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Regulation of Bearer / Service Flow Selection for Voice over Packet Switched Wireless Networks

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- QoS Framework in 4G Networks.
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Introduction

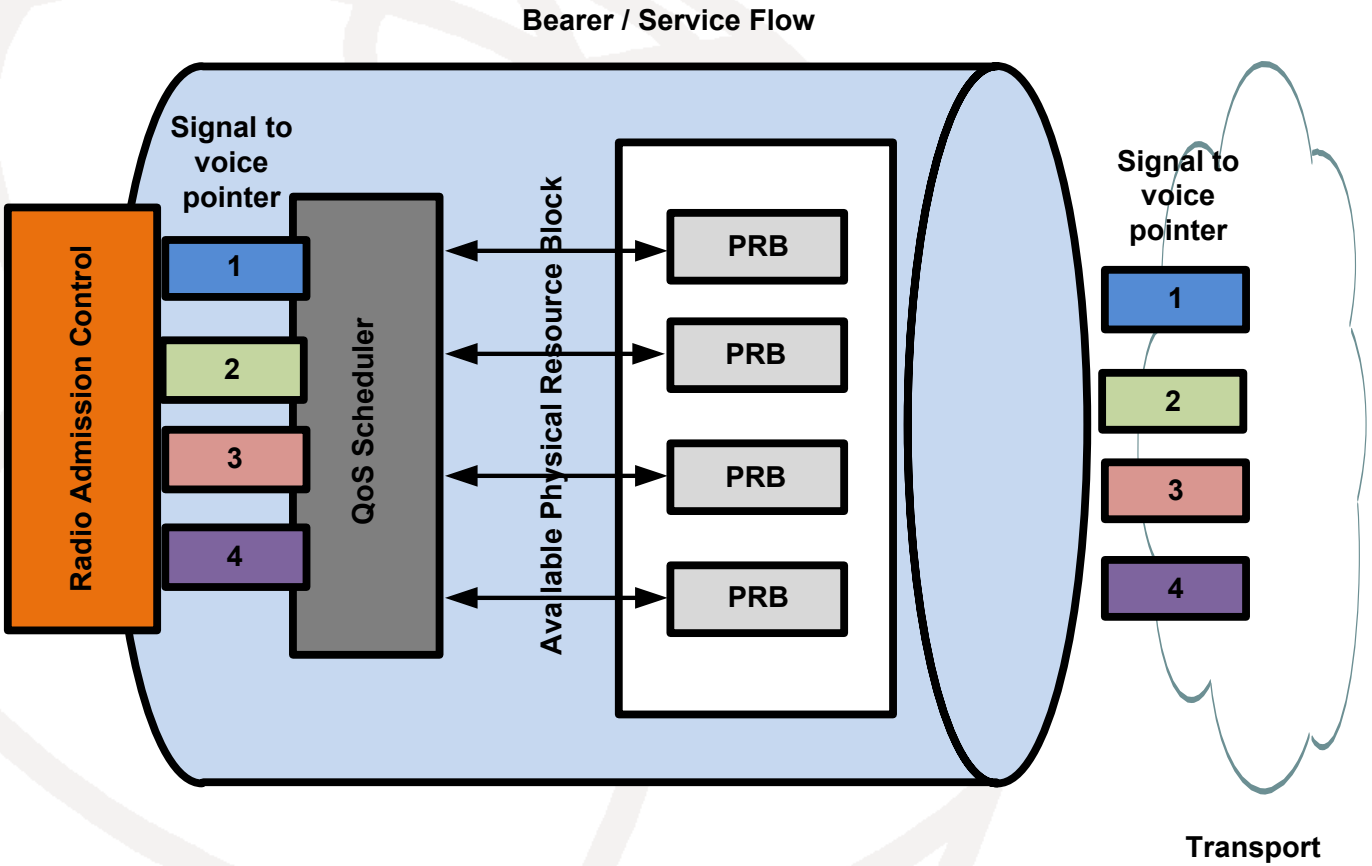
- The QoS provisioning for voice in a packet radio network is difficult because of tight delay, jitter and packet loss demands.
  - Above combined with scarcity of radio resources during bursts of mixed traffic makes quality voice a challenge.
- This Paper investigates the standardisation of QoS metrics for voice across network domains.

Problem Statement

- The goal of this paper is to highlight options available that will enable quality voice over packet switched wireless networks.

In order to carry good quality voice the appropriate physical resources need to be made available above all other traffic classes.

Resource Management Framework for Voice



QoS Framework in 4G Networks LTE

QCI	Resource Type	Priority	Packet Delay Budget	Packet Error Loss Rate
1	GBR	2	100ms	10^{-2}
2	GBR	4	150ms	10^{-3}
3	GBR	3	50ms	10^{-3}
4	GBR	5	300ms	10^{-6}
5	Non-GBR	1	100ms	10^{-6}
6	Non-GBR	6	300ms	10^{-6}
7	Non-GBR	7	100ms	10^{-3}
8	Non-GBR	8	300ms	10^{-6}
9	Non-GBR	9	300ms	10^{-6}

GBR - Guaranteed Bit Rate Bearer, and;
Non-GBR - Non-Guaranteed Bit Rate Bearer.

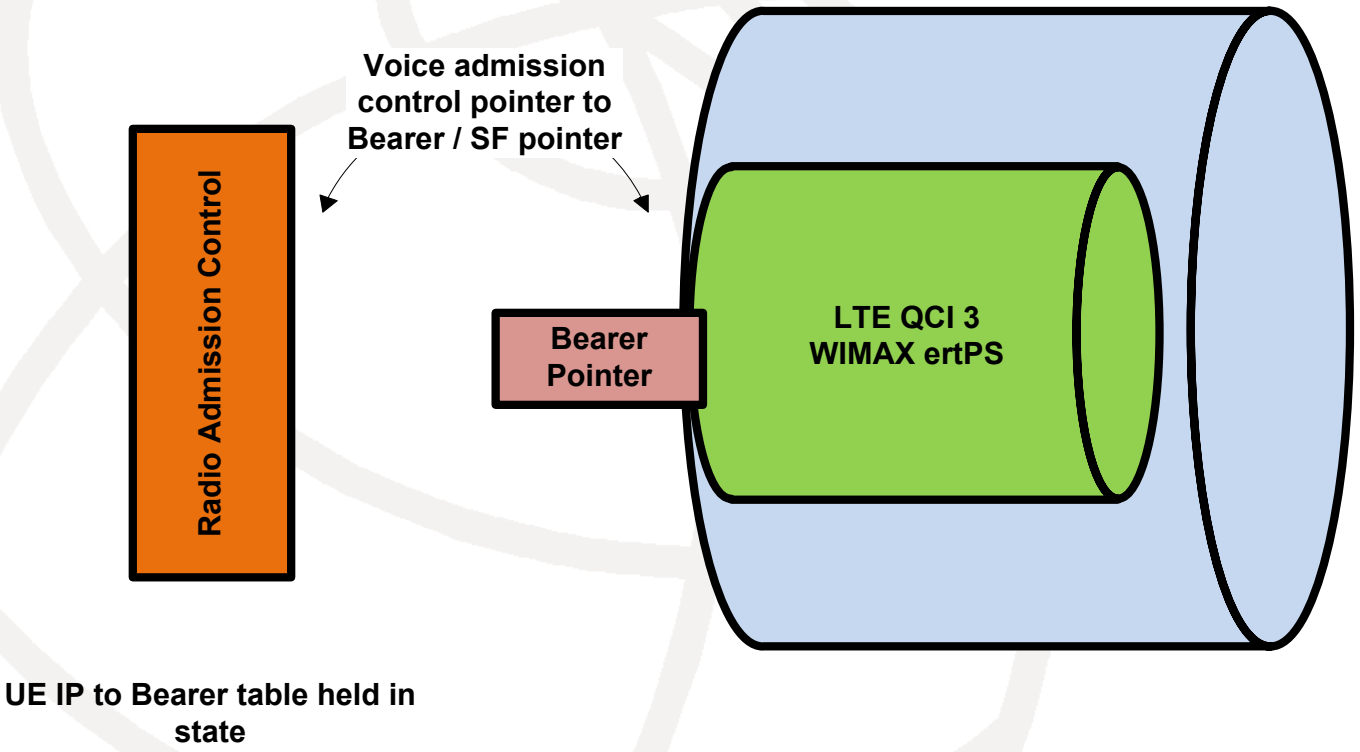
QoS Framework in 4G Networks IEEE 802.16e (WiMAX)

Service Flow Type	MRTR	MSTR	Max Latency	Max Jitter	Traffic Priority
UGS		X	X	X	
ertPS	X	X	X	X	X
rtPS	X	X	X		X
nrtPS	X	X			X
BE		X			X

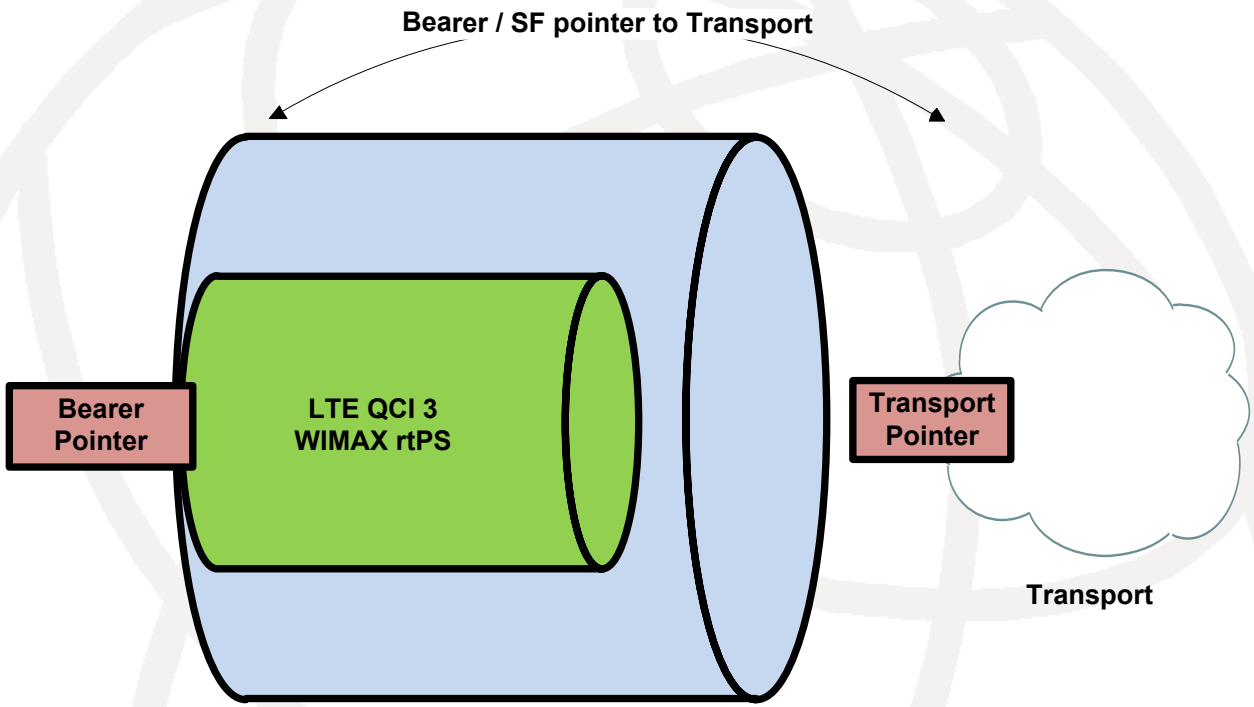
MRTR - Minimum Reserved Traffic Rate;
Max Latency - Maximum packet delay over the air interface;
UGS - Unsolicited Grant Service;
rtPS - real time Polling Service;
BE - Best Effort.

MSTR - Maximum Sustained Traffic Rate;
Max Jitter - Maximum packet variation delay;
ertPS - enhanced real time Polling Service;
nrtPS - non-real time Polling Service, and;

Admission Control to Bearer / Service Flow Resource Mapping



Bearer Resource to Transport Mapping



Diffserv Code Point (DSCP) to LTE QCI and WiMAX SF mapping

DSCP	QCI	Service Flow
EF	1, 2, 3	UGS, ertPS
AF4	5, 7	rtPS
AF3	4	rtPS
AF2	6	nrtPS
AF1	8	nrtPS
BE	9	BE

EF - Expedited Forwarding;
AF4 - Assured Forwarding Class 4;
AF3 - Assured Forwarding Class 3;
AF2 - Assured Forwarding Class 2;
AF1 - Assured Forwarding Class 1, and;
BE - Best Effort.

Voice QoS Classification Across Network Domains

- $p_{domain\,1} + p_{domain\,2} + p_{domain\,3} \leq 0.25\%$

$$j_{domain\,1} + j_{domain\,2} + j_{domain\,3} \leq 5\ ms$$

$$d_{domain\,1} + d_{domain\,2} + d_{domain\,3} \leq 150\ ms$$

Where:

p – Maximum packet loss for an end to end call;
j – Maximum packet jitter for an end to end call, and;
d – Maximum packet delay for an end to end call.

Using LTE QCI Metrics as an example.

***fp* – sum of the maximum packet loss for a network domain in relation to the overall maximum packet loss;**
***fd* – sum of the maximum packet delay for a network domain in relation to the overall maximum packet loss,**

QCI	Packet Delay Budget	Packet Error Loss Rate	f_d	f_p
1	100ms	10^{-2}	0.67	4
2	150ms	10^{-3}	1	0.4
3	50ms	10^{-3}	0.33	0.4
4	300ms	10^{-6}	2	0.0004

Summary and Conclusions

- Quality voice over next generation wireless networks vital to operators.
- Standardisation of voice specific QoS structures across network domains.
- This paper proposes a factor (*f*) that provide operators and system integrators an indication of the preferred QoS service flows that can be used for voice.

THANK YOU!
Q & A

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