



# Welcome to „Post-UMTS: Next generation Networks“

Bonn, April 17, 2002

Presented by:

Vice President Training Wireless & Public Networks

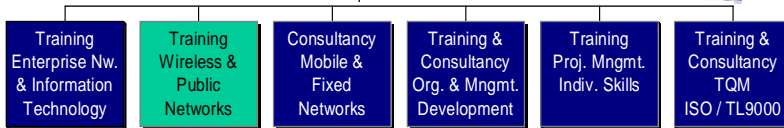
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## About TOP...

TOP Business AG  
*making know-how work*

Business Interactive  
TOP Business AG Tochter

WBTs: GPRS,  
UMTS, TCP/IP,  
GSM, ATM,  
VoIP



- Since 1994, independent training institute, privately owned
- Training centers: Nuremberg, Hamburg, Neuss, Utrecht (NL)
- Total Staff in 2001: 90
- Total Sales in 2001: EUR 9.5m
- DIN EN ISO 9001 certification since 1993
- EFQM member since 1993
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## Presentation Content



- ✦ *Drivers*
- ✦ *Network Aspects*
- ✦ *RAN Aspects*
  - *Terrestrial*
  - *Satellite*
- ✦ *Core Network Aspects*
- ✦ *R-4 Features, Architecture and Services*
- ✦ *R-5 Features, Architecture and Services*
- ✦ *Standardization Approach*

## The NGN / 4G Objective

*"Networks that let operators and service providers design, create, deploy and operate communication services, tailored to their own and their customers' needs"*

This means:

- ✦ Real-time and non-real time services to be carried in same network → Drivers
- Only efficiently, if all data transported on IP
- ✦ Increase of service flexibility
- ✦ Easier support of new services
- ✦ Faster implementation of new transport mechanisms
- ✦ Reduction of operational costs

## 4G Key Characteristics (1)

- ✦ All application data is carried in packets / cells
- ✦ Broadband fixed and wireless access
- ✦ Optical Networking in the core
- ✦ Open distributed architecture replaces the classical "monolithic" switch
- ✦ Distributed intelligent layer that separates control logic from transport
- ✦ Open platforms and open APIs for creation, provisioning and delivery of intelligent services
- ✦ "Web technology" for management of networks and services, including customer "self-management"

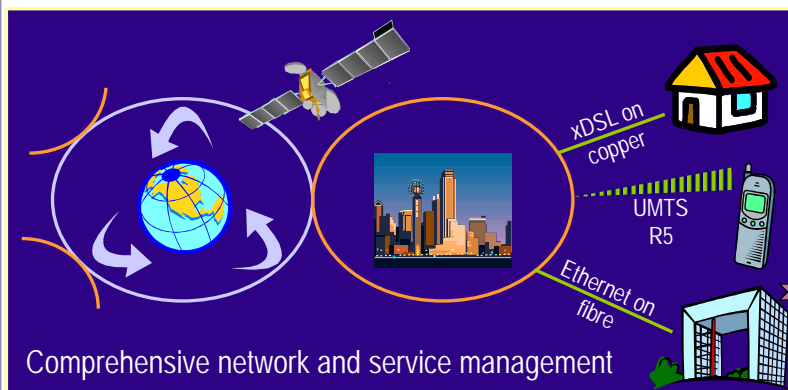
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## 4G Key Characteristics (2)



Purely optical  
 core network

Metro net using  
 IP over Ethernet  
 on fibre

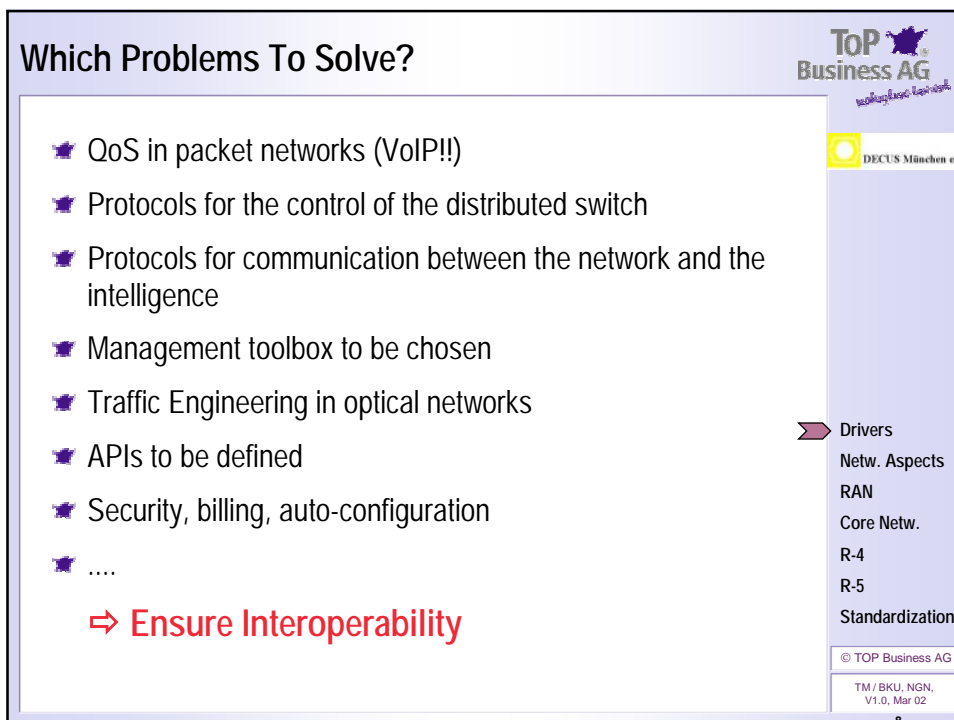
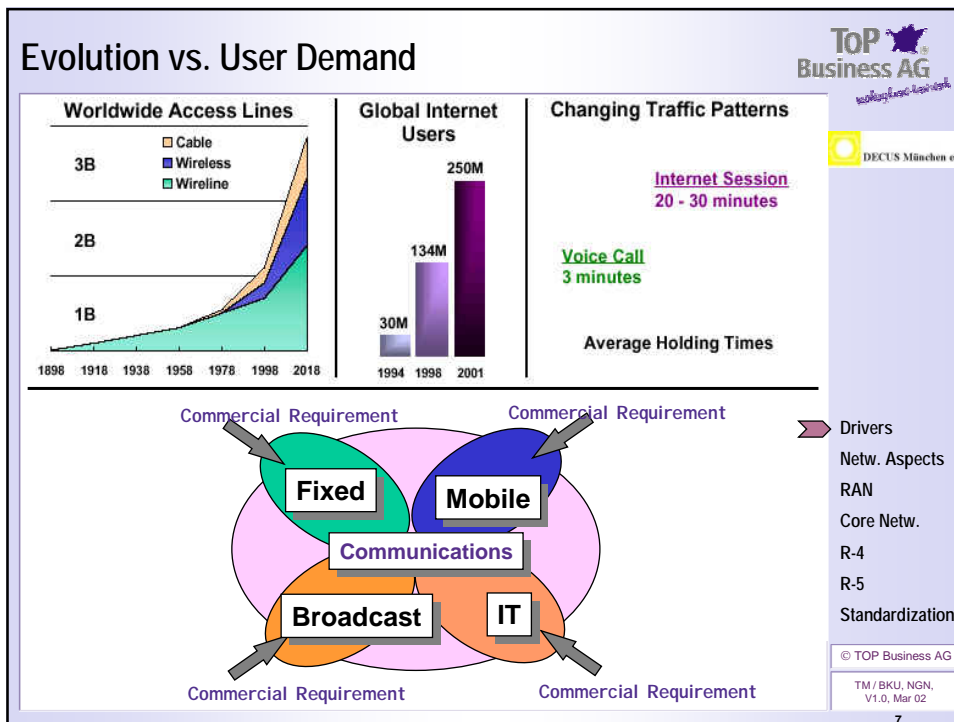
IP-based  
 wireless and  
 fixed access  
 nets

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## NGN Applications Requirement

	QoS	High Reliability	Network Management	Security	Intelligent Networking
VoIP	✓	✓	✓	✓	✓
E-Commerce	✓	✓	✓	✓	✓
Multi-Media	✓	✓	✓		
Multi-casting	✓	✓	✓		
Mobile Access	✓				✓
Value Added Services	✓	✓	✓	✓	✓
VPN	✓	✓	✓	✓	✓

⇒ Urgent need for an integrating network solution!

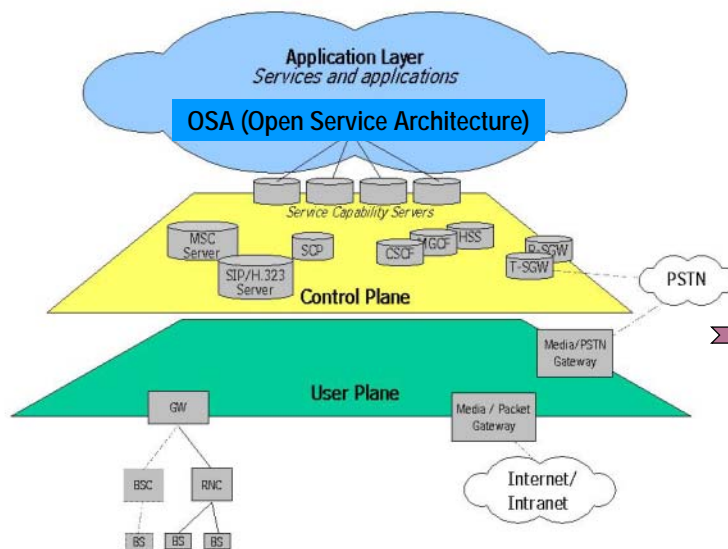
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## 4G Architectural Concept

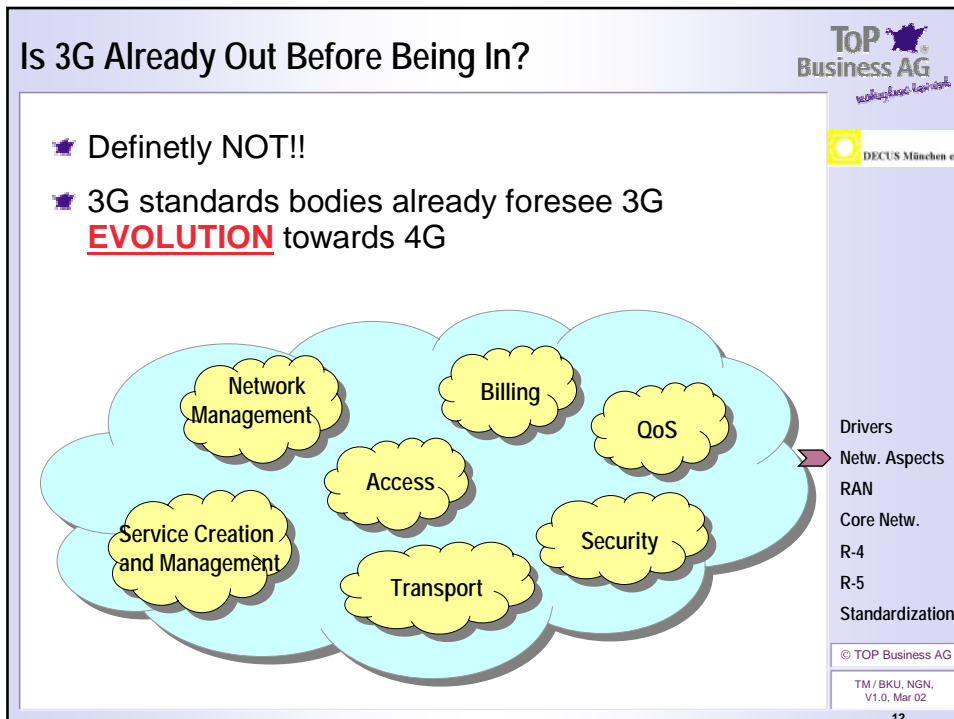
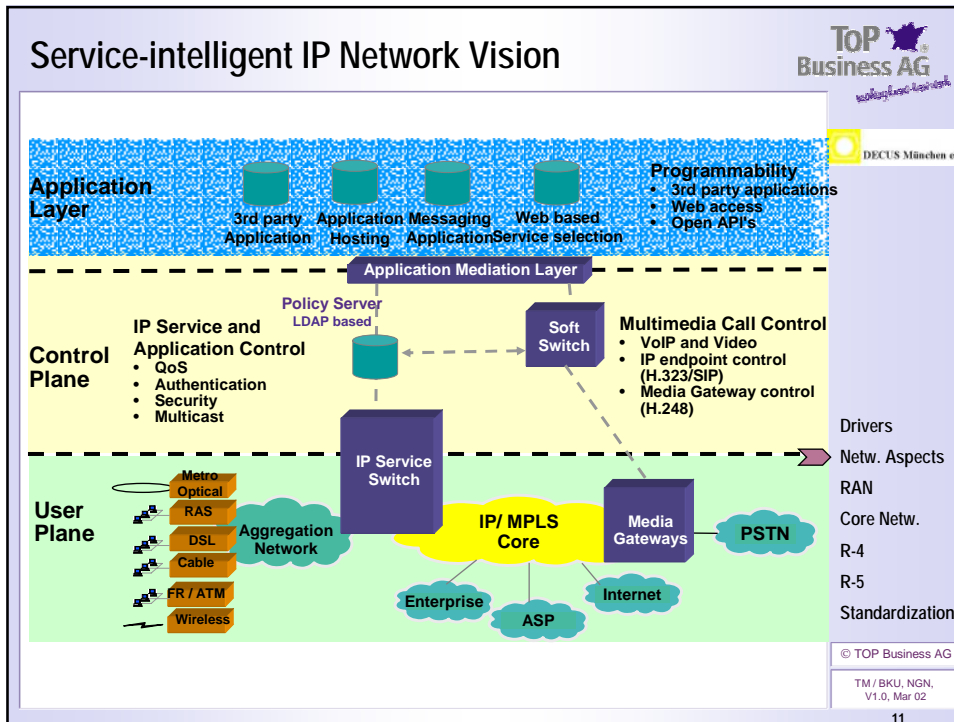


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# 3GPP Specs - Releases, Phases And Stages

GSM/EDGE Release	3G Release	Abbreviated Name	Spec Version No.	Freeze Date (indicative only)
Phase 2+ Release 6 (will be TR 41.104)	Release 6 (will be TR 21.104)	Rel-6	6.x.y	scheduled June 2003
Phase 2+ Release 5 (TR 41.103)	Release 5 (TR 21.103)	Rel-5	5.x.y	scheduled March 2002
Phase 2+ Release 4 (TR 41.102)	Release 4 (TR 21.102)	Rel-4	4.x.y	March 2001
-	Release 2000	R00	4.x.y 9.x.y	see note 1 below
Phase 2+ Release 2000	-	-	-	-
-	Release 1999 (TR 21.101)	R99	3.x.y 8.x.y	March 2000
Phase 2+ Release 1999 (TR 01.01)	-	-	-	-
Phase 2+ Release 1998	-	R98	7.x.y	early 1999
Phase 2+ Release 1997	-	R97	6.x.y	early 1998
Phase 2+ Release 1996	-	R96	5.x.y	early 1997
Phase 2	-	PH2	4.x.y	1995
Phase 1	-	PH1	3.x.y	1992

Note 1: The term "Release 2000" was used only temporarily and was eventually replaced by the term "Release 4".

Note 2: Specifications with a version number of 0.x.y, 1.x.y or 2.x.y indicates that it is a new specification that has not yet been approved. The anticipated release is normally shown on the cover of the document.

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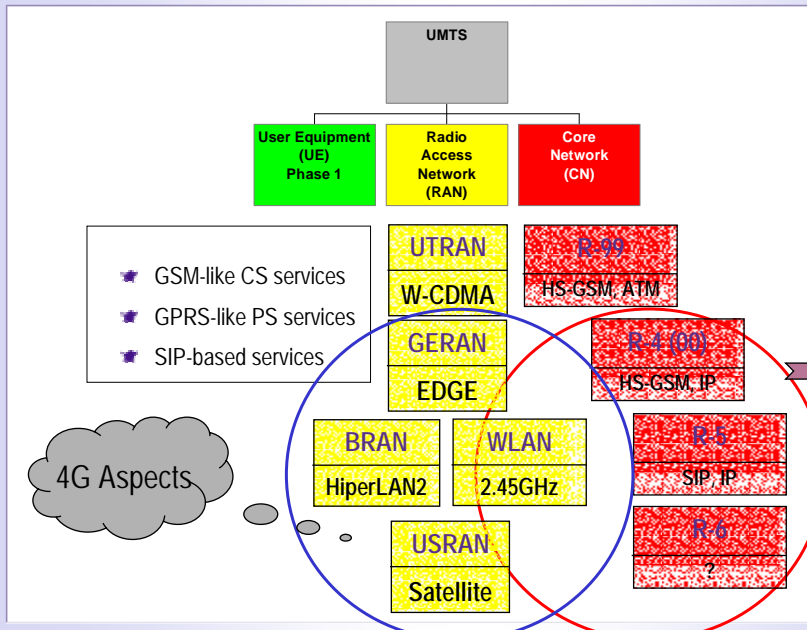
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# UMTS Sub-systems and Releases



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## Integrated UTRAN Approaches

- ✦ **UTRAN** (UMTS Terrestrial Radio Access Network)
  - 5MHz W-CDMA carrier, FDD and TDD mode
  - 144...2,000kbps per user
- ✦ **GERAN** (GSM EDGE RAN)
  - Evolved GSM using 8-PSK modulation
  - EGPRS with a max. of  $8 \times 59.2 = 474$  kbps user data
- ✦ **WLAN** (Wireless LAN)
  - 2.4GHz range (ISM), 10...100m, unlicensed!
- ✦ **BRAN** (Broadband RAN)
  - Short-range radio access (50...300m)

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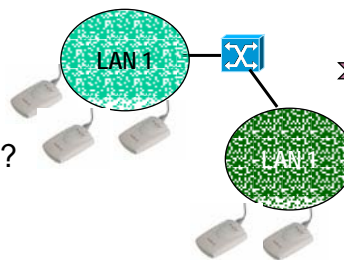
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## WLAN - The Ultimate 3G Threat

- ✦ IEEE802.11 standard available since 1997
  - 2.4GHz ISM band
  - Unlicensed!
  - Access points and terminals **now** available at moderate costs
- ✦ In-house coverage for UMTS-like data services
- ✦ Today: isolated networks
- ✦ Tomorrow: interconnected?



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## WLAN / BRAN Technologies

Standard	Standards Body	Frequency Range	Gross Bit Rate	Coverage Area	Application
DECT	ETSI	~1.9GHz	552kbps 2Mbps	300m ... 15km	CT, WLL WLAN
PHS	ARIB	~1.9GHz	384kbps	5km	ISDN, Video conferences
OpenAir	WLI Forum	2.4GHz	1.6Mbps	100m	Mobile data
802.11	IEEE	2.4GHz	2Mbps	150m	WLAN
802.11b	IEEE	2.4GHz	11Mbps	150m	WLAN
802.11a	IEEE	5.15GHz	24Mbps	150m	WLAN
HiperLAN 1	ETSI (ISO 8820-1 compatible)	5.2GHz	19Mbps	150m	WLAN
HiperLAN 2	ETSI	~4GHz, ~5GHz licensed!	54Mbps	30...200m	Local access to IP, ATM and UMTS networks
HiperAccess	ETSI	?	25Mbps	<5km	Outdoor access to IP and ATM networks
HiperLink	ETSI	17.2GHz	155Mbps	150m	Broadband internetworking
SIR AIR	IrDA	Infrared	115.2 / 255kbps, 4...16Mbps	10m	P-t-P communication between mobile devices
Bluetooth	BluetoothSIG	2.4GHz	<1Mbps	10m	Ad-hoc communication between mobile devices
SWAP	HomeRF	2.4GHz	1...2Mbps	50m	SoHo



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## Current WLAN Implementations

- ✦ Focused on the U.S.
- ✦ PC cards <\$100.-, subscription fee <\$15.-/month
- ✦ Airwave 
  - www.airwave.com
- ✦ Mobilestar 
  - www.mobilestar.com
  - 3000 Starbucks outlets
  - Hotels in 27 U.S. states
  - 16 airport lounges
- ✦ Wayport Inc. 
  - www.wayport.net
- ✦ Surf And Sip Inc. 
  - www.surfandsip.com

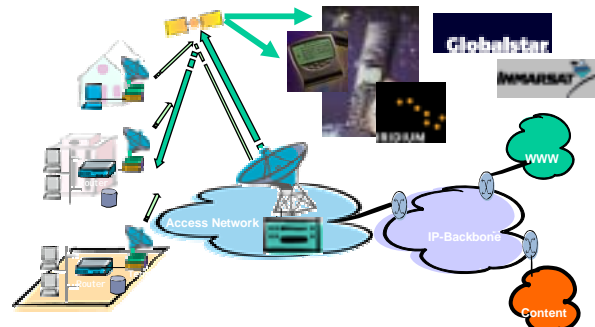
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## Additional USRAN Approaches

### ✦ USRAN (UMTS Satellite RAN)

- Not yet defined
- Role of existing SatCom t.b.d.
- Broadband satellite systems will be one of the major technologies providing broadband access



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## Satellites Offer Many Advantages

- ✦ Wireless Ability to globally support mobile & nomadic terminals
- ✦ Rapid global deployment
  - Global & urban coverage
  - Least developed nations
  - Maritime usage
- ✦ Ad-hoc Networks with temporarily increase in capacity
- ✦ Independent of local and regional censorship
- ✦ Secure communications
- ✦ Flexible and adaptable to changing markets
- ✦ Single point of contact for global organizations
- ✦ Broadcast / Multicast services



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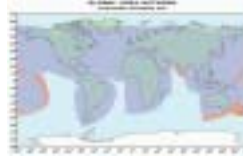
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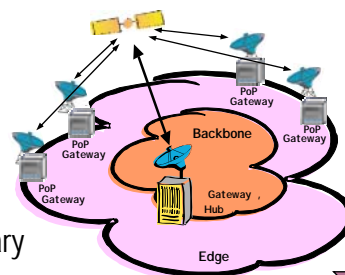
## Some System Differences (1)

- ✦ Frequency bands of operation (Ku / Ka / V / Q)
- ✦ Availability
  - power requirements, antenna sizes
  - Number of planned satellites
  - Satellite lifetime
- ✦ Bent pipe or active on-board processing (OBP)
- ✦ Coverage, e.g. GEO's
  - Circular orbit in the equatorial plane with a 24 hours orbital period
  - Height 35,786 km, appears fixed from Earth
  - Round-trip delay ~250 ms



## Some System Differences (2)

- ✦ Capacity, both total and individual offered
  - Total ~1 to ~100Gbps
  - User ~0.1 to ~100Mbps
- ✦ Use of inter-satellite links (ISL)
- ✦ Number of terminals supported
- ✦ Protocols used
  - TCP/IP, DVB, ATM, Proprietary
- ✦ Terrestrial Network structure
  - Number of gateways required
  - Gateway ownership and operational modes
- ✦ Total costs



## GEO Broadband Satellite Terminals

- ✦ <200 Mbps DL, 144kbps...10Mbps UL
- ✦ Digital TV, MPEG, ATM or other
- ✦ Ka- or Ku-band
- ✦ DVB-RCS compliant
- ✦ <1m antenna, <2W
- ✦ Low cost consumer /prosumer version
  - Low cost set-top box, EUR1,500.-
  - Corporate versions at EUR3,000.-
  - Stand-alone operation with PC interface option
- ✦ High-performance professional versions
- ✦ LEO versions with two tracking antennas

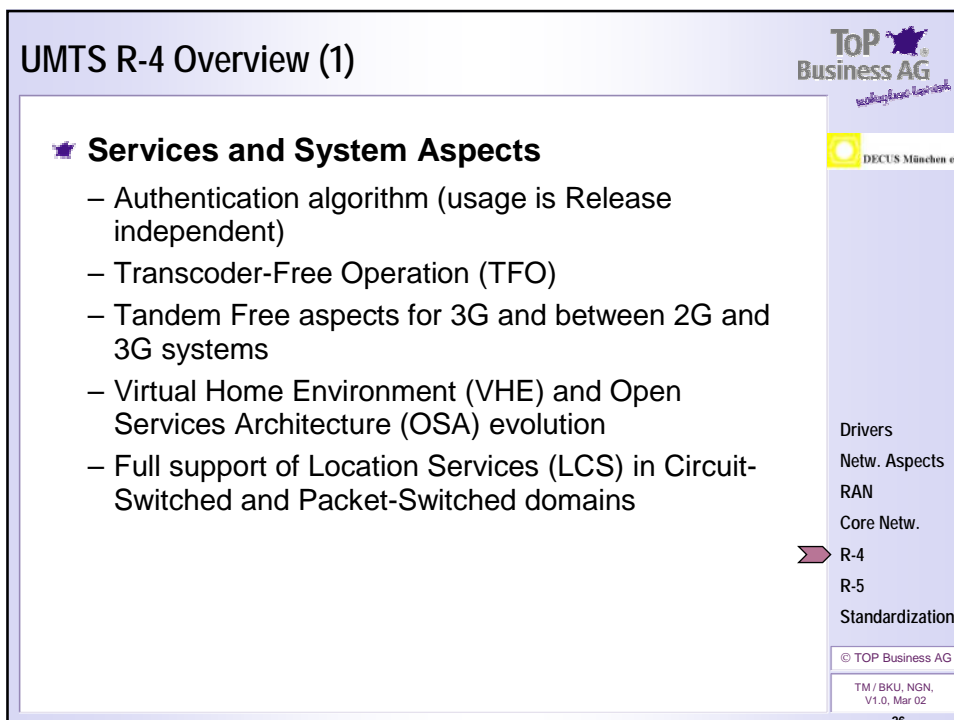
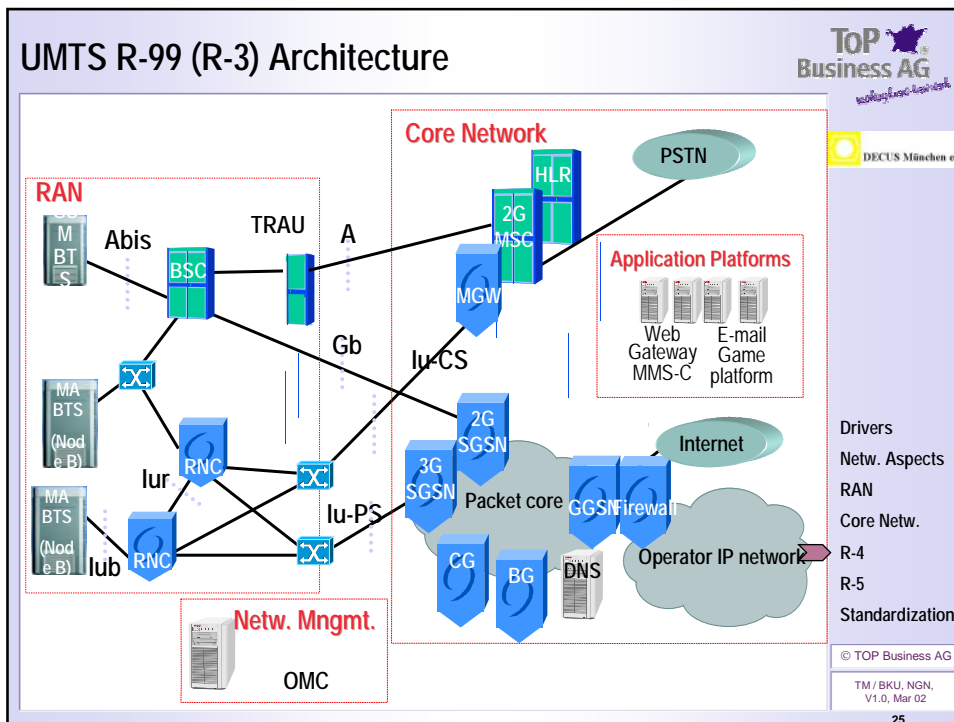


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## UMTS CN Phases

- ✦ R-3 (R-99)
  - Uses GSM NSS with IWF
  - Uses GPRS with IWF
  - ATM transport
- ✦ R-4 (former Rel. 2000)
  - Bearer-independent CS domain
  - Transport and Signaling over IP
  - Using Media Gateway
- ✦ R-5
  - Mobile Internet
  - IP Multimedia
  - Session Initiation Protocol (SIP)
- ✦ R-6
  - Completion of R-5 features, ???

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## UMTS R-4 Overview (2)

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**3G Radio Access**

- New TDD mode (1,28 Mcps) for narrow-band application
- Evolution of UTRAN transport (mostly support of / for IP)
- Various radio interface improvements, e.g. UTRA repeater
- Various RAN improvements, e.g., robust header compression (first use of IETF RFC 3095)

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## UMTS R-4 Overview (3)

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**Terminals**

- Mobile Execution Environment (MExE) R-4
- Multimedia Messaging (MMS) R-4
- Support for SyncML
- Several new AT commands
- Improvements for SMS / EMS
- Terminal Local Model–USAT Local link (allows USIM applications to access other devices via Bluetooth)
- USAT Interpreter Protocol (partly Release 5)
- Test specification for the USAT Java API
- USIM related features from CPHS (Common PCN Handset Specifications)
- Logical Channels for USIM

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## UMTS R-4 Overview (4)

### Core Network

- Evolution of Transport in the CN (IP)
- Non-Transparent Real Time Facsimile
- Circuit Switched (CS) Emergency Call Enhancements
- Enable Bearer Independent CS Architecture
- Transcoder-Free Operation (TrFO)
- ASCI Enhancements for Rel-4
- Operator Determined Barring (ODB) for Packet-Oriented Services

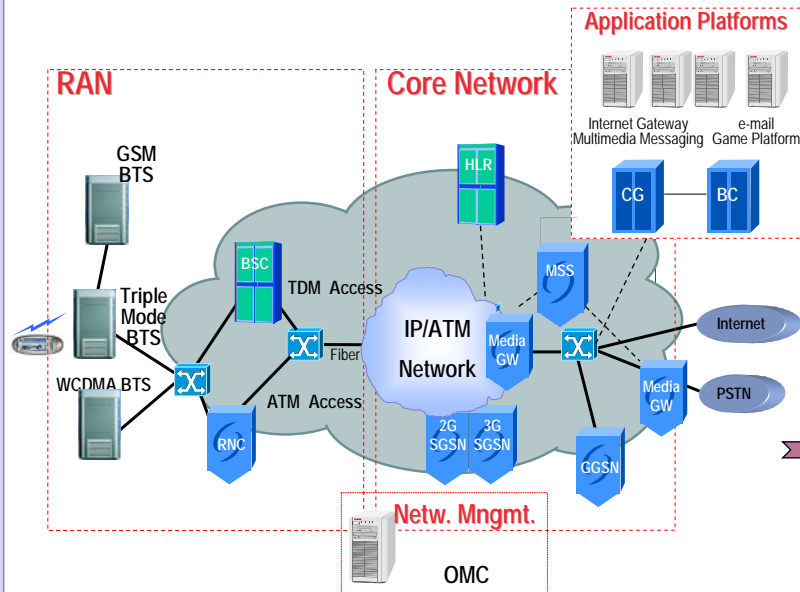
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## UMTS R-4 Architecture



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## R-5 Overview (1)

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Technologische Open-Source-Plattform

**Services and System Aspects**

- Development / selection of a multi-rate Wide-band Speech Codec with extended Acoustic Bandwidth (50Hz-7kHz) for the support of Wide-band Speech Telephony in multiple radio environments
- Provisioning of IP-based speech and multimedia services
- Support of Push Services
- Enhancements to:
  - Security
  - Virtual Home Environment (VHE)
  - Open Services Architecture (OSA)
  - Global Text Telephony (chat functionality)
  - Location Services (LCS)

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## R-5 Overview (2)

**TOP Business AG**  
Technologische Open-Source-Plattform

**3G radio access**

- Intra-domain connection of RAN Nodes to Multiple Core Network Nodes
- High-speed Downlink Packet Access
- Radio Access Network improvements and evolution of bearers on Radio interface to enable efficient IP-based multimedia services in UMTS
- Separation of resource reservation and radio link activation offers benefits to high bit-rate users

**Terminals**

- MExE Rel5
- MMS Rel5
- vObjects and other constructs for use in data synchronization
- Enhancements to USIM Toolkit Secure Messaging

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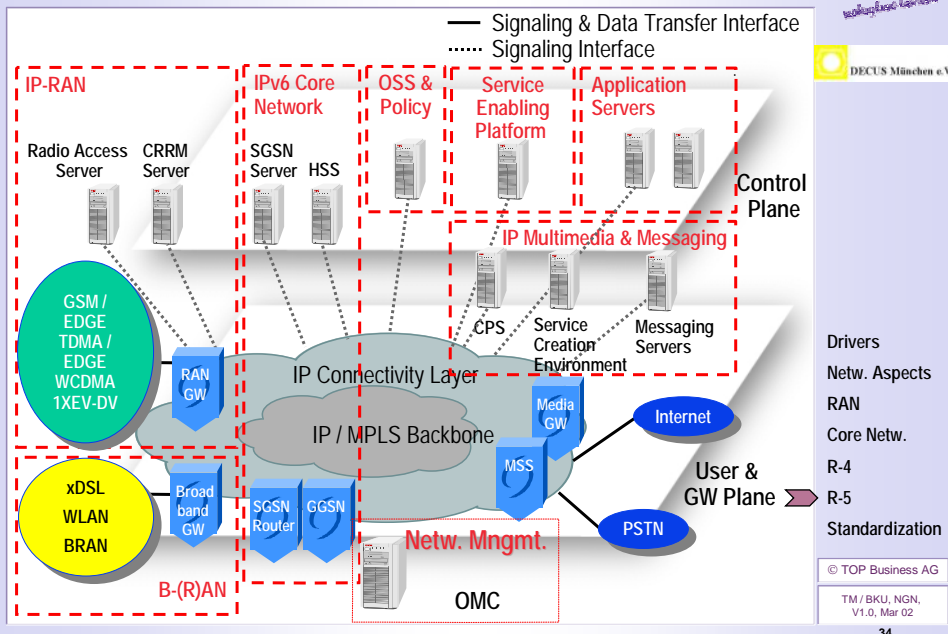


## R-5 Overview (3)


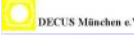
### Core network

- Provisioning of IP-Based speech and multimedia services (SIP Call Control protocol)
- Packet Switched (PS) Emergency Call Enhancements
- CAMEL Phase 4
- Intra Domain Connection of RAN Nodes to Multiple CN Nodes
- Reliable end-to-end QoS for Packet Switched domain
- IP-oriented billing for IMS
- Service-related CDRs for Internet services

## UMTS R-5 Architecture



## New IP-RAN Elements

- ✦ RAS (Radio Access Server) and
- ✦ CRRM Server (Common Radio Resource Management Servers)
  - support of multiple radio access systems
- ✦ RAN-GW (RAN Gateway)
  - evolved RNC

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## MSC Evolution Towards MSS (1)

- ✦ MSS (MSC Server)
  - MSC switching function transferred to MGW
  - Call control logic for CS services
  - Mobility management
  - VLR data base
  - Signaling translation (H.248 / MEGACO)
  - MSS - MGW connection by Ethernet
  - MGW - MGW connection by ATM or IP
  - MSS - MSS signaling by
    - BICC (Bearer-Independent Call Control)
    - SIP (Session Initiation Protocol)
    - ISUP
  - MSS - HSS (evolved HLR) signaling by MAP over IP (SIGTRAN)

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## MSC Evolution Towards MSS (2)

### Two MSS roles:

- VMSS (Visited MSS):
  - contains VLR
  - controls MGWs connected to BSC / UTRAN
- GMSS (Gateway MSS)
  - controls MGWs connected to packet core network or PSTN / ISDN

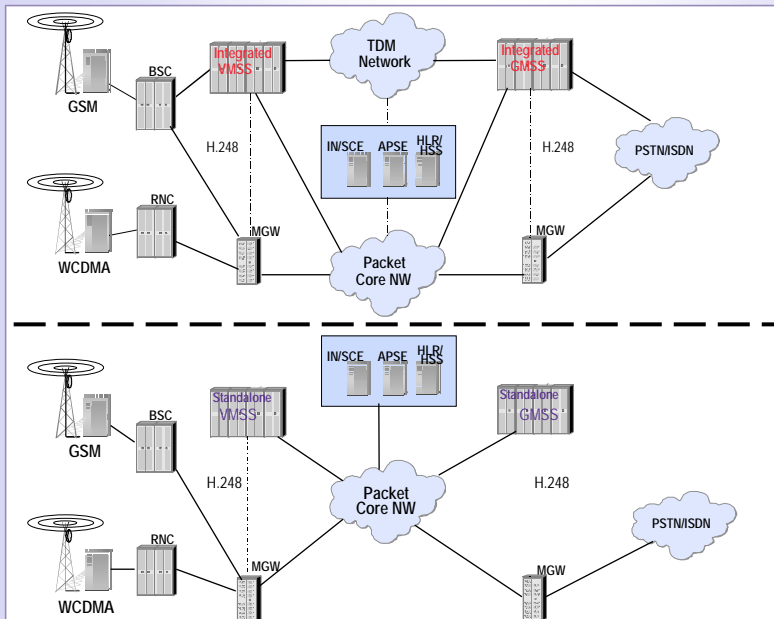
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## Integrated vs. Stand-alone MSS

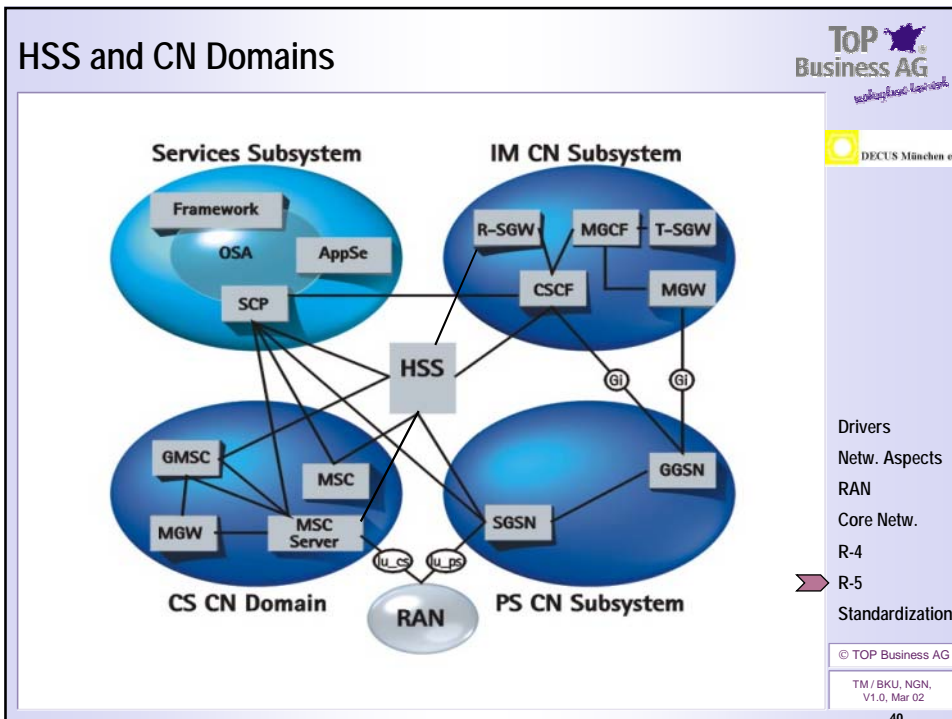
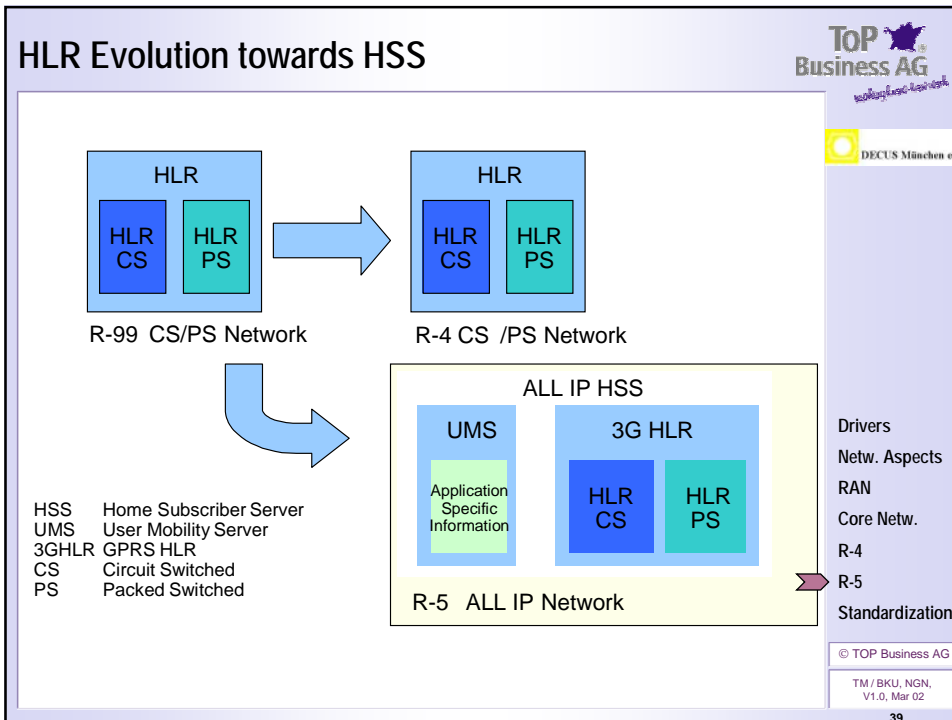


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## HSS Information

- ✦ User IDs
  - IMSI, application ID
- ✦ Subscribed services and profiles
  - GSM, GPRS, IP telephony services
  - subscriber's aliases
  - SS parameter
  - service triggers
- ✦ Mobility Management
  - serving servers
  - location query
- ✦ Authentication / security
  - AUC
  - IP security algorithms

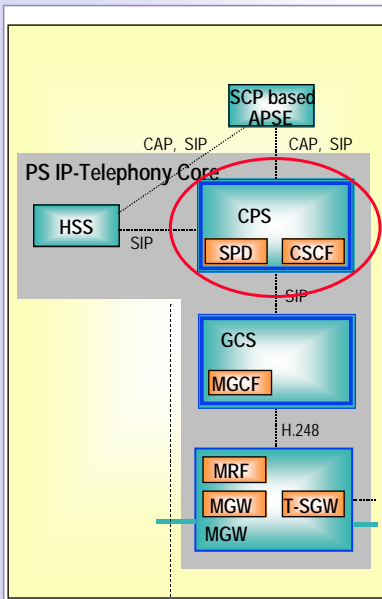
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## Call Processing Server (CPS)



- ✦ Support of end-to-end IP telephony services (H.323)
- ✦ Enables large amount of rich services via interfaces to Service Control Point and Application Servers.
- ✦ Manage subscriber information with the SPD - Subscriber Profile Database (compare with VLR).
- ✦ Controlling the calls (also roaming) with the CSCF - Call State Control Function.

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## 4G / NGN Standardization




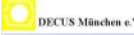
to facilitate Global, Strategic and Innovative Next Generation Networks, Platforms and Solutions

- ✦ A consortium of representatives from leading industries, operators and academia
- ✦ The first European open environment for strategic discussions on topic on NGN issues
- ✦ A project of the IST programme 
  - European Commission DG “Information Society Technology”
- ✦ Details at <http://www.ngni.org>

## NGNI Mission And Objectives

- ✦ Facilitate and support smooth transition to next generation networks
- ✦ Resolve issues that create barriers for NGN deployment
- ✦ Encourage clustering of activities
- ✦ Create open environment for discussions on trends
- ✦ Achieve interoperability for seamless services
- ✦ Achieve compatibility and essential commonality between solutions and products
- ✦ Identify new opportunities, e.g. for convergence ➤

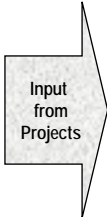
## NGNI Topics And Operations



  


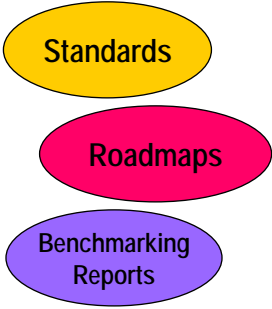
- ✦ Internet infrastructure
- ✦ Mobile and Wireless
- ✦ Optical Networks
- ✦ Home Networks
- ✦ Edge Devices
- ✦ Network Management
- ✦ Interworking, Interoperability


Projects in:


IST  
IETF  
ETSI  
ITU  
EURESCOM  
3GPP  
IPv6  
UMTS  
.....











Drivers

Netw. Aspects

RAN

Core Netw.

R-4

R-5



Standardization

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## Finally...

- ✦ More info...
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  - [www.TOPBusinessAG.com](http://www.TOPBusinessAG.com)
  - [www.business-interactive.com](http://www.business-interactive.com)

*Thanks a lot for Your attention...*



*...and further enjoy the conference!!*

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