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SERIES Q: SWITCHING AND SIGNALLING

Clauses applicable to ITU-T standard systems – Logic and protocols for the control of signal processing network elements and functions

Protocols for the control of signal processing network elements and functions

ITU-T Recommendation Q.115.0

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ITU-T Recommendation Q.115.0

Protocols for the control of signal processing network elements and functions

Summary

Echo Cancellation and Voice Quality Enhancement have become a necessity not only in Circuit Switched Networks (wired and wireless) but also in Next Generation Networks. Signal processing network elements and functions are provided on a per-call basis to guarantee QoS for voice calls. This Recommendation describes the protocols to control, on a per-call basis, the signal processing functions. The protocols described in this Recommendation include TDM-based as well as IP-based protocol versions for TDM networks and IP networks.

Source

ITU-T Recommendation Q.115.0 (2002) was prepared by ITU-T Study Group 11 (2001-2004) and approved under the WTSA Resolution 1 procedure on 29 December 2002.

Keywords

Automatic Level (Gain) Control, Echo cancellation, Echo control, Noise Reduction, Voice Quality Enhancement.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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ITU-T Recommendation Q.115.0

Protocols for the control of signal processing network elements and functions

1 Scope

Echo Control (e.g., echo cancellation) and Voice Quality Enhancement (e.g., voice enhancement device) have become a necessity not only in Circuit Switched Networks (wired and wireless) but also in Next Generation Networks. Signal processing network elements and functions are provided on a per-call basis to guarantee QoS for voice calls. This Recommendation describes the protocols to control on a per-call basis the signal processing functions. The protocols described in this Recommendation include TDM-based as well as IP-based protocol versions for TDM networks and IP networks.

The signal processing function specific logic, i.e. the logic that decides on the need for a signal processing function and the number of signal processing functions to be provided for a call, is defined in ITU-T Recs Q.115.x.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[1] ITU-T Recommendation Q.52 (2001), *Signalling between international switching centres and stand-alone echo control devices*.

[2] ITU-T Recommendation Q.55 (1999), *Signalling between signal processing network equipment (SPNE) and international switching centres (ISC)*.

[3] ITU-T Recommendation Q.56 (2001), *Signalling between signal processing network equipment (SPNE) and international switching centers over an IP network*.

[4] ITU-T Recommendation H.248 (2000), *Gateway Control Protocol*.

[5] ITU-T Recommendation G.173 (1993), *Transmission planning aspects of the speech service in digital public land mobile networks*.

3 Definitions

This Recommendation defines the following terms:

3.1 signal processing function specific logic: A functional entity (part of call control) that decides if a signal processing function is required for this call.

3.2 signal processing function: A functional entity; examples are echo cancellation, noise reduction, automatic level (gain) control, etc.

3.3 signal processing network element: A physical entity that contains one or more signal processing functions assigned to one or more E1/T1 facilities.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

CAS Channel associated signalling

CCF Call Control Function

ECD Echo Control Device

ECF Echo Control Function (echo cancellation, echo suppression)

E1 A transmission link operating at 2048 kbit/s, supporting 30 or 31 64 kbit/s channels.

IP Internet Protocol

LAN Local Area Network

MG Media Gateway

MGC Media Gateway Controller

QoS Quality of Service

SPF Signal Processing Function

SPFCF SPF Control Function

SPFSF SPF Switching Function

SPFSL SPF Specific Logic

SPNE Signal Processing Network Element

TDM Time Division Multiplex

T1 A transmission link operating at 1544 kbit/s supporting 24 speech channels.

VoIP Voice over IP

5 Conceptual model

For each signal processing function SPF there exists a signal processing function specific logic added to call/bearer control; see Figure 1. Any SPF is provided on a per-call basis. A master slave relation exists between the SPF switching function and the SPF control function.

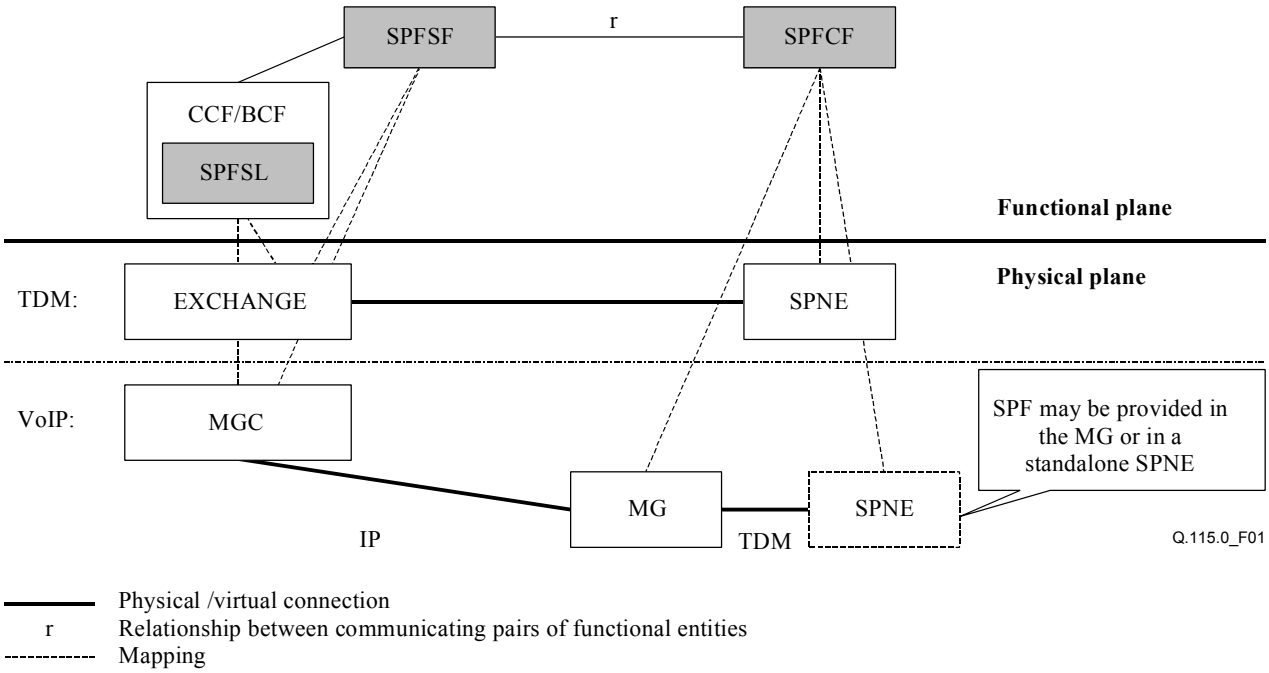


Figure 1/Q.115.0 – Conceptual methodology model

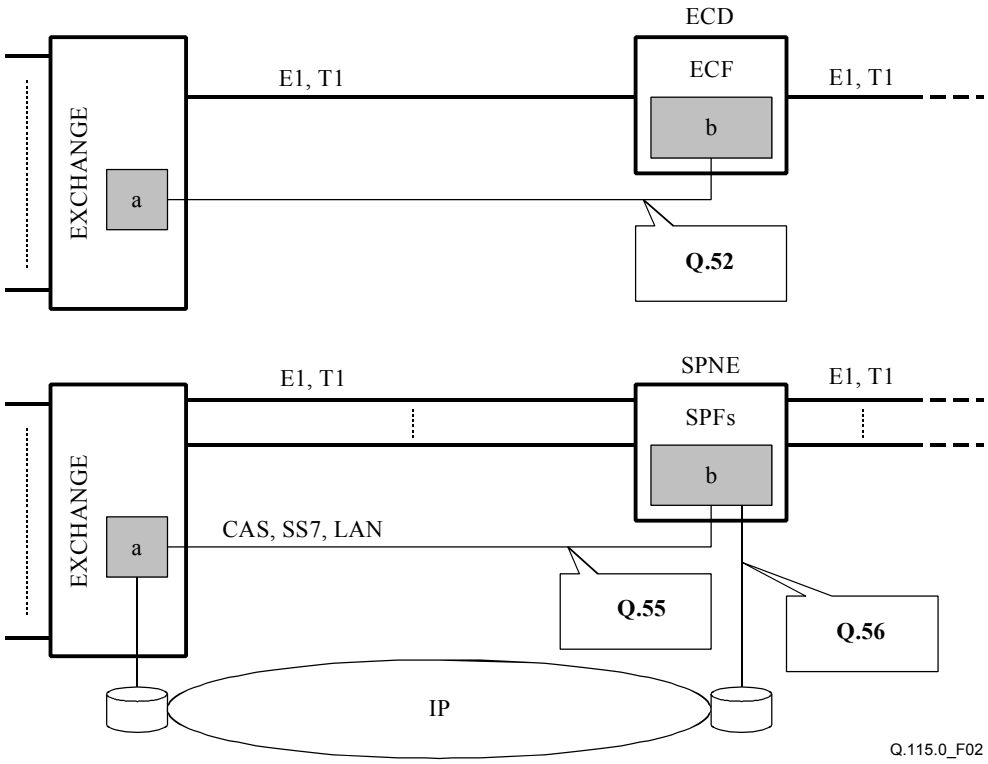
In the VoIP scenario where the MG controls the SPFs provided in a standalone (external) SPNE, the MG has an application protocol interworking function (H.248 SPNE package ↔ Q.52/Q.55/Q.56).

6 Network scenarios

6.1 TDM: Standalone SPNE

Echo suppressors and echo cancellers provided as standalone equipment are considered to be a first generation of SPNE. The protocol to control standalone echo control devices is defined in ITU-T Rec. Q.52; see Figure 2.

A platform providing one or more signal processing functions is referred to as SPNE. The protocols to control standalone SPNEs are defined in ITU-T Recs Q.55 and Q.56; see Figure 2.



a SPFSF
b SPFCF

Figure 2/Q.115.0 – TDM scenarios and the control protocols

6.2 VoIP: SPNE integrated in or external to a media gateway

H.248 is the media gateway protocol used between a media gateway controller and a media gateway in the decomposed architecture. The H.248 SPNE package defined in this Recommendations allows the control of signal processing functions; see Figure 3.

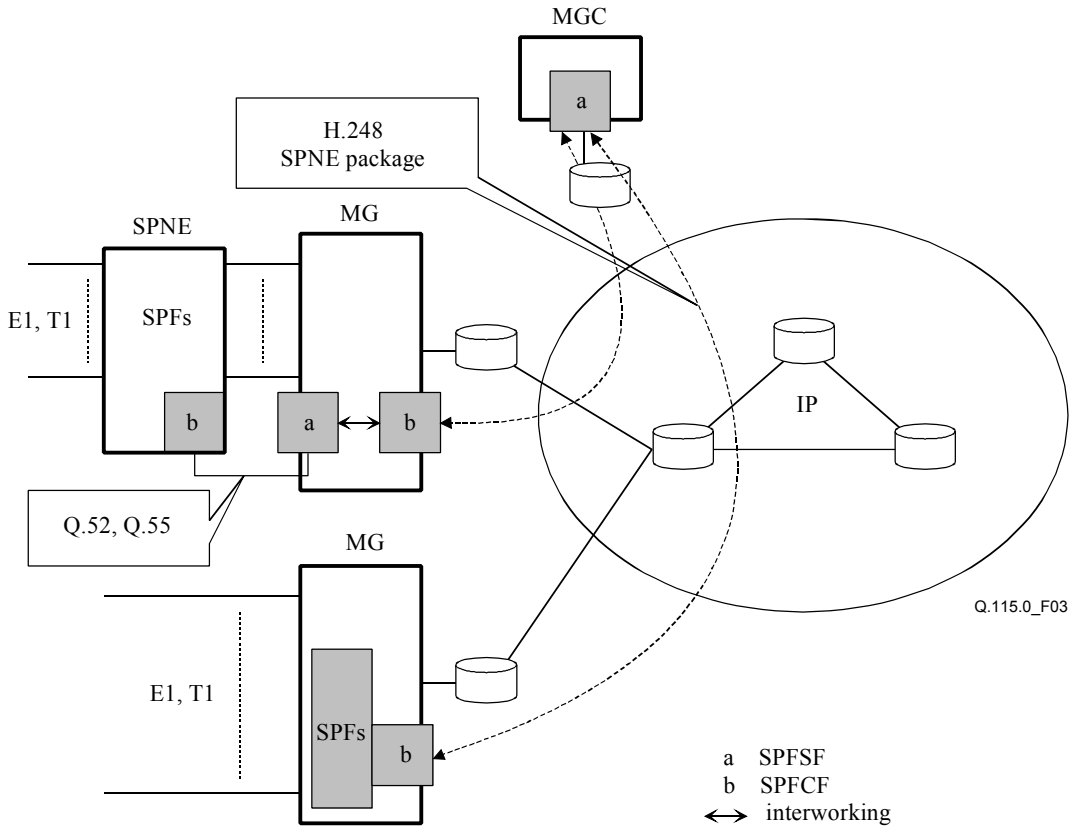


Figure 3/Q.115.0 – VoIP Gateway (decomposed architecture); H.248 SPNE package (as defined in this Recommendation) is the control protocol

7 Protocols

7.1 TDM

The protocol to control standalone Echo Control Devices is defined in ITU-T Rec. Q.52.

The protocols (protocol family, including CAS, SS7 and LAN) to control one or more SPF of a SPNE is defined in ITU-T Rec. Q.55. If a "public" IP network is used for the transport of the control signalling, then ITU-T Rec. Q.56 could be used.

7.2 VoIP

This clause describes the Signal Processing Network Equipment (SPNE) package for H.248. It allows a Media Gateway Controller to control the SPFs of a SPNE equipment either integrated into or attached to a Media Gateway. The SPNE equipment may include echo cancellation (without non linear processor), automatic level control, noise reduction and frequency equalization.

SPNE Control Package

PackageID: spne, (------)

Version: 1

Extends: TDM Package (tdmc (0x000d) Version 1

This package defines properties and events for SPNE functions controlled by or integrated into a media gateway. Note that echo cancellers associated with media gateways are assumed to be compliant with ITU-T Rec. G.168 as indicated in ITU-T Rec. G.177.

Logic that determines which SPNE function is enabled or disabled during a call is outside the scope of this Recommendation.

7.2.1 Properties

Non Linear Processing

PropertyID: nlp (0x0003)

Controls the non-linear processing property of an ECD on the TDM termination.

Type: enumeration

Possible Values:

DISABLE (0x0000)

ENABLE (0x0001)

Defined in: LocalControlDescriptor

Characteristics: Read/Write

Comfort Noise Injection

PropertyID: cni (0x0004)

This controls the comfort noise injection function of the ECD on the TDM termination.

Type: enumeration

Possible Values:

DISABLE (0x0000)

ENABLE (0x0001)

Defined in: LocalControlDescriptor

Characteristics: Read/Write

Automatic Level Control

PropertyID: alc (0x0005)

This provides control information for incoming automatic level control on the TDM termination.

Type: enumeration

Possible Values:

DISABLE (0x0000)

ENABLE TYPE 0 (0x0001)

ENABLE TYPE 1 (0x0002)

ENABLE TYPE 2 (0x0003)

ENABLE TYPE 3 (0x0004)

Defined in: LocalControlDescriptor

Characteristics: Read/Write

Frequency Equalization

PropertyID: fe (0x0006)

This controls the frequency equalization function of a TDM termination. The characteristics of the frequency equalization type is determined and configured by manufacturer and/or carrier.

Type: enumeration

Possible Values:

DISABLE (0x0000)

ENABLE TYPE 0 (0x0001)

ENABLE TYPE 1 (0x0002)

ENABLE TYPE 2 (0x0003)

ENABLE TYPE 3 (0x0004)

Defined in: LocalControlDescriptor

Characteristics: Read/Write

Noise Reduction

PropertyID: in-nrd (0x0007)

This controls the incoming noise reduction function of a TDM termination. The characteristics of the incoming noise reduction function type is determined and configured by manufacturer and/or carrier.

Type: enumeration

Possible Values:

DISABLE INCOMING (0x0000)

ENABLE INCOMING TYPE 0 (0x0001)

ENABLE INCOMING TYPE 1 (0x0002)

ENABLE INCOMING TYPE 2 (0x0003)

ENABLE INCOMING TYPE 3 (0x0004)

Defined in: LocalControlDescriptor

Characteristics: Read/Write

PropertyID: out-nrd (0x0009)

This controls the outgoing noise reduction function of a TDM termination. The characteristics of the outgoing noise reduction function type is determined and configured by manufacturer and/or carrier.

Type: enumeration

Possible Values:

DISABLE OUTGOING (0x0000)

ENABLE OUTGOING TYPE 0 (0x0001)

ENABLE OUTGOING TYPE 1 (0x0002)

ENABLE OUTGOING TYPE 2 (0x0003)

ENABLE OUTGOING TYPE 3 (0x0004)

Defined in: LocalControlDescriptor

Characteristics: Read/Write

Events: None

Signals: None

Statistics: None

7.2.2 Procedures

Echo Cancellation

When a MGC determines, through Q.115.1 echo control logic, a need to provide an echo control device (ECD) on a connection, it initiates a command to the MG. The MG, upon receipt of a property with the ECD indication, enables the echo control device associated with the specified termination if the value is ENABLE, or disables the echo control device if the value is DISABLE.

Non Linear Processing

Echo cancellers include a function called a non-linear processor (NLP). This operates as a smart attenuator, and eliminates residual echo during periods when only one party is speaking. In some cases the NLP function is automatically enabled when the ECD is enabled, however, in other network configurations, it is beneficial to speech quality to disable the NLP independent of the ECD. A network operator may determine that the NLP should be disabled for certain calls. When a MGC determines a requirement for disabling the NLP associated with a termination, it will send this package to the MG. How the MGC determines the requirement for use of the NLP is outside the scope of this Recommendation.

Automatic Level Control

When a MGC determines a requirement for automatic level control of the media stream, it will send a package to a MG to enable a selected Type ALC associated with the termination. How the MGC determines the requirement for use of the ALC is outside the scope of this Recommendation.

Frequency Equalization

When a MGC determines a requirement for frequency equalization of the media stream, it will send a property to a MG to enable a selected type of FE associated with the termination. How the MGC determines the requirement for use of the FE is outside the scope of this Recommendation.

Noise Reduction

When a MGC determines to insert a Noise Reduction Device/Function to reduce the amount of unwanted noise, it will enable a NRD associated with the termination by sending a property to the MG. How the MGC determines the requirement for use of the NRD is outside the scope of this Recommendation.

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