3GPP TSG SA WG2 Architecture — S2#48 **S2-052339**
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Source:	**Cingular Wireless, T-Mobile**
Title:	**Use of CoS based DiffServ for providing QoS over I-WLAN using 3GPP IP Access**
Document for:	**Discussion and Decision**
Agenda Item:	**7.5**
Work Item / Release:	**I-WLAN / Rel-7**

Following is a technically agreed document from the last SA2 meetings. The figures and tables that were copied from other specification have now been redrawn.

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Conclusion

It is proposed to include the aforementioned text to appropriate sections within the TR.

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1st Change

2 References

[7] IEEE 802.1D, 1998 Edition (ISO/IEC 15802-3:1998), IEEE Standard for Information technology--Telecommunications and information exchange between systems--IEEE standard for local and metropolitan area networks--Common specifications--Media access control (MAC) Bridges

[8] IEEE 802.11e [draft]

2nd Change

3.2 Symbols

WMM	Wi-Fi Multimedia
CoS	Class of Service

3rd Change

5.1 Architecture for QoS support

5.1.1 General

Figure 5.1 shows the considered QoS architecture for WLAN Direct IP Access.

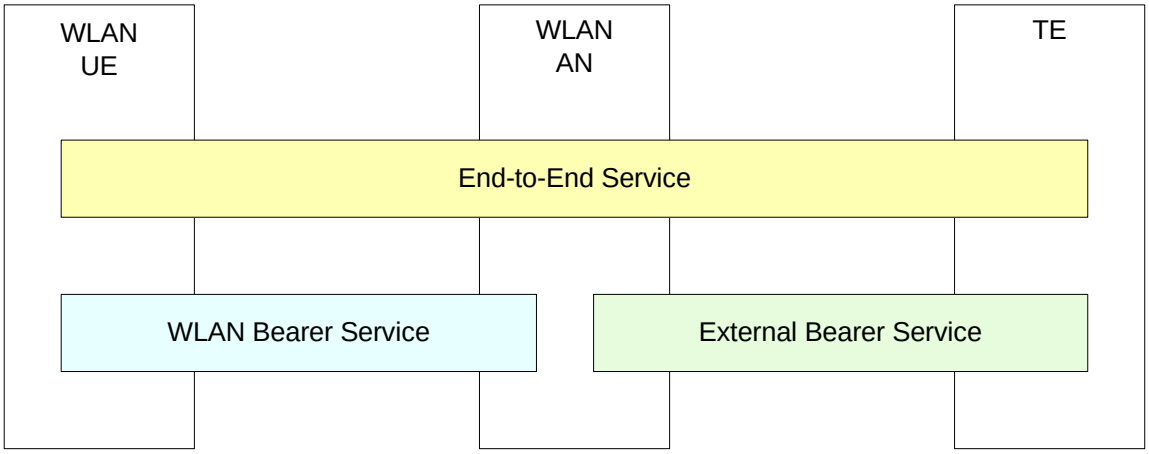


Figure 5.1 QoS Architecture for WLAN Direct IP Access

Figure 5.2 shows the considered QoS architecture for WLAN 3GPP IP Access.

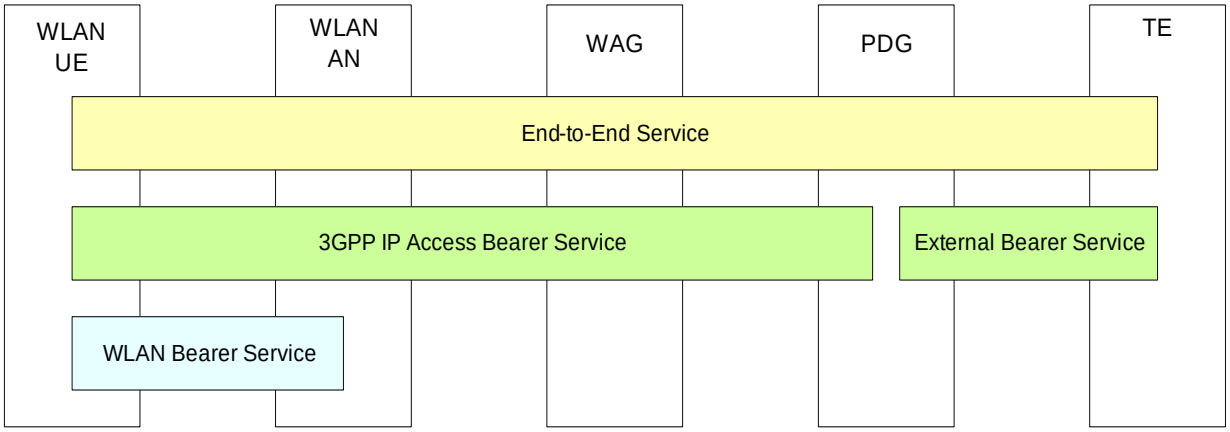


Figure 5.2 QoS Architecture for WLAN 3GPP IP Access

The End-to-End Service provides transport of the signalling and user data between the WLAN UE and another (external) TE (or correspondent node) passed over different bearer services of the network. In case of WLAN Direct IP Access, it consists of WLAN Bearer Service and External Bearer Service. In case of WLAN 3GPP IP Access, it consists of 3GPP IP Access Bearer Service and External Bearer Service.

The External Bearer Service is not further elaborated here as this bearer may be using several network services, e.g. another UMTS Bearer Service (TS 23.107 [6]). The 3GPP IP Access Bearer Service provides transport of signalling and user data between WLAN UE and PDG and supports I-WLAN QoS.

WLAN Bearer Service supports WLAN AN specific bearer capability between WLAN UE and WLAN AN.

5.1.2 Use of CoS based DiffServ for providing QoS over I-WLAN using 3GPP IP Access

When using 3GPP IP Access, a tunnel from UE to PDG is established for carrying 3GPP PS domain services traffic. This tunnel traverses over inter PLMN backbone (e.g. GRX) in the case of a roaming user. While accessing home network services, one or more tunnels will be setup that will carry traffic for all home network services that are being accessed irrespective of the level of QoS required for an individual service. It is possible that data for more than one IP flows and for different services is carried in one tunnel. Since the data within these tunnels (including the inside IP headers) is likely to be encrypted, it may not be possible to separate out individual IP flows and service traffic based on QoS at intermediate nodes.

A possible way to provide QoS in such a situation would be the use of DiffServ by the UE and PDG to appropriately colour the DiffServ bits in the external IP header based on the service that the individual packet belongs to. The DiffServ therefore will implement different classes of traffic to provide different levels of QoS. Such use of DiffServ mechanism works well with WMM guidelines from WiFi Alliance and GSMA's specifications on GRX (IR 34). WMM also provides a mapping from 802.11e priority categories to 802.1D priority levels. This mechanism is shown in Figure x.1. See Annex X for further details on these specifications.

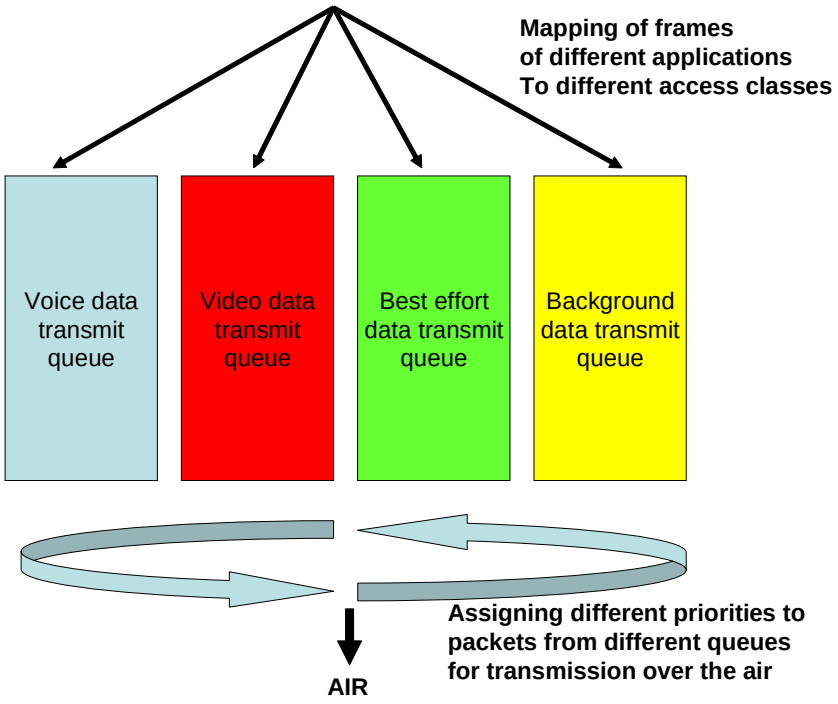


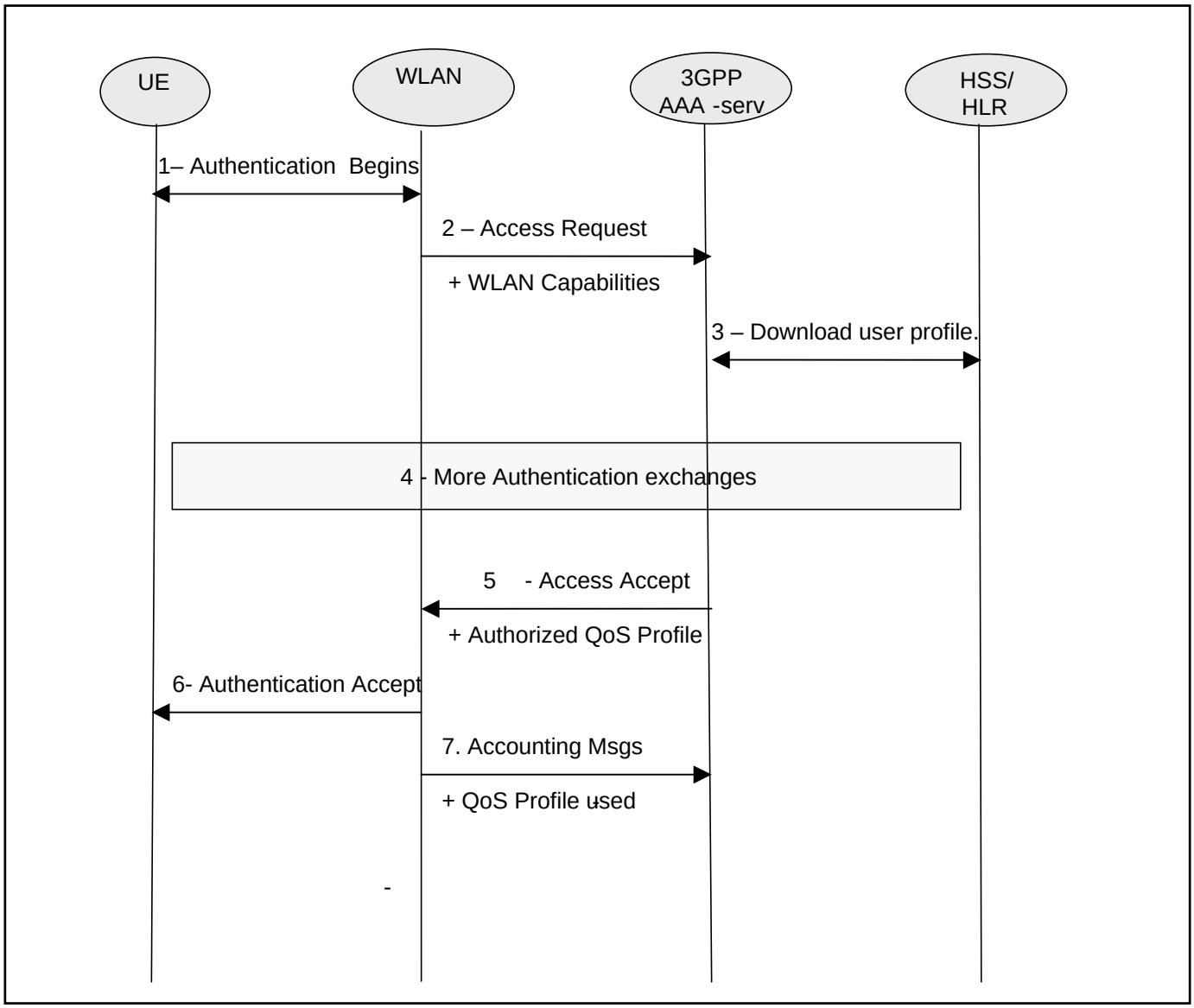
Figure x.1

Once the QoS provisioning has been accomplished during the authentication phase, based on the information included in Table 1 and Table 2 of Annex X, it is possible to map different types of QoS traffic from the home network to DSCP and then onwards to 802.1D tags and 802.11e classes in the WLAN. Similarly UE can appropriately mark the traffic in the reverse direction.

The provisioned QoS profile may include for example information on bandwidth allowed to the user and maximum DSCP allowed for the user. The points of enforcement of bandwidth policies within 3GPP system are FFS. Entities within WLAN can implement similar enforcement. Also the entities responsible for proper DSCP marking are the end points of the tunnel (namely the UE and the PDG). If there is an inconsistent marking of QoS request from UE between layer 2 and layer 3 (for fraudulent reasons or due to error), the inconsistency will be resolved in the favour of layer 3 marking once the packet enters the 3GPP system. This will be consistent with the 3GPP flow based charging architecture that operates at layer 3.

4th change

5.2.1 QoS Provisioning Call Flow



1. UE starts the Authentication process for WLAN access.

Note: This authentication process is not for accessing 3GPP PS domain services.

2. WLAN sends out its capabilities along with the user Access Request to 3GPP AAA server. Standardized techniques for capabilities exchange are FFS, e.g., based on draft-lior-radext-end-to-end-caps-00.txt, draft-lior-radius-bandwidth-capability-01

3. User QoS profile is downloaded into AAA Server from HLR/HSS

4. Authentication message exchanges occur per TS 33.234

5. The user request for access is accepted and Access Accept message along with the authorized QoS profile is sent by 3GPP AAA server to WLAN. Standardized techniques for including the QoS profile in AAA messages is FFS.

6. WLAN informs the UE of successful authentication

7. The accounting messages from WLAN include the QoS profile being used. Standardized techniques for including the QoS profile in AAA messages is FFS.

Note: While roaming, AAA proxy in the visited network will be in the path of AAA messages and will therefore have access to the authorized QoS profile in case of a successful authentication.

5th change

Annex X

WMM specifications from Wi-Fi Alliance

WMM defined by Wi-Fi Alliance, is a profile based on IEEE 802.11e draft specifications. WMM provides support for multimedia applications by defining four access categories derived from 802.1D specifications. These access categories as shown in the following table, map to priority levels in 802.1D specifications of IEEE.

Table 1

Access Category	802.1d Tags
WMM Voice Priority	**7,6**
WMM Video Priority	**5,4**
WMM Best Effort Priority	**0,3**
WMM Background Priority	**2,1**

802.1D specifications from IEEE

The IEEE 802.1D specification is the IEEE standard for bridges that also addresses how to prioritise different classes of user traffic at layer 2. Section 6.4 of 802.1D specifications provide the following definition of user priority,

*"The **user_priority** parameter is the priority requested by the originating service user. The value of this parameter is in the range 0 through 7.*

NOTE—The default user_priority value is 0. Values 1 through 7 form an ordered sequence of user_priorities, with 1 being the lowest value and 7 the highest. See 7.7.3 and Annex G (informative) for further explanation of the use of user_priority values."

Annex G in 802.1D specifications provide traffic class mapping as shown in the following Table 2.

Table 2Table 2

Number of queues in the system	Types/classes of traffic supported by the queues
1	{Best Effort, Excellent effort, Background, Voice, Controlled Load, Video, Network Control}
2	{Best Effort, Excellent effort, Background} {Voice, Controlled Load, Video, Network Control}
3	{Best Effort, Excellent effort, Background} {Controlled Load, Video} {Voice, Network Control}
4	{Background} {Best Effort, Excellent effort} {Controlled Load, Video}

5	{Voice, Network Control} {Background} {Best Effort, Excellent effort} {Controlled Load} {Video}
6	{Voice, Network Control} {Background} {Best Effort} {Excellent effort} {Controlled Load} {Video}
7	{Voice, Network Control} {Background} {Best Effort} {Excellent effort} {Controlled Load} {Video} {Voice} {Network Control}

Figure x.1 shows the mapping of 802.1D user priorities to various traffic classes defined under WMM's 802.11e profile.

IR 34 specifications from GSMA

GSMA's IREG 34 is a specification for the GRX. It also describes how DiffServ's bits are interpreted by the inter PLMN backbone (GRX). Table 3 shows this mapping.

Table 3

3GPP QoS Information		Diffserv PHB	DSCP	QoS Requirement on GRX				Service Example
Traffic Class	THP			Max Delay	Max Jitter	Packet Loss	SDU Error Ratio	
Conversational	N/A	EF	101110	20ms	5ms	0.5%	10^{-6}	VoIP, Video Conferencing
Streaming	N/A	$AF4_1$	100010	40ms	5ms	0.5%	10^{-6}	Audio/Video Streaming
Interactive	1	$AF3_1$	011010	250ms	N/A	0.1%	10^{-8}	Transactional Services
	2	$AF2_1$	010010	300ms	N/A	0.1%	10^{-8}	Web Browsing
	3	$AF1_1$	001010	350ms	N/A	0.1%	10^{-8}	Telnet
Background	N/A	BE	000000	400ms	N/A	0.1%	10^{-8}	E-mail Download