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for Wireless Local Area Network (WLAN)
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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:

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x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

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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.

Introduction

The present document is part of a TS-family covering the 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; as identified below:

32.401 Performance Management (PM); Concept and requirements

52.402 Performance Management (PM); Performance measurements – GSM

32.404 Performance Management (PM); Performance measurements - Definitions and template

32.405 Performance Management (PM); Performance measurements Universal Terrestrial Radio Access Network (UTRAN)

32.406 Performance Management (PM); Performance measurements Core Network (CN) Packet Switched (PS) domain

32.407 Performance Management (PM); Performance measurements Core Network (CN) Circuit Switched (CS) domain

32.408 Performance Management (PM); Performance measurements Teleservice

32.409 Performance Management (PM); Performance measurements IP Multimedia Subsystem (IMS)

32.425 Performance Management (PM); Evolved Performance measurements Universal Terrestrial Radio Access Network (E-UTRAN)

32.426 Performance Management (PM); Evolved Packet Core (EPC)

28.401 Telecommunication management; Performance Management (PM); Performance measurements for Core Network (CN) and non-3GPP access Interworking System

28.402 Telecommunication management; Performance Management (PM); Performance measurements for Evolved Packet Core (EPC) and non-3GPP access Interworking System

28.403 Performance Management (PM); Performance measurements for Wireless Local Area Network (WLAN)

1 Scope

The present document describes the measurements for WLAN.

TS 32.401 [3] describes Performance Management concepts and requirements.

The present document is valid for all measurement types provided by an implementation of a WLAN.

Only measurement types that are specific to WLAN are defined within the present document. Vendor specific measurement types used in WLAN are not covered. Instead, these could be applied according to manufacturer's documentation.

Measurements related to "external" technologies (such as WLAN or IP) as described by "external" standards bodies (e.g. IEEE or IETF) are only referenced within the present document, wherever there is a need identified for the existence of such a reference.

The definition of the standard measurements is intended to result in comparability of measurement data produced in a multi-vendor network, for those measurement types that can be standardised across all vendors' implementations.

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*.

[1] 3GPP TS 32.600: "Telecommunication management; Configuration Management (CM); Concept and high-level requirements".

[2] 3GPP TR 32.841: "Telecommunication management; Study on Wireless Local Area Network (WLAN) management".

[3] 3GPP TS 32.401: "Telecommunication management; Performance Management (PM); Concept and requirements".

[4] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[5] IETF RFC 2863: "The Interfaces Group MIB".

[6] IEEE 802.11™-2012: "IEEE Standard for Information technology--Telecommunications and information exchange between systems Local and metropolitan area networks--Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [4] apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [4].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [4] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [4].

ACK	Acknowledgement
CSMA/CA	Carrier Sense Multiple Access/Collision Avoidance
CTS	Clear to Send
FCS	Frame Check Sum
MPDU	MAC Protocol Data Unit
PER	Packet Error Rate
RTS	Request to Send
TF	Transparent Forwarding

4 Measurement family

The measurement names defined in the present document are all beginning with a prefix containing the measurement family name (e.g. RRC.AttConnEstab.*Cause*). This family name identifies all measurements which relate to a given functionality and it may be used for measurement administration (see TS 32.401 [3]).

5 Measurements related to WLAN

5.1 Measurements related to WLAN AP data volume

5.1.1 Number of incoming unicast IP packets received at WLAN AP

a) This measurement provides the number of incoming unicast IP packets received at the WLAN AP (see `ifHCInUcastPkts` in IF-MIB [5]).

b) TF.

c) This counter is defined in IF-MIB in IETF RFC 2863 [5].

d) A single integer value.

e) IP.InUnicastPacketWlanAP.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

5.1.2 Number of outgoing unicast IP packets transmitted by WLAN AP

a) This measurement provides the number of outgoing unicast IP packets transmitted by the WLAN AP (see `ifHCOutUcastPkts` in IF-MIB in IETF RFC 2863 [5]).

b) TF.

c) This counter is defined in IF-MIB in IETF RFC 2863 [5].

d) A single integer value.

e) IP.OutUnicastPacketWlanAP.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

5.1.3 Number of incoming multicast IP packets received at WLAN AP

a) This measurement provides the number of incoming multicast IP packets received at the WLAN AP (see `ifHCInMulticastPkts` in IF-MIB in IETF RFC 2863 [5]).

b) TF.

c) This counter is defined in IF-MIB in IETF RFC 2863 [5].

d) A single integer value.

e) IP.InMulticastPacketWlanAP.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

5.1.4 Number of outgoing multicast IP packets transmitted by WLAN AP

a) This measurement provides the number of outgoing multicast IP packets transmitted by the WLAN AP (see `ifHCOutMulticastPkts` in IF-MIB in IETF RFC 2863 [5]).

b) TF.

c) This counter is defined in IF-MIB in IETF RFC 2863 [5].

d) A single integer value.

e) IP.OutMulticastPacketWlanAP.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

5.1.5 Number of incoming broadcast IP packets received at WLAN AP

a) This measurement provides the number of incoming broadcast IP packets received at the WLAN AP (see `ifHCInBroadcastPkts` in IF-MIB in IETF RFC 2863 [5]).

b) TF.

c) This counter is defined in IF-MIB in IETF RFC 2863 [5].

d) A single integer value.

e) IP.InBroadcastPacketWlanAP.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

5.1.6 Number of outgoing broadcast IP packets transmitted by WLAN AP

a) This measurement provides the number of outgoing broadcast IP packets transmitted by the WLAN AP (see `ifHCOutBroadcastPkts` in IF-MIB in IETF RFC 2863 [5]).

b) TF.

c) This counter is defined in IF-MIB in IETF RFC 2863 [5].

d) A single integer value.

e) IP.OutBroadcastPacketWlanAP.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

5.2 Measurements related to CSMA/CA protocol

5.2.1 Number of successful RTS responses

a) This measurement provides the number of CTS (Clear to Send) received in response to an RTS (Request to Send) at the WLAN AP (see `dot11RTSSuccessCount` in IEEE802dot11-MIB in IEEE 802.11 [6]).

b) TF.

c) This counter is defined in IEEE802dot11-MIB in IEEE 802.11 [6].

d) A single integer value.

e) MAC.SuccRtsWlanAP.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

5.2.2 Number of failed RTS responses

a) This measurement provides the number of CTS not received in response to an RTS at the WLAN AP (see `dot11RTSFailureCount` in IEEE802dot11-MIB in IEEE 802.11 [6]).

b) TF.

c) This counter is defined in IEEE802dot11-MIB in IEEE 802.11 [6].

d) A single integer value.

e) MAC.FailRtsWlanAP.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

5.2.3 Number of failed ACK responses

a) This measurement provides the number of ACK (Acknowledgement) not received after transmitting the data at the WLAN AP (see `dot11ACKFailureCount` in IEEE802dot11-MIB in IEEE 802.11 [6])..

b) TF.

c) This counter is defined in IEEE802dot11-MIB in IEEE 802.11 [6].

d) A single integer value.

e) MAC.FailAckWlanAP.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

5.3 Measurements related to WLAN data packets

5.3.1 Number of successful MPDU receptions

a) This measurement provides the number of incoming MPDU (MAC Protocol Data Unit) successfully received at the WLAN AP (see `dot11ReceivedFragmentCount` in IEEE802dot11-MIB in IEEE 802.11 [6]).

b) TF.

c) This counter is defined in IEEE802dot11-MIB in IEEE 802.11 [6].

d) A single integer value.

e) MAC.successMpduWlanAP.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

5.3.2 Number of failed MPDU receptions

a) This measurement provides the number of MPDU received with FCS (Frame Check Sum) error at the WLAN AP (see `dot11FCSErrorCount` in IEEE802dot11-MIB in IEEE 802.11 [6].

b) TF.

c) This counter is defined in IEEE802dot11-MIB in IEEE 802.11 [6].

d) A single integer value.

e) MAC.failedMpduWlanAP.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

5.4 Measurements related to station association

5.4.1 Number of associated stations

a) This measurement provides the number of stations (see `dot11AssociatedStationCount` from IEEE802dot11-MIB in IEEE 802.11 [6]) that are associated with the WLAN AP.

b) TF.

c) This counter is defined in IEEE802dot11-MIB in IEEE 802.11 [6].

d) A single integer value.

e) NumberOfAssociatedStation.

f) APFunction.

g) Valid for packet switched traffic.

h) Combined.

Annex A (informative): Use cases for performance measurements definition

A.1 Use case for WLAN AP data volume related measurements

WLAN AP data volume related measurements are used to measure data volume on the WLAN air interface, including incoming and outgoing data packets at IP layer. The measurements provide indication on how much UE traffic have been carried over the WLAN. If the data volume measurements are too low, it may indicate to operators that potential problems exist at a WLAN AP to prevent UEs from transmitting or receiving the data packets. If the data volume measurements are too high, it may signal the hot spot areas where additional WLAN APs may need to be deployed.

A.2 Use case for CSMA/CA protocol related measurements

CSMA/CA (Carrier sense multiple access with collision avoidance) is a technology used in WLAN AP to enable multiple UEs to access a common wireless carrier without conflict. CSMA/CA protocol related measurements count the number of successful RTS / CTS responses, failed RTS/CTS responses, and failed ACK responses that are tied closely to the WLAN performance. For example, higher percentage of RTS failure rate (i.e. the number of failed RTS response / (the number of failed RTS response + the number of successful RTS response) may indicate higher number of conflicts among AP and UEs that prevent the UE from responding with CTS. Failed ACK responses indicate that AP has received CTS to send the data packet, but the UE cannon received data packet successfully. Therefore, higher percentage rate of ACK failure rate (i.e. the number of failed ACK responses / (the number of failed ACK responses + the number of successful ACK responses) may indicate higher number of data packets being corrupted or lost, due to reasons, such as interferences, signal fading, etc. So, higher percentage of RTS and ACK failure rates may indicate to operators why the users are suffering from poor WLAN performance.

A.3 Use case for WLAN data packets related measurements

WLAN data packets related measurements include the number of successful MPDU reception, and the number of failed MPDU reception that can be used to calculate WLAN Packet Error Rate (PER). WLAN PER may indicate to operators the performance of a WLAN AP. For example, higher WLAN packet error rate may imply poor WLAN performance.

A.4 Use case for station association measurements

A station is associated with a WLAN AP, when the station passed the authentication process, and is able to gain full access to the WLAN AP. Association allows the WLAN AP to record each station so that frames may be received from a station or sent to a station. The station association measurements enable operators to compute the mean and maximum numbers of associated station in a given interval that provide statistical information on how many station(s) are served by the WLAN AP.

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2015-12	SP-70	SP-150689			Presented for approval	1.2.0	2.0.0
					Upgrade to Rel-13	2.0.0	13.0.0

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2017-03	SA#75					Promotion to Release 14 without technical change	14.0.0

History

Document history		
V14.0.0	April 2017	Publication