3G-WLAN QoS

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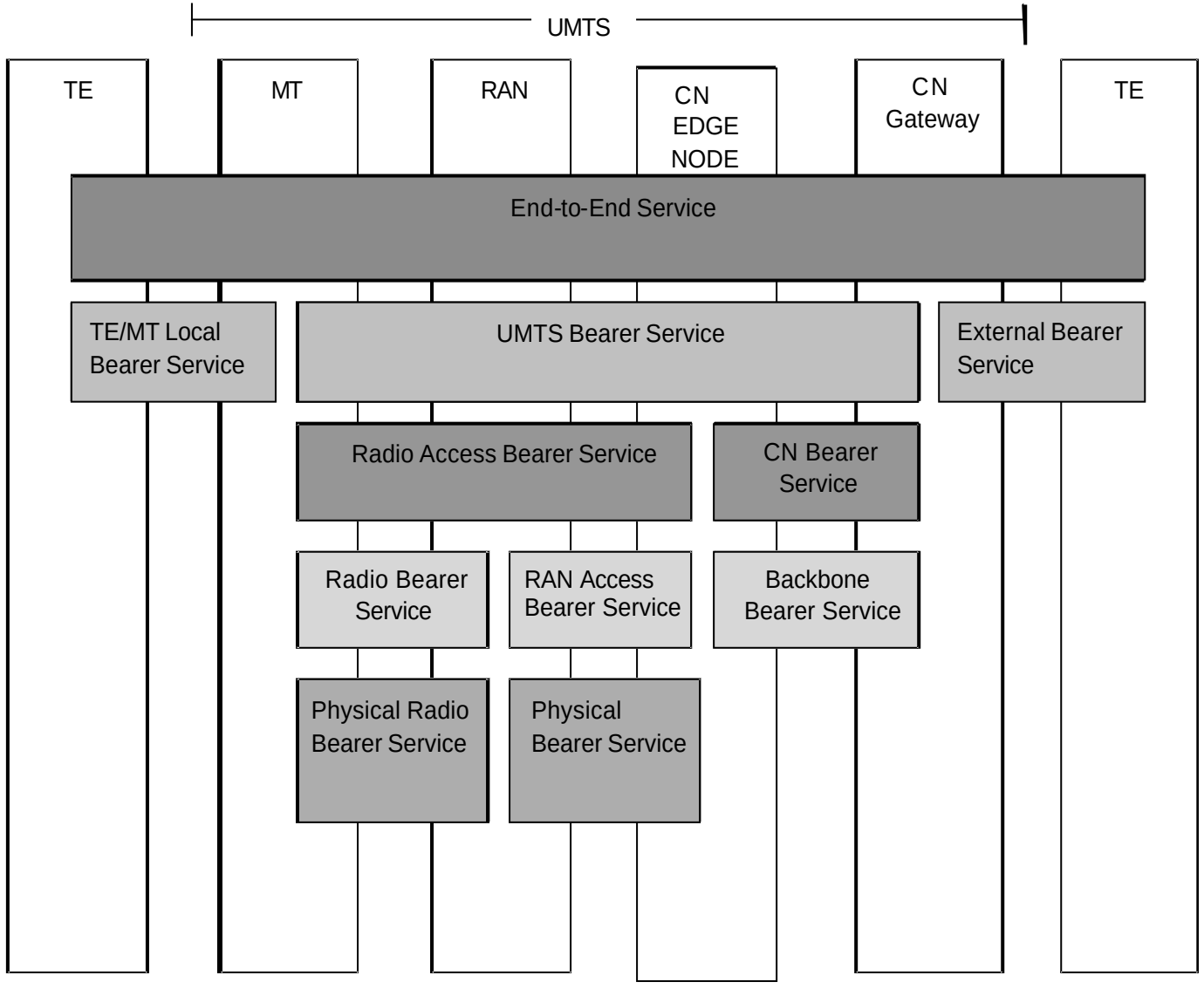
Introduction

- Mobile Network operators can support quality of service (QoS) sensitive IP applications like voice over IP (VoIP) and streaming over UMTS Packet Switched (PS) domain.
- In the designing of 3G network QoS was taking in account from the very beginning.
- WLAN original target was for home access with a very tight mobility.
- QoS was not a study item of WLAN. Now when WLAN started to be used in public places as Airports some user differentiation and most important service differentiation and prioritisation is needed.

3G QoS Architecture

1. The *End-to-End-Service* used by the TE will be realised using a *TE/MT Local Bearer Service*, a *UMTS Bearer Service,* and an *External Bearer Service*.
2. The *Radio Access Bearer Service* provides confidential transport of signalling and user data between MT and CN Edge Node with the QoS adequate to the negotiated UMTS Bearer Service or with the default QoS for signalling.
3. The *Core Network Bearer Service* of the UMTS core network connects the UMTS CN Edge Node with the CN Gateway to the external network



UMTS QoS Classes

When defining the UMTS QoS classes, also referred to as traffic classes, the restrictions and limitations of the air interface have to be taken into account. It is not reasonable to define complex mechanisms as have been in fixed networks due to different error characteristics of the air interface

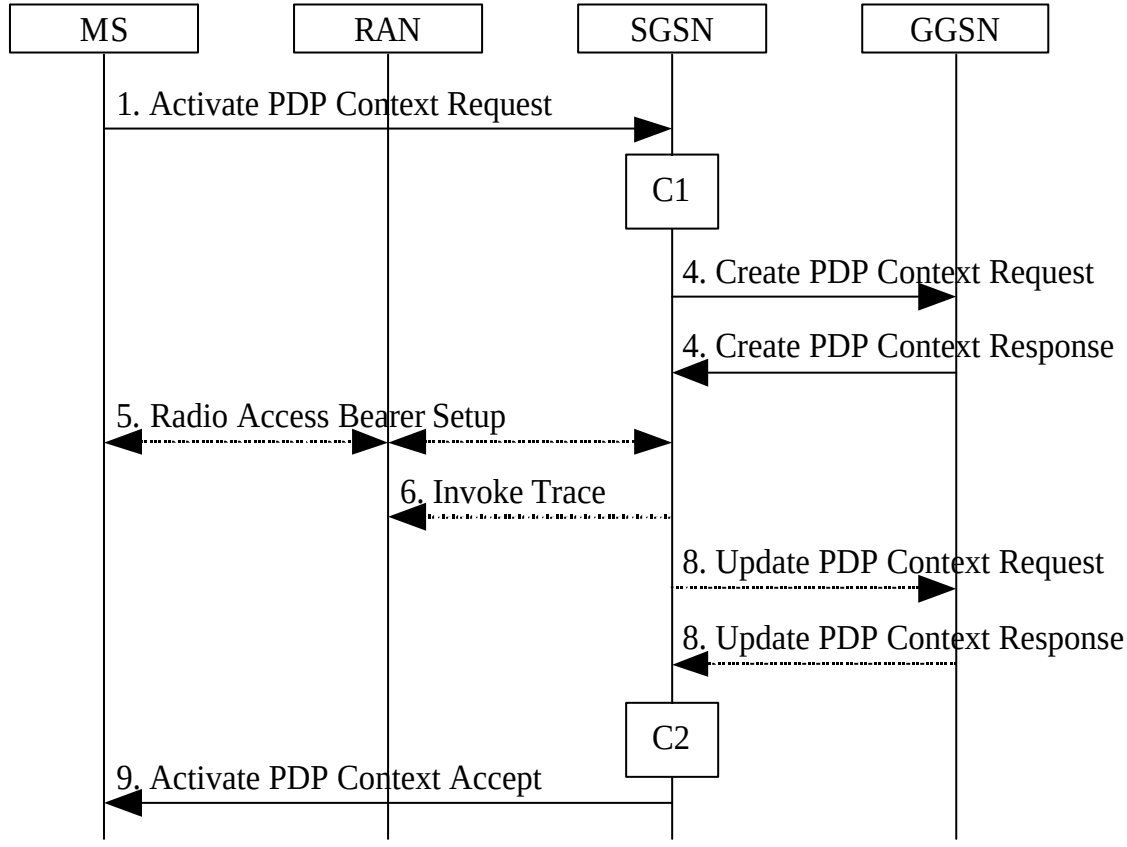
Traffic class	**Conversational class conversational RT**	**Streaming class streaming RT**	**Interactive class Interactive best effort**	**Background Background best effort**
Fundamental characteristics	- Preserve time relation (variation) between information entities of the stream Conversational pattern (stringent and low delay)	- Preserve time relation (variation) between information entities of the stream	- Request respond pattern - Preserve payload content	- Destination is not expecting the Des data within a certain time - Preserve payload content
Example of the application	- voice	- Streaming video	- Web browsing	- Background download of e-mail

3G Attributes per Traffic Class

Traffic class	Conversational class	Streaming class	Interactive class	Background class
Maximum bitrate	X	X	X	X
Delivery order	X	X	X	X
Maximum SDU size	X	X	X	X
SDU format information	X	X		
SDU error ratio	X	X	X	X
Residual bit error ratio	X	X	X	X
Delivery of erroneous SDUs	X	X	X	X
Transfer delay	X	X		
Guaranteed bit rate	X	X		
Traffic handling priority			X	
Allocation/Retention priority	X	X	X	X
Source statistics descriptor	X	X		
Signalling indication			X	

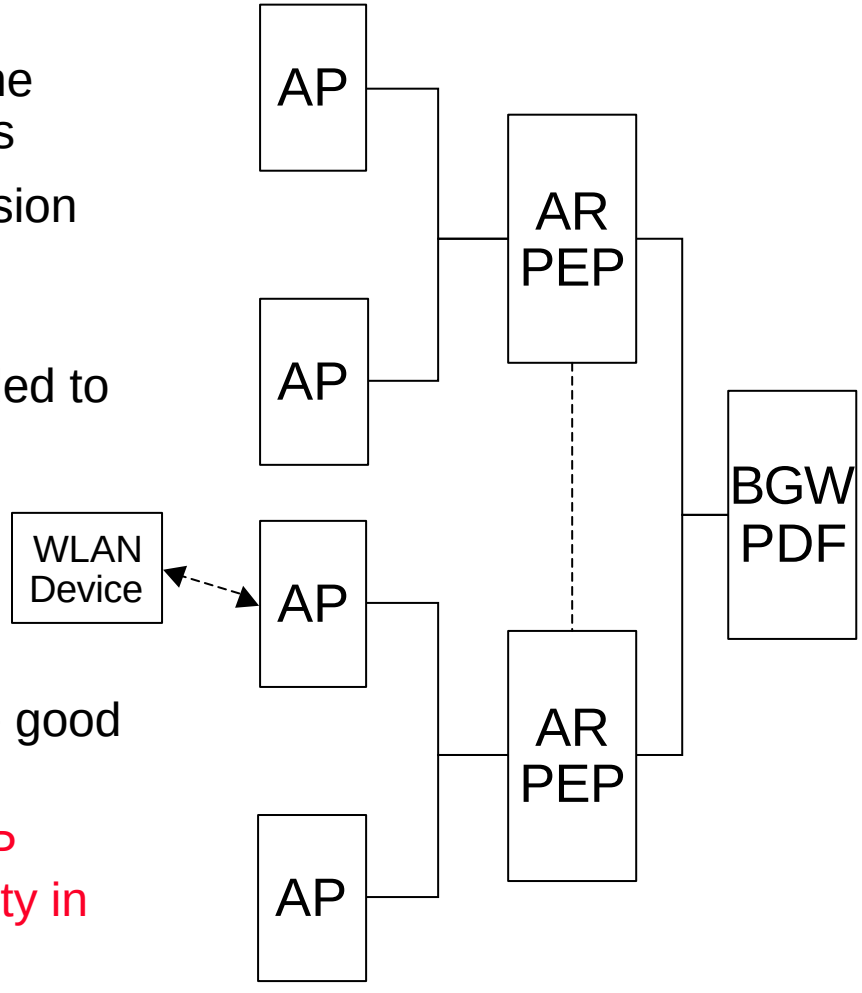
3G Activation PDP Context Procedure

- Assumptions
  1. *Authentication had been successfully*
  2. *Mobile station (MS) is in GPRS attach stated*
- Before the MS can send/receive any packet a PDP context needs to be activated. This PDP context is associated to an Access Point.
- Within the activation PDP context request message all/partial QoS parameters are included.
- The network checks the bandwidth/resources available in every component before accepted message to the MS can be sent.
- In case that some component does not have resource to support the requested QoS; the negotiated QoS can be smaller than the requested. It is up to the MS to accept the new negotiated QoS or not.



QoS architecture in WLAN

- In this architecture is assumed that Diffserv. is supported including queuing and scheduling in all network elements. Also a tunnel between WLAN device and BGW is used.
- Policy enforcement point (PEP) should have the information of the WLAN devices under its APs
- Policy decision function (PDF) is where a decision of accepting a new WLAN device in the whole Domain is done (QoS negotiation).
- Communication channel between PEP is needed to support better mobility between AR (Access Routers).
- In WLAN is very difficult to guarantee any bandwidth, delay or jitter because of the unexpected interferences that may occur. Wherever, with a good network planning some good QoS support could be provided.
- In order to provide QoS support, all existing AP should be changed. Moreover extra functionality in Access routers is needed."



Analysis of the existing approaches of 3G-WLAN interworking

Three types of WLAN-3G interworking architecture have been developed:

1. Different Radio Access Networks connected to 3G SGSN
2. Connecting both access network to a common already existing 3G GGSN
3. Mobile IP: Connection through any access network to your Home Agent (HA)

Different Radio Access Networks connected to 3G SGSN (1)

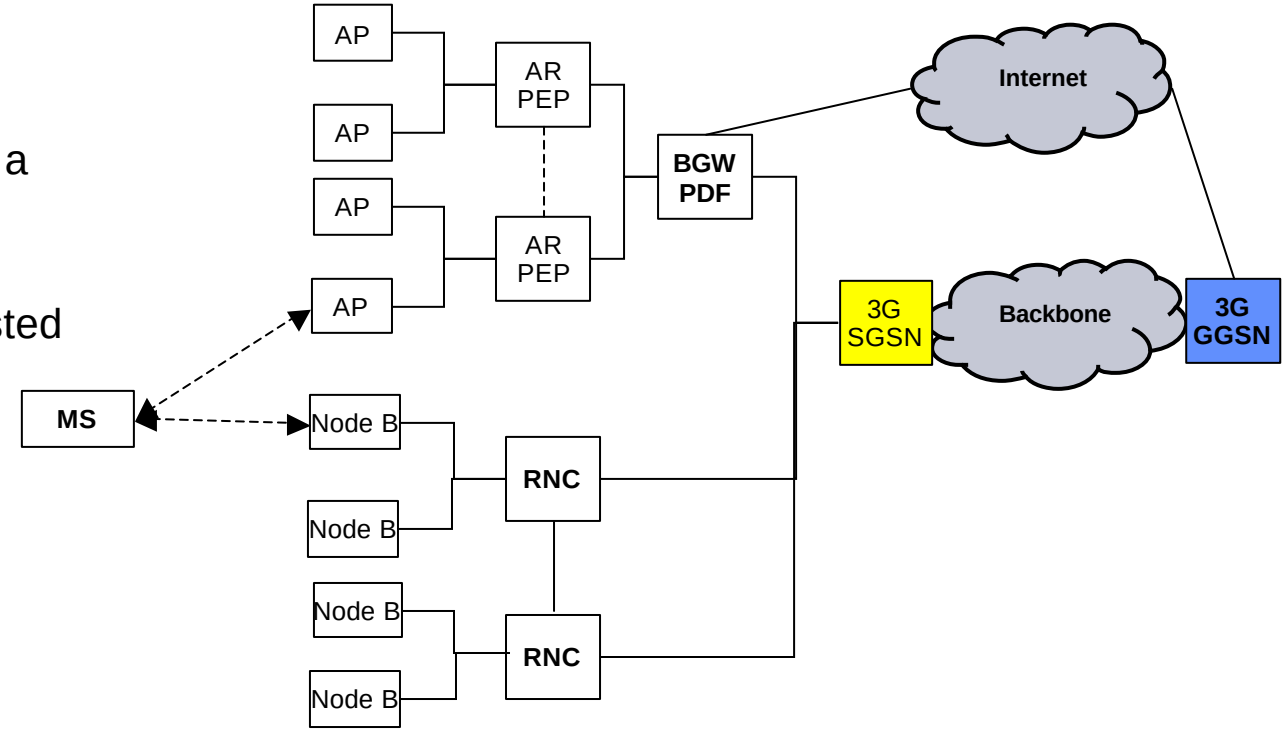
A) Connecting the BGW/PDF from WLAN to the 3G SGSN

In this case the QoS Policy Management is done as 3G network.

WLAN BGW/PDF is acting as a normal RNC for 3G.

3G SGSN negotiates the best access network for the requested QoS with the MS.

If MS does not want uses 3G Network it can still use WLAN QoS Policy Management

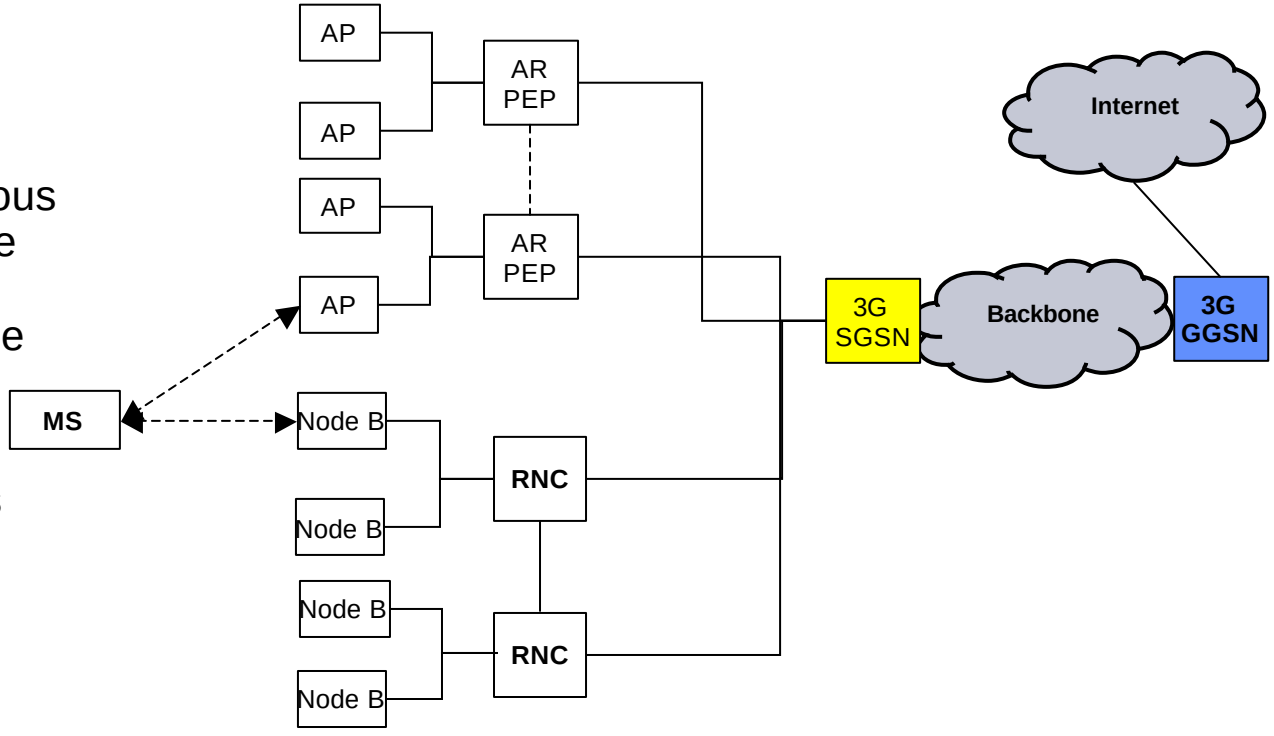


Different Radio Access Networks connected to 3G SGSN (2)

B) Connecting the AR/PEP from WLAN to the 3G SGSN

The difference from the previous architecture is that in this case the only way of connecting to internet services is through the 3G network.

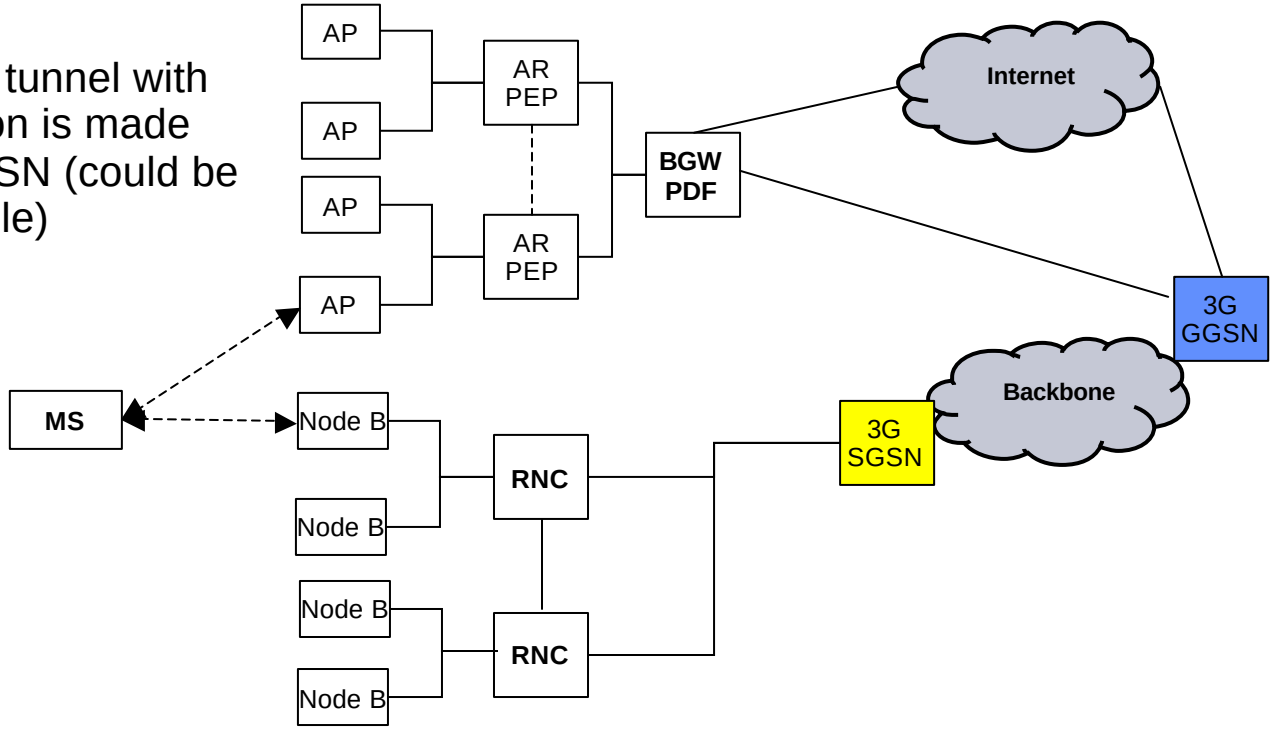
From QoS point of view this architecture limits the access capacity to the capacity of 3G network elements.



Connecting both access network to a common already existing 3G GGSN

In this case the MS can be connected to 3G system or directed to Internet.

BGW/PDF can have a tunnel with GGSN. QoS negotiation is made between PDF and GGSN (could be PDP context QoS profile)

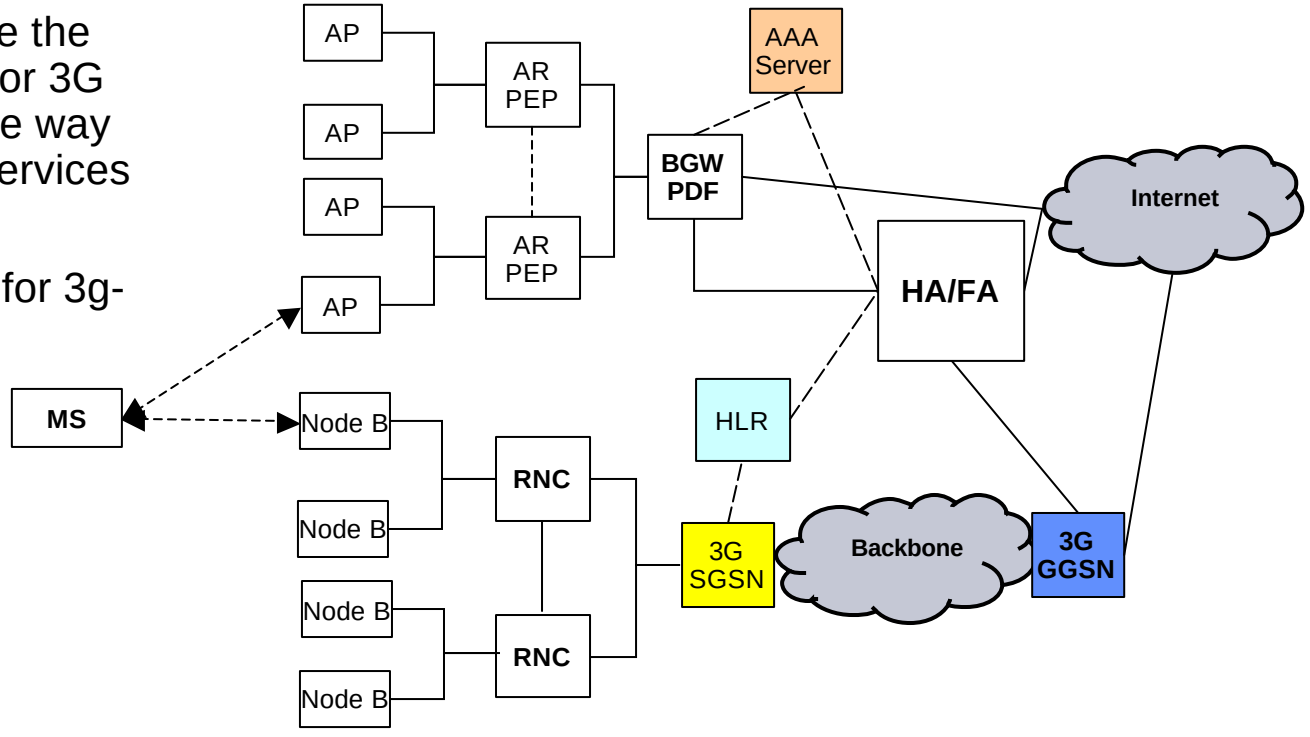


Mobile IP: Connection through any access network to your Home Agent (HA)

In the case of mobile IP the HA/FA will negotiate with the mobile the QoS parameters for each access network for these services that the MS is ready to get without taking in account the type of access network.

At the same time MS can use the normal 3G QoS negotiation for 3G services only and in the same way with WLAN PDF for WLAN services only.

This is the most flexible way for 3g-WLAN interworking.



Summary

- 3G WAS designed to support QoS. 3G was designed to support different type of services including real time services.
- WLAN was not designed to support real time services,
- Using unlicensed frequencies in WLAN makes it very difficult to support real time services.
- Three different architecture of interworking between WLAN and 3G system have been analysed.
- 3GPP is making a big effort to standardize an architecture of interworking between WLAN-3G taking in account only Operators interest.
- Mobile IP seems to be the best solution for 3G-WLAN interworking. One of the most important advantages of mobile IP is the flexibility.

References

1. Wei Zhuang, Yung-Sze Gan, Kok-Jeng Loh and Kee-Chaing Chua.; Policy-Based QoS Management Architecture in an Integrated UMTS and WLAN Environment.
2. Dave Wisely, Philip Eardley and Louise Burness; IP for 3G Networking Technologies for Mobile Communications.
3. 3GPP, “Group Services and Systems Aspects; 3GPP systems to Wireless Local Area Network (WLAN) Interworking; System Description (release 6)“, TS 23.234 v2.4.0
4. 3GPP, “3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General Packet Radio Services (GPRS); service description (release 6)” , TS 23.060 v6.2.0
5. 3GPP, “3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Quality of Service (QoS) concept and architecture (release 5)” , TS 23.107 v5.10.0
6. 3GPP, “3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; End-to-end Quality of Service (QoS) concept and architecture (release 6)”, TS 23.207 v6.0.0
7. ftp://ftp.3gpp.org/Specs/latest/Rel-6/23_series/ (Link for the 3GPP uses references)

Home work

1. What are MBR, GBR, THP and ARP in 3G QoS? Describe their uses (hint reference 5).
2. If Mobile IP is used as in slide 13, Is it possible to do seamless handover between 3G-WLAN for real time services? Why?