



TECHNICAL REPORT

End to End Network Architectures (E2NA); Location of Transcoders for voice and video communications

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Foreword

This Technical Report (TR) has been produced by ETSI Project End-to-End Network Architectures (E2NA).

Modal verbs terminology

In the present document "shall", "shall not", "should", "should not", "may", "may not", "need", "need not", "will", "will not", "can" and "cannot" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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Introduction

As the number of voice and video codecs available on the market place increases, resorting to transcoding functions becomes unavoidable. There seems to be little guidance on where to implement and invoke these functions within and between networks. Which network (e.g. the originating, transit or terminating network, the fixed or the mobile network) should be responsible for transcoding and which entity inside this network (e.g. home gateway, edge gateway, border gateway, trunking gateway, specialized media gateway in the core network, etc.) should perform transcoding are typical questions that have to be answered to ensure successful call setup procedures with optimal end-to-end quality of experience.

1 Scope

The present document provides a review of standardization activities on the location of transcoders for voice and video communications inside and across networks. It identifies issues that are not addressed in current standards and provides recommendations to fill these gaps.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] GSMA™ IN.24: "Voice IPX break in - out interworking scenarios recommendation on IPX Hubbing Quality", Version 1.1, 12th February 2013.
- [i.2] i3 forum document: "Voice path engineering in international IP-based networks", Release 3, May 2011.
- [i.3] ETSI TS 123 228: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; IP Multimedia Subsystem (IMS); Stage 2 (3GPP TS 23.228)".
- [i.4] ETSI TS 123 153: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Out of band transcoder control; Stage 2 (3GPP TS 23.153)".

3 Definitions and abbreviations

3.1 Definitions

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

direct interconnection: interconnection without intermediate networks between two service provider's networks

non direct interconnection: interconnection with a least one intermediate network between service provider's networks

service provider: specific type of application service provider that provides voice related services and optionally text and video-related services

3.2 Abbreviations

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

AMR-WB	Adaptive Multi Rate - WideBand
ATM	Asynchronous Transfer Mode
CN	Core Network
CS	Circuit Switched
CSCF	Call Service Control Function
GSMA™	Global System for Mobile communications Association
HD	High Definition
IBCF	Interconnect Border Control Function
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IPX	IP eXchange
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
MRFC	Multimedia Resource Function Controller
MSC	Mobile services Switching Centre
PCM	Pulse Code Modulation
P-CSCF	Proxy CSCF
SA	System Architecture (Technical Specification Group of 3GPP)
STQ	ETSI technical committee for Speech, Transmission planning, and Quality of service
TDM	Time Division Multiplexing
TTC	Telecommunications Technology Committee (Japan)
UE	User Equipment
UMTS	Universal Mobile Telecommunications System

4 Background

The review performed in the present document is based on an analysis of standards and technical specifications from the following organizations and liaisons statements received from these organizations:

- 3GPP SA
- ETSI STQ
- GSMA™ IWG/IMQ
- i3 forum
- ITU-T SG16
- TTC Media Coding

5 Review of standards and technical specifications

5.1 Interconnection between service provider networks

5.1.1 Interconnection between circuit-switched networks

5.1.1.1 Direct interconnection between fixed service provider networks

The present document has not identified any publicly available standards or technical specification providing guidelines on the location of transcoders for this configuration.

5.1.1.2 Direct interconnection between mobile service provider networks

According to ETSI TS 123 153 [i.4], where no compatible codec type can be selected between the UEs then the default PCM coding is expected to be selected. The originating MSC is expected to insert a transcoder in the path from the originating UE. Codec selection for the terminating UE is then performed within the terminating MSC, independently of the originating MSC.

In configurations where one service provider uses ATM or IP transport (i.e. bearer-independent CS core network) and the other service provider uses TDM transport, the capability to insert transcoder a (in cases where transcoder free operation is not possible) at the most appropriate location (i.e. to save bandwidth), should be located at the CN edge between an ATM or IP transport network and a TDM network.

5.1.1.3 Direct interconnection between a fixed and a mobile service provider network

The present document has not identified any publicly available standards or technical specification providing guidelines on the location of transcoders for this configuration.

5.1.1.4 Non-direct interconnection between service provider networks

The present document has not identified any publicly available standards or technical specification providing guidelines on the location of transcoders for this configuration.

5.1.2 Interconnection between a circuit-switched service provider network and an IP-based service provider network

5.1.2.1 Direct interconnection between fixed service provider networks

The present document has not identified any publicly available standards or technical specification providing guidelines on the location of transcoders for this configuration.

5.1.2.2 Direct interconnection between mobile service provider networks

The present document has not identified any publicly available standards or technical specification providing guidelines on the location of transcoders for this configuration.

5.1.2.3 Direct interconnection between a fixed and a mobile service provider network

The present document has not identified any publicly available standards or technical specification providing guidelines on the location of transcoders for this configuration.

5.1.2.4 Non-direct interconnection between service provider networks

According to the i3 forum [i.2], in general, intermediate networks are transparent and do not perform transcoding but, if under specific conditions and/or commercial agreement they are requested to transcode, this function usually takes place in different locations:

- a) for the A-law/m-law conversion transcoding is performed by the m-law carrier;
- b) in case of conversion from IP to TDM transcoding is performed by the media gateway before passing the media to the TDM carrier;
- c) in other cases, many different cases could be described depending on the architecture and network capabilities of the Service Providers and Carriers involved in the end-to-end communication.

According to [i.2], if the call is to be routed to a TDM network and if the originating terminal does not support G.711 interconnection, the carrier interconnecting to the TDM network is expected to perform transcoding.

5.1.3 Interconnection between IP-based service provider networks

5.1.3.1 Direct interconnection

For IMS, there are no defined end to end mechanisms to determine the location of transcoding functions since there are many factors which would affect such decision which include specific call scenarios, network deployment, business agreement between operators and mobility cases.

5.1.3.2 Non-direct interconnection

According to the i3 forum [i.2], in general, intermediate networks are transparent and do not perform transcoding but, if under specific conditions and/or commercial agreement they are requested to transcode, this function usually takes place in different locations:

- for the A-law/m-law conversion transcoding is performed by the m-law carrier;
- in other cases, many different cases could be described depending on the architecture and network capabilities of the Service Providers and Carriers involved in the end-to-end communication.

According to GSMA [i.1], only if no coincidences are met between the service providers' codec lists, transcoding will be performed by the IPX Hub. This only will apply to break in/out scenarios:

- 1) IPXP1 and IPXP2 will negotiate on bilateral basis that will perform the transcoding when needed.
- 2) For all obligations described in the different scenarios, the cascading responsibility applies. In case the IPXP1 relies on the services of IPXP2 in regards to the IPX break in/out functionalities, IPXP1 needs to ensure that a proper contract with the IPXP2 is in place in order for IPXP1 to be able to make a commitment in front of the SP1.
- 3) For the avoidance of doubt, the cascading responsibility principle only applies within the IPX domain and the break in/out functionalities described in GSMA [i.1] are considered inside the IPX.

5.2 Location of transcoders inside networks

5.2.1 Circuit-switched service provider networks

5.2.1.1 Fixed networks

The present document has not identified any publicly available standards or technical specification providing guidelines on the location of transcoders for this configuration.

5.2.1.2 Mobile Networks

Negotiation of codec capabilities and specifications covering codec optimization to avoid transcoding as well as to optimize the location of transcoders to network edge have been developed for CS networks since the beginning of UMTS. For the CS, there has been some focus on specifying where transcoders should be located (e.g. transcoder at network edge, during/after handovers) but not covering all end to end cases.

According to ETSI TS 123 153 [i.4], where no compatible codec type can be selected between the UEs then the default PCM coding is expected to be selected. The originating MSC is expected to insert a transcoder in the path from the originating UE. Codec selection for the terminating UE is then performed within the terminating MSC, independently of the originating MSC.

5.2.2 VoIP service provider networks

5.2.2.1 IMS

ETSI TS 123 228 [i.3] has some generic guidelines within its specifications around how the transcoding should be used for IMS, such as in clause I.3.3 and annex P. IMS enables invoking transcoding functions at the edge network by the P-CSCF, at the interconnection with other networks by the IBCF and at the core network by an Application Server that can invoke an MRFC located in the home, the visited or another network.

5.2.2.2 Other networks

The present document has not identified any publicly available standards or technical specification providing guidelines on the location of transcoders for non-IMS networks.

6 Gap Analysis

The present document has not identified any publicly available standards or technical specifications providing guidelines on the location of transcoders for the following configurations:

- a) Direct interconnection between two fixed service provider networks operating in CS mode
- b) Direct interconnection between a fixed service provider network and a mobile service provider network operating in CS mode
- c) Non direct interconnection between service provider networks operating in CS mode
- d) Direct interconnection between a service provider network operating in CS mode and a VoIP service provider
- e) Direct interconnection between two service providers operating over IP

The present document has not identified any publicly available standards or technical specifications providing guidelines on the location of transcoders inside fixed service provider networks operating in CS mode and inside non-IMS VoIP service provider networks.

7 Recommendations

7.1 Guidance for service providers

The present document recommends that in case of direct interconnection between service providers operating over IP, the following rules be applied:

- a) **Narrowband voice communication:** A default codec should be agreed between service providers (usually G.711 in case of narrowband voice communications). Both service providers are responsible for transcoding to/from this default codec in case they do not natively use this default codec and no other common codec can be negotiated at session setup.
- b) **HD voice communication between fixed and mobile service providers:** A default codec should be agreed between service providers among the mandatory HD voice codecs for fixed (G.722) and for mobile (AMR-WB). Both service providers are responsible for transcoding to/from this default codec in case they do not natively use this default codec and no other common codec can be negotiated at session setup.

NOTE 1: For fixed/fixed or mobile/mobile HD voice communications no transcoding is expected to occur in case of direct interconnection between service providers operating over IP.

NOTE 2: For any other voice communication (wideband, superwideband, etc.) a default codec is to be agreed between service providers. G.722 and AMR-WB are fully suitable to be used as default codecs for wideband voice interconnection if no other common codecs can be negotiated.