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SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS

Digital terminal equipments – Other terminal equipment

Mechanism for dynamic coordination of signal processing functions

Recommendation ITU-T G.799.2



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Mechanism for dynamic coordination of signal processing functions

Summary

As a result of the evolution of the telecommunication networks in recent years, signal processing features such as voice quality enhancement processing may now be found in different communication nodes and combined in different ways on a bearer path. However, instead of the intended purpose of preserving or enhancing voice quality, signal processing functions deployed on the same bearer path could cause overall voice quality degradation due to undesirable side-effects of the interaction of the individual functions.

The concerns about the interaction of signal processing functions can be mitigated if the communication nodes are properly coordinated and controlled to provide the end-to-end communication with the optimal placement of signal processing functions. Whilst local operators may have direct control of some of the equipment, this control by the local operators may not extend to all the nodes in call scenarios such as inter-system links. The traditional "static" approach to the coordination of signal processing functions, such as those found in voice enhancement equipment, may not meet the requirements of modern call topologies, which tend to be dynamic. Lack of coordination of the signal processing functions may result in voice quality degradation.

Recommendation ITU-T G.799.2 defines a generic framework for a coordination mechanism intended to minimize undesirable interactions of signal processing functions present on bearer paths of a communication link. The goal of this Recommendation is to provide a mechanism that can be used to optimize the end-to-end voice quality.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.799.2	2009-12-14	16

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FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). 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.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

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Recommendation ITU-T G.799.2

Mechanism for dynamic coordination of signal processing functions

1 Scope

This Recommendation applies to signal processing functions that are intended for use in a communication link between terminal devices through network connections.

Examples of signal processing functions are echo cancellers, acoustic echo control, automatic level control and noise reduction. Communication networks include GSTN, IP networks, wireless mobile networks and any combination of them.

This Recommendation defines a generic framework for a coordination mechanism intended to minimize undesirable interactions of signal processing functions present on bearer paths of a communication link. The goal of this Recommendation is to provide a mechanism that can be used to optimize the end-to-end voice quality.

The signal processing functions subject to coordination by using this Recommendation could be present in the terminal devices and/or the communication networks. The mechanism performing dynamic coordination of signal processing functions includes the following components: capability announcement, capability identification, capability interaction resolution and capability change.

This Recommendation does not define the protocol to implement the coordination mechanism, but rather defines all the elements and information to be exchanged in support of the coordination mechanism. The implementation aspects of this mechanism will be defined in other ITU-T Recommendations.

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.

- [ITU-T G.160] Recommendation ITU-T G.160 (2008), *Voice enhancement devices*.
- [ITU-T G.161] Recommendation ITU-T G.161 (2004), *Interaction aspects of signal processing network equipment*.
- [ITU-T G.168] Recommendation ITU-T G.168 (2009), *Digital network echo cancellers*.
- [ITU-T G.169] Recommendation ITU-T G.169 (1999), *Automatic level control devices*.
- [ITU-T G.799.1] Recommendation ITU-T G.799.1 (2004), *Functionality and interface specifications for GSTN transport network equipment for interconnecting GSTN and IP networks*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 acoustic echo [ITU-T G.160]: Acoustic echo is the reflected signal resulting from the acoustic path between the earphone/loudspeaker and microphone of a terminal, hand-held or hands-free mobile station.

3.1.2 automatic level control device [ITU-T G.161]: An automatic level control device (ALC) is a signal processing function located in the digital transmission path which automatically adjusts the level of a signal towards a predetermined value. Devices which modify the frequency response or spectral content of the signal in such a way as to affect the overall level of the signal are also defined as ALC devices for the purpose of this Recommendation. An ALC device is designed to process signals in one direction of transmission (see Figure 1).

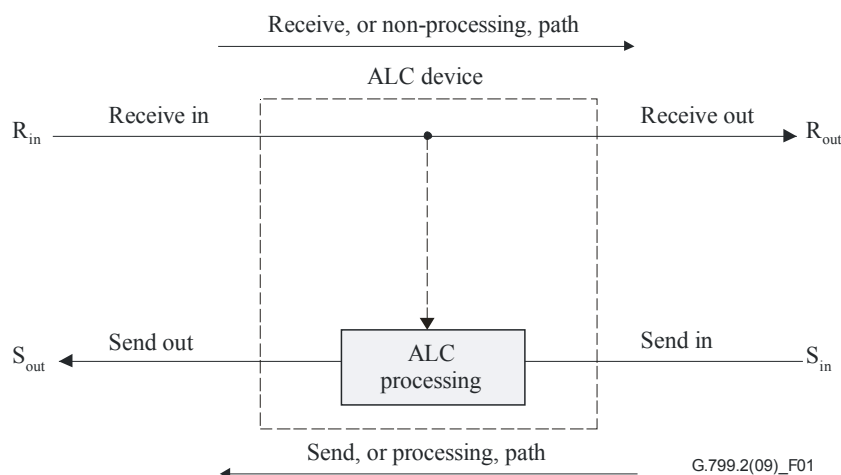


Figure 1 – Block diagram of an automatic level control device [ITU-T G.169]

3.1.3 cancelled end [ITU-T G.161]: The side of an echo canceller which contains the echo path on which this echo canceller is intended to operate. This includes all transmission facilities and equipment (including the hybrid and terminating telephone set) which is included in the echo path.

3.1.4 network acoustic echo controller [ITU-T G.161]: Network acoustic echo controllers are devices placed in the 4-wire portion of a circuit and used for reducing cancelled-end acoustic echo.

3.1.5 network echo canceller [ITU-T G.161]: An network echo canceller is a voice-operated device placed in the 4-wire portion of a circuit and used for reducing the cancelled-end echo present on the send path by subtracting an estimation of that echo from the cancelled-end echo (see Figure 2).

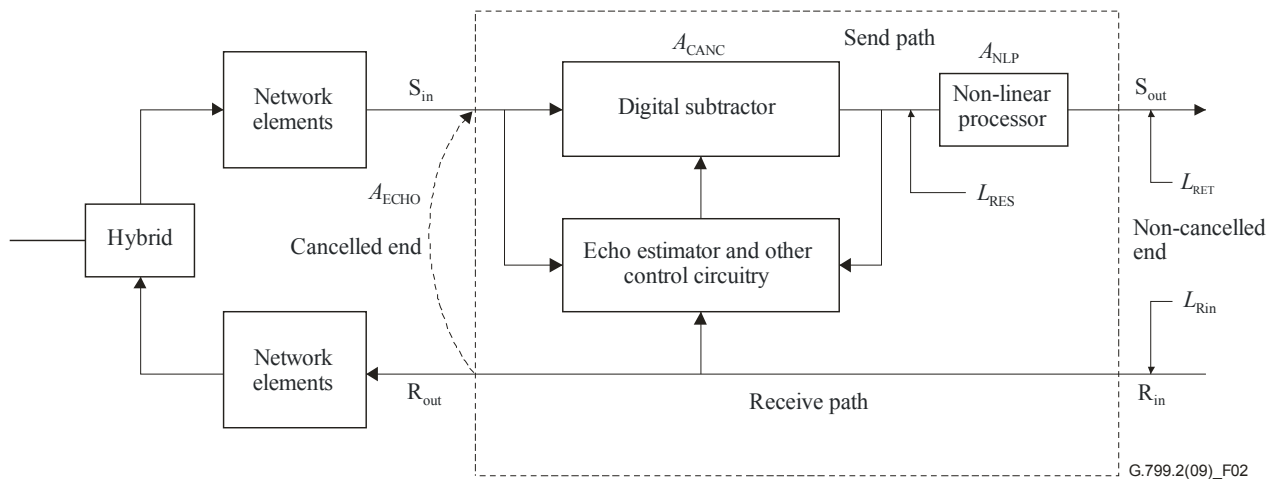


Figure 2 – Block diagram of an echo canceller [ITU-T G.168]

3.1.6 network echo suppressors [ITU-T G.161]: A network echo suppressor is a voice-operated device placed in the 4-wire portion of a circuit and used for inserting loss in the transmission path to suppress echo. The path in which the device operates may be an individual circuit path or a path carrying a multiplexed signal.

3.1.7 terminal acoustic echo controller [ITU-T G.161]: Terminal acoustic echo controllers are voice-operated devices installed in audio terminals on the customer premises, used for the purpose of eliminating acoustic echoes and protecting the communication from howling due to acoustic feedback from loudspeaker to microphone.

3.1.8 voice enhancement device [ITU-T G.161]: Voice enhancement devices are intended for use in digital network-based equipment for mobile applications. Voice enhancement functions include the control of acoustic echo generated by wireless handsets, noise reduction, and the recognition and accommodation of tandem free operation (TFO) and interworking function (IWF) signals.

3.1.9 voice gateways [ITU-T G.161]: A voice gateway is a subset of a gateway that deals with voice and voiceband traffic only, and not data or video traffic.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 automatic listener enhancement (ALE) device: An automatic listener enhancement (ALE) device is defined as any signal processing function located in the digital transmission path that adjusts the level of a signal in one transmission direction based on the measurements of signal in the other transmission direction with the purpose of enhancing audibility in high environmental noise conditions. Devices that modify the frequency response or spectral content of the signal in such a way as to affect the overall level of the signal are also defined as ALE devices.

NOTE – The performance requirement for this function is outside the scope of this Recommendation.

3.2.2 signal processing equipment (SPE): A stand-alone physical entity that supports one or more signal processing functions. Examples of signal processing equipment are signal processing network equipment (SPNE) [ITU-T G.161] and signal processing terminal devices.

3.2.3 signal processing function: A software component or a hardware entity that performs voice processing such as, but not limited to, electric or acoustic echo control, noise reduction or automatic level control.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AEC	Acoustic Echo Control
ACM	Address Complete Message
ALC	Automatic Level Control
ALE	Automatic Listener Enhancement
ANM	Answer Message
BSC	Base Station Controller
CNG	Comfort Noise Generation
EC	Echo Canceller
ECD	Echo Control Device
GSTN	General Switched Telephone Network
IAM	Initial Address Message
IP	Internet Protocol
IWF	Interworking Function
LSB	Least Significant Bit
MGW	Media Gateway
MS	Mobile Station
MSB	Most Significant Bit
MSC	Mobile Switching Centre
NR	Noise Reduction
SC	Switching Centre
SPD	Signal Processing Device
SPE	Signal Processing Equipment
SPID	Signal Processing equipment Identifier
SPF	Signal Processing Function
SPNE	Signal Processing Network Equipment
TCE	Transcoder Equipment
TFO	Tandem Free Operation
VED	Voice Enhancement Device
VoIP	Voice over Internet Protocol
VQ	Voice Quality