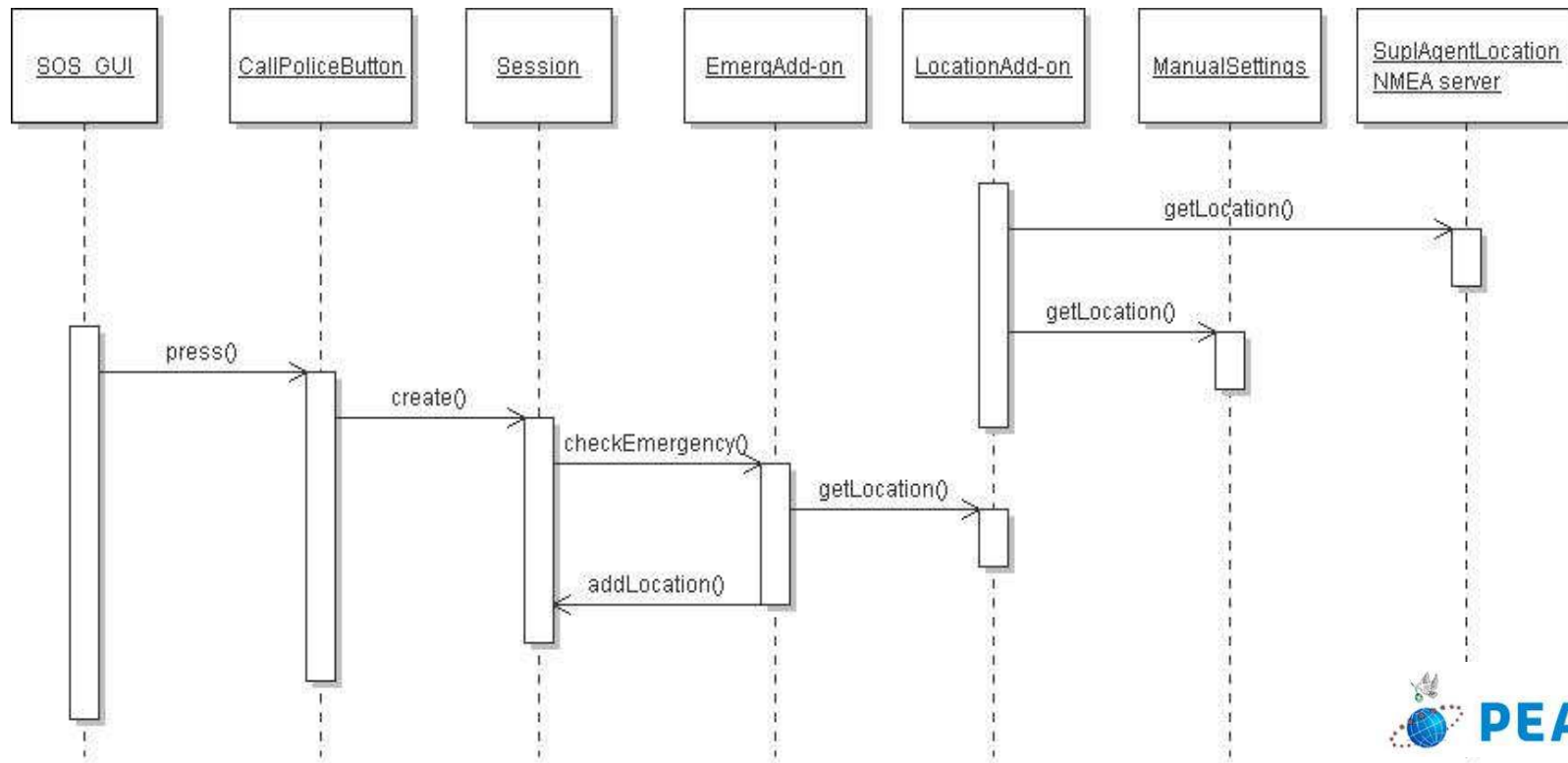
myMONSTER TCS Extension

Session Mobility Manager
Add-on

- The Session Mobility Manager (SMM) extension on myMONSTER TCS interacts with the Mobility Managemer Entity Components (MME) of the EPC network

- provide a seamless experience for the applications running on the client devices, such that operations like network attachment or handovers would be transparently handled

- For value added functionality, the ANDSF assists the SMM with information and operator pushed policies
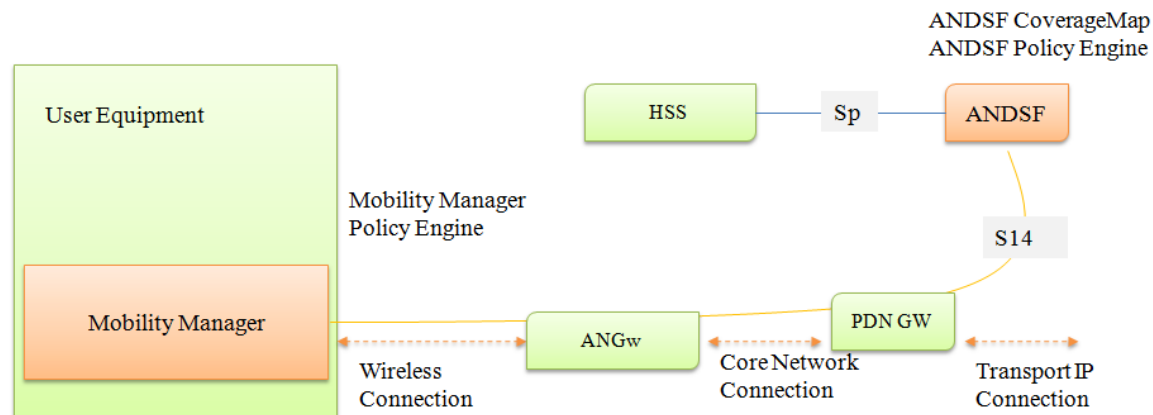
myMONSTER TCS Extension

Session Mobility Manager Add-on

- The ANDSF communicates with the MM running on the UE and exchanging information which would enhance both the Always Best Connected (ABC) concepts, but also allows the network operator to manage and enhance connectivity on a multiaccess environment as specified in 3GPP TS 23.402 and 3GPP TS 24.312.

- The development of this extension is performed under the umbrella of the project OpenEPC, a prototype reference implementation of the 3GPP Release 8 Evolved Packet Core (EPC)
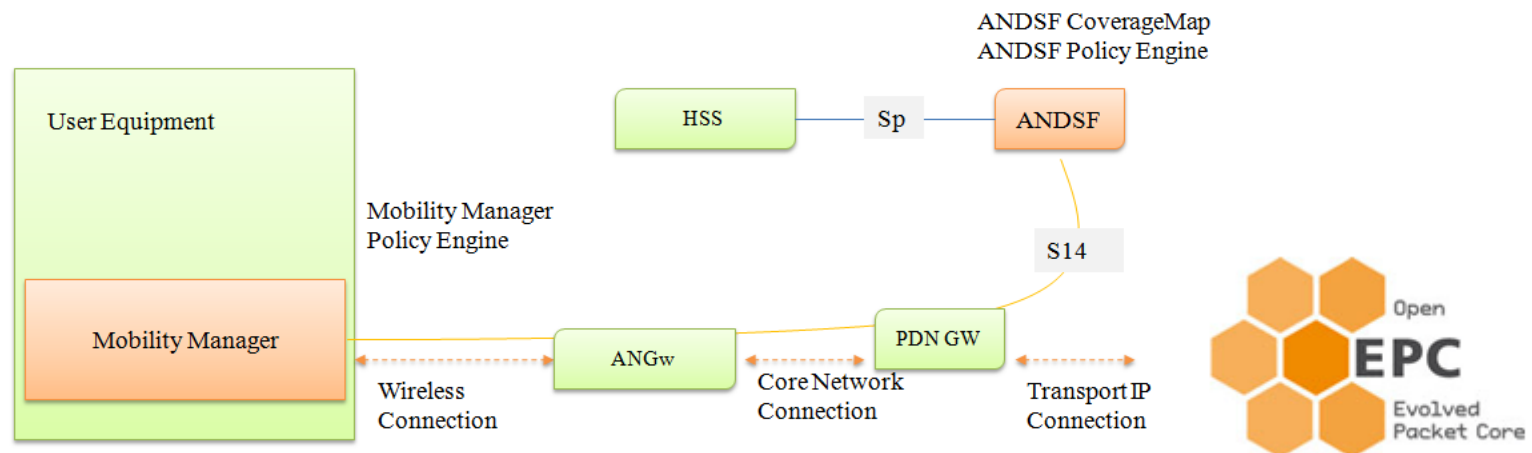
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Conclusion

- The EPC network, from 3GPP Release 8 specification offers together with LTE access technology to form the EPS, providing everywhere coverage and always on broadband access for fixed, nomadic and mobile users.

- This enables a variety of new multimedia. While data services such as E-mail, social networks, video streaming applications, increase in consumer size and leverage the advantages of broadband networks, voice and SMS services which remain their key revenue generating applications for operators are still to be realized.

- Based on the Open Voice Profile, we implemented extensions on the myMONSTER TCS framework

- The extensions were developed and tested within the scope of an industry operator environment, a European project (PEACE) and a reference implementation project (OpenEPC) of the 3GPP Release 8 specification of the Evolved Packet Core

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References

- 3GPP TS 23.402 : "Architecture enhancements for non-3GPP accesses"

- Open Voice Initiative, " One Voice; Voice over IMS Profile V1.0.0" , November 2009

- PEACE, IP based Emergency Application and Services for Next Generation Networks
  http://www.ict-peace.eu/

- 3GPP TR 24.229: "IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP)", Stage 3

- Java Specification Requests JSR 281: IMS Services API. JSRs. [Online] http://jcp.org/en/jsr/detail?id=281

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- myMONSTER, "Client ApplicationToolkit" http://www.mymonster.org

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