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SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements to support the emergency telecommunications service (ETS) in IP networks

ITU-T Q-series Recommendations – Supplement 57

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Supplement 57 to ITU-T Q-series Recommendations

Signalling requirements to support the emergency telecommunications service (ETS) in IP networks

Summary

This supplement identifies the signalling requirements to support preferential capabilities within IP networks for the emergency telecommunications service (ETS).

Source

Supplement 57 to ITU-T Q-series Recommendations was agreed on 23 January 2008 by ITU-T Study Group 11 (2005-2008).

FOREWORD

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Signalling requirements to support the emergency telecommunications service (ETS) in IP networks

1 Scope

This supplement identifies the signalling requirements to support preferential capabilities within IP networks for the emergency telecommunications service (ETS), which involves authority-to-authority communication.

NOTE – National, regional or local emergency and public safety services, where an individual from general public is seeking assistance (i.e., individual-to-authority communication), are outside the scope of this supplement.

2 References

[ITU-T E.106] Recommendation ITU-T E.106 (2003), *International Emergency Preference Scheme (IEPS) for disaster relief operations*.

[ITU-T E.107] Recommendation ITU-T E.107 (2007), *Emergency Telecommunications Service (ETS) and interconnection framework for national implementations of ETS*.

[ITU-T Q.3030] Recommendation ITU-T Q.3030 (2008), *Signalling architecture for the NGN service control plane*.

[ITU-T Q-Sup.53] ITU-T Q-series Supplement 53 (2005), *Signalling requirements to support the International Emergency Preference Scheme (IEPS)*.

[ITU-T Y.2171] Recommendation ITU-T Y.2171 (2006), *Admission control priority levels in Next Generation Networks*.

[ITU-T Y.2701] Recommendation ITU-T Y.2701 (2007), *Security requirements for NGN release 1*.

[IETF RFC 4412] IETF RFC 4412 (2006), *Communications Resource Priority for the Session Initiation Protocol (SIP)*. <http://www.ietf.org/rfc/rfc4412.txt?number=4412>

3 Definitions

This supplement uses the definitions from [ITU-T E.107].

4 Abbreviations and acronyms

This supplement uses the following abbreviations and acronyms:

AGC-FE Access Gateway Control Functional Entity

AMG-FE Access Media Gateway Functional Entity

BGC-FE Breakout Gateway Control Functional Entity

ETS Emergency Telecommunications Service

FE Functional Entity

GSC-FE General Services Control Functional Entity

I-CSC-FE Interrogating Call Session Control Functional Entity

IBC-FE	Interconnection Border Gateway Control Functional Entity
IBG-FE	Interconnection Border Gateway Functional Entity
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISUP	Integrated Services Digital Network User Part
MGC-FE	Media Gateway Control Functional Entity
MRB-FE	Media Resource Broker Functional Entity
MRC-FE	Media Resource Control Functional Entity
MRP-FE	Media Resource Processing Functional Entity
NSIW-FE	Network Signalling Interworking Functional Entity
NGN	Next Generation Network
P-CSC-FE	Proxy Call Session Control Functional Entity
PD-FE	Policy Decision Functional Entity
PIN	Personal Identification Number
PLMN	Public Land Mobile Network
PSTN	Public Switched Telephone Network
RTP	Real Time Protocol
S-CSC-FE	Serving Call Session Control Functional Entity
SAA-FE	Service Authentication and Authorization Functional Entity
SG-FE	Signalling Gateway Functional Entity
SIP	Session Initiation Protocol
SL-FE	Subscription Locator Functional Entity
SUP-FE	Service User Profile Functional Entity
TDM	Time Division Multiplex
TLM-FE	Transport Location Management Functional Entity
TMG-FE	Trunking Media Gateway Functional Entity
UDP	User Datagram Protocol
USIW-FE	User Signalling Interworking Functional Entity

All other relevant abbreviations are contained in the references listed in clause 2.

5 General aspects of ETS

ETS is a national service that enables use of public telecommunications by authorized ETS users for disaster relief operations, security and emergency preparedness. It allows ETS users to have priority access to and priority use of the services offered by public networks. An ETS user is a user authorized to obtain priority telecommunications in national and/or international emergency situations. ETS significantly increases the ability of ETS users to initiate and complete their communications (voice, data and video) via the PSTN, ISDN, PLMN and/or NGN during network failures or congestion. ETS utilizes the features, facilities and applications available in national public networks and service offerings. Implementation of ETS by definition is a national matter.

[ITU-T E.107] provides a description of ETS and an interconnection framework for national implementations of ETS.

6 ETS functional requirements

ETS implementations are likely to exhibit some of the following characteristics that have a bearing on signalling:

a) An originating national network may use various methods to identify a request for ETS communication:

- a special access code preceding the dialled called party number/identity;
- call origination from a specially marked line or access facility, or a uniquely identified user terminal;
- recognition of calls to a set of unique called party numbers or a range of numbers;
- special indicator or marking in the call/session establishment request;
- administrative actions to activate the service for all calls/sessions from a particular line or access facility for a period of time.

b) As a national capability, ETS is specifically designed to serve the telecommunications needs of authorized ETS users. How users, devices or user and device combinations are authenticated and authorized for ETS is a national matter. The calling party's authorization to initiate an ETS call, session or other communication must be authenticated. Authentication may be on a per-call/session basis, on a one-time (time-limited) authentication basis applicable to the calling party's current access, or on a subscription basis. If authentication is per call or session, the authentication process may involve an interactive exchange of authorization details that may include a personal identification number (PIN) or other authorization/identification code. Authorization information may be directly entered by the calling party, by the calling party's terminal, or by the network. ETS authentication and authorization may involve verifying the identities and authorization of the calling user, user device or user and device combination. After the call/session request is authorized, the call/session is marked with ETS indicators and, optionally, the ETS User's priority level.

c) An ETS call, session or communication is provided end-to-end priority treatment beyond that offered to the general public. The priority treatment is applied during the call/session establishment phase, and should continue to be applied for the duration of the call, session or communication. The priority treatment consists of priority mechanisms and features applicable to various aspects (e.g., signalling, control, routing and media traffic) that are essential for the establishment and continuation of the communication. The process of providing end-to-end priority treatment begins with the ETS user's invocation of ETS, and authentication and authorization of the user's request by the service provider. End-to-end priority treatment includes: 1) signalling of ETS-related information; 2) priority treatment mechanisms; and 3) priority at interconnection between service provider networks and protocol interworking between different technology domains. These are briefly described below.

- **Signalling**: A number of network elements providing applications and transport functions (within circuit-switched networks and NGNs) can be involved in providing ETS. Therefore, there is a need to support signalling for the invocation, authentication and authorization of ETS. Upon successful authentication and authorization, there is a need to signal ETS-related information (e.g., ETS authorization-related information, ETS indicators, and possibly priority level of the ETS user) among various network elements involved in providing priority treatment. The means for communicating ETS

indicators include specific addresses, fields within various protocols involved in providing ETS, and attributes within application programming interfaces.

- **Priority treatment**: Priority treatment should be applied to the routing, transport and processing of signalling messages associated with ETS, and to media and flows associated with ETS. Various mechanisms can be used to provide priority treatment. Priority treatment mechanisms can include priority call/session setup (e.g., high call/session admission control priority, priority queuing schemes for network resources), access to additional resources (e.g., via alternate routing), and exemption from restrictive network traffic management controls. Pre-emption in the public network (i.e., terminating any established communication to release resources to serve a new ETS communication request) is a national matter.
- **Network interconnection and protocol interworking**: ETS invocation, authentication, authorization, and the resulting call, session or communication can extend across multiple service provider networks. Therefore, the signalling of ETS indicators and the ETS priority treatment described above need to be extended across service provider network boundaries. Similarly, there is a need to provide interworking of ETS indicators (item 1) and the priority treatment (item 2) between different technology domains (e.g., between a circuit-switched network and an NGN), even within the same service provider network. Interconnection and interworking apply to both the signalling and media. For example, a voice call originating in an IP domain may terminate on a PSTN telephone requiring interworking between SIP and ISUP at the signalling level and between RTP/UDP/IP packets and TDM trunks at the transport level.

d) An ETS user should be able to communicate with any other available user. For example, any restrictions to call/session completion (e.g., call-barring) set by or for the called party should be overridden.

e) Different priority levels may be assigned to ETS users for differentiation among them for the purpose of providing priority treatment. For example, a call/session initiated by a user of higher priority may be serviced before a call/session of lower priority when calls/sessions are queued because of limited resources. A national government/administration decides whether user priority levels will be assigned to ETS users and, if assigned, how many levels will be used and the assignment criteria. As general guidance, the numerical user priority level values should be assigned in the inverse order of the priority, i.e., the lower the numerical value is, the higher the priority. For example, numerical value 0 indicates the highest priority level possible.

f) If a delay is experienced during the setup of an ETS call/session, this information may be conveyed to the calling party by the use of specialized signals that inform the calling party that the setup attempt is continuing.

g) There could be a crisis situation where it is important for an ETS user in one country to communicate with available users in another country. This may require interconnection of two ETS national implementations. [ITU-T E.107] provides guidance for such interconnections.

h) The ETS features described above should be always available in the networks.

i) If a network or network element is not able to distinguish an ETS call/session request from a normal call/session request, then the ETS call/session request should be processed as a normal call/session request and any ETS markings or indicators associated with the call/session should be maintained.

j) Prioritized access to network resources by ETS imposes particularly stringent requirements on ETS authentication and authorization mechanisms. The network infrastructure, including its ETS authentication and authorization mechanisms, may be subject to denial-of-service attacks by malicious users during an emergency. Thus, ETS authentication and authorization mechanisms must be able to survive such attacks and defend the network resources against these attacks. For example, the authentication mechanisms must be resistant to replay, cut-and-paste and bid down attacks. Use of network resources by unauthorized users and amplification of attacks on the network must be minimized. Given the urgency during emergency events, normal statistical fraud detection may be less effective, thus placing a premium on reliable authentication. All aspects of ETS are likely to be sensitive and should be protected from unlawful interception and alteration. In particular, requirements for protecting the confidentiality of communications relationships may be higher than for normal commercial services. Anonymity of ETS users may be required in some cases. See [ITU-T Y.2701] for details.

7 Reference model

Figure 1 illustrates the ITU-T signalling architecture for NGN service control plane [ITU-T Q.3030] highlighting the functional entities involved with ETS.

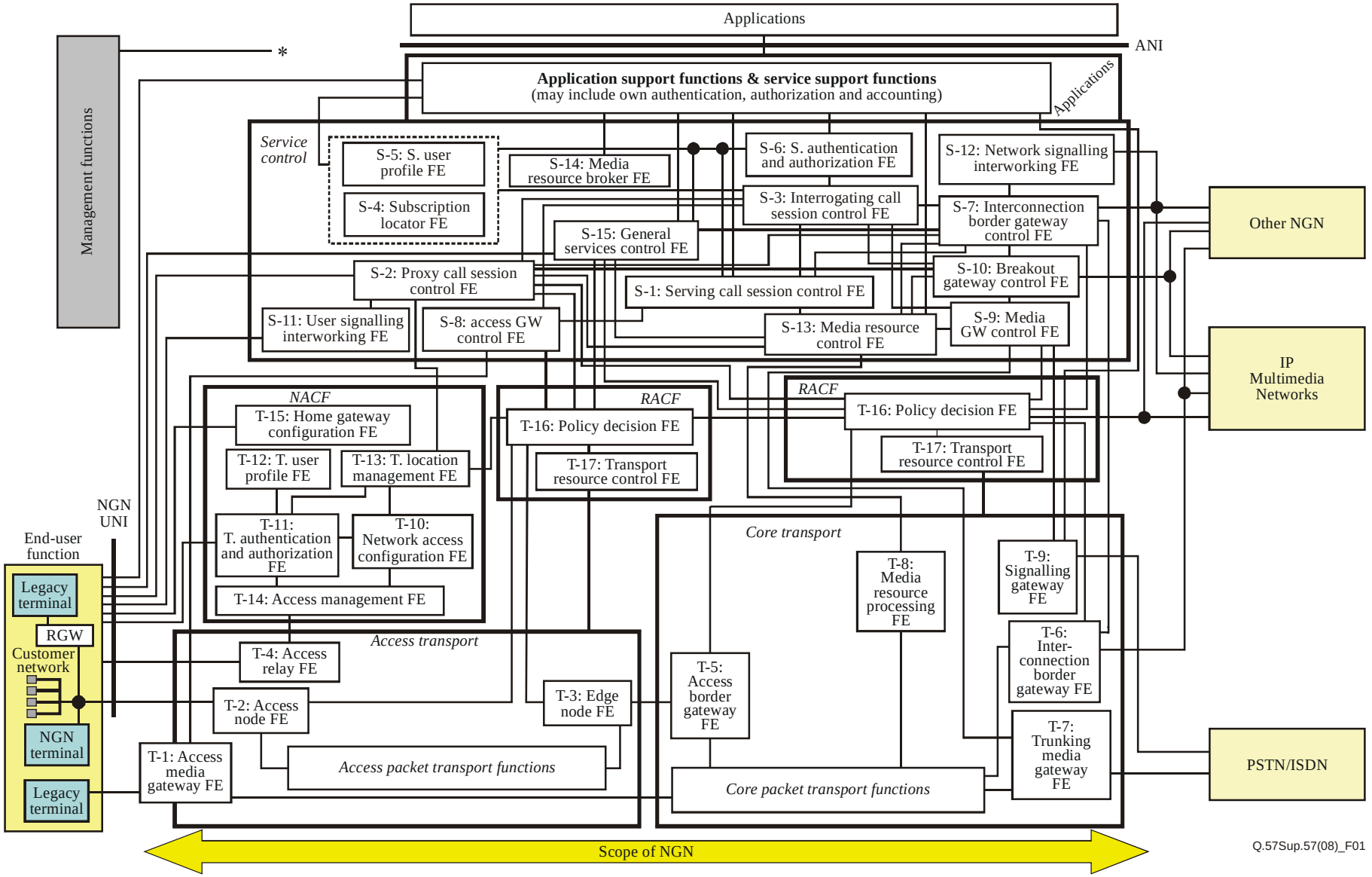

Figure 1 – Signalling architecture for the NGN service control

8 Interfaces and protocols in support of ETS

This clause identifies specific interfaces and protocols in the signalling architecture for NGN service control plane that are impacted by ETS. The impacted interfaces and protocols are expected to support ETS-related information (e.g., ETS authorization related information, ETS indicators, and possibly priority level of the ETS user).

NOTE – The interfaces and protocols for GSC-FE are not considered since this FE is for further study in ITU-T.

The following interfaces are impacted by ETS.

– SIP-based interfaces:

- S-1 (S-CSC-FE) – S-3 (I-CSC-FE)
- S-1 (S-CSC-FE) – S-2 (P-CSC-FE)
- S-1 (S-CSC-FE) – S-9 (MGC-FE)
- S-1 (S-CSC-FE) – S-13 (MRC-FE)
- S-1 (S-CSC-FE) – S-10 (BGC-FE)
- S-1 (S-CSC-FE) – S-8 (AGC-FE)
- S-1 (S-CSC-FE) – S-7 (IBC-FE)
- S-2 (P-CSC-FE) – S-3 (I-CSC-FE)
- S-2 (P-CSC-FE) – S-7 (IBC-FE)
- S-2 (P-CSC-FE) – S-11 (USIW-FE)
- S-2 (P-CSC-FE) – S-13 (MRC-FE)
- S-2 (P-CSC-FE) – S-10 (BGC-FE)
- S-3 (I-CSC-FE) – S-7 (IBC-FE)
- S-3 (I-CSC-FE) – S-9 (MGC-FE)
- S-3 (I-CSC-FE) – S-8 (AGC-FE)
- S-3 (I-CSC-FE) – S-10 (BGC-FE)
- S-7 (IBC-FE)/S-12 (NSIW-FE) – Other NGN/IP multimedia networks
- S-7 (IBC-FE) – S-12 (NSIW-FE)
- S-7 (IBC-FE) – S-10 (BGC-FE)
- S-7 (IBC-FE) – S-13 (MRC-FE)
- S-9 (MGC-FE) – S-10 (BGC-FE)
- S-9 (MGC-FE) – S-13 (MRC-FE)
- S-9 (MGC-FE) – T-9 (SG-FE)
- S-10 (BGC-FE) – S-10 (BGC-FE)
- S-10 (BGC-FE) – Other NGN/IP multimedia networks
- S-13 (MRC-FE) – S-10 (BGC-FE)
- S-13 (MRC-FE) – Application support functions (*)
- S-14 (MRB-FE) – Application support functions (*)

* Other protocols are possible for this interface.

– Diameter-based interfaces:
  - S-1 (S-CSC-FE) – S-5 (SUP-FE), S-6 (SAA-FE)
  - S-1 (S-CSC-FE) – S-4 (SL-FE)
  - S-3 (I-CSC-FE) – S-5 (SUP-FE), S-6 (SAA-FE)
  - S-3 (I-CSC-FE) – S-4 (SL-FE)
  - S-1 (S-CSC-FE) – Application support functions
  - S-4 (SL-FE), S-5 (SUP-FE) – Application support functions
  - S-6 (SAA-FE) – Application support functions
  - S-2 (P-CSC-FE) – T-16 (PD-FE)
  - S-7 (IBC-FE) – T-16 (PD-FE)
  - S-8 (AGC-FE) – T-16 (PD-FE)
– H.248-based interfaces:
  - S-7 (IBC-FE) – T-6 (IBG-FE)
  - S-9 (MGC-FE) – T-7 (TMG-FE)
  - S-13 (MRC-FE) – T-8 (MRP-FE)

The following interfaces may be impacted by ETS.

– SIP-based interfaces:
  - S-2 (P-CSC-FE) – End user function.
– Diameter-based interfaces:
  - S-2 (P-CSC-FE) – T-13 (TLM-FE) (*).

  * Other protocols are possible for this interface.
– H.248-based interfaces:
  - S-8 (AGC-FE) – T-1 (AMG-FE).

9 Call flows

This clause includes an example call flow (Figure 2) to illustrate successful authentication and setup of ETS call/session. Figure 2 illustrates an ETS user authentication method that utilizes a PIN entered by the user. A media server (MS) is a combination of MRC-FE/MRP-FE. All SIP requests include resource-priority header (RPH) [IETF RFC 4412] to indicate that priority treatment is required.

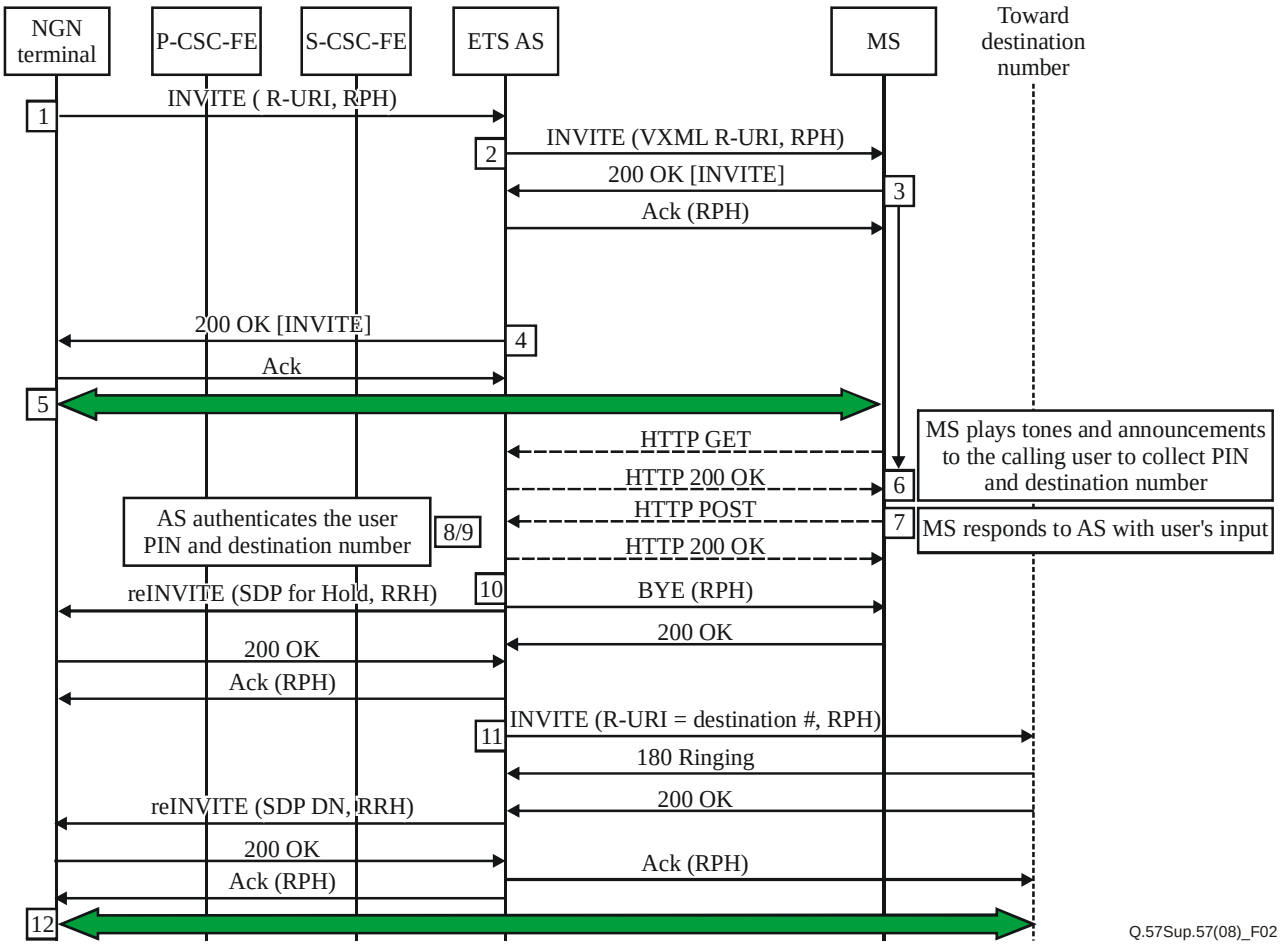

Figure 2 – ETS call/session setup using PIN authentication

1) The call/session is routed to an ETS application server (AS) where user authentication processing is initiated.

2) The ETS AS sends an INVITE message to the selected media server (MS), with an SDP offer associated with the caller. The INVITE message contains the URL of a VoiceXML script, stored at the ETS AS. The script describes how the MS should interact with the caller (what announcement to play, how to collect digits, how many digits to collect, interdigit timers, etc.).

3) Upon receipt of the INVITE message the MS:

   - May send a 100 Trying to the ETS AS;
   - Retrieves the VoiceXML script directly from the ETS AS using HTTP and the URL in the INVITE message (MS sends a HTTP GET to the ETS AS and VoiceXML script is returned from the ETS AS in an HTTP 200 OK);
   - Validates the script;
   - Formulates and sends a 200 OK message containing its own SDP to the ETS AS.

4) The ETS AS sends a 200 OK towards the calling party (NGN terminal), including in it the session information it received from the MS.

5) At this point the media connection is available between the MS and the calling party.

6) Upon receipt of the ACK and VXML script in the HTTP 200 OK, the MS executes the VoiceXML script. It plays a tone and collects digits (PIN) entered by the calling party.

7) The MS then sends the collected digits directly to the ETS AS using an HTTP POST message.

8) Upon receipt of the collected digits, the ETS AS verifies whether the received digits (PIN) are valid.

- If the digits received are invalid (number of digits received or the wrong number), the ETS AS determines that further interaction with the caller is required. The ETS AS returns an HTTP 200 OK message to the MS with a new VoiceXML script. The ETS AS will instruct for final handling treatment.
- If the received digits are valid, the ETS AS will instruct the MS to play the announcement to collect the digits (destination number).

9) The ETS AS determines that the calling party entered destination digits are valid.

10) The ETS AS releases the MS from the call/session with a SIP BYE, and sends a reINVITE toward the calling party, with a SDP to place the media on hold.

11) The ETS AS sends an INVITE toward the destination party. Upon receiving 200 OK (answer), the ETS AS sends a reINVITE with the SDP associated with the destination toward the calling party.

12) The media path is established between the calling party and destination number with the authentication ETS AS in the call control path.

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