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Overview

• NGN Motivation
• IMS as a first step into an NGN Architecture
• IMS Key protocols (IETF SIP and Diameter)
• IMS Key components
• IMS Application Server options
• Evolution toward an all-IP based NGN Core
• ETSI TISPAN
• Summary
• Q & A
3G Service Trends

- Convergence of voice and data services towards all-IP infrastructures
- Lessons learned from the internet – successful Peer 2 Peer applications, presence, chat
- Lessons learned from telecommunications – no real successful data services besides SMS (is that really data??)
- The big fear of the seamless flat rate data access
- Compete on QoS, reliability and security
- Killer applications versus Killer service delivery platform
  - Service delivery platforms providing „service enablers“
    - Location, presence, charging, QoS, etc.
  - Flexible service creation and service deployment is key
  - Openness to third party developers / providers
  - Seamless services – integration of existing and emerging services
Wireless Subscriptions Growth

By 2004 there will be more mobile subscriptions than fixed mainlines. One year later wireless internet users will outstrip fixed internet users.
What are Next Generation Services?

Existing...

- Find-Me, Follow-Me
- Unified Messaging
- Voice & Data Prepaid

Emerging...

- Location-based Services (Directions, Promotions)
- Click2Dial
- Alerting Services (Weather, Traffic)
- Intelligent Call Screening
- Presence-driven Services
- Video conferencing
- PushToTalk
- Web-based Conferencing
- Ambient Intelligence
- Video
- Internet
- Multimedia
- Voice
- Commerce
- Instant Messaging
- 3G Mobile
The NGN Integrated Service Space
Network Convergence

Circuit-Switched domain

Voice Services

Seamless Services

Uniform Service Delivery Platform

Data Services

IP domain

Traditional CS

Co-existence

All IP World
Evolution of Service Delivery Platforms

Focus of Part 1

IMS

Multimedia Services

SIP App. Server

AAA Server

SIP Server

Diameter

VoIP

GPRS/UMTS

GSM

PSTN

3rd Party Application Services (Enterprises / Content)

OSA / Parlay Interface

IN / CAMEL Services

INAP/CAP Interface

Stored Program Control Services

○ = Services
Multi-Service, Multi-Access networks

Today
Single service networks

Future
Multiservice networks/client server

Content

Control

Media gateways

All IP

Access transport and switching networks

Clients/applications

Cellular PLMN

PSTN/ISDN

CATV

Data/IP networks

IP networks

Wireless access

Wireline access

Cable access
Why move to a packet based Architecture?

The economic benefits of a packet based core network are:

• **Lower Opex and Capex:**
  – Shared network infrastructure enables voice data and multimedia services to be delivered over common network core
  – Lower cost of infrastructure (eg. Softswitch & Media Gateway cheaper than circuit switches for equivalent number of subscribers)
  – Reduced network complexity associated with distributed switching enables more efficient use of transmission facilities

• **Increased Revenue**
  – Enables multi-media applications and converged services

“Enhanced Services will be the critical factor to the success or failure of 3G mobile businesses Across Europe”
Internet Control vs. Telecommunications Control

No single point of failure
All services enabled by protocols: From ftp to web

User has control of all applications and choice of servers

Services supported by interfaces and central controllers

ITU Intelligent Network Control:
POTS, ISDN, BISDN, FR, ATM, H.323, MEGACO/H.248, GSM

User has little control
SIP as an open communications protocol is considered a key enabler for real-time converged communications and the development of interactive services.
Next Generation Network 3 Tier Architecture

- Enhanced services for the next generation network will be enabled by a tiered architecture where “Application Servers” will provide an independent service layer for the execution of enhanced services and content.

- Session / Call Control based on advanced signaling protocols (i.e. SIP) is performed in Softswitches, or “Call Servers”.

- Transport of signaling and content (incl. Voice) data will be done by routers in the classical IP fashion. Dedicated nodes, i.e. “Media Gateways” and “Media Servers” are in charge for processing content data controlled by the Call Servers.
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Todays Communications Space

- Minute fees for Voice over Circuits (fixed and mobile)
- From volume tariffs to flat rates for packet network use
- What about VoIP? ➔ The killer of the voice minutes
The Mobile View of the World

1. Voice traffic generates the revenues (minutes)
2. Data revenues are based on SMS mainly (CS signaling!!)
3. GPRS packet net is promoted for Pull Services
4. BUT „Peer to Peer“ packet traffic started (IM, PTT, Agile Messenger!)

2. Packet Pull Services

3. Support for Person to Person IP communication is needed

1. Person to Person Call (incl. SMS based on CS Signaling!)
IMS Idea: Try to get Control of IP Services

- The IP network allows free communication between endpoints
- IMS is able to control S(IP) services on an IP network
IMS enabling Control of WCDMA / IP services

IMS Core Idea:
- Define an *IP Multimedia Overlay-Network over GPRS* (for Session control based on Internet protocols!)
- *Data* (Media) transport (as well as signaling transport) via GPRS
- *Provide control* (QoS, security, Charging) for IP services and person-to-person communication

*Note that IMS is for fixed networks applicable too*
IMS Motivation – Rich Call

IMS Service Idea: Rich call

1. Make a call
2. During the call exchange additional information, such as pictures, videos, documents
IMS Motivation – PSTN/ISDN Replacement

Mid term Circuit Network Replacement
- Usage of Session Initiation Protocol enables Voice and Multimedia over IP
- Inherent multi party session support
IMS Motivation – Flexible Service Provision

Provision of service enablers
- Presence and Group server are considered key for the future
- Example: Push to Talk, but more generally community services

Packet Net (WCDMA)
IP Multimedia System (IMS)
Transport (RTP)
Signalling (SIP)
Application Server
Messaging Server
Presence Server
Call / Session Server
IMS Motivation – Seamless Service Provision

- Mobility and QoS enabled IP core
- Simplified service provisioning independent of access
IMS Motivation

• IP network connectivity is given (GPRS, UMTS, WLAN, DSL, etc.)
• Use IP network for CS-like, synchronous, QoS enabled MM services
• Enable an open set of innovative services (like in the internet)
• Provide a controlled, secure service environment with QoS and charging capabilities
• Provide a minimum set of interfaces (common denominator) for interoperability
• Reuse as much as possible standard IP protocols for session control, management and bearer transport (SIP, AAA, RTP)
• Extend these protocols to achieve security and managebility
• Take into account existing mobility services and infrastructure
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 Multimedia over IP services !!

Architecture

- Horizontal Architecture
- Build on existing IETF and telco SDP standards
- Use standard service enablers (e.g. Presence, GLMS/XDMS, etc.)
- Modular design and open interfaces
**IMS as Multimedia Service Enabler**

**IP Multimedia System (IMS)**

- **Packet Access Networks** (WLAN, UMTS, DSL)
- **Circuit Access Networks** (GSM, UMTS)
- **Legacy Networks** (GSM, ISDN, etc.)

**Key Components**

- **SIP UA**
- **AAA Server**
- **SIP Server**
- **OSA GTW**
- **SIP AS**
- **WAP GTW**
- **Media Server**
- **Legacy Networks**
- **Web Server**
- **Enterprise Server**
- **Media Signalling Gateway**
- **3rd Pty AS**
3GPP IP Multimedia Subsystem (IMS)

• The IMS was originally standardised by 3GPP as part of UMTS Release 5
  – Basic VoIP, IM, Presence support on top of GPRS
  – Adaptations to “real word” have been made in Release 6 (QoS, PoC support)
  – Release 7 will look at unified IMS for all IP access networks (DSL, WLAN, etc.)

• The IMS is based on the IP world protocols, namely
  – SIP (Session Initiation Protocol) for Session Control, and
  – Diameter for AAA (Authentication, Authorisation & Accounting)
  – plus many others, i.e. SDP, RTP, RTCP, MGCP, etc.

• Key components of the IMS architecture are
  – Extended AAA Server (Home Subscriber System – as evolution of the HLR)
  – SIP servers / soft switches
  – Media Servers & Media Gateways
  – and Application Servers
IMS Layers: Transport, Session Control, Apps

IMS Service Framework

HSS (AAA)

Application Server

Media Server

IMS Core

P-CSCF

I-CSCF

S-CSCF

Media Server

Media Gateway

Underlying IP Core Network

Access Networks (WLAN, UMTS, DSL)

Interworking with Legacy Networks (GSM, ISDN, DVB)
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Most important IMS Components

- P-CSCF
- I-CSCF
- S-CSCF
- HSS (AAA)
- Application Server
- Media Server
- Breakout Gateway
- Home Network
- Visited Network

Different Access Networks (WLAN, UMTS, DSL)

Interworking with Legacy Networks (GSM, ISDN, DVB)
IETF Session Initiation Protocol (SIP)

- SIP is THE VoIP protocol enabling to initiate, terminate, and modify service sessions
  - Multimedia(!) sessions (not just voice-centric!)
  - Point-to-point and multiparty
- Support for
  - registration and modification of multiple user location information
  - caller and callee authentication / call authorization
  - privacy for call signaling and media streams
  - media path with ensured QoS
- Flexible service creation
  - support through SIP servers (located inside and outside the network)
- Extensible protocol to cover new communication aspects
  - Such as for presence and instant messaging
- Used together with Session Description Protocol
  - No Bearer support (RTP and RTCP are used for that) !!
- Developed and maintained by IETF (MMUSIC and SIP WG)
- RFC 3261: www.ietf.org/html.charters/sip-charter.html
SIP related IETF Working Groups

- Multiparty Multimedia Session Control (MMUSIC9 WG)
  - Origin of SIP
  - SDP extensions
  - SDPng

- SIP WG
  - SIP Core specification maintenance
  - SIP protocol extensions

- Session Initiation Proposal Investigation (SIPPING) WG
  - Requirements for SIP
  - Specific SIP application services

- SIP for Instant Messaging and Presence Leveraging Extensions (SIMPLE) WG
  - SIP for Presence and Instant Messaging
Local SIP Architecture

- Administrative Entity (SIP Server)
  - Registrar
  - Redirect / Proxy Server
  - Location Server

- Local IP network
  - SIP Gateway
  - SIP Gateway
  - SIP Gateway

- PSTN ISDN
- GSM
- H.323

sip: iptel.org
Global SIP Architecture

SIP backbone network

SIP signaling for initial call routing and setup

SIP in-call signaling

RTP media streams
Basic SIP Request

Request Line:
INVITE sip:blum@iptel.org SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd] ; branch=z9hG4bKnashds7
Max-Forwards: 70
Route: <sip:pcscf1.visited1.net ; lr>, <sip:scscf1.home1.net ; lr>
From: <sip:user1_public1@home1.net> ; tag=171828
To: <sip:blum@iptel.org>
Call-ID: cb03a0s09a2sdglkj490333
Cseq: 127 INVITE
Content-Type: application/sdp
Content-Length: 248

Body = SDP
v= 0
o= - 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s= -
c= IN IP6 5555::aaa:bbb:ccc:ddd
t= 907165275 0
m= audio 3458 RTP/AVP 97 96 0 15
a= rtpmap:97 AMR
a= fmontp:97 mode-set=0,2,5,7; maxframes=2
a= rtpmap:96 G726-32/8000
Basic SIP Response

<table>
<thead>
<tr>
<th>SIP Version</th>
<th>Status Code</th>
<th>Header Field Name</th>
</tr>
</thead>
</table>

**Status Line**

- SIP-Version: 2.0
- Status Code: 200 OK
- Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]; branch=z9hG4bKnashds7
- Record-Route: <sip:scscf1.home1.net;lr>, <sip:pcscf1.visited1.net;lr>
- From: <sip:user1_public1@home1.net>; tag=171828
- To: <sip:blum@iptel.org>; tag=314159

**Header**

- Call-ID: cb03a0s09a2sdfglkj490333
- Cseq: 127 INVITE
- Contact: <sip:[5555::eee::aaa:bbb]>
- Content-Type: application/sdp
- Content-Length: 220

**Body**

```plaintext
v=0
o=-2987933615 2987933615 IN IP6 5555::eee::aaa:bbb
s=-
c=IN IP6 5555::eee::aaa:bbb
t=907165275 0
m=audio 3458 RTP/AVP 97 0
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
```

**Status codes in SIP**

- 1xx – Provisional responses
- 2xx – Success
- 3xx – Redirection
- 4xx – Client Error
- 5xx – Server Error
- 6xx – Global Failures
SIP Message Body = SDP

- Message body can be any protocol
- However, in most implementations it is SDP (Session Description Protocol)
  - SDP - Session Description Protocol
  - RFC 2327 4/98 by Handley and Jacobson
  - Used to specify info about a multi-media session.
  - SDP fields have a required order
  - For RTP - Real Time Protocol Sessions:
    - RTP Audio/Video Profile (RTP/AVP) payload descriptions are often used
SDP Example

Session level

- **Version**: v= 0
- **Origin**: o= blum 2987933615 2987933615 IN IP4 192.168.1.1
- **Session Name**: s= course
- **URI**: u= http://www.fokus.fraunhofer.de
- **E-mail address**: e= blum@fokus.fraunhofer.de
- **Phone number**: p= +493034637229
- **Connection Data**: c= IN IP4 192.168.1.1
- **Times**: t= 907165275 0

Media level

- **Media**: m= audio 8000 RTP/AVP 97 0
- **Attributes**: a= rtpmap:97 AMR
- **Attributes**: a= rtpmap:97 mode-set=0,2,5,7; maxframes=2
- **Media**: m= video 8001 RTP/AVP 98
- **Attributes**: a= rtpmap:98 H263
- **Media**: m= application 8002 udp wb

Codecs

Type of media streams

Port number where media is received
**SIP Server Operation Models**

**Redirect Server**
- Perry
- Redirect Server
- Dave

- INVITE
  - 302 Moved
  - ACK
- INVITE
  - 200 OK
- ACK
- RTP
- BYE
- 200 OK

Transaction-oriented, Routing, Translation Services

**Proxy Server**
- Perry
- Proxy Server
- Dave

- INVITE
  - 180 Ringing
  - 200 OK
- ACK
  - RTP
- BYE
- 200 OK

Call Management, Event-driven Services

**B2BUA Server**
- B2BUA Server
- Perry
- Dave

- INVITE no SDP
  - 200 SDP A1
  - ACK SDP held
  - INVITE SDP B'
  - 200 SDP B
  - INVITE no SDP
  - 200 SDP A2
  - ACK SDP A2'
  - RTP

Call (Leg) Creation and Manipulation Services
IETF Diameter Protocol for AAA

• New IETF protocol for Authentication, Authorization and Accounting (AAA) services
  – Internet Draft “DIAMETER Framework” (1998) by IETF AAA WG
• Developed based on the requirements of 3G mobile network operators, ISPs and other IETF groups since 2001
• Used in the 3GPP IMS for HSS access
• Extends the RADIUS functionalities:
  – Introduction of Agent roles (proxy, relay, redirect & translation agents)
  – Enables server-initiated messages
  – Uses UDP, TCP and new SCTP protocol for reliable message transport
  – Is backward compatible to RADIUS infrastructures by using translation agents
  – Integrates vendor specific commands and AVPs
  – Explicit modular structure = is extendible
IETF AAA Work Group

- GOAL
  - Develop the Diameter Standard based on the requirements of other IETF WGs (NASREQ, MOBILE IP, ROAMOPS), 3GPP and 3GPP2

- WG defines: message format, error messages, accounting support, IPv6 support, backward compatibility with RADIUS, data model, security framework, Management Information Base (MIB)

- Achievements:
  - RFC 3588 Diameter Base Protocol
  - Several other AAA RFCs
  - multiple Diameter application drafts

- Web link: www.ietf.org/html.charters/aaa-charter.html
Diameter Base Protocol

- RFC 3588 approved in September 2003 (NEW)
- provides an AAA framework for applications
- works for local AAA and in roaming situations
- The RFC defines
  - agent roles
  - sessions and connections
  - header, AVP and data formats
  - Command codes, AVPs, Result codes and Diameter application IDs
  - the state machines used within Diameter
  - error handling, failover algorithms
  - basic accounting procedures

IETF Diameter Applications

• NAS (network access server) application
  – Allows AAA services in NAS environments (e.g. dial-in PPP) and defines RADIUS backward compatibility

• Mobile IPv4 application
  – Diameter command codes and AVPs for Mobile IPv4 services

• EAP application
  – Allows the use of the Extensible Authentication Protocol (EAP) for authentication purposes

• SIP application
  – Allows a Diameter client in a SIP server for authentication of users and authorization to SIP resource usage
  – IETF equivalent to 3GPP’s Cx reference point

• Credit Control application
  – Used for real-time credit control of end-user services as e.g. network access, SIP services ...
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IM Release 6

Applications
Services

IP Multimedia
Subsystem (IMS)

Operator 2

Multimedia
IP
Networks

CS-Domain
-or-
PSTN
-or-
Legacy
-or-
External

WLAN
Access,
WAG

UTRAN/
GERAN

SGSN

GGSN

IMS Terminal

PS-Domain

PS-Domain

"Mb/Gi-Cloud"

AAA

PDGW

WLAN
(Home)
User Equipment (UE)

- Contains the SIP user agent
- Establishes a GPRS PDP context for
  - Signaling (either dedicated or a general one)
  - Media transport
- Contains ISIM for authentication
  - Public and private user id
  - User Network address
  - Security algorithms and keys
  - At least a USIM
- Correlate between session control and QoS reservation
Home Subscriber Server (HSS)

- Contains user profile information indicating
  - Private and public identities of the user
  - Authentication information
  - Which services and medias the user is eligible for using
  - Filtering criteria for choosing appropriate AS
- Assist I-CSCF in choosing the appropriate S-CSCF
- Maintain subscription information about the user
- Enforce provider policies
  - De-register users with invalid subscription
- Connected through Cx interface to S-CSCF and I-CSCF (DIAMETER)
- Connected also to AS
  - Provide user service information
- Allow multiple instances by using SLF (Subscription Location Function)
Call State Control Function (CSCF)

- Call State Control Function (CSCF)
  - Call set-up/termination and state/event management
  - Address Analysis, translation, modification if required, address portability, mapping of alias addresses
  - provide service trigger mechanisms (service capabilities features) towards Application & services network (VHE/OSA)
  - Interacts with HSS in the home domain to receive profile information for the user and
  - Interact with MRF in order to support multi-party and other services
Proxy Call State Control Function (P-CSCF)

- First contact point for the UE (outbound proxy)
  - Forward registration to I-CSCF
  - Forward requests to S-CSCF (or I-CSCF)
  - Forward replies and incoming requests to UE
- Maintain security association with UE
- Responsible for compression
- Correlation between SIP and QoS
- Enforce local policies
- Possibly support routing to local service infrastructure
  - Emergency call handling
- Discovered through DHCP or during GPRS PDP establishment
Interrogating CSCF (I-CSCF)

- Contact point within an operator
  - Discovered through DNS
- Assign S-CSCF to a user by contacting the HSS
- May act as a THIG (Topology Hiding Inter-Network Gateway)
  - Always on the path (RR and Service-Route) of any message leaving the network
  - Encrypt all entries added by the hiding network in outgoing messages
Serving Call State Control Function (S-CSCF)

- Acts as a registrar
- Acts as a SIP proxy (forward messages ..)
- Allocated to a user during registration
- Always on the path of the user‘s SIP messages (use Service-Route and RR)
- Enforces service policies based on the user‘s subscription profile
- Collects session information for billing
- Interacts with application service platform
- Acts as user agent when required (Notifications about de-registrations and re-authentications, call termination)
Application Server (AS)

- Services include third party CC, personalized routing ....
- Services are offered by home, visited or third party provider
- S-CSCF forwards requests to AS base (possible received from HSS)
- Results of AS sent back to S-CSCF
- AS can act as UA, redirect or proxy
- CAMEL and OSA optional
Media Resource Function (MRF)

- Provide conferencing and announcement services
- Multimedia Resource Control Function (MRFC)
  - Interpret information from S-CSCF and AS
    - Conference booking and floor control from AS for example
    - Control MRPF
- Multimedia Resource Processor Function (MRPF)
  - Establish bearers based on MRFC requests
  - Media mixing and distribution
  - Media streaming for announcements
- Use H.248 (MEGACO) between the two components
Breakout Gateway Control Function (BGCF)

• Select PSTN/CS domain to forward call to
  – If the BGCF determines that the breakout is to occur in the same network in which the BGCF is located within, then the BGCF shall select a MGCF which will be responsible for the interworking with the PSTN/CS Domain.
  – If the break out is in another network, the BGCF will forward this session signalling to another BGCF in the selected network.

• How to choose an MGCF is not specified
  – Configuration
  – TRIP or similar
Media Gateway Control Function (MGCF)

- Gateway to PSTN networks
  - Performs protocol conversion between the Legacy (e.g. ISUP, R1/R2 etc.) and the IM domain call control protocols.
  - Controls the parts of the call state that pertain to connection control for media channels in a MGW.
  - MGCF selects the CSCF depending on the routing number for incoming calls from legacy networks.
    - Establish bearer with appropriate code
    - Possibly translate codec
    - Act as UA (but no registration required)
Media Gateway Function (MGW)

- Media Gateway Function (MGW)
  - This component is PSTN/PLMN transport termination point for a defined network and interfaces UTRAN with the core network over Iu.
  - A MGW may terminate bearer channels from a switched circuit network and media streams from a packet network (e.g., RTP streams in an IP network). Over Iu MGW may support media conversion, bearer control and payload processing (e.g. codec, echo canceller, conference bridge).
    - Interacts with MGCF, MSC server and GMSC server for resource control.
    - Owns and handles resources such as codecs, echo cancellers etc.
• Policy Decision Function (PDF)
  – A Policy Decision Point
  – Authorizes the establishment of media streams
  – Controls gates in the GGSN
  – Integrated in the P-CSCF in 3GPP Release 5
  – Separated functional entity in 3GPP Release 6
  – Protocols: COPS (R5, R6), Diameter (R6)
IMS ALG & TrGW

- **IMS Application Layer Gateway (IMS-ALG)**
  - Provides IPv4/IPv6 interworking in the signaling path
  - Acts as a SIP B2BUA
  - Controls a TrGW through the Ix interface
  - Interfaces I- and S-CSCF
  - Rewrites SDP and SIP to change IP addresses
  - Protocols: SIP, non-standardized for the Ix interface

- **Translation Gateway (TrGW)**
  - Does IPv4/IPv6 translation in the media path
  - Acts as NA(P)T-PT
  - Protocols: RTP, non-standardized for the Ix interface
**3GPP IMS requires multiple outbound proxies**

**P-CSCF** - Proxy CSCF. The terminals point of contact in the visited network after registration. Point where network places constraint on the bearer.

**I-CSCF** - Interrogating-CSCF. Responsible for finding the S-CSCF at registration. May also perform hiding of the S-CSCF network architecture.

**S-CSCF** - Serving-CSCF. Responsible for identifying user’s service privileges. Responsible for selecting access to home network application server (service platform) and for providing access to that server.
IMS: Separation of Signaling and Media transport

**mobile to mobile session**

User A

- A’s visited network
  - P-CSCF
  - GPRS

A’s home network

- S-CSCF
- I-CSCF
- Required on registration, optional on session establish

B’s home network

- I-CSCF
- Optional

B’s visited network

- P-CSCF
- GPRS
- Required on registration, optional on session establish

User B
IMS User Identity Concept

Each IMS User has at least one private and one or more public User Identities

- **IMS Private User Identity:**
  - belongs to the IMS operator
  - is not used for routing of SIP messages
  - uses the format defined in RFC 2486
    - Example: `user-X@ims.operator.com`
  - is stored on the ISIM card (in the mobile phone) and in the HSS (in the IMS User Profile)

- **IMS Public User Identity:**
  - is public and may be subject to Number Portability
  - is used for routing of SIP messages
  - may use the SIP-URI format defined in RFC 3261 and/or the TEL-URI format defined in RFC 2806
    - Example SIP-URI: “sip:user-X@company-X.com”
    - Example TEL-URI: “tel:+491231234567”
  - At least one Public User Identity is stored on the ISIM card
  - All Public User Identities are stored in the HSS
IMS Session Setup & Control

Why do we need the IMS Session Setup?
1. Capability Negotiation (e.g. negotiation of session components, codecs, port numbers, addresses, etc.)
2. Network Resource Reservation and the support of QoS Preconditions

Additional Functions performed by the IMS during the IMS Session Setup:
- Routing to the Terminating IMS (= the IMS of the B-Party)
- Routing / Breakout to the PSTN / CS-Domain when the B-Party is not in the IMS, but in the PSTN / CS-Domain
- Service Control / Invocation of Application Servers to trigger the execution of Originating- and/or Terminating IMS Services
- Integrity/Confidentiality Protection of SIP Messages
- QoS/Media Authorization
- SIP Signalling Compression
User Registration and Authentication

- UE
- SGSN
- HLR
- GGSN
- CSCF’s
- HSS
- IMS-AS

GPRS Attach
PDP Context Activation
IMS Registration and User Authentication
IMS Service Access

Bearer Level Authentication
IP Transport setup
IMS Registration
IMS Service Access
IMS Session Control – Simple Scenario

Originating Part
UE-A
Access
P-CSCF
S-CSCF
DNS
I-CSCF
HSS
S-CSCF
P-CSCF
Access
UE-B

Terminating Part
User A Registered
INVITE
100 Trying

User B Registered
INVITE
100 Trying
180 Ringing
200 OK
ACK
Exchange Of bearer packets (RTP)
IMS QoS Support

- The actual Network QoS for IMS services is provided by the Access Network (e.g. based on UMTS QoS) and the IMS network infrastructure (e.g. based on Diff-Serv support in routers and switches).

- The IMS provides a correlation and control mechanism based on the use of the Policy-Decision-Function (PDF).

- Key functions of the PDF:
  - acts as Policy Decision Point (PDP):
    - the GGSN is the corresponding Policy Enforcement Point (PEP).
  - authorizes and controls the resource usage for each bearer (e.g. GPRS/UMTS PDP-Context):
    - this prevents the misuse of Network QoS and the theft of service.
    - this allows to limit the resource consumption.
  - exchanges Charging Correlation Identifiers with the GGSN (ICID, GPRS Charging ID):
    - this allows the correlation of charging information generated in the PS-Domain (SGSN, GGSN) and in the IMS (e.g. CSCF, AS).
IMS Session Control – Complex Scenario

User A Registered

INVITE/ 180 PR

S

PRACK/ 200 OK

180 Ringing

200 OK

ACK

Exchange of bearer packets (RTP)

S

Service Control

1

Token generation

2

Resource Authorization

RR

Resource Reservation

B

Verify binding

O

Same as 1,2

User B Registered

Go

B

Go

O

Go

200 OK

Go

B

Open gate
The IMS charging architecture, described in TS 32.200, distinguishes:

- **offline charging:**
  - charging mechanism where charging information does not affect, in real-time, the service rendered
  - *For offline charging all communications between the IMS network entities and the Charging Collection Function (CCF) are carried out on the Rf interface.*

- **online charging:**
  - charging mechanism where charging information can affect, in real-time, the service rendered and therefore a direct interaction of the charging mechanism with session/service control is required
  - *For online charging the Ro interface is used by the AS and MRFC towards the Event Charging Function (ECF) and the ISC interface is used between the S-CSCF and the Session Charging Function.*
For offline Charging, CCF and CGF are responsible for collecting charging information from PS domain and IMS entities.
For online charging, ECF and SCF are responsible for charging information from PS domain and IMS entities.
Overview

• NGN Motivation
• IMS as a first step into an NGN Architecture
• IMS Key protocols (IETF SIP and Diameter)
• IMS Key components
• IMS Application Server options
• Evolution toward an all-IP based NGN Core
• ETSI TISPAN
• Summary
• Q & A
IMS Application Server Options

Application Servers
- SIP AS
- OSA AS
- OSA GTW
- CAMEL
- IM-SSF

HSS (AAA)

P/I/S-CSCF (SIP Proxy)

Local AS

SIP Server

PDF

Media Server

IMS Core Server

Diameter
SIP

Application Server

IMS Application Server Options

IKLAS BLUM / THOMAS MAGEDANZ – FRAUNHOFER FOKUS 2006
How does a SIP AS Provide Enhanced Services

• S-CSCF determines that a call requires enhanced service processing
  – Filtering may be based on calling / called party or other mechanism (defined by filtering criteria) eg. SIP message type, header fields, etc.

• Based on filtering criteria, the S-CSCF determines the address of the Application server and relays the call to the AS function. The Application Server receives the call and invokes the appropriate service logic taking one of the following actions:
  – Redirects the call to a new destination
  – Send the call back through the S-CSCF in order to monitor subsequent call events (ie act as a SIP Proxy)

• The Application Server (based on some other input) can also set-up calls between other entities in the network (ie. act as a B2BUA)
Major Service Platform Interfaces

Service Delivery Platform (Application Server)
- Value Added Services
- Service Platform
- SIP Interface

Detection Points:
- Methods / Responses,
- Headers, SDP info, etc

Filter criteria

DP Criteria:
- AS-Specific Methods / Responses,
  Headers, SDP info, etc set by AS/HSS

ISC = Session Initiation Protocol

Cx = Diameter
Sh = Diameter

User Authentication
User location
User Profile (Filter Information)

Application Data
(Filter Information)
User status changes

SIP Interface

S-CSCF
SIP-Server

Application specific service control

HSS

Session Initiation Protocol (SIP)
IMS Filter Criteria

• IFC Details:
  - the IFC contents:
    1) Trigger Point
    2) Service/AS Identifier
  - Trigger Point contains one or more Service Triggers linked via the logical expressions (AND, OR, NOT, EQUAL)
  - Service Trigger includes:
    1) Request URI content
    2) SIP Method, eg. INVITE, REGISTER ...
    3) SIP Header content
    4) Session Mode (originating, terminating)
    5) SDP content
• AS Identifier have SIP URI format e.g. sip:As1@as.operator.com
# IMS Filter Criteria Example

<table>
<thead>
<tr>
<th>Trigger Point</th>
<th>AS Identifier</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>method== „MESSAGE“</td>
<td>sip:<a href="mailto:im@as.domain.com">im@as.domain.com</a></td>
<td>Sends SIP Message to the messaging application on as.domain.com</td>
</tr>
<tr>
<td>method== „INVITE“ and sessionCase== „originating“</td>
<td>Sip:<a href="mailto:callscreening@as2.domain.com">callscreening@as2.domain.com</a></td>
<td>Sends initial SIP INVITE messages from originating party to the AS at as2.domain.com</td>
</tr>
<tr>
<td>uri== „domain.com“</td>
<td>sip:<a href="mailto:anyservice@asx.domain.com">anyservice@asx.domain.com</a></td>
<td>If the uri contains the string „domain.com“ then sent the request to the <a href="mailto:anyservice@asx.domain.com">anyservice@asx.domain.com</a></td>
</tr>
</tbody>
</table>
Service Examples – Multiple AS case

Example 2: Multiple application servers triggering

Initial Filter Criteria of Prepaid Server
Application Server Address: prepaid.operator.com
Trigger point:
Method = MESSAGE OR INVITE AND From="sip:blum@open-ims.org"
Handling: Proxy
Priority: 1

Initial Filter Criteria of Messaging Server
Application Server Address: message.operator.com
Trigger point:
Method = MESSAGE
Handling: Proxy
Priority: 2
3GPP Service Architecture Options

- SIP AS
- OSA Service
- Camel CSE
- OSA
- OSA SCS
- Serving CSCF

ISC = SIP

ISC = SIP
SIP Application Server

- SIP AS = SIP Server plus Programming Model
- Programming is the way to generate new services
  - Examples:
    - “discard all calls from Monica during my business hours”
    - “redirect authenticated friends to my cell phone, anyone else to my secretary”
    - “if busy, return my homepage and redirect to recorder”
- SIP follows HTTP programming model
- Mechanisms suggested in IETF are:
  - Call Processing Language (CPL) - A Language for User Control of Internet Telephony Services
  - Common Gateway Interface (CGI) for SIP
    - http://ietf.org/rfc/rfc3050.txt
  - SIP Servlet API (JSR 116)
  - See also: /www.sipcenter.com/sip.nsf/html/Programming+SIP
SIP Application Server (3GPP)

- SIP Application Server
  - CPL
  - CGI
  - SIP Servlets
  - S-CSCF (SIP Proxy + Registrar)
  - P/I-CSCF (SIP Proxy)
- HSS
- MGC-F
- MR-F (Media Server)

Connections:
- SIP
- DIAMETER
- SIP
3GPP Service Architecture Options

- SIP AS
- OSA Service
- Camel CSE
- OSA SCS
- IM SSF
- Serving CSCF

ISC = SIP

ISC = SIP
AS Option - 3GPP CAMEL

- CAMEL = Customized Applications for Mobile Enhanced Logic
  - Is the use of IN in mobile circuit switched and packet switched networks: GSM/GPRS
  - IN-based architecture enabling to offer operator specific services (OSS) to mobile subscribers even when roaming in another network (international roaming)
    - Server in Home Network = CAMEL Service Environment (CSE)
    - Service access from enhanced MSCs = Service Switching Functions/Points (SSPs)
  - CAMEL Application Protocol (CAP) is based on IN Capability Sets 1 and 2
  - CAMEL additionally exploits Mobile Application Part (MAP)
- CAMEL Documents:
- CAMEL evolves in Phases
  - Camel Phase 4: Interworking with IP Multimedia Subsystem
    - TS 23.278: (CAMEL) Phase 4 - Stage 2 IM CN Interworking
CAMEL Phases

• Camel Phase 1
  – Basic Call Control functionalities for GSM calls

• Camel Phase 2
  – ApplyCharging in VPLMN : GSM calls are monitored directly in VPLMN
  – Announcement : access to announcements directly from the VPLMN

• Camel Phase 3
  – Handling of GPRS Sessions and pdp-contexts for session control, monitoring (location update, QoS,…) and charging (time and volume triggers)
  – Support of SMS-MO through CS and PS networks
  – Anytime interrogation and modification of customer data in HLR
  – Mobility management enhancements

• Camel Phase 4
  – Multi-leg GSM call handling
  – Creation of a new GSM call
  – PLUS: Interworking with IP Multimedia Subsystem
**CAMEL Evolution**

**Camel Phase 1 + 2**
- HLR
- MSC (SSF)
- IVR (IP)

**Camel Phase 3**
- SGSN (SSF)
- 2.5G Packet Switch
  - GPRS Data Network

**Camel Phase 4**
- HSS
- IM-SSF
- S-CSCF
- 3G IP based Voice & Data Networks
- CAP (over IP)

**Home Network**
- CAMEL (SCF)
- MAP
- SIP

**2G Circuit Switch Voice Network**
- CAP

**3G IP based Voice & Data Networks**
- CAP (over IP)
CAMEL Phase 4 in IMS Domain

- CSE (CAMEL Support Environment) = IN Service Control Point
- imSSF = SIP to IN / CAMEL Application Protocol (CAP) Gateway
- CSE and imSSF talk standard CAP!!

![Diagram of CAMEL Phase 4 in IMS Domain](image-url)
3GPP Service Architecture Options

- SIP AS
- OSA Service
- OSA SCS
- Camel CSE
- Serving CSCF

ISC = SIP

ISC
ISC
ISC
ISC
ISC
ISC
Parlay/OSA (Open Service Access) define an API that enables operator and 3rd party applications to make use of network functionality through a set of open, standardised service interfaces.

Applications (independent of underlying network technology)

Parlay/OSA API

Mapping to network specific protocols (e.g. INAP, CAP, MAP, ISUP, SIP)

Value Added Telco Functions
- Call Control, User Interaction
- Location, Presence
- Realtime Charging, etc.

Specifications are available from:
http://www.parlay.org and
http://www.3gpp.org/osa

3GPP TS 29.198 Open Service Architecture (OSA)
Parlay’s Technical Approach

- Framework Interface Set - Common Functions That Are Required to Enable Services to Work Together in a Coherent Fashion e.g.
  - Authentication, Discovery, Manageability
- Transport interface
  - CORBA, WSDL (Web Services)
- Service Interface Set(s) - Common Functions That Deliver Whole Complex Services or Sub-components of Services e.g.
  - Call Control, User Interaction, Content-based Charging, Location, Presence and Availability, Messaging, Policy Management, Quality of Service …
- Resource Interfaces - Interfaces used between a Parlay Gateway and network elements
  - not specified in Parlay (but hints in OSA)
Parlay / OSA – EAI Approach

Application

Parlay/OSA API

Framework2Service Interface

Framework

Gateway

Applications Interface

SCF X

Service Interface

SCF y

SCF z

SCF a

Network Resources

Proprietary Service Interface X
Applications – Inside or Outside

Non-trusted Environment

- 3rd Party Application Server
- Applications provided from outside operators domain (other operators, ASPs, corporates,...)

Trusted Environment

- Mission critical applications (IN type services)
- Non-mission critical but operators applications (e.g. “find-a-taxi”)
- Operator Application Server
- OSA/Parlay
- Carrier Grade Gateway with Application Server

Open API: OSA/Parlay/JAIN
Parlay Interfaces – Classic vs. Parlay X

Parlay X App

XML Script
Java
VB

“Web Services” App

XML
Java
VB

Parlay X Gateway

XML Transport:
Simple XML sequences over SOAP, CORBA, ...

XML Transport:
Complex XML sequences over SOAP, CORBA, ...

createCall()
routeReq(A)
routeReq(B)
...

routeRes(A)
routeRes(B)
...

createCall()
routeReq(A)
routeReq(B)
...

routeRes(A)
routeRes(B)
...

Not really Demanded!

Parlay C++ / Java App

XML CORBA
IDL, Java,
XML, ...

Parlay Gateway

CORBA
IDL, Java

Parlay X APIs

“MakeACall (A,B)”

“GetCallInfo”

XML Transport:

IIOP

Classic Parlay APIs

CORBA
IDL, Java

SIP
Server

SCP/CSE

HLR
OSA / Parlay AS

Service Delivery Platform (Application Server)

HSS

S-CSCF
SIP-Server

Filter criteria

SIP Server

Parlay API (MPCC, MMM, Pres, Charg, ...)

SIP Interface

Diameter

Sh = Diameter

Cx = Diameter

ISC

Ro + Rf = Diameter

Online & Offline Charging (ECF, CCF)
OSA / Parlay Examples

OSA / Parlay Case Study for community-based services at the IMS Playground @ FOKUS tomorrow!
Summary: 3GPP Release 5 (done)

- Basic IMS Definition
- Basic Call Control (based on SIP extensions)
- Access Security For IP-Based services
- Network Domain Security (NDS) for ”IP-based protocols“
  - (Usage of IPSec)
- CSCF-HSS (Cx) based on Diameter
- IMS Service Provisioning (Sh) based on Diameter
- MRF (Multimedia Resource Function)
IMS Release 6

- IMS Work on Rel-6 has been finished March 2005
- Support for emergency sessions, SIP forking, multiple private user identities, etc
- Interworking and migration scenarios for IPv4 based IMS
- Gq/Policy Control Evolution: opening the i/f between the PDF (Policy Decision Function) and AFs (Application Functions)
- 3GPP enablers to support OMA PoC
IMS Release 6

Applications Services

IP Multimedia Subsystem (IMS)

Operator 2

Multimedia IP Networks

CS-Domain -or- PSTN -or- Legacy -or- External

WLAN (Home)

WLAN Access, WAG

UTRAN / GERAN

IMS Terminal

AS

Presence

IM

IM-SSF

OSA-SCS

HSS

HLR

SLF

CSCF

BGCF

IMSSF

OSA-SCS

PS-Domain

GGSN

MGW

MGCF

PDGW

AAA

CSCF

MRF-C

MRF-P

WLAN (Home)

Operator 2

IP Multimedia Subsystem (IMS)

HSS

HLR

SLF

CSCF

BGCF

PS-Domain

GGSN

MGW

MGCF

PDGW

AAA

CSCF

MRF-C

MRF-P

WLAN (Home)
Outlook: IMS Release 7

- IMS Rel-7 has just started - full scope of work is not yet decided
- Approved or likely to be approved work in the following fields:
  - End-to-end QoS
  - IMS adaptations for NGN (fixed access)
  - IMS enhancements for All-IP Networks
  - Evolution of Policy Control and Charging
Overview

- NGN Motivation
- IMS as a first step into an NGN Architecture
- IMS Key protocols (IETF SIP and Diameter)
- IMS Key components
- IMS Application Server options
  - Evolution toward an all-IP based NGN Core
- ETSI TISPAN
- Summary
- Q & A
**IMS as Multimedia Service Enabler**

Diagram showing the integration of different network types and service enablement through the IP Multimedia System (IMS). The diagram includes:

- **Packet Access Networks (WLAN, UMTS, DSL)**
- **Circuit Access Networks (GSM, UMTS)**
- **Legacy Networks (GSM, ISDN, etc.)**
- **Internet**
- **AAA Server**
- **SIP Server**
- **OSA GTW**
- **SIP AS**
- **CAMEL**
- **Media Server**
- **WAP GTW**
- **3rd Pty AS**
- **Email Server**
- **Media Signalling Gateway**
- **Enterprise Server**
- **Web Server**
- **SIP UA**

The diagram illustrates how IMS acts as a service enabler by integrating these various networks and services, providing a unified multimedia service platform.
IMS as Universal Service Enabler

Uniform Access to Data Services & Multimedia Calls and Messaging

Access Networks (WLAN, UMTS, DSL)

Legacy Networks (GSM, ISDN, etc.)

Session Control Call Server, Content

Web Server

Content Games

Session Control M-Content

AAA Server

CAMEL

Prepaid

Application Servers

3rd Pty AS

SIP Server

OSA GTW

SIP AS

Session Control Call Server, Content

Signalling Gateway

Uniform Access to Data Services & Multimedia Calls and Messaging

Multimedia System (IMS)
IMS as Multimedia Service Enabler (Content)

M-Content Services

IP Multimedia System (IMS)

Legacy Networks (GSM, ISDN, etc.)

Packet Access Networks (WLAN, UMTS, DSL)

AAA Server

OSA GTW

SIP Server

Media / Signalling Gateway

SIP AS

WAP GTW

Media Server

Legacy Networks (GSM, ISDN, etc.)

AAA Server

OSA GTW

SIP Server

Media / Signalling Gateway

SIP AS

WAP GTW

Media Server

Legacy Networks (GSM, ISDN, etc.)

AAA Server

OSA GTW

SIP Server

Media / Signalling Gateway

SIP AS

WAP GTW

Media Server

Legacy Networks (GSM, ISDN, etc.)

AAA Server

OSA GTW

SIP Server

Media / Signalling Gateway

SIP AS

WAP GTW

Media Server

Legacy Networks (GSM, ISDN, etc.)

AAA Server

OSA GTW

SIP Server

Media / Signalling Gateway

SIP AS

WAP GTW

Media Server

Legacy Networks (GSM, ISDN, etc.)
IMS as Multimedia Service Enabler (Control)

- Presence, Group Server, Instant Msg, PTT, ...
- Legacy Networks (GSM, ISDN, etc.)
- Internet
- IP Multimedia System (IMS)
- AAA Server
- Media / Signalling Gateway
- SIP AS
- OSA GTW
- 3rd Pty AS
- Web Server
- Enterprise Server
- Media Signalling Gateway
- Session Control Call Server, Content
- Media Server
- SIP Server
- SIP UA
- WAP
- Packet Access Networks (WLAN, UMTS, DSL)
- CAMEL
Overview

• NGN Motivation
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  • ETSI TISPAN
• Summary
• Q & A
The NGN Definition

• A new telecommunications network for broadband fixed access
• NGN facilitates convergence of networks and services
• NGN enables different business models across access, core network and service domains
• NGN will be an IP based network
• SIP will be used for call & session control
• 3GPP release 6 IMS will be the base for NGN IP Multimedia Subsystem
• NGN enables any IP access to Operator IMS; from
  – Mobile domain
  – Home domain
  – Enterprise domain
• NGN enables service mobility
• NGN enables interworking towards circuit switched voice
• NGN maintains Service Operator control for IMS signalling & media traffic
The NGN Players

Legend

ATIS NGN FG: Alliance for Telecommunication Industry Solutions, Next Generation Network Focus Group

ITU-T NGN FG: International Telecommunication Union (Telecom). Next Generation Networks Focus Group

ETSI TISPAN: European Telecommunications Standards Institute. Telecoms & Internet converged Services & Protocols for Advanced Networks

3GPP: Third Generation Partnership Project
**TISPAN NGN Goals & Technical overview**

- A multi-service, multi-protocol, multi-access, IP based network - secure, reliable and trusted
  - Multi-services: delivered by a common QoS enabled core network.
  - Multi-access: several access networks; fixed and mobile terminals.
  - Not one network, but different networks that interoperate seamlessly.
- An enabler for Service Providers to offer
  - real-time and non real-time communication services
  - between peers or in a client-server configuration.
- Nomadicity and Mobility
  - of both users and devices
  - intra- and inter-Network Domains, eventually between Fixed and Mobile networks

*“My communications services” always reachable, everywhere, using any terminal.*
**NGN Design Requirements**

- **IP-based network**
  - Characteristics: secure, reliable, trusted
  - No technological distinction between public and private network
- **Distributed and open control**
  - Adapt to distributed nature of IP networks
  - Support third party services
- **Independence from transport technology**
- **Independence from access technology**
  - Diversity of user equipment
  - Support of modern access technologies (DSL, Cable, WLAN, WiMAX, …)
  - Inherent mobility support, both of users and devices
- **Clear separation from application plane**
  - Multi-service platform
  - Enabler of real-time and non-real time services
- **Support of PSTN / ISDN migration**
NGN Architecture

• A sub-system oriented approach, enabling:
  – The addition of new subsystems over the time to cover new demands and service classes.
  – To import (and adapt) subsystems from other standardisation bodies.
  – Flexibility to adjust a subsystem architecture with no or limited impact on other subsystems.

• IP connectivity is provided using two subsystems:
  – Network Attachment Subsystem (NASS)
  – Resource and Admission Control Subsystem (RACS)

• First service-oriented subsystems include
  – the 3GPP IMS (suitably adapted to the fixed BB access context)
  – a PSTN/ISDN Emulation Subsystem (PES)

• Future service-oriented subsystems may include
  – A streaming subsystem, a TV Broadcasting subsystem, etc.

_A focussed and pragmatic approach to provide multimedia services over IP networks with emphasis on xDSL_
Overall TISPAN NGN Architecture

ETSI TISPAN
Telecoms & Internet converged Services & Protocols for Advanced Networks
Overall TISPAN NGN Architecture

NGN as a modular system for independance of subsystems evolution

- Transfer Functions
- Network Attachment Subsystem (NASS)
- Resource Admission and Control Subsystem (RACS)
- PSTN / ISDN Emulation Subsystem (PES)
- IP Multimedia Subsystem (IMS)
- NGN Common Functions
- Applications (out of scope)
Network Attachment Sub System (NASS)
NASS in a Nutshell

• NASS Target: Hide access technology from control structure
• Dynamic provision of IP addresses, authentication, authorization of network access and access network configuration
• Location information, location management and user privacy preferences (e.g. for emergency services)
NASS Functionality

- Dynamic provision of IP address and other user equipment configuration parameters (e.g. using DHCP)
- User authentication, prior or during the IP address allocation procedure
- User authentication based on user network profile
  - Based on PPP, IEEE 802.11X or IETF PANA
- Line authentication based on layer 2 line identification
- Location management (e.g. for emergency calls)
- Customer premises equipment configuration
- The NASS can be distributed between a visited and a home network
  - Allows nomadicity and roaming
- P-CSCF announcement
NASS Mobility Support

• Mobility management functions provided by the NASS in the TISPAN NGN Release 1 are limited to the ability of
  – a terminal to be moved to different access points and access networks (which may be owned by a different access network provider) and
  – a user to utilise different terminal, access points and access networks to retrieve his TISPAN NGN services (even from another network operator).

• The TISPAN NGN Release 1 does not require the support of handover and session continuity between access networks
  – without excluding autonomous mobility capabilities provided within the access networks.

• **NOTE:** Support of mobility is limited to the case where the terminal moves between access networks. Those network attachment procedures are based on the NASS specification (i.e. moving from DSL to UTRAN is not supported).
NASS Functional Architecture

- The Network Attachment Subsystem (NASS) comprises the following functional entities:
  - Network Access Configuration Function (NACF)
  - Access Management Function (AMF)
  - Connectivity Session Location and Repository Function (CLF)
  - User Access Authorisation Function (UAAF)
  - Profile Data Base Function (PDBF)
  - CNG Configuration Function (CNGCF)
- The NASS has interactions with the following TISPAN NGN functional entities:
  - TISPAN Service control subsystems and applications
  - Resource Admission Control Subsystem (RACS)
  - Access Relay Function (ARF)
  - Customer Premises Equipment
NGN Security Architecture

• Application Specific Key Management.
• SEGFs (Security Gateway Functions) to Secure Signaling and control communication among network entities/FEs
• Security Gateways (SEGs) for IMS Network Domain Security are considered Primarily Functional Components
• The NGN Security Endorses SEGs and calls them Security Gateway Function (SEGF)
• IMS Residential Gateway to Secure Access of Legacy UEs
• NGN-specific security mechanisms at various protocols/logical layers such as
  – NASS authentication based on explicit line authentication
  – NASS authentication based on implicit physical line authentication
  – NASS-IMS bundled authentication
• NGN Subsystem specific Security Measures (e.g. for PES)
The NGN security architecture consists of three logical security planes with respective of Functional Entities (FEs)

1. NASS Security Plane
2. IMS Security Plane
3. GAA/GBA key management plane
IMS Security Architecture

IMS security architecture in an NGN environment where the 3GPP specific transport domain is replaced by the Generic IP transport domain:

- The IMS is independent of the transport network.
- Generic Entities (GE) equivalent to the 3GPP transport entities will be present in the Generic IP transport domain.
- In NGN the AuC functionality is performed by UPSF.
- The Security Associations (SA) are retained:
  - SA-1, SA-3, SA-4 and SA-5 are endorsed as is.
  - SA-2 is endorsed with the extension to ensure transport across NAT/Firewall boundaries.

Diagram:
- NGN-UE
- I-SIM
- Home NGN
- UPSF
- I-CSCF
- Visited NGN
- S-CSCF
- UA
- P-CSCF
- Generic IP Transport
- GE
- MM IP networks
The NASS bundled authentication (NBA) works by extending the successful authentication in the NASS layer to the service layer.
Resource and Admission Control System (RACS)

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RACS in a Nushell

• QoS handling: checks resource availability and allocates resources
• Has no service knowledge, only session knowledge
• Provides admission control and gate control functionalities (including the control of Media Gateways, Access Gateways, NATs and Firewalls)
• Interface to transport layer
RACS Functionality

• Support for two types of QoS:
  – Guaranteed QoS: resources are reserved
  – Support for relative QoS: diffserv marking

• Service-based local Policy Control: authorisation of QoS requests and definition of the policies to be enforced by the bearer service network elements

• Resource reservation
  – Support for two mechanisms
    • Application Function (AF) initiated
    • CPE initiated (Authorization token a la 3GPP)
  – QoS support over multiple access networks (e.g. ADSL and GPRS) and CPE types

• Admission Control: apply admission control to resource reservation requests
  – Based on knowledge of transport resource availability of the „last mile access“ and aggregation segments of the access network

• NAPT / Gate Control: control near-end and far-end NAT and FW functions, when required, between
  – Two core TISPAN NGN networks or
  – at the border between core and access TISAN NGN networks
TISPAN IP Multimedia Subsystem (IMS)

ETS TISPAN
Telecoms & Internet converged Services & Protocols for Advanced Networks

Applications

Other Components ...

Streaming Services (RTPP based)

IP Multimedia Components (Core IMS, SIP based)

PSTN / ISDN Emulation (SIP)

Network Attachment Functionality NASS

Resource and Admission Control Functionality RACS

“Gq” interface

“Go” interface

Legacy Terminals

GW

Customer Networks

NGN Terminals

3GPP Terminals

Access Network

Core Network

3GPP IP-CAN

TGW

MBG

PSTN / ISDN
TISPAN IMS in a Nutshell

- IMS provides main control elements and “mobility framework”
- Only the IMS component of 3GPP, not the whole 3GPP architecture is used in TISPAN-NGN.
- IMS is only one component within TISPAN-NGN, not all of it.
TISPAN IMS Core Environment

• The core of NGN IMS is a subset of 3GPP IMS Release 6
  – Responsible for the session control functionalities
  – P-/I-/S-CSCF, MRFC, MGCF and BGCF

• The IMS interfaces the following components:
  – User Equipment
  – The Resource and Admission Control Subsystem
  – The Network Attachment Subsystem
  – The PSTN/ISDN
  – The PSTN/ISDN Emulation Subsystem
  – Other multimedia subsystems
  – Charging Functions
  – Network Management Functions
  – Applications and other common architectural elements
    • ASs, UPSF (formerly HSS), and SLF

• Note: Application server, MRFPs, MGFs and BGFs are outside of the IMS core
Functional Entities of Core IMS

• The CSCFs establish, monitor, support and release multimedia sessions and manage the user's service interactions

• BUT the P-CSCF behaviour differs from the behaviour in 3GPP IMS
  – Acts as an application layer functions to interact with Network Address and Port Translation (NAPT) functions located in the transfer plane, via the RACS
  – Interfaces with NASS to retrieve information related to the IP-connectivity access session

• The MGCF, the MRFC and the BGCF remain the same as defined in 3GPP IMS
IMS Interfaces

- All internal and external interfaces defined in 3GPP IMS have been not changed.
- Interfaces to interconnect TISPAN IMS with other networks are defined
  - via the SGF and MGCF with PSTN/ISDN at the signaling level and
  - via the T-MGF at the media level
- Other IP-based subsystem such as including PSTN/ISDN Emulation subsystems and other IMS subsystems
  - Interconnection Border Control Function (IBCF) at the signaling level and
  - Interconnection Border Gateway Function (I-BGF) at the media server
- The NGN IMS interacts with the Resource and Admission Control Subsystem (RACS) at the Gq reference point
- The e2 interfaces is new and supports information transfer between the P-CSCF and the Network Attachment Subsystem (NASS)
• The TISPAN IMS provides services to user equipment connected via a plurality of IP connectivity access networks

• IMS subsystem provides services to user equipment connected to
  – fixed broadband access network
  – GPRS-based IP-CAN
Overview

• NGN Motivation
• IMS as a first step into an NGN Architecture
• IMS Key protocols (IETF SIP and Diameter)
• IMS Key components
• IMS Application Server options
• Evolution toward an all-IP based NGN Core
• ETSI TISPAN

• Summary

• Q & A
Summary

• IMS
  – is an overlay service network architecture applicable to any IP network (GPRS, UMTS, WLAN, DSL, ..) based on internet standards (IETF)
  – is a global standard (supported by 3GPP, 3GPP2, ETSI, OMA, IETF)
    • First standardised with 3GPP Release 5
    • Release 6 is finished, work is under progress for Release 7
  – can be considered as THE universal Service Delivery Platform for NGNs supporting also Fixed Mobile Convergence (FMC)
  – Trials are underway, first deployments will happen end of 2005
• IMS should be mainly considered as a service enabler (i.e. no real IMS services are standardised!)
  – but OMA defines services to be mapped onto IMS
  – Push to Talk / PoC can be regarded as first IMS real life proof of concept
  – Service implementation is flexible (CAMEL, SIP AS, OSA/Parlay) and requires probably more investigations
• ➔ More information at www.fokus.fraunhofer.de/ims
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Any Questions?