

**Regional Development Forum - Africa:  
"NGN and Broadband, Opportunities and  
Challenges"**

**Lusaka, Zambia; 18-19 May 2009**

**IP Multimedia systems  
and IP enabled services**

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**Abstract**

- Building on the NGN Overview presentation, this presentation will describe the key aspects of the IMS (IP Multimedia Subsystem), examine how it functions and provide some examples of the services and service features supported by this infrastructure.

## Outline

- Introduction
- Key Aspects: Separation and Models
- How the IMS Functions
- Services and Features

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## Introduction I

- What is the IP Multimedia Subsystem?
  - An architectural framework for delivering IP multimedia services in the 3GPP environment
  - Part of 3GPP vision for evolving mobile networks beyond GSM
  - Original formulation (R5) an approach to delivering "Internet services" over GPRS
  - Updated by 3GPP, 3GPP2, TISPAN through including support of other access network technologies, e.g., Wireless LAN, CDMA2000, fixed line, ADSL, ...

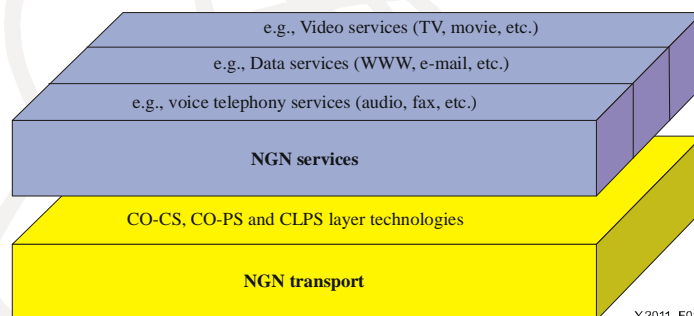
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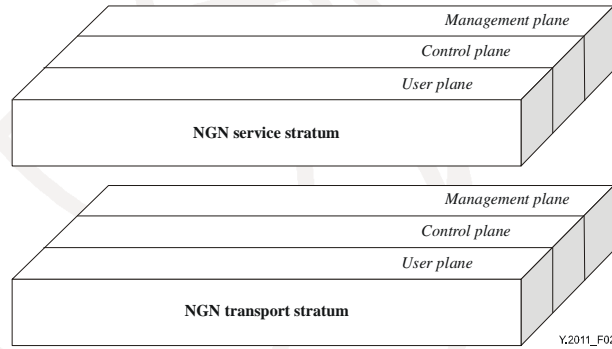
## Introduction II

- What is the IP Multimedia Subsystem?
  - To ease integration with the Internet, uses IETF protocols wherever possible, e.g., SIP
  - Not intended to standardize applications but rather aid the access of multimedia and voice applications from wireless and wireline terminals, i.e., convergence of fixed and mobile

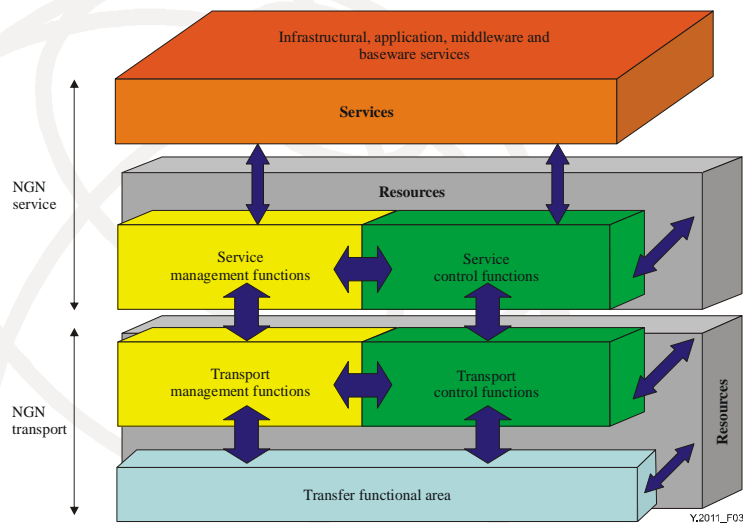
## NGN: Separation of Services and Transport



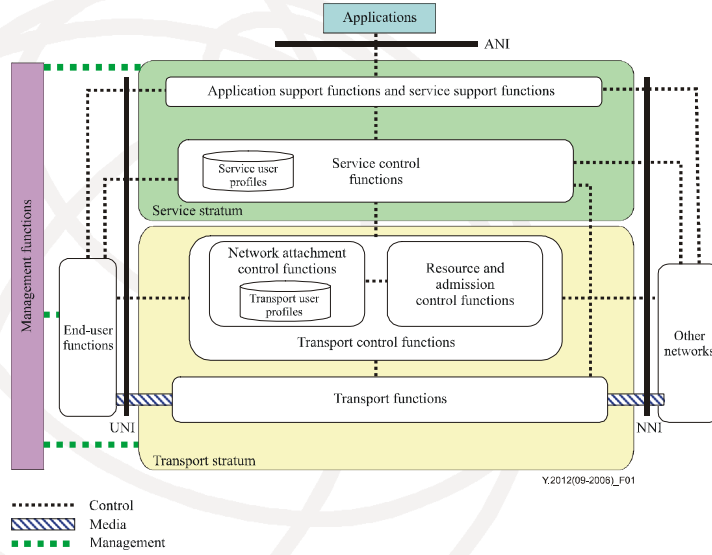
# NGN Basic Reference Model



# NGN General Functional Model



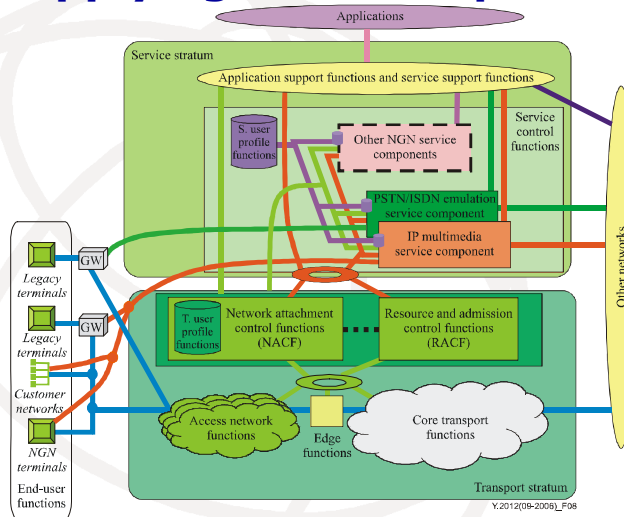
# Structures: NGN Architecture



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# Structures: applying NGN Components

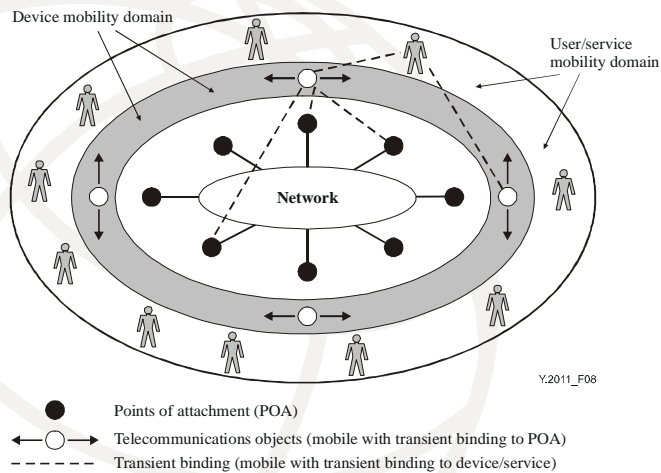


NOTE – Gateway (GW) may exist in either transport stratum or end-user functions.

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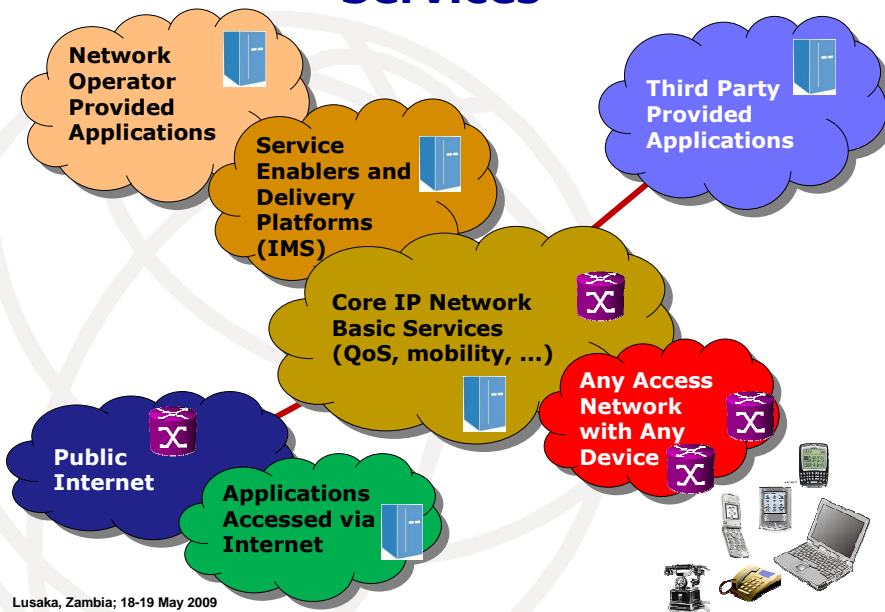
# NGN: Relationship of Users, Devices and Locations



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# Services



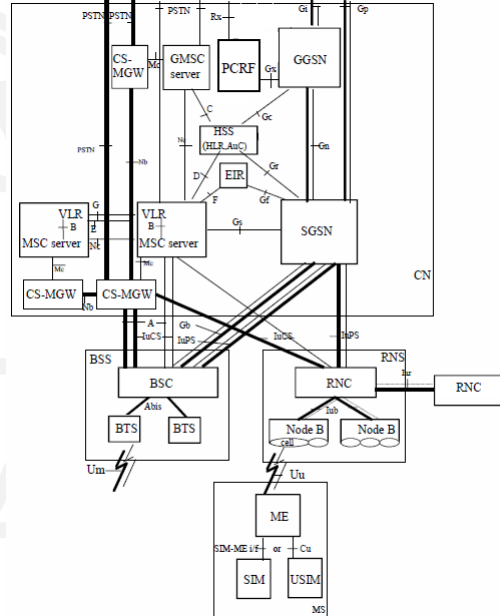
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## 3GPP Network Reference Model

Basic parts of the mobile system:

- Core Network (CN)
- Access Network (AN)
- Mobile Station (MS)
- User Equipment (UE)

From ETSI TS 123 002 V8.4.0 (2009-01):  
Figure 1: Basic Configuration of a PLMN supporting CS and PS services (using GPRS) and interfaces



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## Functional Entities I

### Entities common to the PS and CS domain:

- Home Subscriber Server (HSS)
- Home Location Register (HLR)
- Authentication Centre (AuC)
- Visitor Location Register (VLR)
- Equipment Identity Register (EIR)
- SMS Gateway MSC (SMS-GMSC)
- SMS Interworking MSC (SMS-IW MSC)
- Subscription Locator Function (SLF)
- Border Gateway (BG)

### Entities of the CS domain:

- Mobile-services Switching Centre (MSC)
- MSC Server
- Circuit Switched - Media Gateway Function (CS-MGW)
- Gateway MSC (GMSC)
- Gateway MSC Server (GMSC Server)
- Interworking Function (IWF)

### Entities of the GPRS PS domain:

- Serving GPRS Support Node (SGSN)
- Gateway GPRS Support Node (GGSN)

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## Functional Entities II

### Entities of the EPC PS Domain:

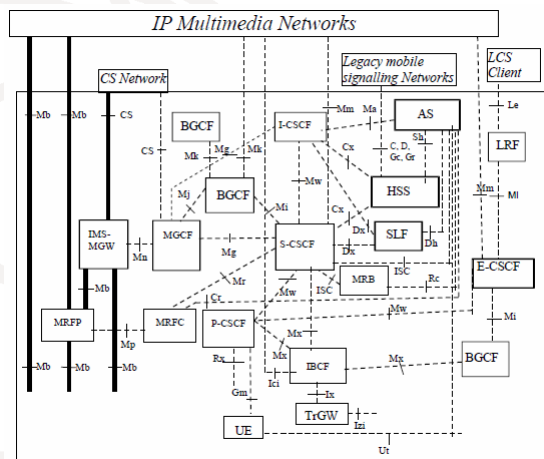
- MME
- Gateways
- Serving GW
- PDN GW
- SGSN
- Trusted and Untrusted Non-3GPP
- ePDG
- 3GPP AAA Server
- 3GPP AAA Proxy

### Access Network (AN) entities:

- Base Station System (BSS)
  - Base Station Controller (BSC)
  - Base Transceiver Station (BTS)
- Radio Network System (RNS)
  - Radio Network Controller (RNC)
  - Node B
- Access Network elements for E-UTRAN
  - E-UTRAN Node B (eNB)
  - Evolved UTRAN
- Mobile Station (MS)
- User Equipment (UE)

## IM Subsystem entities

From ETSI TS 123 002  
V8.4.0 (2009-01):  
Figure 6: Configuration  
of IM Subsystem entities





## IMS Entities

### IP Multimedia (IM) Core Network (CN) Subsystem entities

- Call Session Control Function (CSCF)
- Media Gateway Control Function (MGCF)
- IP Multimedia Subsystem - Media Gateway Function (IMS-MGW)
- Multimedia Resource Function Controller (MRFC)
- Multimedia Resource Function Processor (MRFP)
- Media Resource Broker (MRB)

### IP Multimedia (IM) Core Network (CN) Subsystem entities (continued)

- Breakout Gateway Control Function (BGCF)
- Application Server (AS)
- Interconnection Border Control Function (IBCF)
- Transition Gateway (TrGW)
- Location Retrieval Function (LRF)
- Service Centralization and Continuity Application Server (SCC AS)

## How the IMS Functions

- SIP is like SS7: signalling to set up calls, between IMS and UMTS
  - INVITE, OK, ACK, BYE, ACK to initiate and terminate media transmission (greatly simplified!)
  - All SIP messages are in pairs except ACK
- Media do not go through IMS
- IMS controls nodes controlling media flows

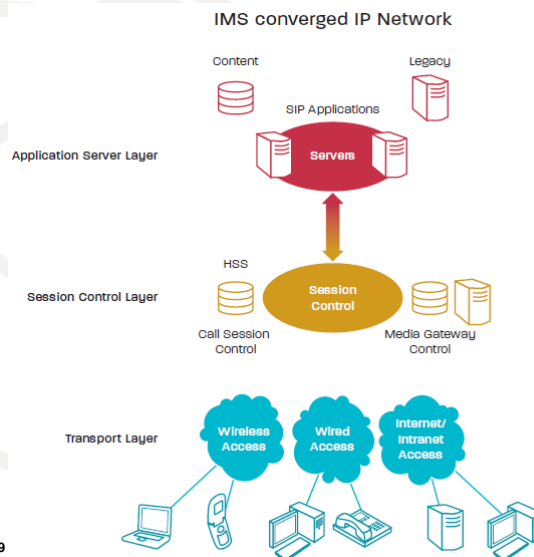
## How the IMS Functions

- Need IP addresses of users' machines: SIP registrar
  - Users register with their SIP Proxy/SIP Registrar (DHCP)
  - Inviting user asks SIP Proxy/Registrar for location of party to be invited
  - SIP Proxies can relay INVITEs, other messages
  - Find other SIP Proxies through DNS lookup
  - More detail? Basic, then highly detailed:
    - [http://en.wikipedia.org/wiki/IP\\_Multimedia\\_Subsystem](http://en.wikipedia.org/wiki/IP_Multimedia_Subsystem)
    - [http://pda.etsi.org/exchangefolder/ts\\_123228v080800p.pdf](http://pda.etsi.org/exchangefolder/ts_123228v080800p.pdf)

## Complex?

- Yes, but brings added value (other networks, content adaptation, etc.)
- Scalability thanks to the potential for replication of IMS elements

## IMS and IP Networks - Simplified



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## Services and Features

- Services are in application end points, not in IMS
- Do not want to standardize all services
  - Limits competition, slow response to market, etc.
- Instead aim to provide an environment able to support many applications. Some features:
  - Subscribe to friends' proxies: track their status
  - Move, initiate new INVITE to send media to new location
  - Multiple devices: transfer media data to another device where logged in
  - Call filtering by many criteria
- Numerous stage 1 related 22.nnn-series specifications are available at:
  - [www.3gpp.org/ftp/Specs/html-info/22-series](http://www.3gpp.org/ftp/Specs/html-info/22-series)

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## Summary

- IMS is an architectural framework for delivering IP multimedia services in the 3GPP environment
- IMS brings internet and UMTS together
  - Based on strong separations between control/bearer, call/session, application/service
- ➔ IMS architecture appears complex, involves a lot of signalling, but brings significant benefits, e.g.,
  - Ability to handle many types of accesses
  - Scalability!!
  - Ability to handle third party service providers

## Acronyms

AIN	Acronym Intensive Environment	MGF	Media Gateway Function
AAA	Authentication, Authorization, and Accounting	MME	Mobility Management Entity
AIN	Acronym Intensive Environment	MS	Mobile Station
AuC	Authentication Centre	MSC	Mobile-services Switching Centre
BG	Border Gateway	NAT	Network Address Translation
BSC	Base Station Controller	Node B	BTS using WCDMA
BSS	Base Station System	NP	Number portability
BTS	Base Transceiver Station	OSA	Open Services Architecture
CSCF	Call Session Control Function	P-CSCF	Proxy-CSCF
CS-MGW	Circuit Switched - Media Gateway Function	PDG	Packet Data Gateway
DHCP	Dynamic Host Configuration Protocol	PDN	Packet Data Network
DNS	Domain Name System	RAB	Radio Access Bearer
EIR	Equipment Identity Register	RNC	Radio Network Controller
eNB	E-UTRAN Node B	RNS	Radio Network System
ENUM	E.164 Number Mapping	S-CSCF	Serving-CSCF
ePDG	enhanced Packet Data Gateway	SGSN	Serving GPRS Support Node
GGSN	Gateway GPRS Support Node	SGSN	Serving GPRS Support Node
GMSC	Gateway MSC	SIM	Subscriber Identity Module
GPRS	General Packet Radio Service	SIP	Session Initiation Protocol
GW	Gateway	SLF	Subscription Locator Function
HLR	Home Location Register	SMS-GMSC	SMS Gateway MSC
HSS	Home Subscriber Server	SMS-IWMSC	SMS Interworking MSC
I-CSCF	Interrogating-CSCF	SSF	Service Switching Function
IMS	IP Multimedia Core Network Subsystem	UE	User Equipment
IMSI	International Mobile Subscriber Identifier	UMTS	Universal Mobile Telecommunications System
IN	Intelligent Network	URL	Universal Resource Locator
IP	Internet Protocol	USIM	UMTS SIM
ISIM	IMS SIM	UTRAN	UMTS Terrestrial Radio Access Network
IWF	Interworking Function	VLR	Visitor Location Registry
MGCF	Media Gateway Control Function		