Mobile Technologies and their Evolution

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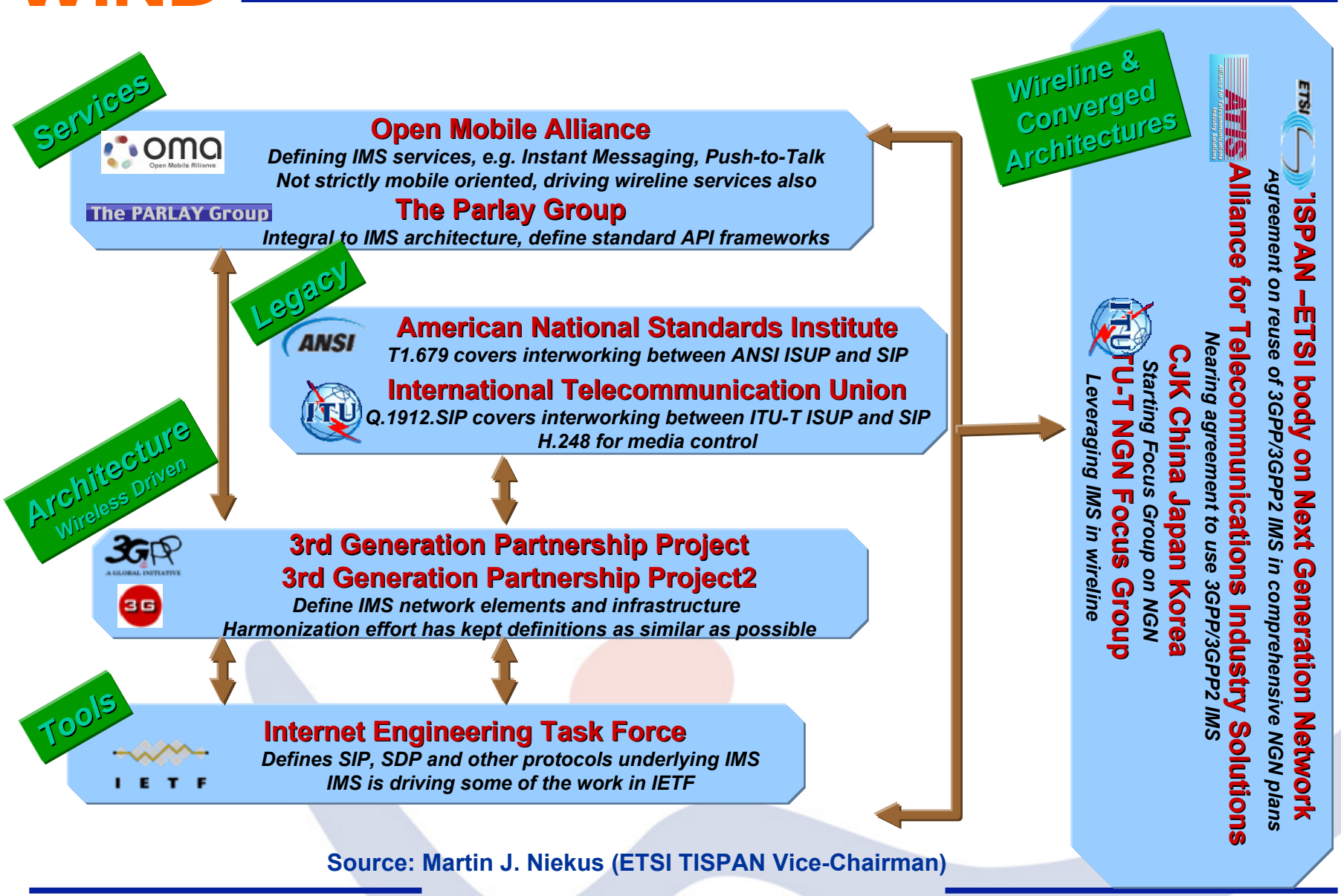
ITU-T Definition of a **Next Generation Network** (Y.2001)

Next Generation Network (NGN): a packet-based network able to provide telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. It enables unfettered access for users to networks and to competing service providers and/or services of their choice. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users

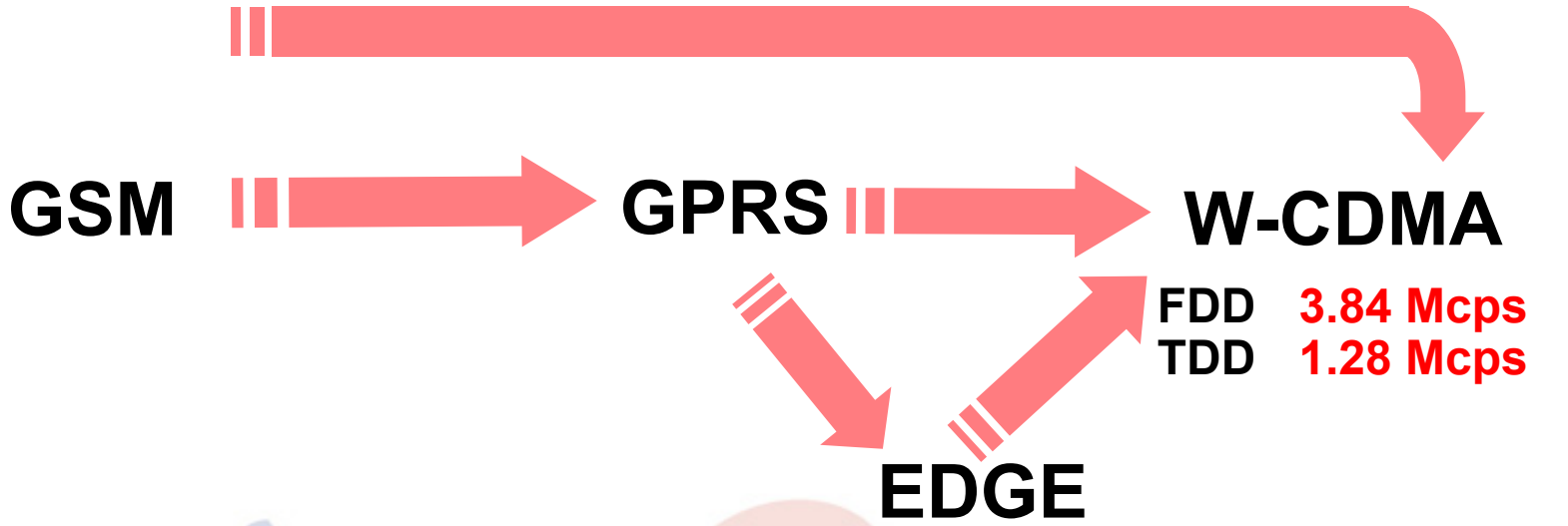
- Mobile evolution according to standardization process
- Wind Mobile Network Evolution
- Towards fourth generation

Global Standard Cooperation



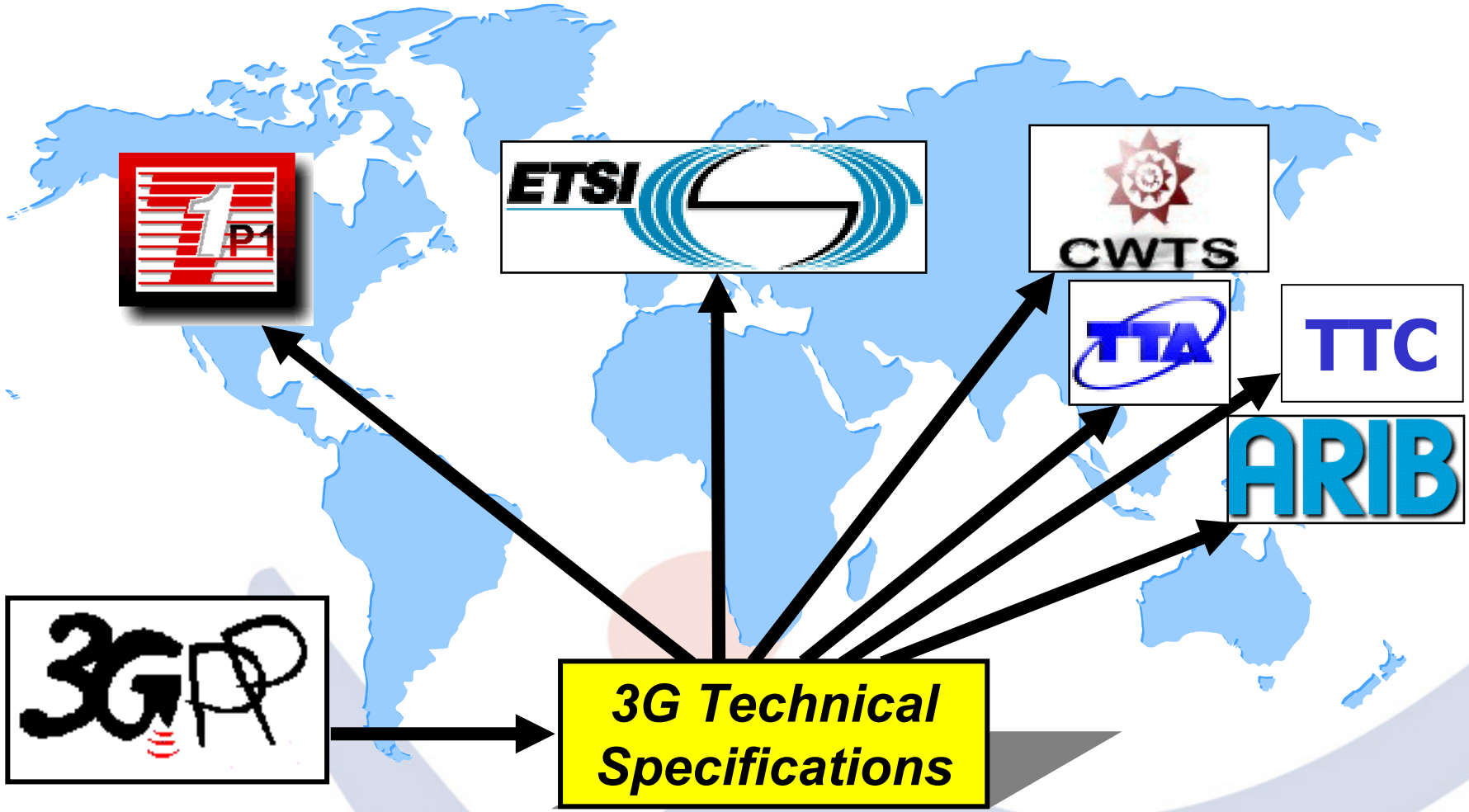
Source: Martin J. Niekus (ETSI TISPAN Vice-Chairman)

- Mobile Network Evolution is lead by 3GPP group, that has got the responsibility to produce globally applicable Technical Specifications and Technical Reports for a 3rd Generation Mobile System based on evolved GSM core networks and the new radio access technologies (URAN)

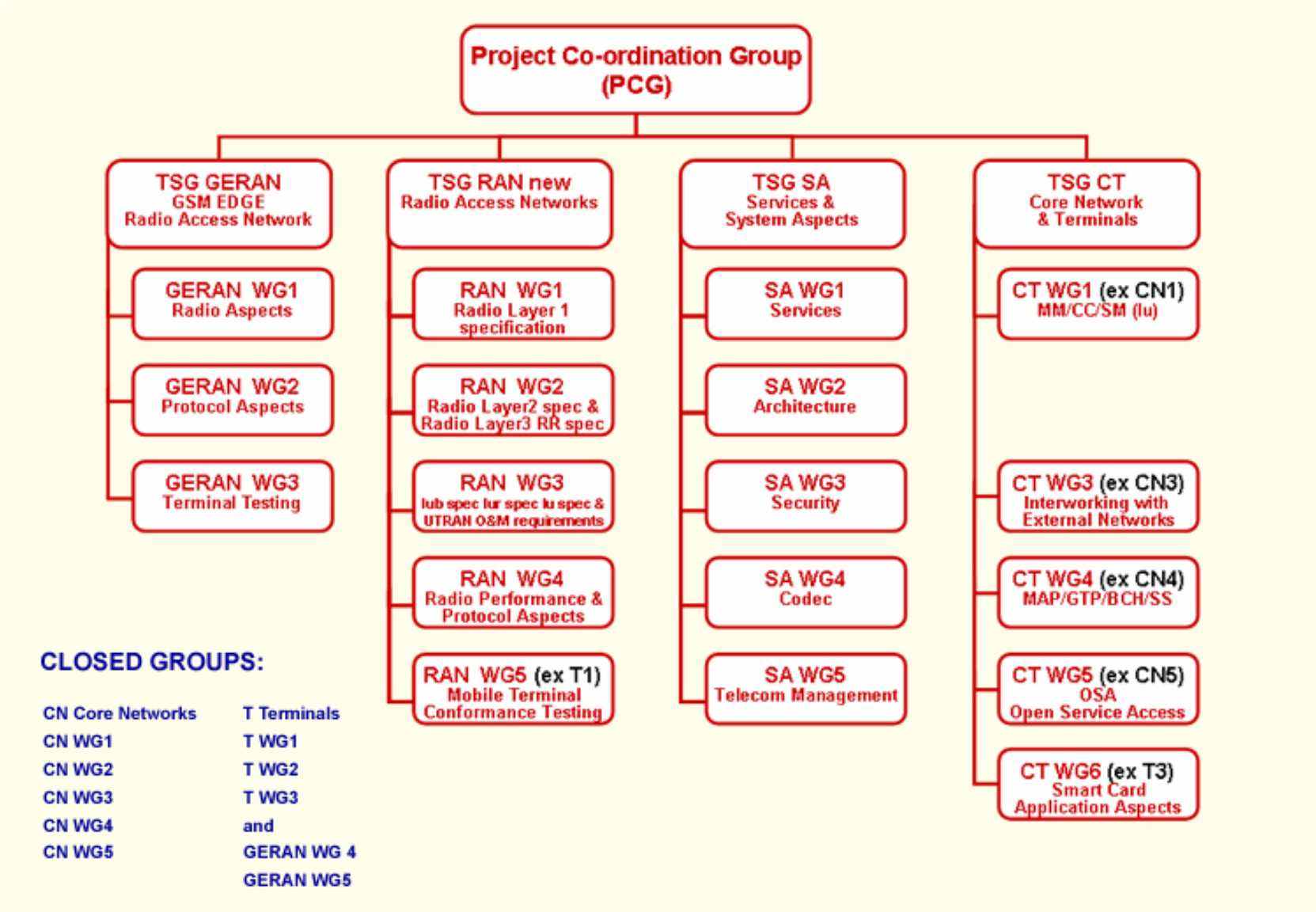


3GPP organization

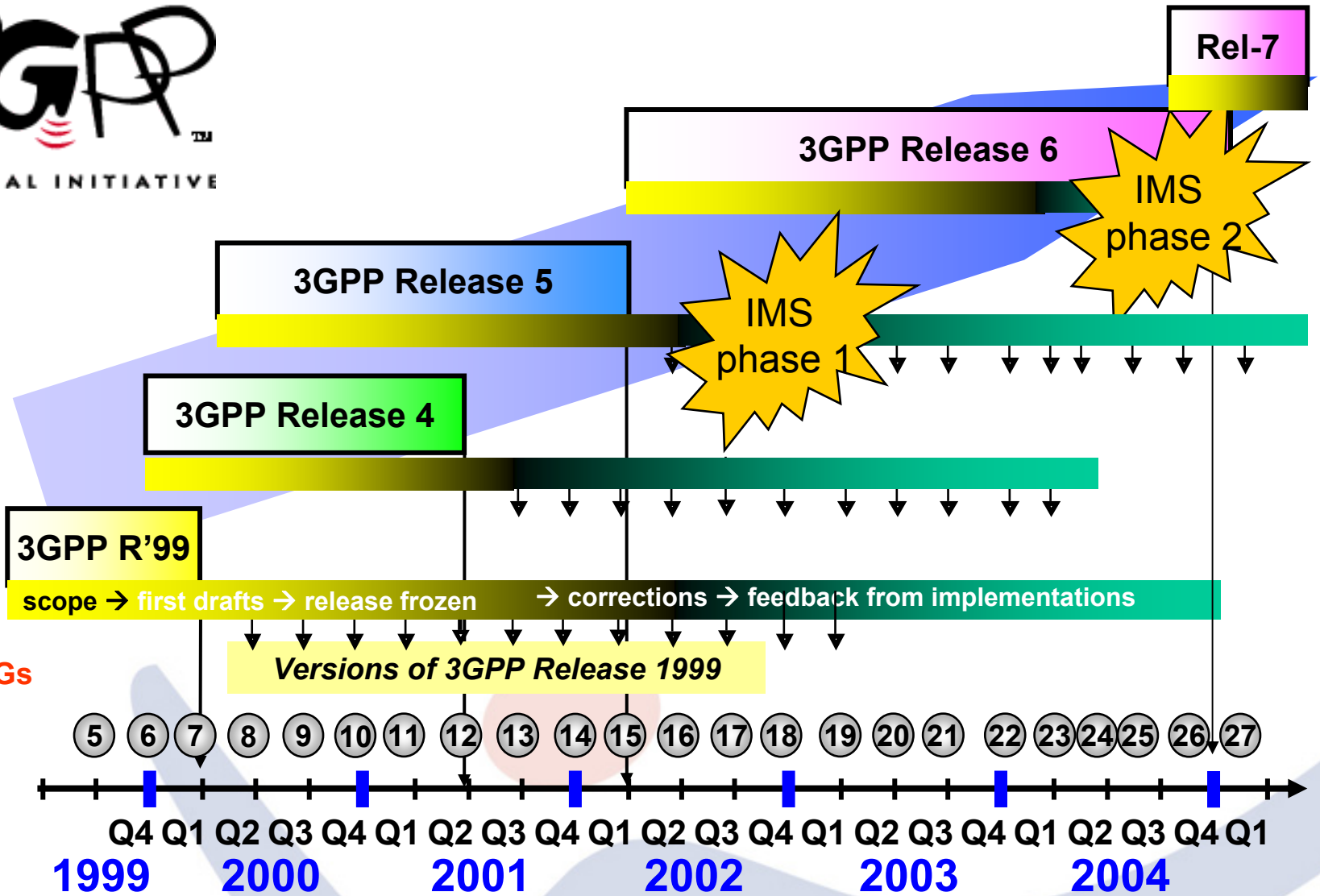
The 3rd Generation Partnership Project (3GPP) is a collaboration agreement established in December 1998. It brings together a number of telecommunications standards bodies which are known as "Organizational Partners"



3GPP Technical Specification Groups



Standardization process



Main functional content of 3GPP releases

Release 4

- Bearer Independent CS Architecture
- Signalling over IP in Core Network
- QoS Architecture for PS Domain
- Transcoder Free Operation
- Gb over IP

Release 5

- IP transport in UTRAN
- HSDPA
- Iu flex
- IMS phase 1
- CAMEL phase 4
- End-to-End QoS
- GERAN enhancement

Release 6

- MBMS
- IMS phase 2
  - Interworking between IMS and IP networks
  - Interworking between IMS and CS networks
- QoS improvements
- IP flow based bearer level charging

Release 7, not yet frozen, will include some enhancement for IMS, like Fixed Broadband Access to IMS and Policy Control Evolution and Charging

- **Packet Switched (PS) Subsystem:**
  - provides IP connectivity between the CN and the IP terminal
- **IP MultiMedia Subsystem:**
  - runs a new SIP-based Multimedia Call Control
  - makes use of the IP PS domain for the transport of signalling and user data
  - separation of the call control from the bearer level allows the IMS to operate on any IP access network other than the PS domain (e.g. fixed)
- **Circuit-Switched Subsystem:**
  - control and transport should separate to allow IP transport
  - runs the legacy call control for circuit services between terminals and the UMTS system (the same as in R99)
  - R99 terminals can still be supported (backward compatibility)

Main drivers for IMS introduction

- IMS technology and services represent the main step on Mobile Network evolution foreseen in the next years
- Main drivers that lead to the definition of IMS standard are the following ones:

✓ The possibility to introduce new person-to-person services integrating voice and data with a user experience better than traditional vertical services

✓ the necessity for an operator to have a standard-based multimedia infrastructure in order to guarantee interoperability between services and platform and to reduce integration costs

✓ faster and more efficient service deployment and delivery

✓ better control of business value chain with respect to “Internet model”

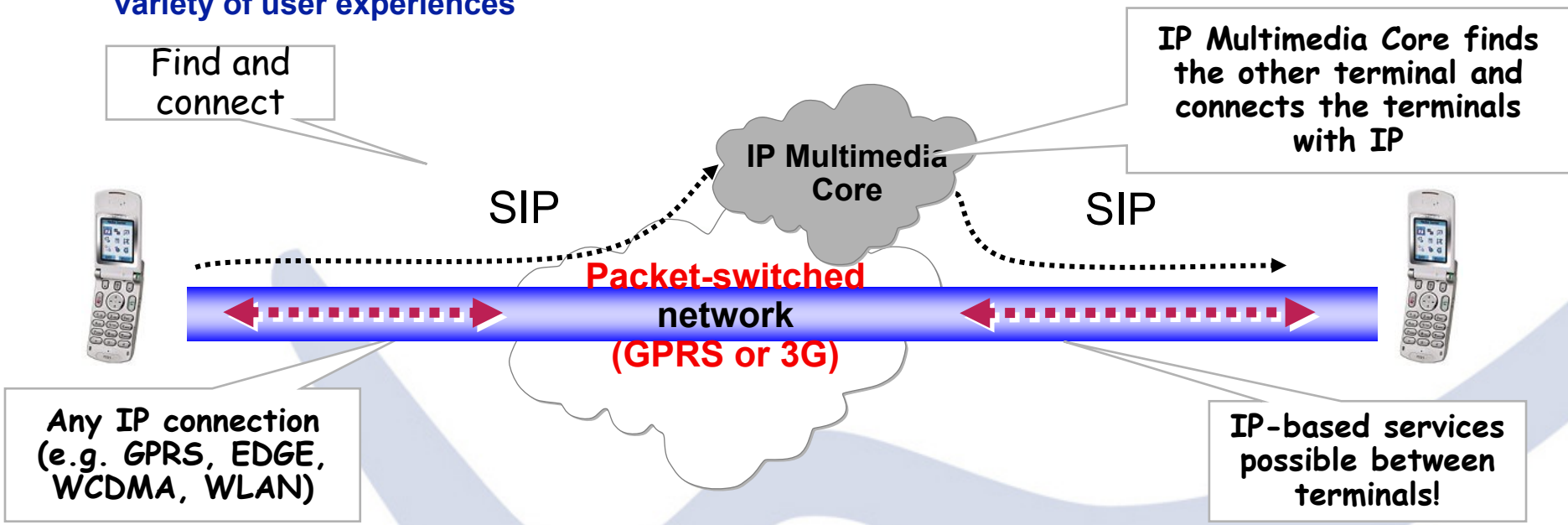
✓ a flexible charging in terms of single event or media exchanged also for person to person applications, correlating charging information generated at transport, service and content charging levels by the network entities in PS domain and IMS

IMS technical requirements

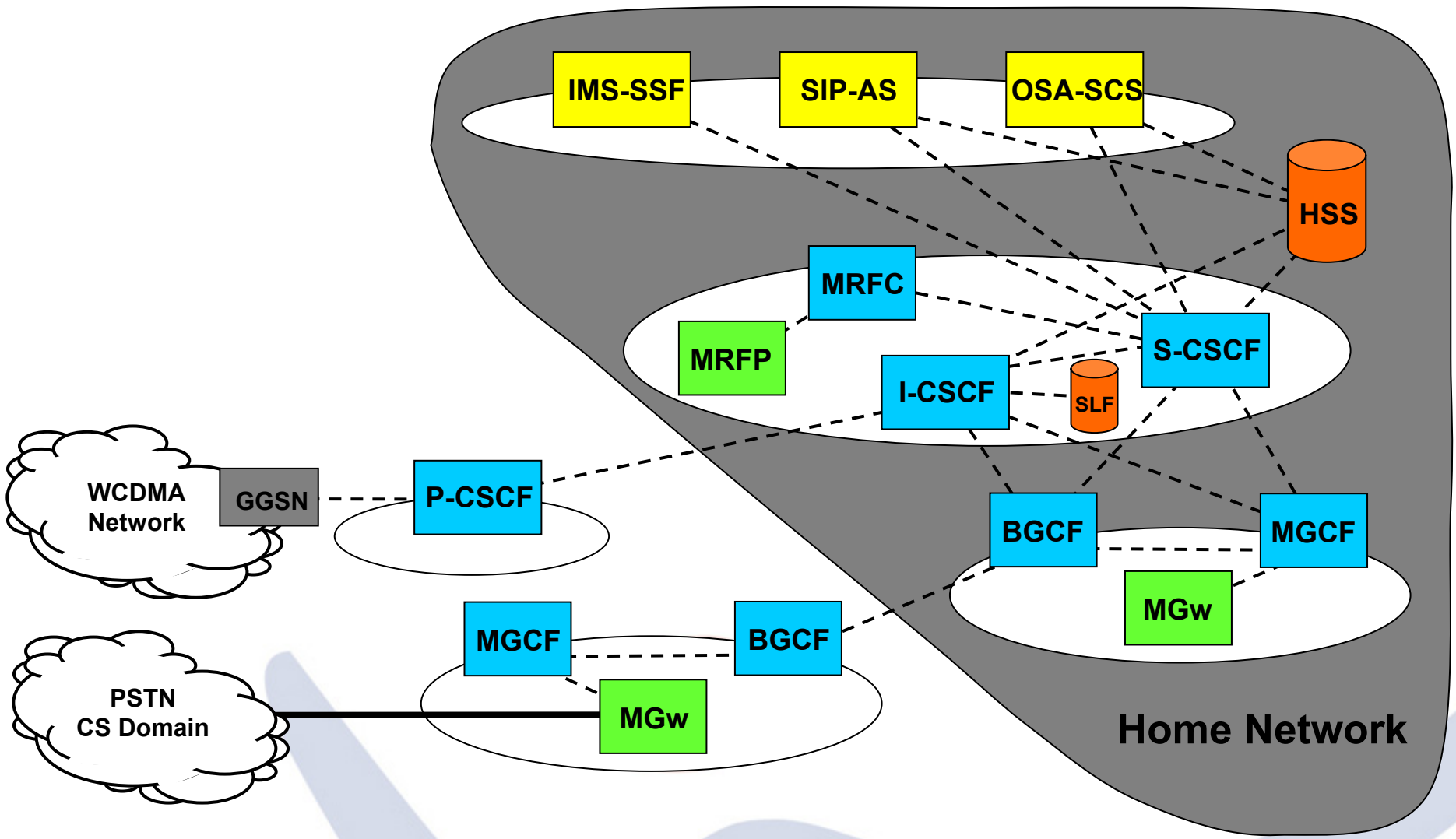
- Support of IP multimedia sessions with:
  - unified handling of different media types, including VoIP, thus enabling peer-to-peer real-time services, such as voice and video over the PS domain
  - end to end QoS negotiation
- Flexibility in resource utilization
  - mix of network and terminal based resources
  - scalable common service control – the ability to manage parallel user services
- Support of interworking with PSTN, ISDN and Internet
- Support of access independence :
  - operators should be able to offer services to users regardless of how they obtain an IP connection (e.g. GPRS, UMTS, xDSL, LAN).
- Open Interfaces: IP multimedia applications shall, as a principle, not be standardised, allowing operator specific variations
  - enable rapid service creation and deployment using service capabilities for all user equipment (fixed/mobile) and all application servers

IMS services

- **Person to Person Multimedia Services**
  - Exchange of any file type - data, video, voice
- **New Services**
  - Rich Calls
  - Push-to-Talk & Push-to-See
  - Media / application sharing
  - Fully Integrated Messaging Services
  - Person-to-person gaming
- **Service Integration**
  - IMS allows all voice & data services to be integrated into a single proposition allowing a variety of user experiences



IMS architecture



Requirements for combining CS and IMS

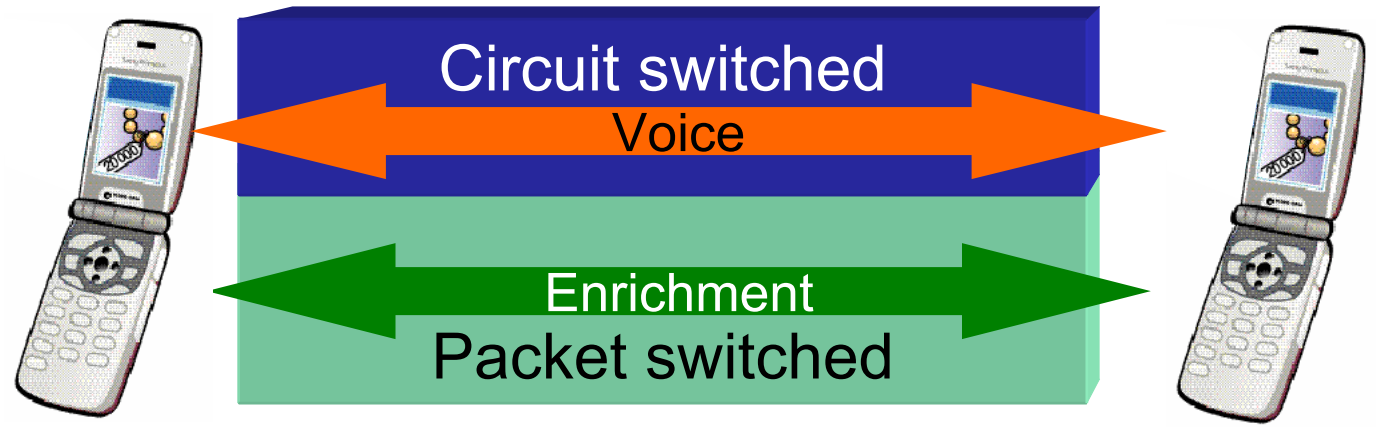
- Voice is a key component of multimedia services
- Conversational voice bearer in packet domain will not be ready for commercial deployment soon

  - define services exploiting CS+PS in parallel: MultiRAB (WCDMA), DTM (GSM)
  - reuse existing CS assets

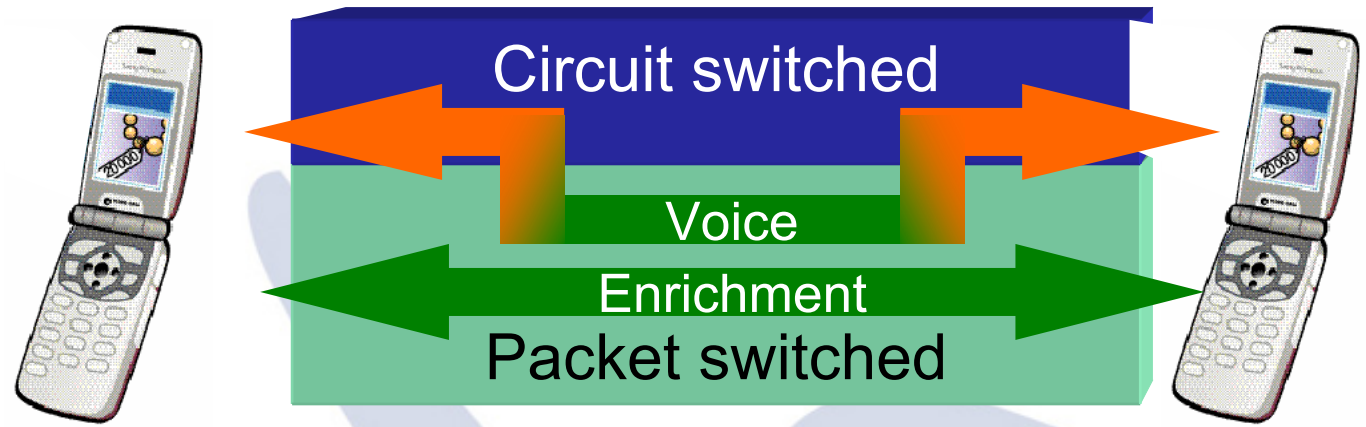
IMS Synergies with CS domain

- IMS will not replace CS domain soon: QoS end-to-end over packet is still an issue
- IMS can complement CS, for offering multimedia services (Instant/Video Messaging, Chat, Gaming...)
- CS and IMS can be used simultaneously, glued-up at application level (combining services): e.g. CS connection for real-time services (voice) in parallel to an IMS session for near/non real-time services (messaging, video)

Person to Person Media sharing



Voice + Image
Voice + Video
Voice + IM
Voice + Gaming



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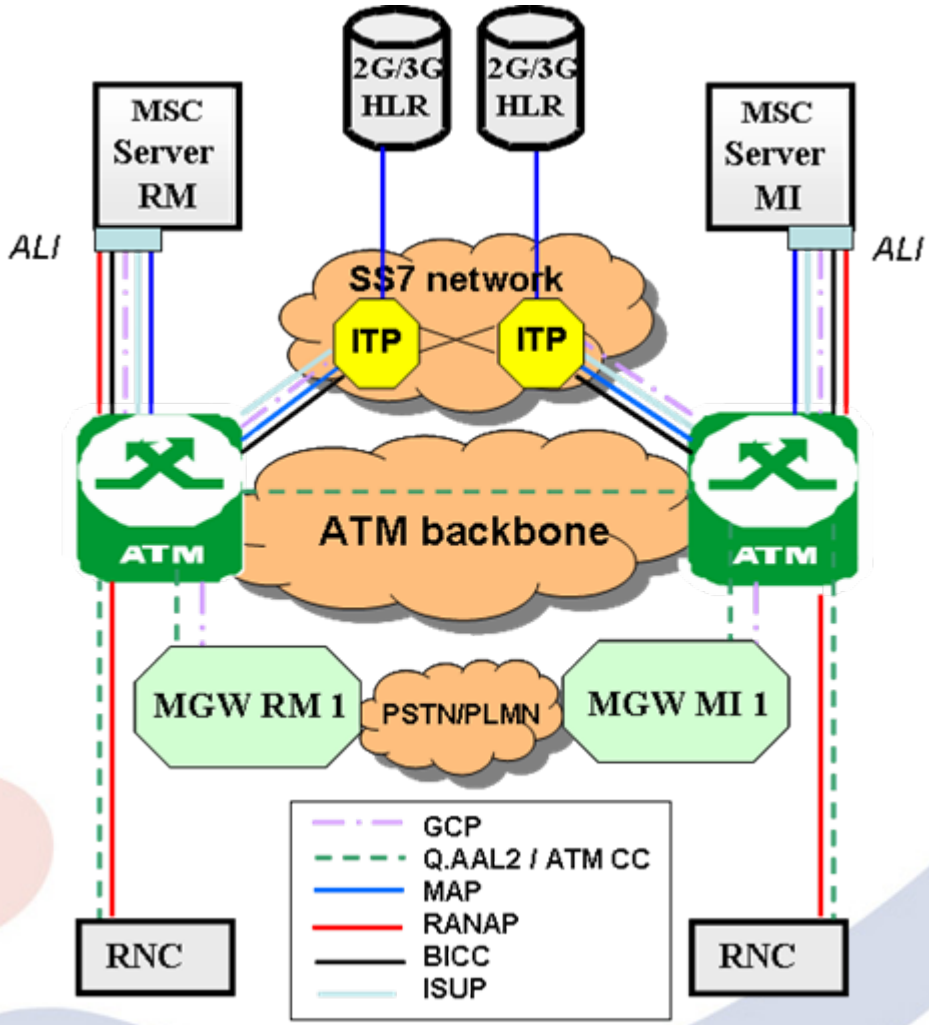
Main steps for Wind Mobile Network Evolution

1. Split architecture for 3G Core Network CS domain
2. IMS services
3. HSDPA
4. Evolution towards an all IP network

UMTS CS Layered Architecture

- The layered architecture for UMTS CS domain, currently in progress, consists on splitting control plane devices (MSC Server) for mobility and call management, and transport plane devices (Media Gateway) for user payload handling and protocol adaptation. Main benefits are:
  - ✓ packet data network between Core Network nodes (bandwidth saving);
  - ✓ independence in terms of growth and functionality between transport and control plane;
  - ✓ re-use of existing MGW as breakout devices towards legacy network in IMS architecture (driver for evolving from ATM to IP for UMTS CS)



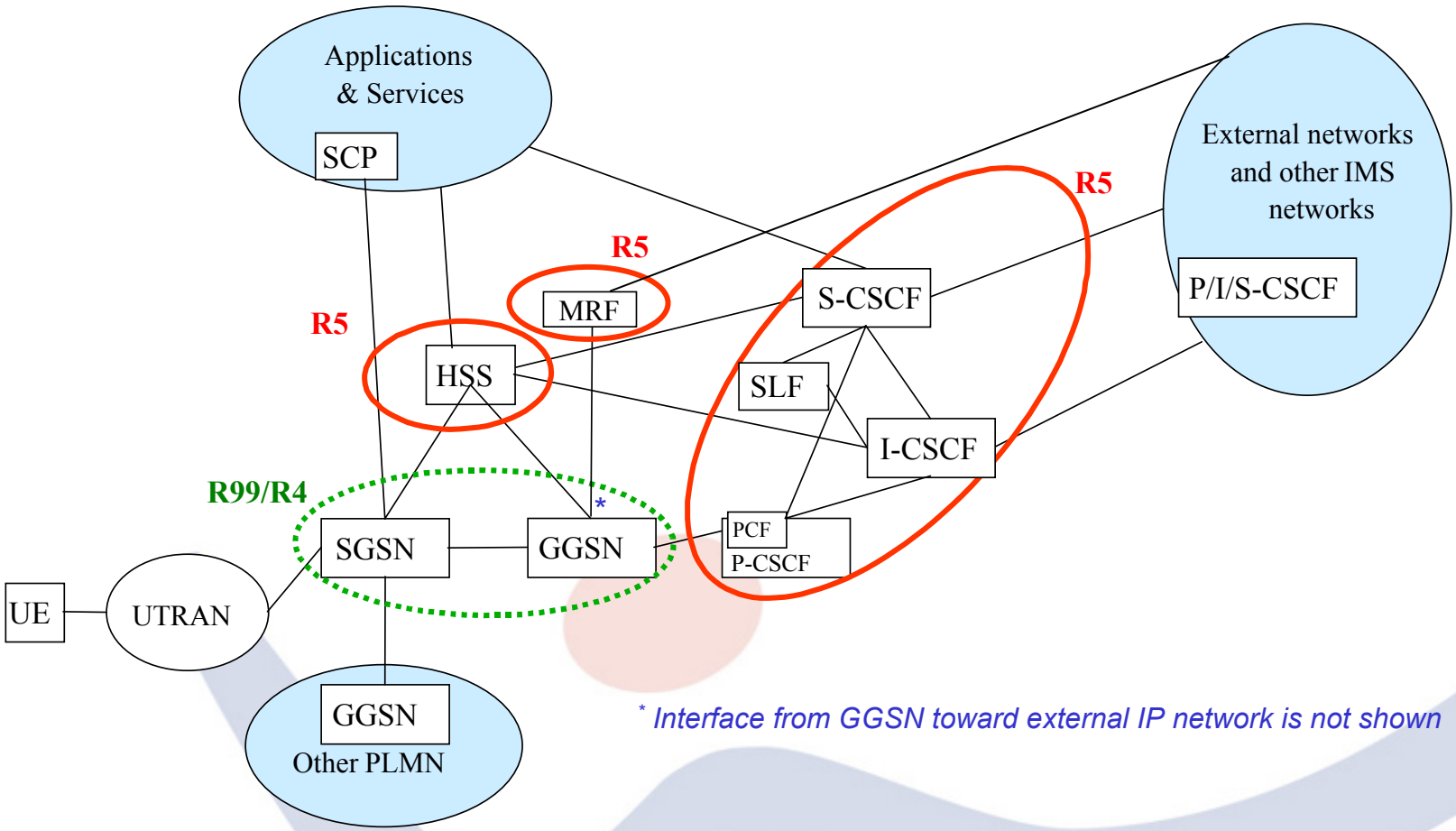
WIND strategy for IMS Domain

- WIND plans to introduce in 2006 IMS service, starting from pre-standard solutions (“early IMS”), in order to offer person-to-person SIP service (eg. PoC, Combinational…). Main exceptions in “early IMS” solutions are use of IPv4 instead of IPv6 and authentication method not based on IMS AKA

- Starting from 2007, full-compliant 3GPP IMS will be introduced in order to offer new multimedia SIP-based services including conversational ones
- Mobile IMS would also allow synergies on service layer with fixed IMS architecture

IMS Domain 3GPP R5

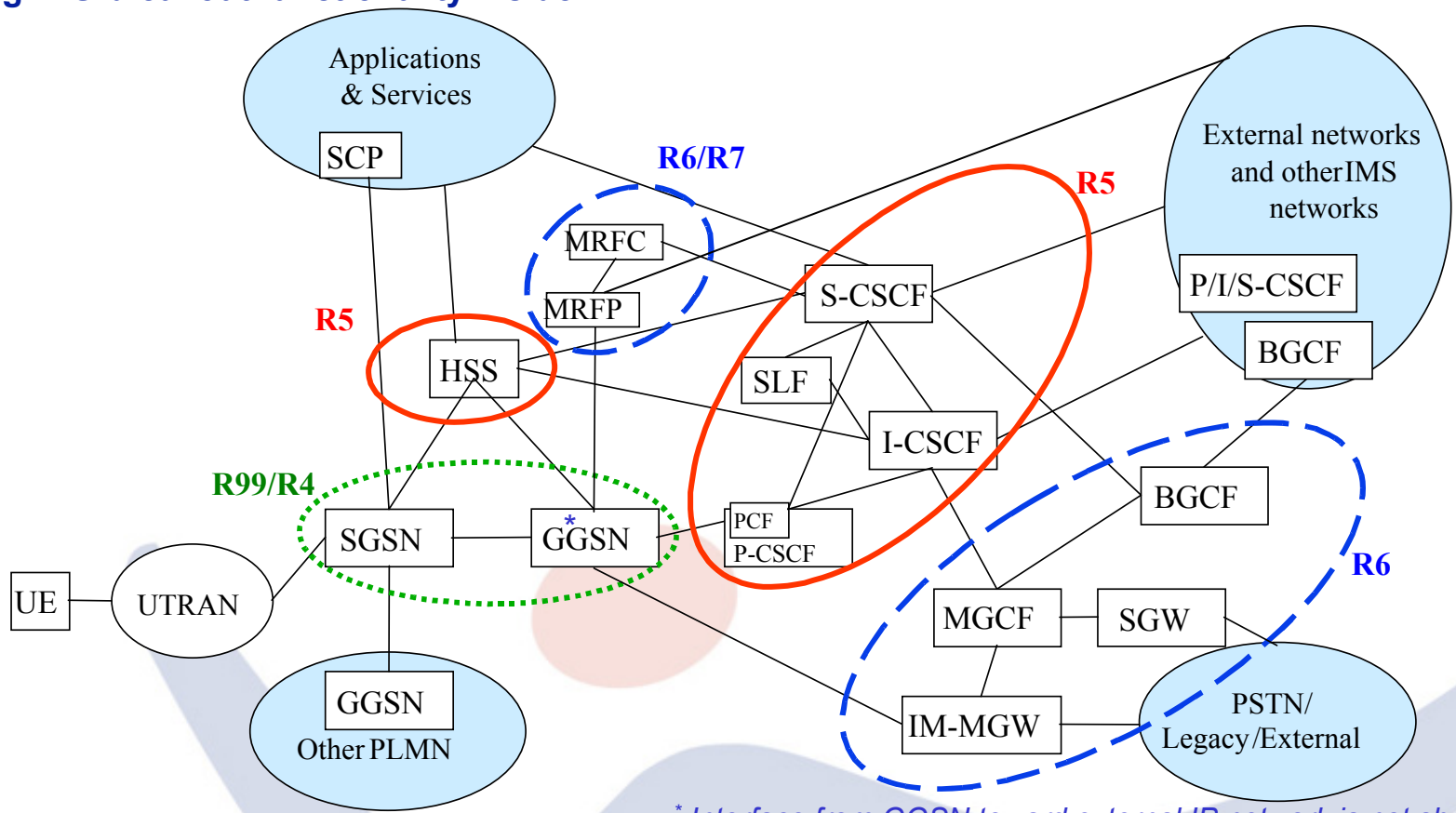
- First introduction of IMS fully compliant with 3GPP R5 specification will be available during 2007
- It mainly consists on introduction of CSCF, that performs the call control in IMS domain, and HSS, that contains subscriber data and authorizes user's registration to IMS services. More, MRF is used for payload processing



* *Interface from GGSN toward external IP network is not shown*

IMS Domain 3GPP R6/R7

- During 2008-2009 timeframe, it will be available target IMS architetture fully compliant with 3GPP R6/R7 specification
- In particular, it will be introduced IMS breakout functionality in order to make possible offering VoIP calls (not available before) to/from legacy CS domain
- It will be possible to reuse existing CS Layered Architecture, evolved with IP connectivity, for converging IMS breakout functionality inside



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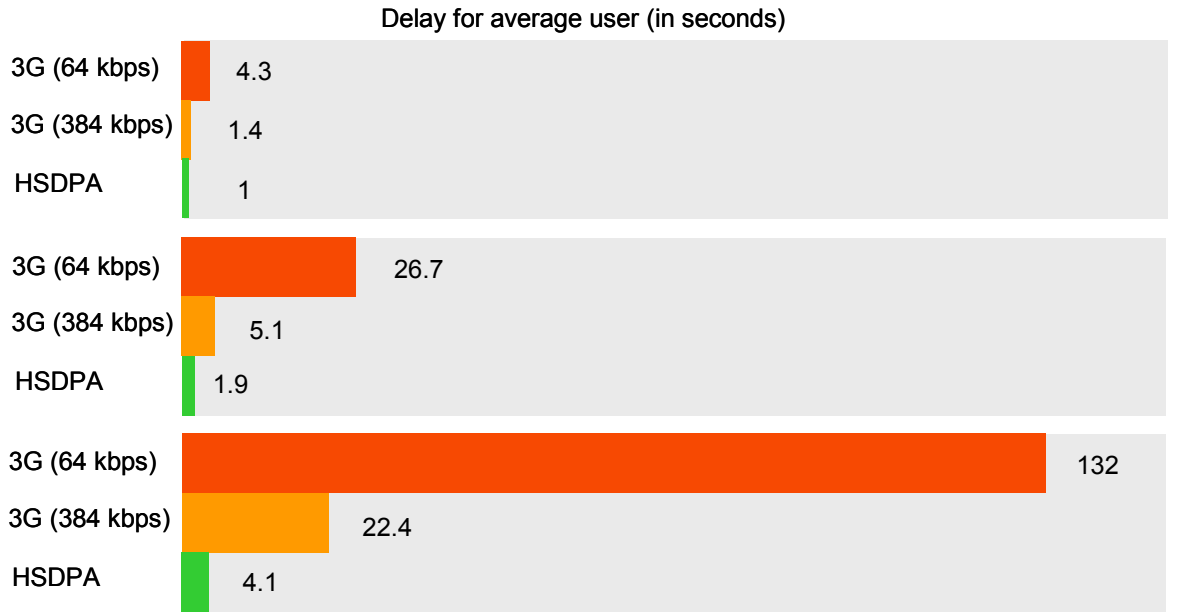
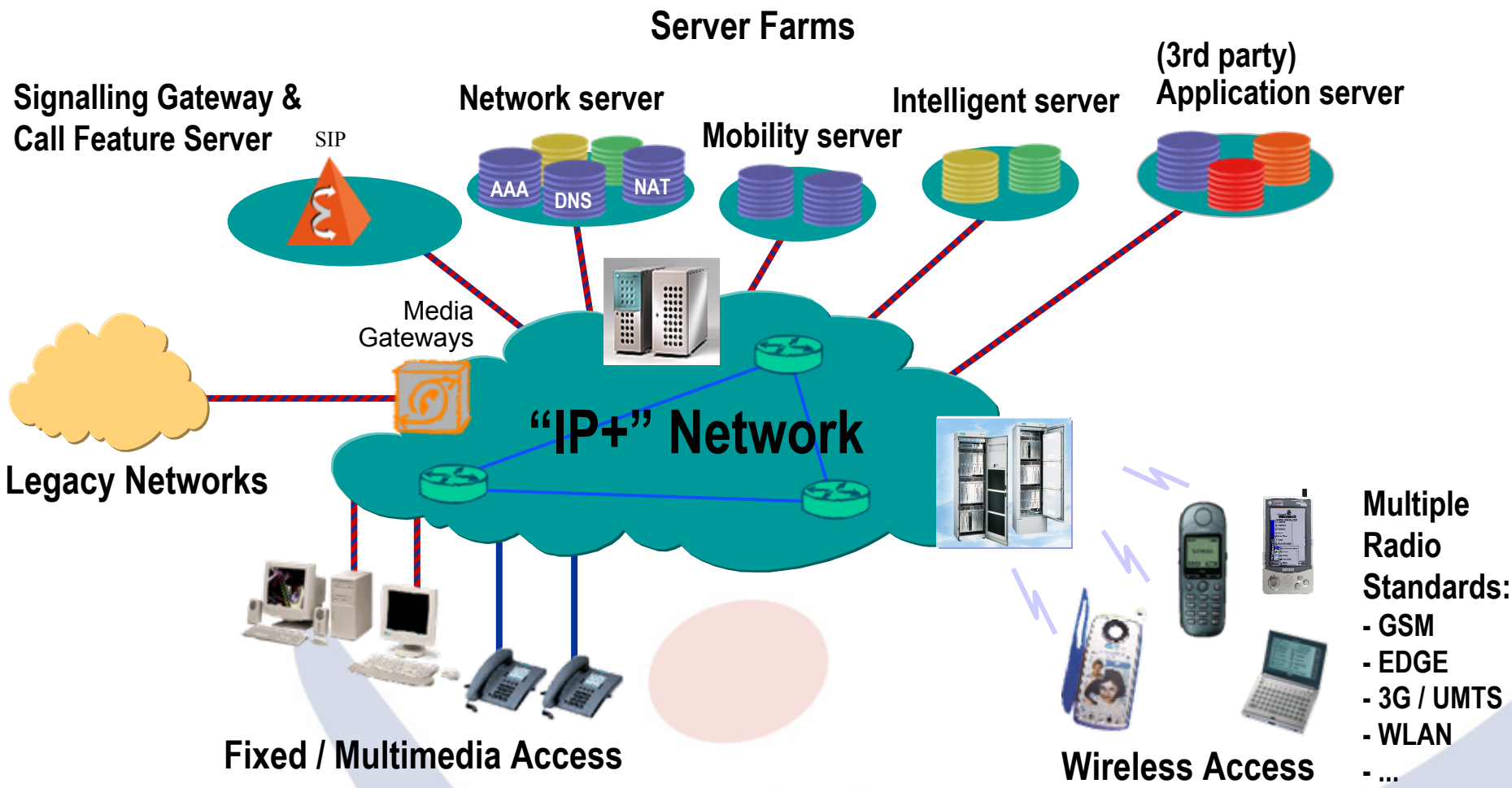
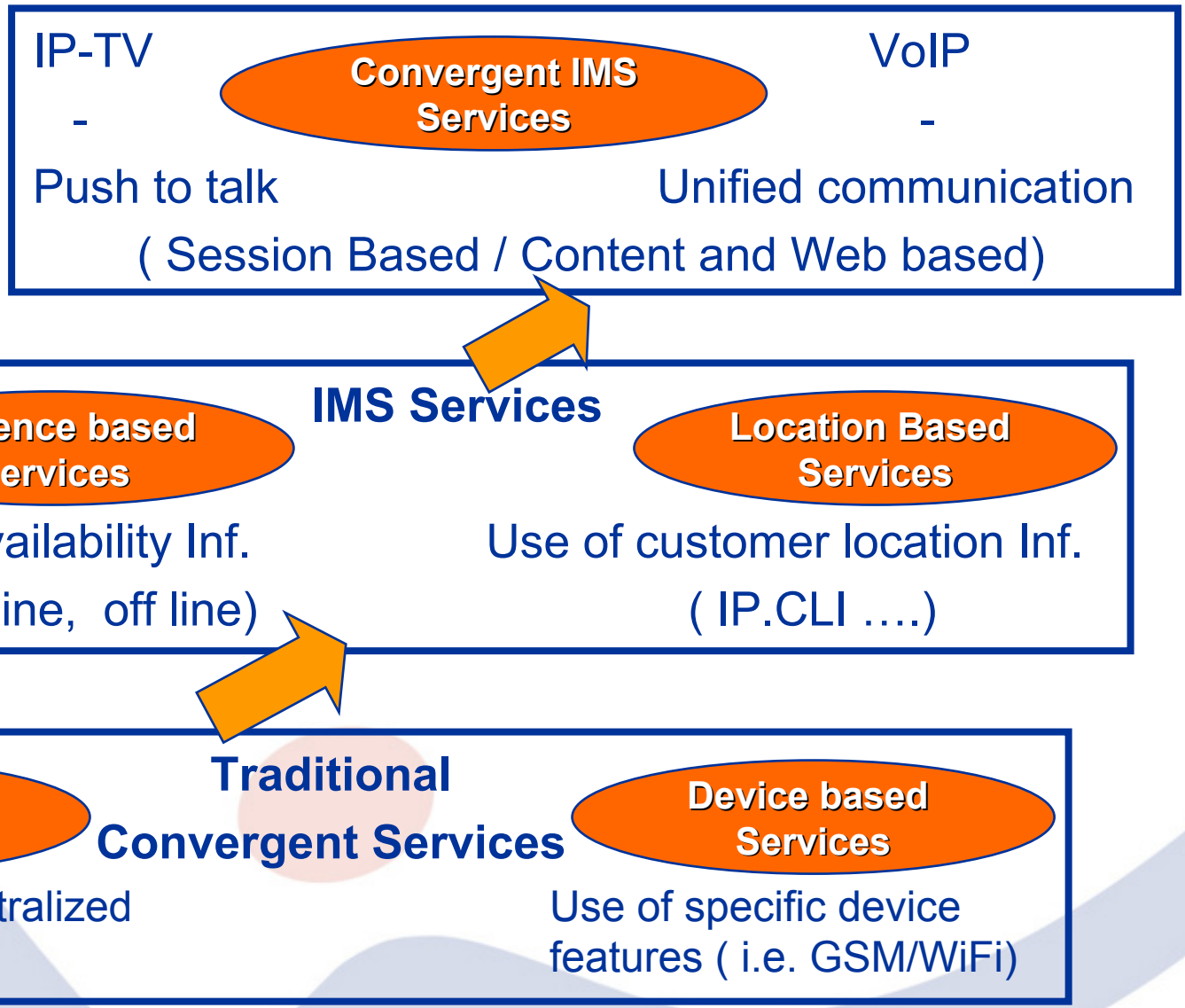


(Source: Ericsson)

- **HSDPA, High-Speed Downlink Packet Access, increased end-user packet data download capacity in WCDMA networks, making more efficient the radio network resources usage for voice and data traffic**
- **Significantly improves the download times for end-users and will allow operators to deploy new services with requirements on high bandwidth**


Server Farms
Signalling Gateway &
Call Feature Server
SIP
Network server
AAA
DNS
NAT
Mobility server
Intelligent server
(3rd party)
Application server
Media
Gateways
"IP+" Network
Legacy Networks
Fixed / Multimedia Access
Wireless Access
Multiple
Radio
Standards:
- GSM
- EDGE
- 3G / UMTS
- WLAN
- ...

Convergent Service Evolution



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Towards fourth generation (1/3)

• To ensure competitiveness of the 3GPP systems in a time frame of the next 10 years and beyond, a long-term evolution of the 3GPP access technology needs to be considered

• In particular, to enhance the capability of the 3GPP system to cope with the rapid growth in IP data traffic, the packet-switched technology utilised within 3G mobile networks requires further enhancement. A continued evolution and optimisation of the system concept is also necessary in order to maintain a competitive edge in terms of both performance and cost. Important parts of such a long-term evolution include reduced latency, higher user data rates, improved system capacity and coverage, and reduced overall cost for the operator

• Additionally, it is expected that IP based 3GPP services will be provided through various access technologies. A mechanism to support seamless mobility between heterogeneous access networks, e.g. I-WLAN and 3GPP access systems, is a useful feature for future network evolution

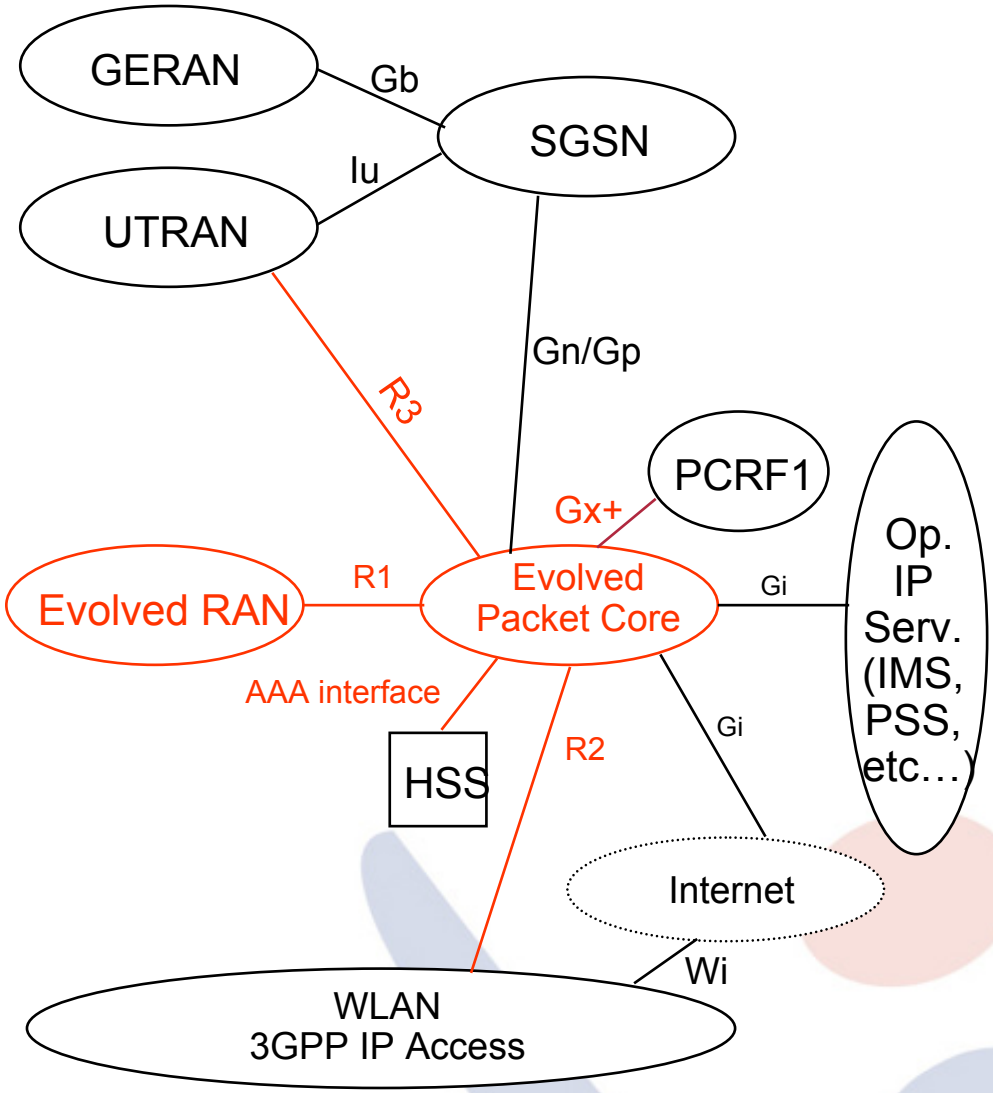
• In order to achieve this, an evolution or migration of the network architecture, as well as an evolution of the radio interface, should be considered

• Architectural considerations will include end-to-end systems aspects, including core network aspects and the study of a variety of IP connectivity access networks (e.g. fixed broadband access)

Towards fourth generation (2/3)

- Emphasis is on efficient support of IP based services
  - voice and real time multimedia services
  - ftp, web browsing
  - Multi –QoS
- Reduce Round Trip Time
- High throughput
  - higher average sector throughputs
  - Increased cell edge rates
  - Increased peak bit rates
- Lower cost
- Faster call setup/session establishment
- Support a high numbers of active users
  - Increased user base means reduced UE pricing
  - Infrastructure costs shared by many more users

Towards fourth generation (3/3)



- **3GPP is currently investigating which architecture figures could satisfy new requirements coming from vendors and operators**
- **Main issues is related to the way in which inter access system mobility is achieved and managed**
- **The study should be completed by June 2006, with the selection of a new air interface and the layout of the new architecture**

* **Color coding:** red indicates new functional element / interface

The risk of ubiquitous network

Source: NRI Paper "Ubiquitous Networking: Business Opportunities and Strategic Issues"

Acronyms

AKA: Authentication Key Agreement
ALI: ATM Line Interface
BGCF: Breakout Gateway Control Function
BICC: Bearer Indipendent Call Control
CS: Circuit Switched
CSCF: Call Session Control Function
DNS: Domain Name Server
EDGE: Enhanced Data rates for GSM
GCP: Gateway Control Protocol
GERAN: GSM EDGE Radio Access Network
GPRS: General Packet Radio Service
HSDPA: High Speed Downlink Packet Access
HSS: Home Subscriber Server
IMS: IP Multimedia Subsystem
MGCF: Media Gateway Control Function
MGW: Media GateWay
MRF: Media Resource Function
MSC: Mobile Switching Center
PDF: Policy Decision Function
PoC: Push over Cellular
QoS: Quality of Services
RANAP: Radio Access Network Application Protocol
RNC: Radio Network Controller
SGW: Signalling GateWay
SIP: Session Initiation Protocol
SLF: Subscriber Locator Function
TrFO: Transcoder Free Operation
3GPP: 3G Partnership Project
UE: User Equipment
UTRAN: UMTS Terrestrial Radio Access Network
W-CDMA: Wideband Code Division Multiple Access
W-LAN: Wireless Local Area Network