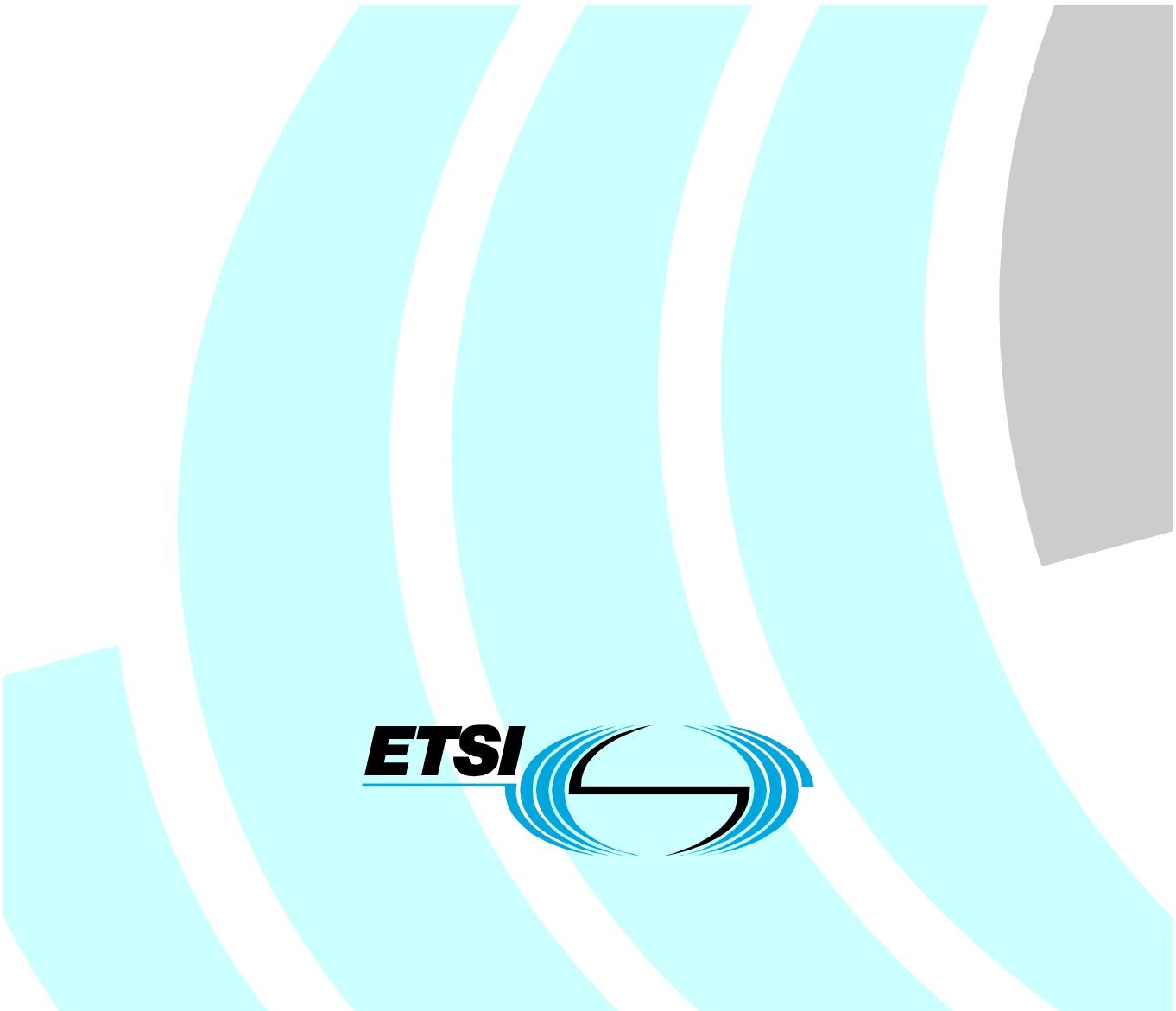
ETSI TS 102 229 V4.1.1 (2003-08)

Technical Specification

Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 4; Interface Protocol Requirements Definition; Aggregate Bearer Load Control - H.248 Package



Reference
DTS/TIPHON-03022R4

Keywords
bearer, control, H.248, IP, protocol, telephony,
voice, VoIP

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Foreword

This Technical Specification (TS) has been produced by ETSI Project Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON).

Introduction

Aggregate Bearer functionality in ETSI TIPHON has been first described in TS 101 329-3 [2].

With aggregated transport resource reservation or bulk reservation the IP Telephony Application Plane reserves an amount of resources for media transport that is sufficient to support a number of media flows. This allows the application plane to more efficiently use allocated resources by using statistical multiplexing of variable bit-rate media streams.

Resource aggregation may be performed in the Transport Plane under the control of either Transport Network Operators or IP Telephony Service Provider (ITSP). Aggregation involves a quantity of transport resource with guaranteed QoS characteristics being allocated prior to the set up of an individual media flow. Individual media flows will then consume a portion of this.

When control of the aggregated resource is performed by a Service Provider, an IP Telephony application may reserve a quantity of transport resource with quaranteed QoS characteristics prior to the set up of an individual media flow. This would be by agreement with the Transport Network Operator. The IP Telephony application then maintains the availability of QoS reserved resource calculating the actual utilization of the aggregate resource.

Resource aggregation requires aggregate bearer bandwidth management and connection admission control functionality.

The following methods are identified for aggregate resource creation:

a) provisioning on a semi-permanent basis (pre-assigned);

b) dynamic aggregate resource establishment/clear down. A dynamic aggregate may also be implemented with optional bandwidth negotiation.

Connection admission control to the aggregate resource shall be performed on a per call flow basis. The resource usage information may be used for connection admission control.

Aggregate resource usage can be calculated by different methods, e.g.:

a) traffic engineering methods taking into account Traffic Descriptors;

b) resource usage measurements.

Resource reservation renegotiation may take place at any time. For example when the resource usage of the aggregate flow exceeds a predetermined percentage of the reserved resource the allocation may be renegotiated or a new aggregate flow created. Similarly in low traffic conditions it may be desirable to renegotiate a lower aggregate reservation.

The present document supports the following methods:

- **Aggregate Resource Creation**: Provisioned aggregate bearer creation.
- **Aggregate Resource Usage**: Resource usage measurements.

1 Scope

The present document defines the aggregate load control information flows which are part of the N2 and N3 reference points network architecture as described in TS 101 882 release 4 [1].

The present document is supporting only provisioned aggregate bearer functionality. Mixing of different bearer capabilities of PSTN/ISDN service over the same aggregate bearer is supported. The aggregate bearer is provisioned with a single set of QoS parameters.

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference

[1] ETSI TS 101 882 (all parts): " Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 4; Protocol Framework Definition".

[2] ETSI TS 101 329-3: " Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; End-to-end Quality of Service in TIPHON systems; Part 3: Signalling and control of end-to-end Quality of Service (QoS)".

[3] ITU-T Recommendation H.248: "Gateway control protocol 3".

[4] ITU-T Recommendation Q.50: "Signalling between Circuit Multiplication Equipment (CME) and International Switching Centres (ISC)".

[5] IETF RFC 1889: "RTP: A Transport Protocol for Real-Time Applications".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

aggregate bearer: logical association of functional entities in an IP Telephony application and Transport Network which creates one or more concurrent end to end media flows and which is not limited to the duration of a single call

Aggregate Bearer Admission Control (ABAC) function: functional entity that determines whether or not a flow is to be admitted as part of an established Aggregate Bearer

Aggregate Bearer Measurement (ABM) function: function that determines the capacity used and remaining in an aggregate bearer as a result of measuring the actual media flows after taking into account what flows were requested

InterConnection Function (ICF): functional entity connecting two networks having differing administrative policy such as Quality of Service (QoS) or addressing policy but employing the same signalling protocol, and transport technology, at the point of interconnect

Transport Resource Manager (TRM): functional entity that applies a set of policies and mechanisms to a set of transport resources to ensure that those resources are allocated such that they are sufficient to enable transport flows with QoS guarantees across the domain of control of the TRM

3.2 Abbreviations

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

ABAC	Aggregate Bearer Admission Control
ABLC	Aggregate Bearer Load Control
ABM	Aggregate Bearer Measurement
BC	Bearer Control
CC	Call Control
ICF	Interconnection functionMG = Media Gateway
ITSP	IP Telephony Service Provider
MGC	Media Gateway Control
QoS	Quality of Service
RTP	Real Time Protocol
TMR	Transmission Medium Requirement
TRM	Transport Resource Manager

4 Reference architecture

The aggregate load control information flows are part of the N2 and N3 reference points in the ETSI-TIPHON architecture (see TS 102 882 series [1]). **The Aggregate Bearer Admission Control (ABAC) function** determines whether or not a flow is to be admitted as part of an established Aggregate Bearer. It also keeps track of the capacity available for flows as they may change for reasons other than the admission or cessation of media flows.

The Aggregate Bearer Measurement (ABM) function determines the capacity used and remaining in an Aggregate Bearer as a result of measuring the actual media flows after taking into account what flows were requested.

Aggregate load control information flow may also be applied on the I3 reference point of TS 102 882 series [1].

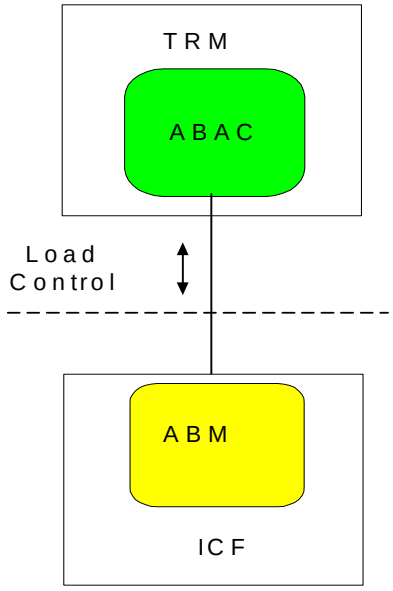

Figure 1: Aggregate Load Control application

5 General load control functions

Load Control information flows between ABM and ABAC provide the capability to provide admission control functionality based on aggregate bandwidth usage measurements and transport network QoS performance. The load control shall enable the following functions:

a) Admission control based on aggregate capacity availability.

b) Admission control based on transport network QoS performance.

c) Support of traffic management (e.g. load balancing, codec rate reduction etc.) by means of bandwidth usage (or unused bandwidth) report.

6 Admission control - aggregate capacity availability

6.1 Support of different media types

Load control may be performed per Media types. ITU-T Recommendation Q.50 [4] defines load control for two Transmission Medium Requirement (TMR) types:

- 3,1 kHz audio or speech - capacity available/unavailable
- 64 kbit/s unrestricted - capacity available/unavailable

For traffic originating from the PSTN/ISDN, the load control protocol shall support the aggregation of different PSTN/ISDN bearer capabilities over the same aggregate bearer. Bearer capabilities are described as Media types.

6.2 Support of High/Low load thresholds

When the bandwidth usage of the aggregate flow exceeds a predetermined percentage of the reserved bandwidth (High_threshold) "capacity unavailability" shall be declared.

"Capacity unavailability" shall be changed to " Capacity available" when the bandwidth usage of the aggregate flow is below a predetermined percentage of the reserved bandwidth (Low_threshold).

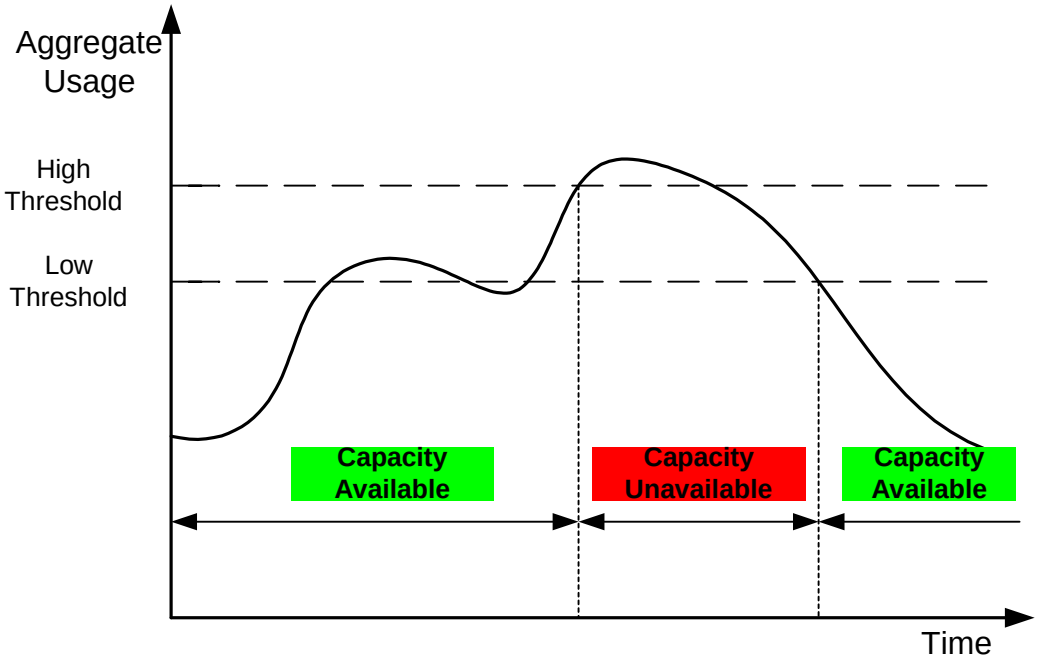

Figure 2: Example of capacity Available/Unavailable transitions

It shall be possible to define the following types of load thresholds:

- High/Low threshold of bandwidth usage of total aggregate (percentage).

Optionally the thresholds may be set in addition also per media type:

- High/Low threshold of bandwidth usage of media type (percentage).

6.3 Load Control message from ABM to ABAC

Load threshold passing shall be indicated from the ABM to the ABAC. The load control message from ABM to ABAC shall consist of:

- The status of the capacity (available/unavailable), and the media type.

NOTE: One of the media types shall represent the total aggregate (i.e. all media types).

6.4 Admission control mechanism

6.4.1 ABAC admission control

The ABAC shall not admit any new calls to the aggregate after reception of "aggregate capacity unavailable" message. Reception of "aggregate capacity available" message will enable again the admission of new calls to the aggregate.

How the MGC handles calls that cannot be admitted to an aggregate bearer is implementation dependent.

6.4.2 Media Layer admission control (ABM in media layer application)

For ABM implementations in the media layer the following procedure may be applied:

- **The media layer may reject the admission of a call to the aggregate during any phase of the connection establishment process**. i.e. even if the ABAC has admitted a call to the aggregate, the media layer may still reject the connection request. This mechanism takes into account that the most updated information about aggregate bearer usage resides in the media layer ABM functional unit. This mechanism also resolves any possible inconsistencies between ABAC and media layer.

7 Admission control - transport network QoS performance

An aggregate is provisioned with a set of QoS parameters. In spite of the aggregate being provisioned with a set of QoS performance parameters, the transport network performance may deteriorate during the lifetime of the aggregate.

A new call shall be admitted by the ABAC function, only if the per call QoS parameters requirement can be accommodated with the current transport network QoS parameters.

QoS performance notifications may be obtained from the transport layer via the T2 interface defined in TS 102 882 series [1]. Optionally, aggregate QoS measurements may also be performed in the media layer.

The Aggregate QoS Parameters sequence is as follows:

```
maxDelay                    INTEGER, -- value in ms -
maxDelayVariation           INTEGER, -- value in ms -
maxPacketLoss               Percentage -- value as a mean percentage –
```

When one of the QoS parameters exceeds its maximum value, a QoS control message shall be send from the media layer to the ABAC function. The "aggregate QoS control message" shall consist of QoS Alarm ON/OFF indication and the current values of the QoS parameters sequence.

8 Traffic management support - Capacity event report and capacity statistics

The capacity event/statistics reports support traffic management functionality (e.g. load sharing, codec rate reduction etc.). It enables pre-emptive actions (e.g. codec rate reduction for new calls) in order not to reach the "capacity alarm-unavailable" state.

The capacity event report is send when the capacity usage of the aggregate exceeds an "early warning" threshold. The capacity event report is also send when the capacity usage is below or equal to a "normal load" threshold.

The capacity statistics report consists of the same information elements like the capacity event report but is send periodically at the end of the statistics interval.

The capacity event report and the capacity statistics report shall consist of the following parameters:

- Aggregate ID.
- Average percentage of capacity used (0 % to 100 %) in last measurement interval.
- Peak percentage of capacity used (0 % to 100 %) in last measurement interval.
- Total reserved bandwidth (this is a fixed parameter set by configuration management).

9 Load Control primitives and parameters

Table 1

	Direction	Primitive	Parameters
1)	ABM -> ABAC	Aggregate Load Control - CAPACITY ALARM	Aggregate ID, MediaType, Capacity available/unavailable
2)	ABM -> ABAC	CAPACITY EVENT Report	Aggregate ID, % average capacity used, % peak capacity used, total bandwidth,
3)	ABM -> ABAC	Aggregate QoS Control	Aggregate ID, QoS Alarm ON/OFF, QoS Parameters Type Sequence
4)	ABM -> ABAC	Capacity Statistics Report	Aggregate ID, % average capacity used, % peak capacity used, total bandwidth

Annex A (normative): Aggregate Bearer Load Control (ABLC) - H.248 Package

PackageID: aggr (0xYYYY)

Version: 1

Extends: none

This package defines aggregate bearer load control information flows between a ABM and ABAC in order to provide admission control functionality based on aggregate bandwidth usage measurements and transport network QoS performance.

This package is based on the assumption that the Aggregate Bearer is created as an "ephemeral" termination.

A.1 Events

A.1.1 Aggregate Load Control – Capacity Alarm

Event ID: CapacityAlarm, 0x0001.

Description: This event allows the ABM to indicate aggregate load threshold passing.

EventsDescriptor parameters:

Media type

ParameterID: mediaproperty, 0x0001.

Type: enumeration.

Possible values: "all"(0x0001);

"audio/speech" (0x0002);

"64 kbit/s" (0x0003).

Description: "all" = total of all media types;

"audio/speech"= 3.1 KHz audio or speech media type;

"64 Kbit/s" = unrestricted 64 kbit/s media type.

NOTE: Other media types may be added by extensions.

Capacity Alarm High_threshold

ParameterID: highthcap, 0x002.

Type : integer.

Possible values: 0 to 100 (decimal).

Description: This threshold is used when aggregate capacity is "available" and is expressed as a percentage of the provisioned bandwidth.

Capacity Alarm Low_threshold

ParameterID: lowthcap, 0x0003.

Type : integer.

Possible values: 0 to 100 (decimal).

Description: This threshold is used when aggregate capacity is "unavailable and is expressed as a percentage of the provisioned bandwith".

ObservedEventsDescriptor parameters:

ParameterID: mediatype, 0x0001.

Type: enumeration.

Possible values: "all" (0x0001);

" audio/speech" (0x0002);

"64 kbit/s" (0x0003);

ParameterID: Capacity, 0x0004.

Type: enumeration.

Possible values: "available" or "unavailable".

Description: This observed event is send from the ABM to the ABAC in order to inform about changes in aggregate capacity availability per media type. Capacity availability/unavailability events are triggered by threshold passing.

A.1.2 Capacity event - Report

Event ID: CapacityReport, 0x0003

Description: The ABM issues an capacity event report to the ABAC. The capacity event report shall be send when an "early warning" capacity threshold is exceeded. The capacity event report shall also be send when the capacity usage is below or equal to the "normal" threshold.

EventsDescriptor parameters:

Early threshold for Capacity Event Report

ParameterID: earlythcap, 0x003.

Type : integer (percentage).

Possible values: 0 to 100 (decimal).

Description: This threshold is used to trigger an "early warning" capacity event report.

Normal threshold for Capacity Event report

ParameterID: normalthcap, 0x0003.

Type : integer (pertcentage).

Possible values: 0 to 100 (decimal).

Description: This threshold is used to trigger a "Normal Load" capacity report.

ObservedEventsDescriptor parameters

Average Capacity Usage

Parameter ID: avcapacity, 0x0010.

Description: Describes the average aggregate capacity usage (percentage) in the last measurement interval. Average usage is expressed as a percentage value.

Type: integer (percentage).

Possible values: 0 to 100 (decimal).

Peak capacity Usage

Parameter ID: peakcapacity, 0x0011.

Description: Describes the peak aggregate capacity usage (percentage) in the last measurement interval. Peak usage is expressed as a percentage value.

Type: integer (percentage).

Possible values: 0 to 100 (decimal).

Aggregate Provisioned Bandwith

Parameter ID: aggprovbw, 0x0012.

Description: Describes the aggregate provisioned bandwidth in kbit/s.

Type: integer.

Possible values:

A.1.3 AggregateQoS

EventID: aggrQoS, 0x0002.

EventsDescriptor parameters:

Max Delay

ParameterID: maxdelay, 0x0005.

Type: integer.

Possible values: value in ms.

Max Delay variation

ParameterID: maxdelay, 0x0006.

Type: integer.

Possible values: value in ms.

Max Packet Loss

ParameterID: maxpacketloss, 0x0007.

Type: Double.

Possible values: a 32 bit whole number and a 32 bit fraction.

ObservedEventsDescriptor:

QoSAlarm

ParameterID: qosalarm, 0x0008.

Type: enumeration.

Possible values: "ON" or "OFF".

Max Delay

ParameterID: maxdelay, 0x0005.

Type: integer (ms).

Possible values: value in ms.

Max Delay variation

ParameterID: maxdelay, 0x0006.

Type: integer (ms).

Possible values: value in ms.

Max Packet Loss

ParameterID: maxpacketloss, 0x0007.

Description: Describes the current rate of packet loss on an RTP stream, as defined in IETF RFC 1889. Packet loss is expressed as percentage value: number of packets lost in the interval between two reception reports, divided by the number of packets expected during that interval.

Type: double.

Possible values: a 32 bit whole number and a 32 bit fraction.

A.2 Statistics

Average Capacity Usage

Statistics ID: avcapacity, 0x000A

Description: Describes the average aggregate capacity usage (percentage) in the last statistics interval. Average usage is expressed as a percentage value.

Type: integer (percentage)

Possible values: 0-100 (decimal)

Peak capacity Usage

Statistcs ID: peakcapacity, 0x000B

Description: Describes the peak aggregate capacity usage (percentage) in the last statistics interval. Peak usage is expressed as a percentage value.

Type: integer (percentage)

Possible values: 0-100 (decimal)

Aggregate Provisioned Bandwith

Statistcs ID: aggprovbw, 0x000C

Description: Describes the aggregate provisioned bandwidth in kbit/s.

Type: integer

Possible values:

Max Delay

StatisticsID: maxdelay, 0x000D

Type: integer (ms)

Possible values: value in ms

Max Delay variation

ParameterID: maxdelay, 0x000E

Type: integer (ms)

Possible values: value in ms

Max Packet Loss

ParameterID: maxpacketloss, 0x000F

Description: Describes the current rate of packet loss on an RTP stream, as defined in IETF RFC 1889 [5]. Packet loss is expressed as percentage value: number of packets lost in the interval between two reception reports, divided by the number of packets expected during that interval.

Type: double

Possible values: a 32 bit whole number and a 32 bit fraction.

History

Document history		
V4.1.1	August 2003	Publication