Source: **SA5 (Telecom Management)**

Title: **Rel-6 TS 32252-100 WLAN Charging - for SA Information**

Document for: **Information**

Agenda Item: **7.5.3**

3GPP TSG-SA5 (Telecom Management) S5-054182
Meeting #41, Lisbon, PORTUGAL, 24 - 28 January 2005

Presentation of Specification to TSG

Presentation to: **TSG SA Meeting #27**
Document for presentation: **TS 32.252, Version 1.0.0**
Presented for: **Information**

Abstract of document:

- TS 32.252 contains the 3GPP WLAN Charging specification for Rel-6.
- Work done against the WID contained in SP-040773 (Work Item ID: CH).

Changes since last presentation to TSG:
New

Outstanding Issues:

- Flow based charging for WLAN
- Data description for Direct IP Access.
- Further use cases for online and offline charging are needed.
- Roaming scenarios and charging for roaming scenarios need to be completed.
- Use of WLAN Access Gateway (WAG) for end use charging needs to be finalised.
- Correlation of charging information needs to be completed.

Target for TSG SA Approval remains: June 2005

Contentious Issues:
None

3GPP TS 32.252 V.1.0.0 (2005-03)

Technical Specification

3rd Generation Partnership Project;
Technical Specification Group Service and System Aspects;
Telecommunication management;
Charging management;
Wireless Local Area Network (WLAN) charging;
(Release 6)

Keywords

UMTS, charging, accounting, management,
WLAN

3GPP

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

http://www.3gpp.org

Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document is part of a series of documents that specify charging functionality and charging management in GSM/UMTS networks. The GSM/UMTS core network charging architecture and principles are specified in 3GPP TS 32.240 [1], which provides an umbrella for other charging management documents that specify:

- the content of the CDRs per domain and subsystem (offline charging);
- the content of real-time charging messages per domain / subsystem (online charging);
- the functionality of online and offline charging for those domains and subsystems;
- the interfaces that are used in the charging framework to transfer the charging information (i.e. CDRs or charging events).

The complete document structure for these TSs is defined in TS 32.240 [1].

The present document specifies the Offline and Online Charging description for the 3GPP interworked Wireless LAN (WLAN), based on the functional stage 2 description of 3GPP WLAN interworking in TS 23.234 [201]. This charging description includes the offline and online charging architecture and scenarios specific to the 3GPP interworked WLAN, as well as the mapping of the common 3GPP charging architecture specified in TS 32.240 [1] onto the 3GPP interworked WLAN. It further specifies the structure and content of the CDRs for offline charging, and the charging events for online charging. The present document is related to other 3GPP charging TSs as follows:

- The common 3GPP charging architecture is specified in TS 32.240 [1];
- The parameters, abstract syntax and encoding rules for these CDR types are specified in TS 32.298 [51];
- A transaction based mechanism for the transfer of CDRs within the network is specified in TS 32.295 [54];
- The file based mechanism used to transfer the CDRs from the network to the operator's billing domain (e.g. the billing system or a mediation device) is specified in TS 32.297 [52];
- The 3GPP Diameter application that is used for WLAN offline and online charging is specified in TS 32.299 [50].

All references, abbreviations, definitions, descriptions, principles and requirements, used in the present document, that are common across 3GPP TSs, are defined in the 3GPP Vocabulary, TR 21.905 [100]. Those that are common across charging management in GSM/UMTS domains or subsystems are provided in the umbrella document TS 32.240 [1] and are copied into clause 3 of the present document for ease of reading. Finally, those items that are specific to the present document are defined exclusively in the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

a) The 3GPP charging specifications

[1] 3GPP TS 32.240: "Telecommunication management; Charging management; Charging Architecture and Principles".

[2]-[9] Void.

[10] 3GPP TS 32.250: "Telecommunication management; Charging management; Circuit Switched (CS) domain charging".

[11] 3GPP TS 32.251: "Telecommunication management; Charging management; Packet Switched (PS) domain charging".

[12]-[19] Void.

[20] 3GPP TS 32.260: "Telecommunication management; Charging management; IP Multimedia Subsystem (IMS) charging".

[21]-[29] Void.

[30] 3GPP TS 32.270: "Telecommunication management; Charging management; Multimedia Messaging Service (MMS) charging".

[31] 3GPP TS 32.271: "Telecommunication management; Charging management; Location Services (LCS) charging".

[32]-[49] Void.

[50] 3GPP TS 32.299: "Telecommunication management; Charging management; Diameter charging application".

[51] 3GPP TS 32.298: "Telecommunication management; Charging management; Charging Data Record (CDR) parameter description".

[52] 3GPP TS 32.297: "Telecommunication management; Charging management; Charging Data Records (CDR) file format and transfer".

[53] 3GPP TS 32.296: "Telecommunication management; Charging management; Online Charging System (OCS) applications and interfaces".

[54] 3GPP TS 32.295: "Telecommunication management; Charging management; Charging Data Record (CDR) transfer".

[55]-[69] Void.

b) other charging specifications

[70] ITU-T Recommendation D.93: "Charging and accounting in the international land mobile telephone service (provided via cellular radio systems)".

[71] 3GPP TS 23.125: "Overall High Level Functionality and Architecture Impacts of Flow Based Charging; Stage 2”

[72]-[99] Void.

c) Common 3GPP specifications

[100] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[101] 3GPP TS 22.101: "Service aspects; Service Principles".

[102] 3GPP TS 22.115: "Service aspects; Charging and billing".

[103] 3GPP TS 23.002: "Network Architecture".

[104] 3GPP TS 23.003: "Numbering, addressing and identification".

[105] 3GPP TS 27.001: "General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[106]-[199] Void.

d) other Domain and Service specific 3GPP / ETSI specifications

[200] 3GPP TS 22.934: "Feasibility study on 3GPP system to WLAN interworking".

[201] 3GPP TS 23.234: "3GPP system to Wireless Local Area Network (WLAN) Interworking Subsystem; System Description".

[202] 3GPP TS 23.934: “3GPP system to WLAN Interworking; Functional and architectural definition”.

[203] 3GPP TS 24.234: “3GPP System to WLAN Interworking; UE to Network protocols; Stage 3”.

…. Editor’s note: to be completed

[2xy]-[299] Void.

e) Relevant ITU Recommendations

[300] ITU-T Recommendation D.93: "Charging and accounting in the international land mobile telephone service (provided via cellular radio systems)".

[301]-[309] Void.

[310] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".

[311]-[329] Void.

[330] ITU-T Recommendation Q.767: "Application of the ISDN user part of CCITT signalling System No.7 for international ISDN interconnections".

[331]-[349] Void.

[350] ITU-T Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

[351] ITU-T Recommendation X.121: "International numbering plan for public data networks".

[351352]-[399] Void.

f) Relevant IETF RFCs

[400] IETF RFC 959 (1985): "File Transfer Protocol".

[401] RFC 3588: “diameter base protocol”.

[402] IETF Internet-Draft “Diameter Credit Control Application”.

[403] IETF RFC 783: "Trivial File Transfer Protocol (TFTP)".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions given in 3GPP TR 21.905 [50], 3GPP TS 32.240 [1], 3GPP TS 22.934 [200] and 3GPP TS 23.234 [201] and the following apply:

Billing Domain: Part of the operator network, which is outside the core network, that receives and processes charging information from the core network charging functions. It includes functions that can provide billing mediation and billing end applications.

Offline Charging:

Online Charging:

PS based services: In WLAN interworking, PS based service is a general term to refer to the services provided by a PLMN using IP bearer capability between WLAN UEs and the PLMN in scenario 3 and upwards. They include all services provided by 3G PS domain that use the IP bearer service, (e.g., IMS, Internet access, Corporate IP network access), and other services (e.g., SMS and LCS).

WLAN:

WLAN-attach status: indicates whether a UE is WLAN-attached or not. A WLAN UE is “WLAN-attached” after successful authentication and WLAN Access Authorization. A WLAN UE is “WLAN-detached” after its disconnection, or its authentication or WLAN access authorisation being cancelled.

Editor’s Note: to be completed

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Rf
Ro

D'	Reference point between a pre-R6 HSS/HLR and a 3GPP AAA Server
Dw	Reference point between a 3GPP AAA Server and an SLF
Gr'	Reference point between a pre-R6 HSS/HLR and a 3GPP AAA Server
Wa	Reference point between a WLAN Access Network and a 3GPP AAA Server/Proxy (charging and control signalling)
Wd	Reference point between a 3GPP AAA Proxy and a 3GPP AAA Server (charging and control signalling)
Wf	Reference point between an Offline Charging System and a 3GPP AAA Server/Proxy
Wg	Reference point between a 3GPP AAA Server/Proxy and WAG
Wi	Reference point between a Packet Data Gateway and an external IP Network
Wm	Reference point between a Packet Data Gateway and a 3GPP AAA Server or 3GPP AAA proxy
Wn	Reference point between a WLAN Access Network and a WLAN Access Gateway
Wp	Reference point between a WLAN Access Gateway and a Packet Data Gateway
Wo	Reference point between a 3GPP AAA Server and an OCS
Wu	Reference point between a WLAN UE and a Packet Data Gateway
Wx	Reference point between an HSS and a 3GPP AAA Server

Editor’s Note: to be completed

3.3 Abbreviations

For the purposes of the present document, the abbreviations defined in 3GPP TR 21.905 [50], 3GPP TS 22.934 [200], 3GPP TS 23.234 [201], 3GPP TS 23.934, 3GPP TS 32.240 [1] and the following apply:

3GPP	3rd Generation Partnership Project
BD	Billing Domain
CDR	Charging Data Record
IP	Internet Protocol
LAN	Local Area Network
PS	Packet Switched
TS	Technical Specification
UMTS	Universal Mobile Telecommunications System
WLAN	Wireless LAN

Editor's Note: to be completed.
How do we treat this (for all TSs)? As all the abbreviations are either in the reference TSs from other groups, or in TS 32.240. List them here anyway, or just provide references?

4 Architecture considerations

4.1 High level WLAN architecture

The WLAN – 3GPP interworking architecture is specified in 3GPP TS 23.234 [201]. It distinguishes between two interworking scenarios:

- WLAN Access, Authentication and Authorisation, which provides for access to the WLAN and the locally connected IP network (e.g. Internet) to be authenticated and authorised through the 3GPP System. Access to a locally connected IP network from the WLAN, is referred to as WLAN Direct IP Access.
- WLAN 3GPP IP Access, which allows the WLAN UEs to establish connectivity with External IP networks, such as 3G operator networks, corporate Intranets or the Internet via the 3GPP system.

  WLAN Access Authentication and Authorisation and WLAN 3GPP IP Access are technically independent.

Figure 4.1.1 illustrates the basic WLAN networks from the point of view of 3GPP interworking.

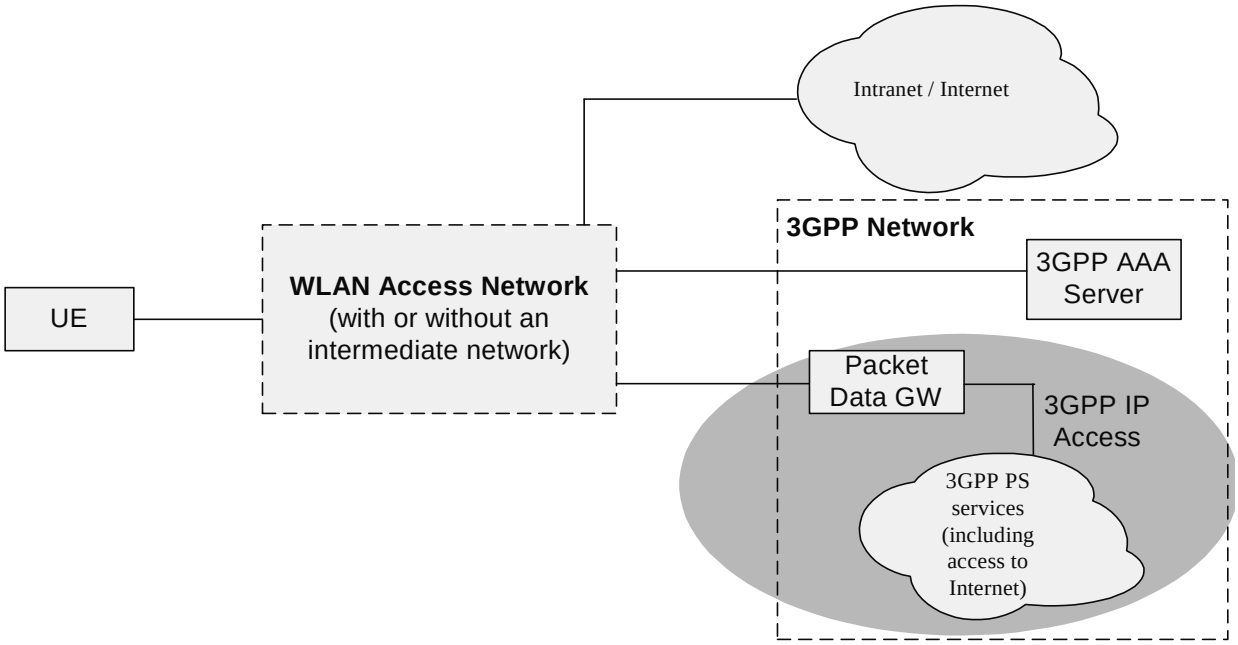
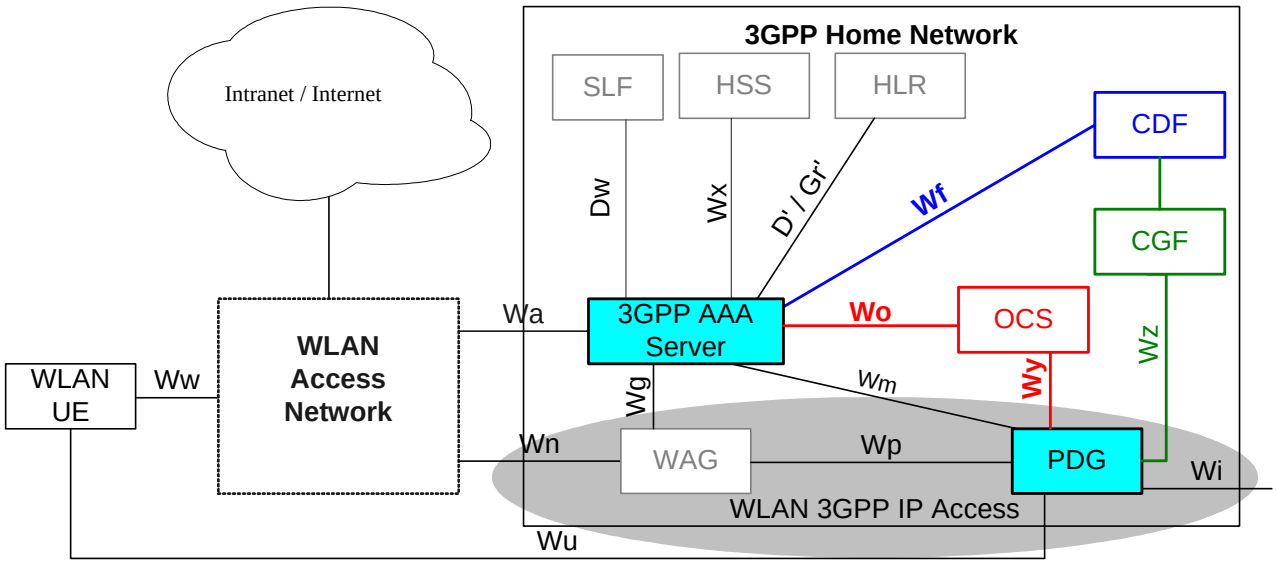


Figure 4.1.1 : Simplified WLAN Network Model
(the shaded area refers to WLAN 3GPP IP Access functionality)

The Packet Data Gateway supports WLAN 3GPP IP Access to External IP networks. The WLAN includes WLAN access points and intermediate AAA elements. It may additionally include other devices such as routers. The WLAN User Equipment (WLAN UE) includes all equipment that is in possession of the end user, such as a computer, WLAN radio interface adapter etc.

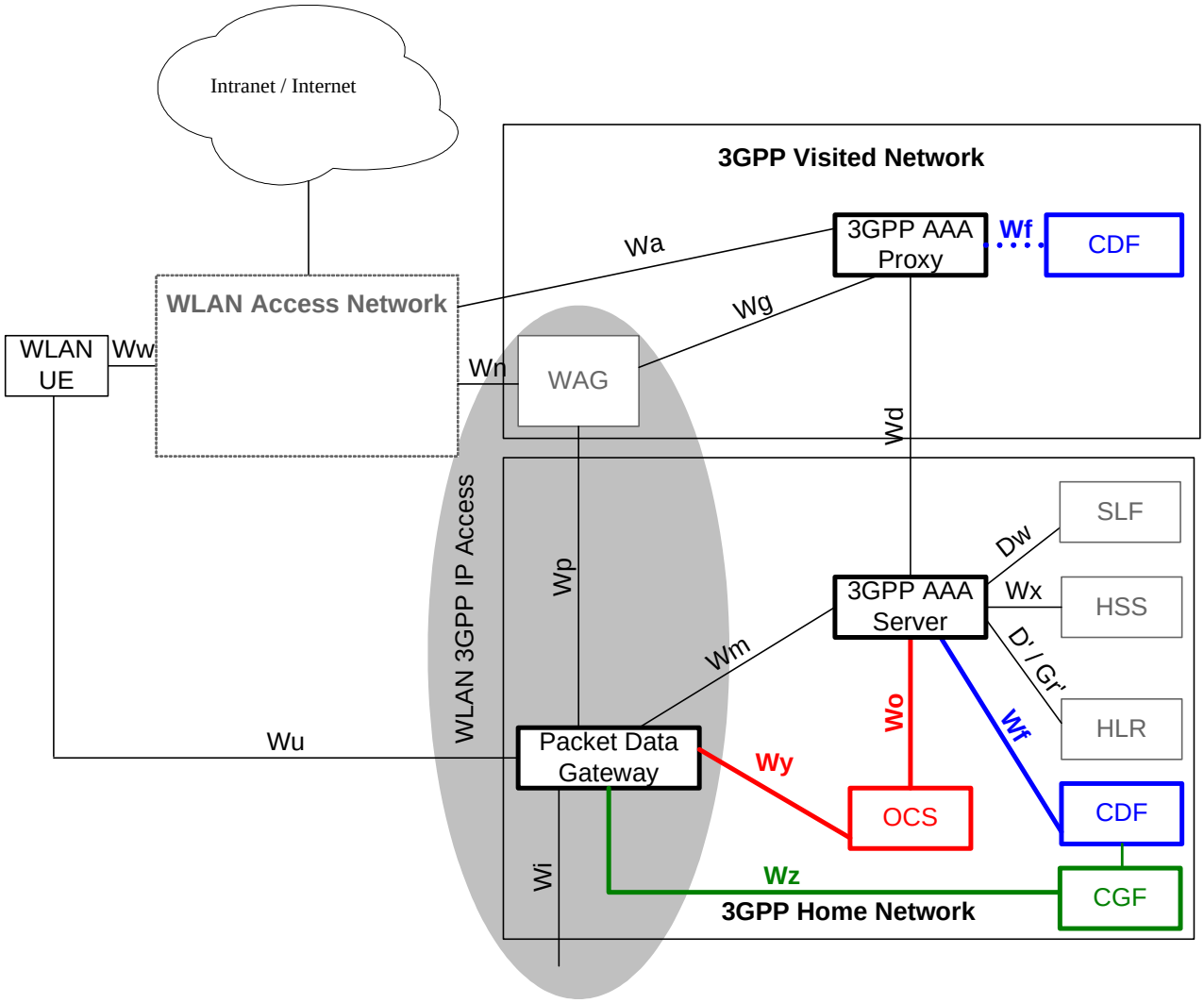
Figure 4.1.2 depicts the non-roaming WLAN inter-working reference model for both Direct IP Access and 3GPP IP Access.



NOTE: The shaded area refers to WLAN 3GPP IP Access functionality.

Figure 4.1.2 : Non Roaming Reference Model

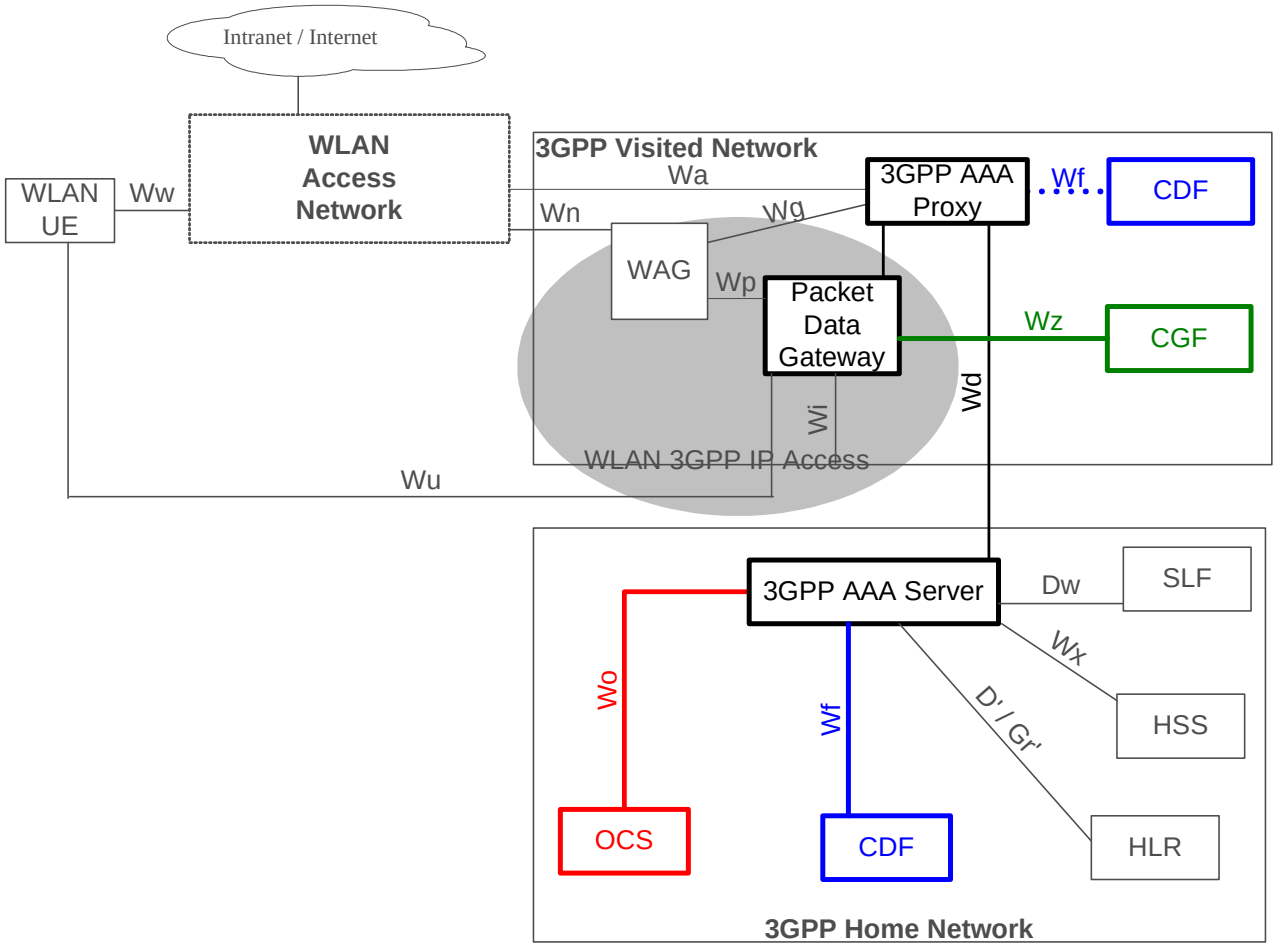
Figure 4.1.3 depicts the roaming WLAN inter-working reference model where 3GPP PS based services are provided by the home PLMN based on 3GPP IP Access.



NOTE: The shaded area refers to WLAN 3GPP IP Access functionality.

Figure 4.1.3 : Roaming reference model - 3GPP PS based services provided via the 3GPP Home Network

Finally, figure 4.1.4 shows the case of the 3GPP IP Access PS based services being provided by the visited PLMN. Note that there is no difference between figure 4.3 and figure 4.4 for the case of WLAN Access, Authentication and Authorisation.



NOTE: The shaded area refers to WLAN 3GPP IP Access functionality.

Figure 4.1.4 : Roaming reference model - 3GPP PS based services provided via the 3GPP Visited Network

Detailed descriptions of nodes and reference points in Figures 4.1.2, 4.1.3 and 4.1.4 are provided in TS 23.234 [201]. Following is a short description of each. Coloured nodes and reference points are relevant for charging thus explained in more detail.

WLAN UE: a WLAN UE is the User Equipment using a UICC card utilized by a 3GPP subscriber to access the WLAN network for 3GPP interworking purpose.

WLAN Access Network (WLAN AN): WLAN AN provides the wireless IP connectivity to the WLAN UE. It generates per user charging information about the WLAN AN usage. WLAN AN is outside of 3GPP scope.

3GPP AAA Proxy: the 3GPP AAA Proxy represents a proxying and filtering function that resides in the Visited 3GPP Network, i.e it exists only in the roaming case. For charging purposes the 3GPP AAA Proxy functions include:

- Relaying the AAA information between WLAN and the 3GPP AAA Server;
- Reporting per-user charging/accounting information to the VPLMN offline charging system for roaming users;
- Protocol conversion when the Wa and Wd reference points do not use the same protocol;

For WLAN 3GPP IP Access only:

- Receiving per-tunnel charging information based on the tunnel identifier from the WAG and mapping of a user identifier and a tunnel identifier from the PDG; generating per user charging records for roaming users.

3GPP AAA Server: the 3GPP AAA server is located within the 3GPP HPLMN. It performs the AAA functions and may also act as an AAA proxy. For WLAN 3GPP IP Access it provides authorization, policy enforcement and routing information to the PDG, WAG and WLAN AN. For charging the 3GPP AAA Server:

- Generates and reports per-user charging/accounting information to the HPLMN CDF.

- Performs online charging control for the WLAN AN.

WLAN Access Gateway (WAG): the WAG applies to a WLAN 3GPP IP Access enabled system. It is a gateway via which the data to/from the WLAN Access Network is routed via the PLMN to provide a WLAN UE with 3G PS based services in a WLAN 3GPP IP Access enabled system. The WLAN Access Gateway resides in the VPLMN in the roaming case, and in the HPLMN in the non-roaming case. From charging point of view the WLAN Access Gateway:

- Allows VPLMN to generate charging information for users accessing via the WLAN AN in the roaming case;

- Performs collection of per tunnel accounting information, e.g. volume count (byte count) and elapsed time, to be used e.g. for inter-operator settlements;

Note: per tunnel accounting generation in the WAG is not required when the WAG and PDG are in the same network, i.e. the non-roaming case.

Packet Data Gateway: the Packet Data Gateway (PDG) applies to a WLAN 3GPP IP Access enabled system. 3GPP PS based services are accessed via a PDG in the user's Home Network or a PDG in the selected VPLMN. 3GPP PS based services may be accessed via a PDG in the user's HPLMN or a PDG in the selected VPLMN. From charging point of view the Packet Data Gateway:

- Generates charging information related to user data traffic for offline and online charging purposes.

- May apply IP flow based bearer level charging, e.g. in order to differentiate or suppress WLAN bearer charging for 3GPP PS based services.

Editor's Note: PDG functionality may be provided by re-using the existing GGSN functionality. The current working assumption is that the TPF is a logical function allocated to the PDG providing IP flow based bearer level charging capabilities.

Editor's Note: The charging interfaces from PDG are missing from TS 23.234 [201] reference model figures.

Following is a functional description of the reference points depicted in the above figures.

Wa: the Wa reference point connects the WLAN Access Network, possibly via intermediate networks, to the 3GPP Network (i.e. the 3GPP AAA Proxy in the roaming case and the 3GPP AAA server in the non-roaming case). The prime purpose of the protocols crossing this reference point is to transport authentication, authorization and charging-related information in a secure manner. The reference point has to accommodate also legacy WLAN Access Networks.

To minimize the requirements put on the WLAN Access Network and to protect the confidentiality of the subscriber's charging status the fact whether a user is offline or online charged by his 3GPP subscription provider shall be transparent for the WLAN AN and thus for the Wa reference point.

Editor's note: this statement from TS 23.234 contradicts to the online charging description in TS 23.234 clause 7.7 that actually mandates the existence of a CC client on the WLAN.

Wz: this reference point is used by the PDG for transfer of offline charging records from the PDG CDF to the CGF. The prime purpose of the protocols crossing this reference point is to transport/forward charging information towards 3GPP operator's offline charging system, located in the VPLMN or HPLMN.

Wy: this reference point is used by the PDG to communicate with the Online Charging System. The prime purpose of the protocol(s) crossing this reference point is to transport online charging related information so as to perform credit control for the online charged subscriber. This reference point applies the common 3GPP online charging interface as specified in TS 32.299 [50].

Wo: the Wo reference point is used by the 3GPP AAA Server to communicate with 3GPP Online Charging System (OCS). The prime purpose of the protocol(s) crossing this reference point is to transport online charging related

information so as to perform credit control for the online charged subscriber. This reference point applies the common 3GPP online charging interface as specified in TS 32.299 [50].

Wf: the Wf reference point is located between the 3GPP AAA Server and 3GPP offline charging system. The prime purpose of the protocols crossing this reference point is to transport/forward charging information towards 3GPP operator's offline charging system, located in the VPLMN or HPLMN, so as to generate CDRs for offline charged subscribers and to calculate inter-operator accounting.

The components of the "offline charging system" are further explained in subclause 4.2.

This reference point applies the 3GPP Diameter based offline charging interface as specified in TS 32.299 [50].

Wd: the Wd reference point applies to roaming cases only. The Wd reference point connects the 3GPP AAA Proxy, possibly via intermediate networks, to the 3GPP AAA Server. The prime purpose of the protocols crossing this reference point is to transport authentication, authorisation and related information. The functionality of the reference point is to transport AAA messages including charging signalling per WLAN user used for purging a user from the WLAN access for immediate service termination.

4.2 WLAN offline charging architecture

A simplified architecture for WLAN offline charging is described in figure 4.2. The Diameter based Rf interface on which the Wf interfaces are based on is described in 3GPP TS 32.299 [50].

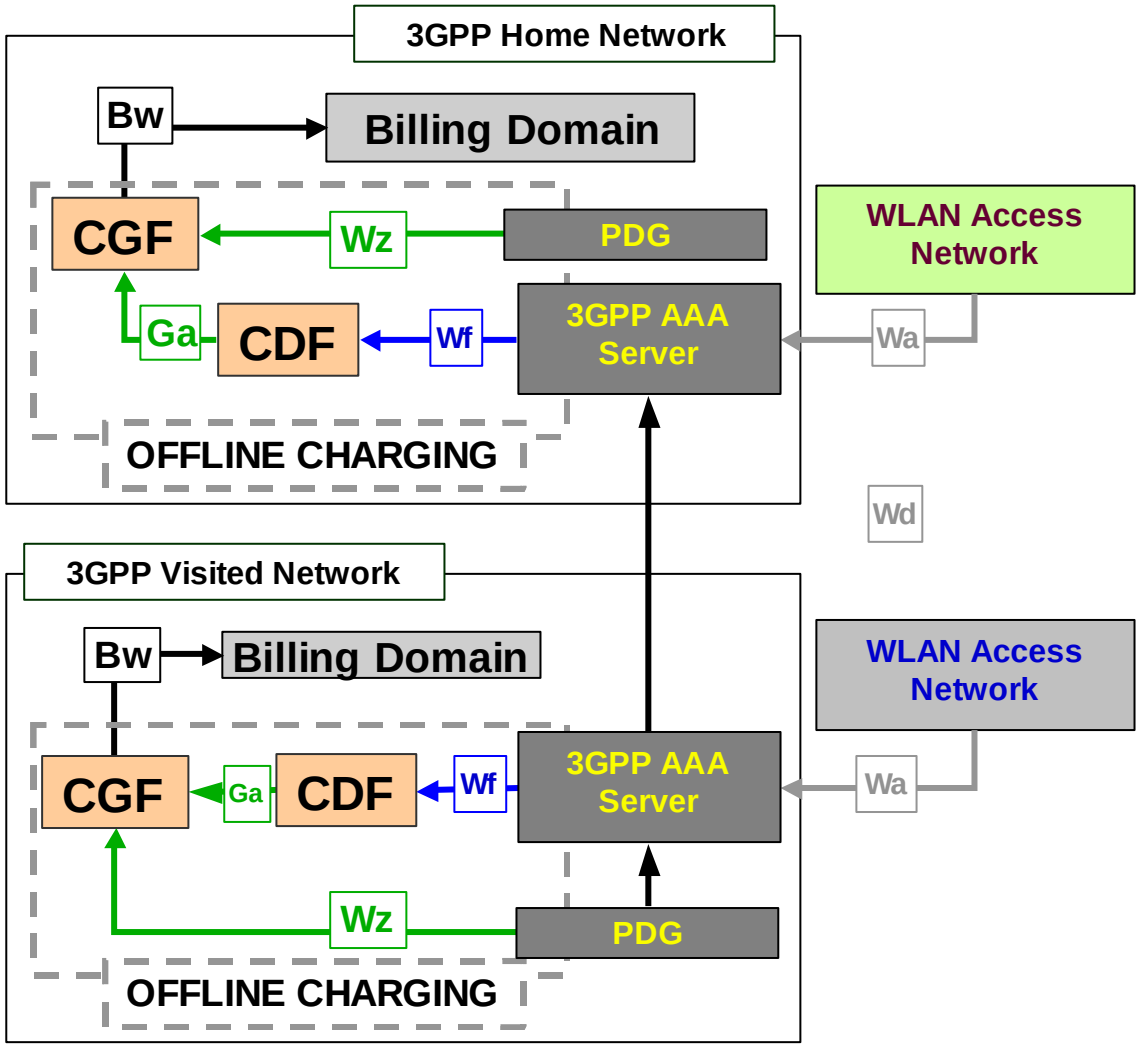


Figure 4.2 : WLAN offline charging architecture

Working assumptions for the further specification of this clause:

1) Charging information passes from the WLAN AN to the AAA server and further to the home CDF.

2) The PDG is capable of applying IP flow based bearer level offline charging (as specified in TS 23.125 [71]). Charging information passes from the PDG directly to the home CGF in case of WLAN 3GPP IP Access.

3) Charging information passes from WAG via the 3GPP AAA proxy to the visited CDF. WAG collects charging information in roaming WLAN 3GPP IP Access cases only. This information is used to create inter-operator accounting records. Charging information from WAG is not provided to the home CDF.

4) The 3GPP AAA proxy is responsible for providing charging information routed through it in the VPLMN to the visited CDF for the purpose of producing CDRs and inter-operator accounting records in roaming cases. This includes charging information from the WLAN AN and from the WAG.

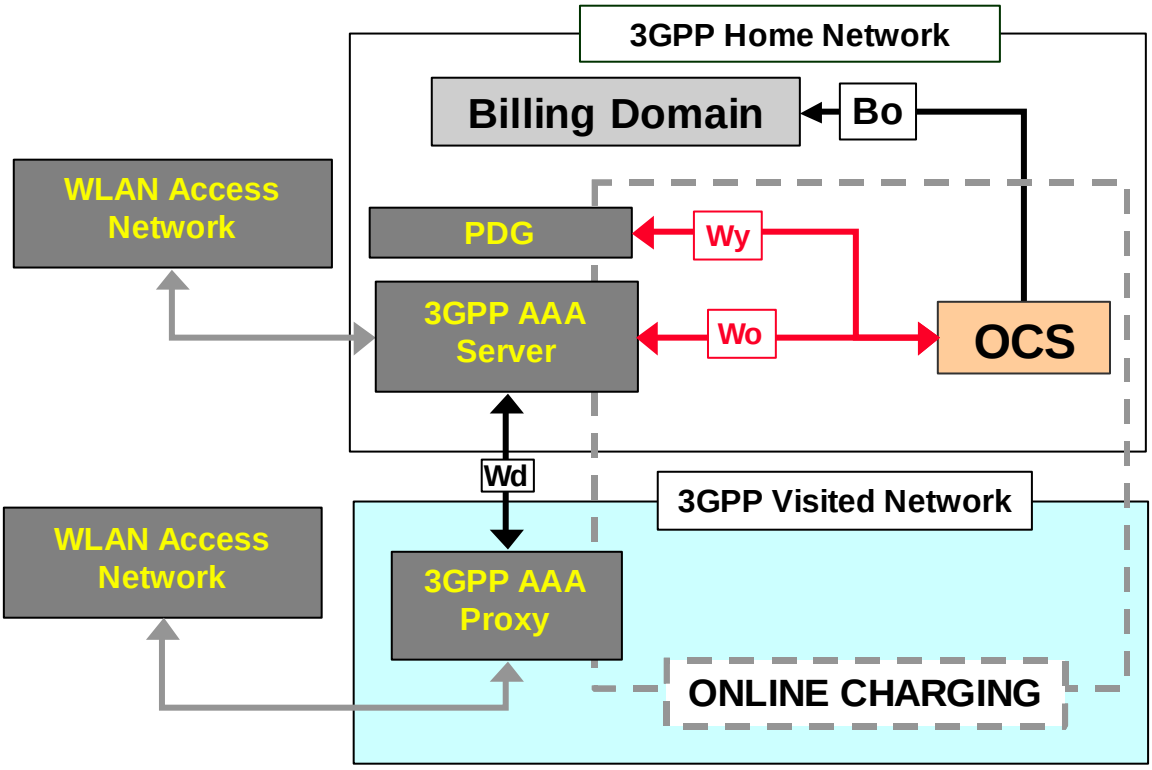
5) The 3GPP AAA server/proxy are connected to a CDF in the HPLMN/VPLMN via the Wf reference point that uses the 3GPP Diameter based offline charging application as specified in TS 32.299 [50]. Alternatively, the AAA server may implement a CDF, connecting directly to the CGF.

6) WLAN charging should support both distributed and integrated CDF/CGF.

7) The CGF implements the Bw interface to the BD.

4.3 WLAN online charging architecture

A simplified architecture for WLAN online charging (for both roaming and non roaming cases (roaming parts specified in light blue)) is described in figure 4.3. The Ro (Wo & Gy) interface(s) are described in 3GPP TS 32.299 [50].



Editor's note: The offline charging entities should be removed from this figure (Billing Domain and the Bo interface from the OCS).

Figure 4.3 : WLAN online charging architecture

Working assumptions for the further specification of this clause:

1. Charging information passes from the WLAN AN through the AAA proxy (roaming only) to the AAA server and further to the OCS.

2. The PDG is capable of applying IP flow based bearer level online charging (as specified in TS 23.125 [71]). Charging information passes from the PDG directly to the OCS in the Home Network in case of WLAN 3GPP IP Access (previously known as scenario 3).

Editor's note: The roaming scenario is FFS

3. The 3GPP AAA server is connected to the OCS via the Wo reference point that uses the common 3GPP online charging application as specified in TS 32.299 [50].

Editor's note: Without quota allocation mechanism, true online charging is not possible.

5 WLAN charging principles and scenarios

The following functionality and requirements have been identified for charging:

- The WLAN Access Network shall be able to report the WLAN access usage to the appropriate 3GPP system (i.e. VPLMN in the roaming case and HPLMN in the non-roaming case).
- It shall be possible for the 3GPP system to control a specific ongoing WLAN access session for online charging purposes.
- It shall be possible for an operator to maintain a single prepaid account for WLAN, PS, CS, and IMS for a user.
- The 3GPP system shall be able to process the WLAN access resource usage information,and convert it into the format used in 3GPP networks (e.g. CDR).
- It shall be possible to correlate charging and accounting records generated in WLAN Access related nodes and records generated in 3GPP nodes.
- It shall be possible to apply offline charging and online charging mechanisms for the WLAN interworking with 3GPP network.

Additionally, for WLAN 3GPP IP Access:

- It shall be possible to generate per user charging information in the HPLMN and in the VPLMN irrespective of whether the service is provided in the HPLMN or in the VPLMN.

5.1 WLAN charging principles

WLAN charging comprises of: the WLAN Direct IP Access charging and WLAN 3GPP IP Access charging. WLAN Direct IP Access charging is always on when a user is connected to the WLAN Access Network. WLAN 3GPP IP Access charging is performed only when 3G PS services are used. The 3GPP system internal reference points shall use Diameter as charging protocol.

5.1.1 WLAN Direct IP Access charging

WLAN AN is responsible for generating per user charging data and monitoring usage for WLAN Direct IP Access. Charging data is sent, possibly via 3GPP AAA Proxy (roaming case) to the 3GPP AAA Server. The 3GPP AAA Server connects to the appropriate charging system. In case of roaming, the 3GPP AAA Proxy sends the charging information also to the CDF at the visited network for roaming settlement purposes.

5.1.2 WLAN 3GPP IP Access charging

Packet Data Gateway is responsible for generating per user charging data and monitoring usage for WLAN 3GPP IP Access charging.

Editor's Note: It is assumed that the PDG may implement TPF functionality (TS 23.125).

Editor's Note: The role of the WAG for end user charging is tbd. Potentially it is only used by the visited network to identify the amount of data relayed between the WLAN AN and the HPLMN and used for roaming settlement. Note that the charging information from the WLAN AN does not differentiate the user data transferred between the WLAN AN and PDG and between the WLAN AN and IP network directly connected to the WLAN AN. Hence, WLAN AN information can not be used to identify how much data the VPLMN has relayed.

Editor's Note: Procedure needs to be verified from CN4. The following description needs to be clarified: Correlation of PDG and WLAN AN charging data is enabled by exchanging correlation identifiers. When the PDG requests tunnel authorisation over the Wm reference point, it sends the PDG Charging Identifier to the 3GPP AAA Server. In the response the 3GPP AAA Server sends the WLAN Session ID back to the PDG. PDG includes the WLAN Session ID to the PDG charging data. 3GPP AAA Server includes the PDG Charging Identifier to the WLAN AN charging data.

5.2 WLAN offline charging scenarios

5.2.1 Basic principles

Editor's note: This subclause should be moved into subclause 5.1.

The WLAN Direct IP Access offline charging is based on the Accounting Requests..

Editor's Note: The Accounting Requests from the 3GPP AAA Server are terminated at the home CDF that together with CGF converts the information to Billing System compatible format. Accounting requests could also be terminated at the 3GPP AAA Server. 3GPP AAA Server could then provide accounting information to the CGF in files. This is how a typical AAA infrastructure operates.

Editor's Note: The accounting information required for Wd reference point should be specified and communicated to 3GPP CN4 for inclusion into the protocol specifications.

Offline charging protocol conversions and related functionality are illustrated in the figure 5.2.1 and 5.2.2 below.

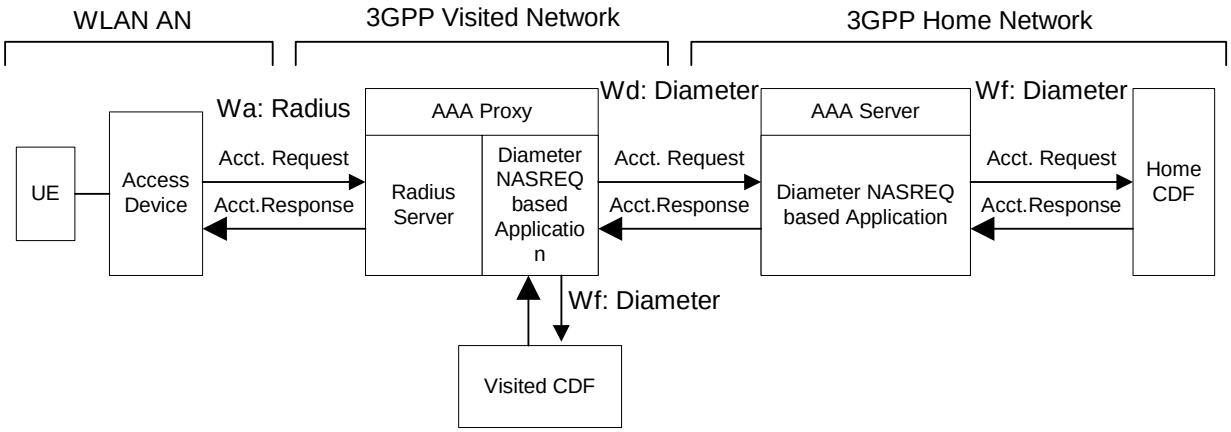


Figure 5.2.1 Offline Charging Accounting Requests – Wa based on Radius

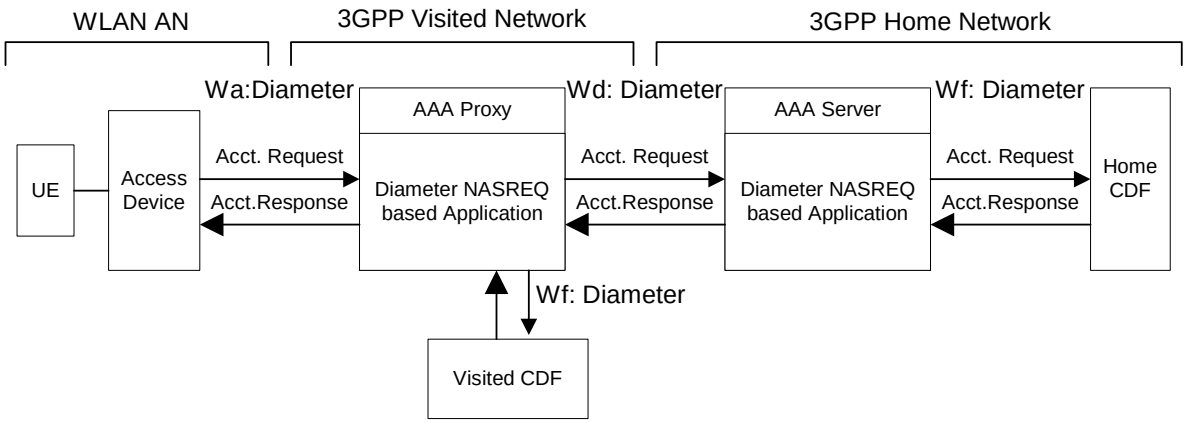


Figure 5.2.2 Offline Charging Accounting Requests – Wa based on Diameter.

Editor's note: The figures 5.1 and 5.2 reflect not all possible protocol options.

Editor's Note: TS 32.299 [50] defines 3GPP Diameter application for offline charging that would be used in Wf reference point. However this would mean that another protocol conversion should be performed from NASREQ accounting to 3GPP Diameter application. NASREQ is one option for Wd because NASREQ proposes a mechanism for Radius – NASREQ conversion. This issue should be resolved.

Editor's Note: The physical mapping of CDF / CGF and the supported configurations are for further study. Options are to integrate CDF and CGF (implementing only Wf interface) or to integrate 3GPP AAA Server/Proxy and CDF (implementing Ga-like interface towards CGF or even file-based interface as a typical AAA infrastructure would do).

5.2.2 Rf message flows

Editor's Note: Basic message flows are shown in the previous chapter. When the exact protocol selection is made more detailed message flows are provided here.

5.2.3 CDR generation

5.2.4 Ga record transfer flows

Editor's Note: This applies for the Wz reference point.

5.2.5 B_W CDR file transfer

5.3 WLAN online charging scenarios

5.3.1 Basic principles

Editor's note: This subclause should be moved into subclause 5.1.

Editor's note: The description below doesn't allow volume based online charging.

The WLAN Direct IP Access online charging is be based on Authentication-Authorisation (AA) Requests and quota allocation mechanism. . The AA-Requests are terminated at the home 3GPP Server. Home 3GPP Server initiates Diameter Credit Control procedures over Wo reference point as defined TS 32.299 [50].

Editor's Note: The AA messaging based online charging mechanism would require that WLAN AN implements RADIUS prepaid extensions (only valid in figure 5.3.1, no Diameter prepaid extensions available in figure 5.3.2) or similar functionality thus imposes requirements to WLAN domain. If such requirements can not be imposed, the online charging mechanism needs to be based on the accounting requests used in offline charging. This means that reliable and credit risk free online charging can not be implemented.

Editor's Note: The Diameter AA-application selection for Wd is defined in CN4. Diameter EAP is assumed.

Editor's note: The correlation of charging information is a valid point for both, offline and online charging scenarios and should be described in the basic principles.

Editor's note: However, the procedure description below (same as in offline charging) cannot be applied in online charging (remove this note when deleting the text in deleted clause 5.3.2.1).

Online charging protocol conversions and related functionality are illustrated in figure 5.3.1 and figure 5.3.2 below.

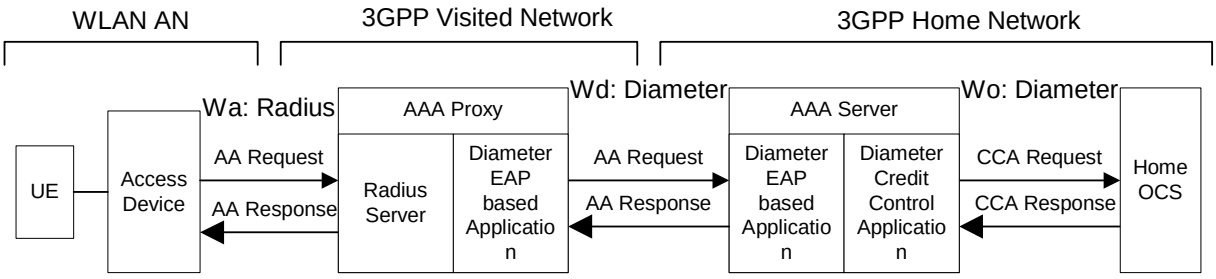


Figure 5.3.1 : Online Charging AA-Requests – Wa based on Radius

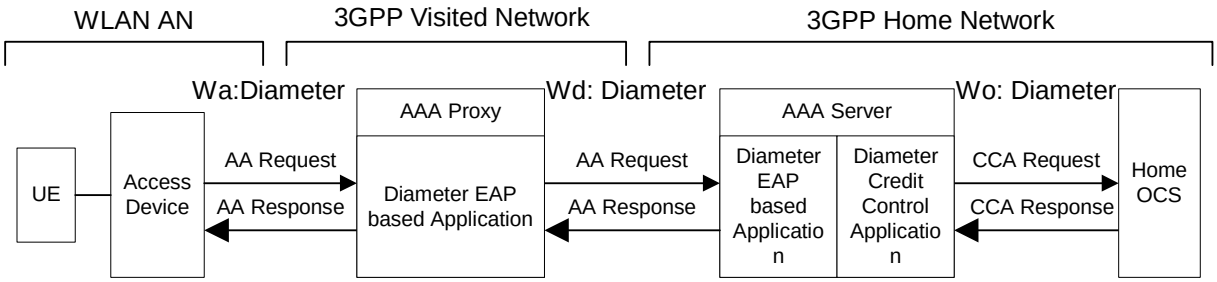


Figure 5.3.2 : Online Charging AA-Requests – Wa based on Diameter

Editor's Note: The Diameter Credit Control Application (CCA) proposes a mechanism for Radius – NASREQ conversion. This should be clarified!

Editor's note: The figures 5.3.1 and 5.3.2 reflect not all possible protocol options.

5.3.2 Ro message flows

Editor's Note: This is extracted from TS 23.234?

Editor's note: This scenario is incomplete, correction and the addition of further scenarios is required.

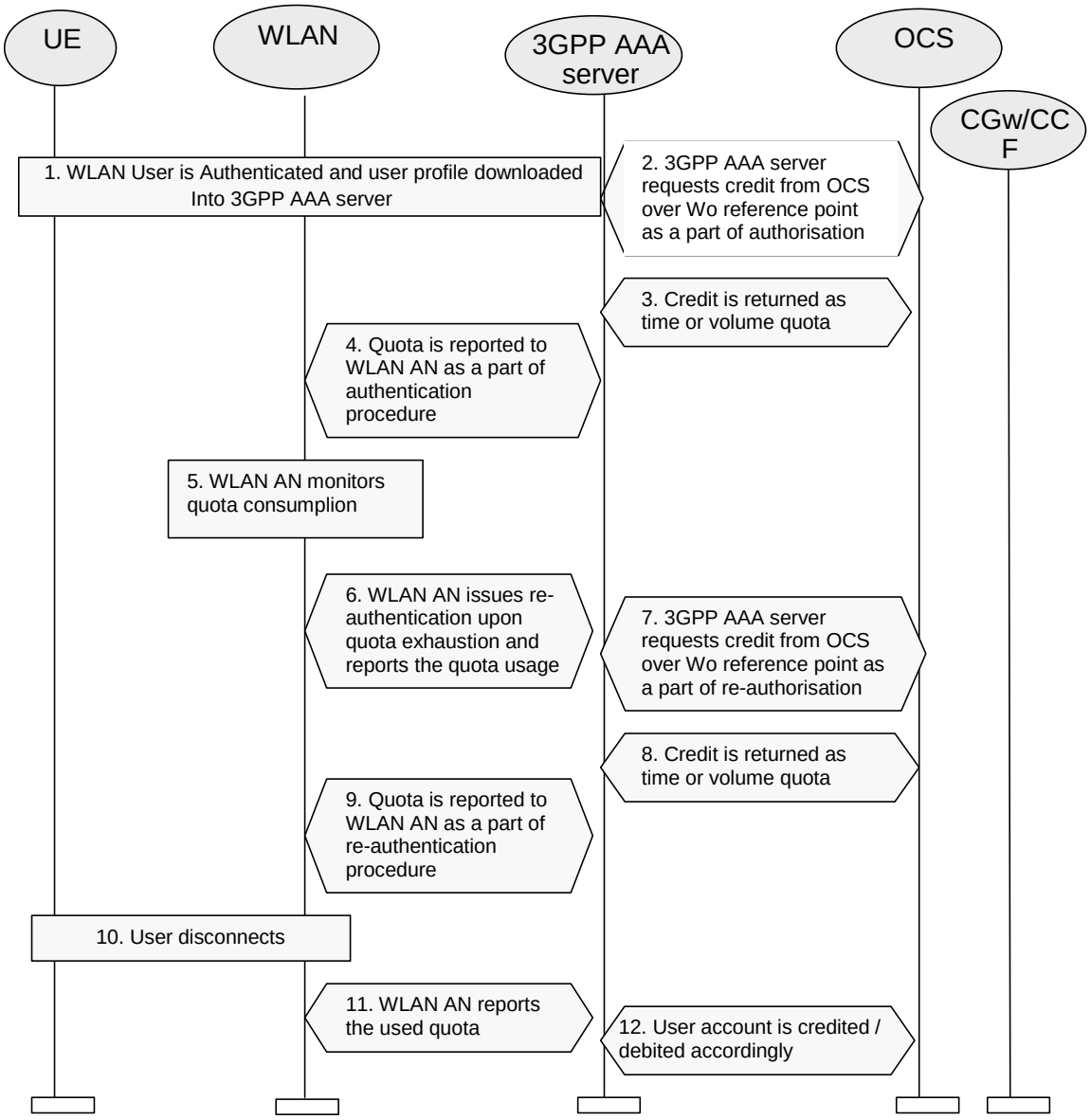


Figure 5.3.3 : Charging Procedure for (S2, add for S3) Online Charged Subscribers

1. WLAN user is authenticated and authorized for WLAN access. User profile is downloaded into 3GPP AAA server. Part of the profile is information that the user is to be online charged.
2. 3GPP AAA server requests online charging credit from the OCS.
3. OCS returns credit as time and/or volume quota
4. Allocated quota is indicated to the WLAN AN
5. WLAN AN monitors the quota consumption
6. When quota is almost used, WLAN AN issues re-authentication message over Wa reference point. Used quota is indicated in the request
7. 3GPP AAA Server requests more credit from the OCS
8. OCS returns credit as time and/or volume quota
9. Allocated new quota is indicated to the WLAN AN
10. User disconnects from WLAN
11. WLAN AN reports the used quota to 3GPP AAA Server over Wa reference point.
12. User account is debited / credit according the usage information in the final message

NOTE: In visited network the 3GPP AAA Proxy may also periodically report the usage of resources to the local CGw/CCF over Wf reference point. In home network the 3GPP AAA Server may also report the usage to the CGw/CCF over the Wf reference point using offline charging procedures for statistical or other purposes.

Editor's Note: It is assumed that the PDG implements TPF functionality (TS 23.125).

Editor's Note: The role of the WAG for end user charging is tbd. Potentially ti is only used by the visited network to identify the amount of data relayed between the WLAN AN and the HPLMN and used for roaming settlement. Note that the charging information from the WLAN AN does not differentiate the user data transferred between the WLAN AN and PDG and between the WLAN AN and IP network directly connected to the WLAN AN. Hence, WLAN AN information can not be used to identify how much data the VPLMN has relayed.

6 Definition of charging information

6.1 Data description for WLAN offline charging

The tables in the subsequent parts of clause x specify the Mandatory (M), Conditional (C) and Operator optional (O_M or O_C) designations. The category of a CDR parameter can have one of two primary values:

M This parameter is **M**andatory and shall always be present in the CDR.

C This parameter shall be present in the CDR only when certain Conditions are met. These Conditions are specified as part of the parameter definition.

All other parameters are designated as Operator **(O)** provisionable, which replaced the "Optional" category, specified in earlier releases. Using network management functions or specific tools provided by an equipment vendor, operators may choose if they wish to include or omit the parameter from the CDR. Once omitted, this parameter is not generated in a CDR. To avoid any potential ambiguity, a CDR generating element MUST be able to provide all these parameters. Only an operator can choose whether or not these parameters should be generated in their system.

Those parameters that the operator wishes to be present are further divided into a mandatory and conditional categories:

O_M This is a parameter that, if provisioned by the operator to be present, shall always be included in the CDRs. In other words, an O_M parameter that is provisioned to be present is a mandatory parameter.

O_C This is a parameter that, if provisioned by the operator to be present, shall be included in the CDRs when the required conditions are met. In other words, an O_C parameter that is configured to be present is a conditional parameter.

The following tables provide a brief description of each CDR parameter. Full definitions of the parameters, sorted by the parameter name in alphabetical order, are provided in 3GPP TS 32.298 [51].

6.1.1 WLAN 3GPP IP Access charging message contents

If the collection of CDR data is enabled then the TPF associated with the PDG shall make available the following data available for each WLAN 3GPP IP Access session.

Table : Wz interface CDR content (eG-CDR generated by TPF used as a basis)

Field	Category	Description
Record Type	M	WLAN PDG record.
Served IMSI	M	IMSI of the served party.
Served MSISDN	O_M	The primary MSISDN of the subscriber.
PDG Address used	M	IP address of the PDG used.
Node ID	O_M	Name of the recording entity.
Serving WAG Address	M	Serving WAG address used during this record.
WAG PLMN Identifier	O_M	WAG PLMN Identifier (MCC and MNC) used during this record.
Serving AAA Server/proxy Address	M	Serving AAA Server/Proxy address.
WLAN UE's remote IP address	O_C	
WLAN UE's Local IP address	O_C	
Charging ID	M	PDG identifier used to correlate WLAN AN generated information to PDG generated information
WLAN session id	M	WLAN session identifier used to correlate WLAN AN generated information to PDG generated information
Access Point Name Network Identifier	O_M	The logical name of the connected access point to the external packet data network (network identifier part of APN).
APN Selection Mode	O_M	An index indicating how the APN was selected.
List of Service Data Volumes	O_M	List of each separately charged service data flow. Detailed structure is explained in TS 32.298
Charging Characteristics	M	The Charging Characteristics applied to the PDP context.
Charging Characteristics Selection Mode	O_M	Holds information about how Charging Characteristics were selected.
Record Opening Time	M	Time stamp when End-to-end Tunnel is activated in this PDG or record opening time on subsequent partial records.
Duration	M	Duration of this record in the PDG.
Cause for Record Closing	M	The reason for the release of record from this PDG.
Record Sequence Number	C	Partial record sequence number, only present in case of partial records.
Record Extensions	O_C	A set of network operator/manufacturer specific extensions to the record. Conditioned upon the existence of an extension.
Local Record Sequence Number	O_M	Consecutive record number created by this node. The number is allocated sequentially including all CDR types.
Diagnostics	O_M	A more detailed reason for the release of the connection.

6.1.2 Diameter message contents

6.1.2.1 Direct IP Access - Refer to NASREQ – S2

6.1.2.2. 3GPP IP Access

6.1.3 GTP' message contents

Editor's Note: This applies for the Wz reference point.

6.1.4 CDR description on the Bw interface

Editor's Note: This text needs to be edited from MMS in order to fit WLAN.

Dedicated types of CDRs can be generated in the service domain for MMS by the MMS Relay/Servers. The content of each CDR type is defined in one of the tables that are part of this subclause. For each CDR type the parameter definition includes the parameter name, description and category.

Equipment vendors shall be able to provide all of the parameters listed in the CDR content table in order to claim compliance with the present document. However, since CDR processing and transport consume network resources, operators may opt to eliminate some of the parameters that are not essential for their operation. This operator provisionable reduction is specified by the parameter category.

A parameter category can have one of two primary values:

M This parameter is **M**andatory and shall always be present in the CDR;

C This parameter shall be present in the CDR only when certain Conditions are met. These Conditions are specified as part of the parameter definition.

Some of these parameters are designated as Operator (**O**) provisionable. Using TMN management functions or specific tools provided by an equipment vendor, operators may choose, if they wish, to include or omit the parameter from the CDR. Once omitted, this parameter is not generated in a CDR. To avoid any potential ambiguity, a CDR generating element MUST be able to provide all these parameters. Only an operator can choose whether or not these parameters should be generated in its system.

Those parameters that the operator may configure to be present or absent are further qualified with the 'Operator provisionable' indicator as follows:

Mo This is a parameter that, if provisioned by the operator to be present, shall always be included in the CDRs. In other words, a Mo parameter that is provisioned to be present is a mandatory parameter;

Co This is a parameter that, if provisioned by the operator to be present, shall be included in the CDRs when the required conditions are met. In other words, a Co parameter that is configured to be present is a conditional parameter.

The MMS Relay/Server shall be able to provide the CDRs at the Billing System interface in the format and encoding described in the present document. Additional CDR formats and contents, generated by the MMS Relay/Server, may be available at the interface to the billing system to meet the requirements of the billing system, these are outside of the scope of 3GPP standardisation.

The following tables provide a brief description of each CDR parameter. Full definitions of the parameters, sorted by the parameter name in alphabetical order, are provided in TS 32.298 [41].

Editor's Note: The following text needs to be refined and reworded. In its current shape, it only intends to provide a basic idea of the proposed CDR types.

6.1.4.1 WLAN Session CDR

Note: this CDR type is similar to the GPRS M-CDR.

One or more CDRs of this type capture the time between a user's logon to the WLAN network (session start) and the corresponding logoff from that session (session end). The first CDR is generated after successful authentication of the 3GPP WLAN user with his home PLMN and thus the home and, if applicable, visited AAA server(s). The last CDR is closed after the network has completed the logoff of the user from the HPLMN and the AAA server(s), thus withdrawing the user's authorisation to use the interworked WLAN without a new logon procedure. See TS xxx for a description of these procedures.

6.1.4.2 WLAN Usage CDR

Note: this CDR type is similar to the GPRS PDP context CDR.

One or more CDRs of this type capture the amount of time the user was active on the WLAN and/or the volume that was transmitted during the session. The first CDR is opened when the user starts transmitting data over the session. The last CDER is closed when the user stops transmitting data over that session.

Editor's Note: Does time make sense here, resp. is it possible? Should the two CDR types be combined into one? We might need to differentiate here between scenario 2 and scenario 3!

Editor's Note: Information from WLAN AN does not separate the scenario 2 and scenario 3 usage

6.2 Data description for WLAN online charging

Editor's Note: To be completed

6.2.1 Diameter message contents

6.2.1.1 Summary of Online Charging Message formats

WLAN Online Charging uses the Credit-Control-Request (CCR) and Credit-Control-Answer (CCA) messages defined in TS 32.299 [50].

The following table describes the use of these messages for 3GPP IP Access based online charging.

Table : Online Charging Messages Reference Table for PDP context

Command-Name	Source	Destination	Abbreviation
Credit-Control-Request	PDG	OCS	CCR
Credit-Control-Answer	OCS	PDG	CCA

6.2.1.2 Credit Control Request message

Table : Credit Control Request Message for WLAN 3GPP IP Access

AVP	Category	Description
Session-Id	M	Described in TS 32.299 [50]
Origin-Host	M	Described in TS 32.299 [50]
Origin-Realm	M	Described in TS 32.299 [50]
Destination-Realm	M	Described in TS 32.299 [50]
Auth-Application-Id	M	Described in TS 32.299 [50]
Service-Context-Id	M	Described in TS 32.299 [50]
CC-Request-Type	M	Described in TS 32.299 [50]
CC-Request-Number	M	Described in TS 32.299 [50]
Destination-Host	O_M	Described in TS 32.299 [50]
User-Name	O_M	Described in TS 32.299 [50]
Origin-State-Id	O_C	Described in TS 32.299 [50]
Event-Timestamp	O_C	Described in TS 32.299 [50]
Subscription-Id	O_M	Described in TS 32.299 [50]. As a minimum the IMSI and the MSISDN have to be included.
Termination-Cause	O_C	Described in TS 32.299 [50]
Requested-Service-Unit	O_C	Described in TS 32.299 [50]
Multiple-Services-Indicator	O_C	Described in TS 32.299 [50]
Multiple-Services-Credit Control	O_C	Described in TS 32.299 [50]
CC-Correlation-Id	O_C	Described in TS 32.299 [50]
Route-Record	O_C	Described in TS 32.299 [50]
AVP	O_M	Described in TS 32.299 [50]
Service-Information	O_C	Described in TS 32.299 [50]
WLAN-Information	O_C	Described in subclause 6.2.1.2

6.2.1.3 WLAN-Information AVP

				AVP Flag rules			
AVP Name	**AVP Code**	**Defined**	**Value Type**	**Must**	**May**	**Should not**	**Must not**
[IMSI]		[50]	UTF8String				
[MSISDN		[50]	UTF8String				
[PDG-Charging-Id		[50]	UTF8String				
[WLAN-Session-Id		[50]	UTF8String				
[PDG-Address		[50]	IPAddress				
[PDG-IPv6-Address		[50]	IPAddress				
[WAG-Address		[50]	IPAddress				
[WAG-IPv6-Address		[50]	IPAddress				
[WAG-PLMN-Id		[50]	UTF8String				
[AAA-Server/Proxy-Address		[50]	IPAddress				
[AAA-Server/Proxy-Ipv6-Address		[50]	IPAddress				
[WLAN-UE's-Remote-IP-Address		[50]	IPAddress				
[WLAN-UE's-Remote-Ipv6-Address		[50]	IPAddress				
[WLAN-UE's-Local-IP-Address		[50]	IPAddress				
[WLAN-UE's-Local-Ipv6-Address		[50]	IPAddress				
[CG-Address		[50]	IPAddress				
[CG-IPv6-Address		[50]	IPAddress				
[APN-Info		[50]	UTF8String				
[Selection-Mode		[50]	UTF8String				
[Session-Stop-Indicator		[50]	Unsigned32				
[Charging-Characteristics		[50]	Unsigned32				
[Charging-Rule-Based-Name]		[50]	UTF8String				

6.2.1.4 Credit Control Answer message

Table : Wy interface Credit-Control-Answer (CCA) content

AVP	Category	Description
{Session-Id}	M	Described in 32.299 [50]
{Result-Code}	M	Described in 32.299 [50]
{Origin-Host}	M	Described in 32.299 [50]
{Origin-Realm}	M	Described in 32.299 [50]
{Destination-Realm}	-	Described in 32.299 [50]
{Auth-Application-Id}	M	Described in 32.299 [50]
{Service-Context-Id}	-	Described in 32.299 [50]
{CC-Request-Type	M	Described in 32.299 [50]
{CC-Request-Number}	M	Described in 32.299 [50]
[Destination-Host]	-	Described in 32.299 [50]
[User-Name]	-	Described in 32.299 [50]
[Acct-Multi-Session-Id]	-	Described in 32.299 [50]
[Origin-State-Id]	-	Described in 32.299 [50]
[Event-Timestamp]	-	Described in 32.299 [50]
*[Subscription-Id]	-	Described in 32.299 [50]
[Service-Identifier]	-	Described in 32.299 [50]
[Termination-Cause]	-	Described in 32.299 [50]
[Requested-Service-Unit]	-	Described in 32.299 [50]
[Requested-Action]	-	Described in 32.299 [50]
*[Used-Service-Unit]	O_C	Described in 32.299 [50]
[Multiple-Service-Indicator]	O_C	Described in 32.299 [50]
*[Multiple-Services-Credit-Control]	O_M	Described in 32.299 [50]
*[Service-Parameter-Info]	-	Described in 32.299 [50]
[CC-Correlation-Id]	-	Described in 32.299 [50]
[User-Equipment-Info]	-	Described in 32.299 [50]
[CC-Session-Failover]	O_C	Described in 32.299 [50]
[Final-Unit-Indication]	O_C	Described in 32.299 [50]
[Credit-Control-Failure-Handling]	O_C	Described in 32.299 [50]
[Validity-Time]	O_M	Described in 32.299 [50]
[Redirect-Host]	O_C	Described in 32.299 [50]
[Redirect-Host-Usage]	O_C	Described in 32.299 [50]
[Redirect-Max-Cache-Time]	O_C	Described in 32.299 [50]
[Failed-AVP]	O_C	Described in 32.299 [50]
*[Proxy-Info]	-	Described in 32.299 [50]
*[Route-Record]	O_C	Described in 32.299 [50]
*[AVP]	O_M	Described in 32.299 [50]

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Mar 2005	S_27	SP-050028	--	--	Submitted to TSG SA#27 for Information	1.0.0	