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Technical Specification

Corporate telecommunication Networks (CN); Tunnelling of QSIG over SIP

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Foreword

This Technical Specification (TS) has been produced by ECMA on behalf of its members and those of the European Telecommunications Standards Institute (ETSI).

Introduction

The present document is one of a series of Ecma Standards defining the interworking of services and signalling protocols deployed in corporate telecommunication networks (CNs) (also known as enterprise networks). The series uses telecommunication concepts as developed by ITU-T and conforms to the framework of International Standards on Open Systems Interconnection as defined by ISO/IEC.

This particular Standard specifies tunnelling of QSIG over the Session Initiation Protocol (SIP). This enables calls between "islands" of circuit switched networks that use QSIG signalling to be interconnected by an IP network that uses SIP signalling without loss of QSIG functionality. The present document facilitates the introduction of enhanced SIP and SDP functionality that was specified after publication of the early editions of the present document. These enhancements include payload encryption and mechanisms to negotiate SDP capabilities.

The changes in the present document comprise a mandatory payload renegotiation with reversed direction of the offer/answer exchange compared with early editions. In order to achieve backward compatibility with early editions an indicator for the changed signalling procedures is introduced. This indicator is used to dynamically detect if fallback to signalling procedures compliant to early editions is necessary.

The present document is based upon the practical experience of Ecma member companies and the results of their active and continuous participation in the work of ISO/IEC JTC1, ITU-T, IETF, ETSI and other international and national standardization bodies. It represents a pragmatic and widely based consensus.

1 Scope

The present document specifies tunnelling of "QSIG" over the Session Initiation Protocol (SIP) within a corporate telecommunication network (CN).

"QSIG" is a signalling protocol that operates between Private Integrated services Network eXchanges (PINX) within a Private Integrated Services Network (PISN). A PISN provides circuit-switched basic services and supplementary services to its users. QSIG is specified in Standards, in particular [1] (call control in support of basic services), [2] (generic functional protocol for the support of supplementary services) and a number of Standards specifying individual supplementary services.

NOTE: The name QSIG was derived from the fact that it is used for signalling at the Q reference point. The Q reference point is a point of demarcation between two PINXs [1].

SIP is an application layer protocol for establishing, terminating and modifying multimedia sessions. It is typically carried over IP [4], [6]. Telephone calls are considered as a type of multimedia session where just audio is exchanged. SIP is defined in [9].

Often a CN comprises both PISNs employing QSIG and IP networks employing SIP. A call or call independent signalling can originate at a user connected to a PISN and terminate at a user connected to an IP network or vice versa. In either case, a gateway provides interworking between QSIG and SIP at the boundary between the PISN and the IP network. Basic call interworking at a gateway is specified in [3]. Another case is where a call or call independent signalling originates at a user connected to a PISN, traverses an IP network using SIP, and terminates at a user connected to another (or another part of the same) PISN. The present document addresses this last case in a way that preserves all QSIG capabilities across the IP network. It achieves this by tunnelling QSIG messages within SIP requests and responses in the context of a SIP dialog.

The tunnelling of QSIG through a public IP network employing SIP is outside the scope of the present document. However, the functionality specified in thhe present document is in principle applicable to such a scenario when deployed in conjunction with other relevant functionality (e.g. address translation, security functions, etc.)

The present document is applicable to any interworking unit that can act as a gateway between a PISN employing QSIG and a corporate IP network employing SIP, with QSIG tunnelled within SIP requests and responses.

2 Normative references

[1] ISO/IEC 11572: "Information technology -- Telecommunications and information exchange between systems -- Private Integrated Services Network -- Circuit mode bearer services -- Inter-exchange signalling procedures and protocol" (also published by Ecma as Standard ECMA-143).

[2] ISO/IEC 11582: "Information technology -- Telecommunications and information exchange between systems -- Private Integrated Services Network -- Generic functional protocol for the support of supplementary services -- Inter-exchange signalling procedures and protocol " (also published by Ecma as Standard ECMA-165).

[3] ISO/IEC 17343: "Information technology -- Telecommunications and information exchange between systems -- Corporate telecommunication networks -- Signalling interworking between QSIG and SIP -- Basic services" (also published by Ecma as Standard ECMA-339).

[4] IETF RFC 791: "Internet Protocol".

[5] IETF RFC 2119: "Key words for use in RFCs to Indicate Requirement Levels".

[6] IETF RFC 2460: "Internet Protocol, Version 6 (IPv6) Specification".

[7] IETF RFC 2976: "The SIP INFO Method".

[8] IETF RFC 3204: "MIME media types for ISUP and QSIG Objects".

[9] IETF RFC 3261: "SIP: Session Initiation Protocol".

[10] IETF RFC 3264: "An Offer/Answer Model with the Session Description Protocol (SDP)".

[11] IETF RFC 3311: "The Session Initiation Protocol (SIP) UPDATE Method".

[12] IETF RFC 3840: "Indicating User Agent Capabilities in the Session Initiation Protocol (SIP)".

NOTE: Available at http://tools.ietf.org/html/rfc3840

3 Terms and definitions

In the present document, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in [5] and indicate requirement levels for compliant SIP implementations.

For the purposes of the present document, the following definitions apply.

3.1 External definitions

The definitions in [1] and [9] apply as appropriate.

3.2 Other definitions

3.2.1 Corporate telecommunication Network (CN)

Sets of privately-owned or carrier-provided equipment that are located at geographically dispersed locations and are interconnected to provide telecommunication services to a defined group of users.

NOTE: A CN can comprise a PISN, a private IP network (intranet) or a combination of the two.

3.2.2 Egress gateway

A gateway handling a QSIG call or call-independent signalling connection established in the direction IP network to PISN.

3.2.3 Gateway

An entity that behaves as a QSIG Transit PINX with QSIG carried over a circuit-switched link within a PISN on one side and QSIG tunnelled over SIP within an IP network on the other side.

3.2.4 Ingress gateway

A gateway handling a QSIG call or call-independent signalling connection established in the direction PISN to IP network.

3.2.5 IP network

A network, unless otherwise stated a corporate network, offering connectionless packet-mode services based on the Internet Protocol (IP) as the network layer protocol.

3.2.6 Media stream

Audio or other user information transmitted in UDP packets, typically containing RTP, in a single direction between the gateway and a peer entity participating in a session established using SIP.

NOTE: Normally a SIP session establishes a pair of media streams, one in each direction.

3.2.7 Private Integrated Services Network (PISN)

A CN or part of a CN that employs circuit-switched technology and QSIG signalling.

3.2.8 Private Integrated services Network eXchange (PINX)

A PISN nodal entity comprising switching and call handling functions and supporting QSIG signalling in accordance with [1].

4 Abbreviations and acronyms

CN	Corporate telecommunication Network
IP	Internet Protocol
PINX	Private Integrated services Network eXchange
PISN	Private Integrated Services Network
QSIG	Signalling system for the Q reference point
RTP	Real-time Transport Protocol
SDP	Session Description Protocol
SIP	Session Initiation Protocol
TCP	Transmission Control Protocol
TLS	Transport Layer Security
UA	User Agent
UAC	User Agent Client
UAS	User Agent Server
UDP	User Datagram Protocol
URI	Universal Resource Identifier

5 Background and architecture

5.1 Architecture

The present document concerns the case of a call or call independent signalling that originates at a user connected to a PISN employing QSIG, traverses an IP network employing SIP, and terminates at a user connected to another (or another part of the same) PISN. This can be achieved by employing a gateway at each boundary between a PISN employing QSIG and an IP network employing SIP, as shown in figure 1.

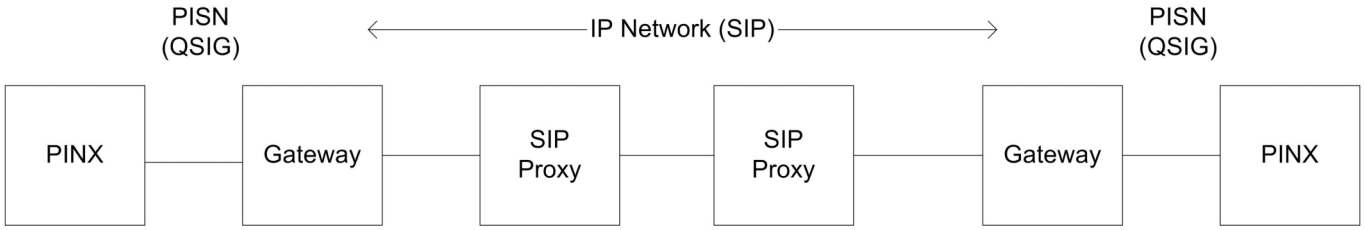

Figure 1: Call from QSIG via SIP to QSIG

Each gateway can provide interworking as specified in [3]. This provides a basic call capability. However, [3] only specifies interworking for QSIG basic call, as specified in [1]. Many of the other capabilities of QSIG (support for supplementary services and additional network features) as specified in other standards and in vendor-specific specifications are not covered. Some of these additional capabilities of QSIG are suitable for interworking with SIP and might be the subject of future Standards or other specifications. Other capabilities of QSIG are unsuitable for interworking with SIP because corresponding capabilities do not exist in SIP or are achieved in ways that are incompatible with QSIG. Therefore interworking at a gateway between QSIG and SIP will be limited to those QSIG capabilities that have sufficiently compatible equivalents in SIP. Each capability requires special implementation in the gateway, and therefore a typical gateway might provide interworking for only a subset of capabilities for which interworking is feasible. The result of this is that there will be a loss of capability on a call or call independent signalling from QSIG to SIP or vice versa. For a case similar to that shown in figure 1 there will likewise be a loss of capability. This can be compounded if the two gateways are of different types, since only those capabilities common to both gateways will survive end-to-end. The solution is to tunnel QSIG messages through the IP network within SIP messages so that no end-to-end QSIG capabilities are lost. One of the two gateways originates a SIP dialog to the other gateway. SIP messages within the dialog are used to tunnel QSIG messages. Through the use of SDP [10], the dialog also establishes a session in which media streams carry user information (e.g. speech) between the two QSIG gateways, if required. The two gateways act as QSIG Transit PINXs, which relay QSIG messages with little or no modification.

In a conventional PISN employing QSIG, two PINXs are connected by means of an inter-PINX link, which comprises a signalling channel (carrying QSIG messages) and one or more user information channels carrying speech, modem information or data. With the tunnelling solution, the IP network provides the inter-PINX link between the two gateways acting as Transit PINXs. The tunnel provided by SIP for QSIG messages acts as the signalling channel and the media streams act as the user information channels.

The present document covers the case where a single dialog between two gateways is used for a single QSIG call or call independent signalling connection, as specified in [2]. This means that the dialog is established when the QSIG call or call independent signalling connection is established and cleared down when the QSIG call or call independent signalling connection is cleared down.

An enhanced scenario in which a single SIP dialog is maintained long term and used to tunnel a multiplicity of QSIG calls or call independent signalling connections, with the possibility of multiple QSIG calls or call independent signalling connections being in progress at any one time, is outside the scope of the present document.

The present document also covers call-independent connectionless transport.

5.2 Basic operation

When a gateway (the ingress gateway) receives a QSIG call or call-independent signalling connection establishment request (QSIG SETUP message) from the PISN, it needs to generate a SIP INVITE request using a Request-URI that will route the request to an appropriate egress gateway. The Request-URI must be derived in some way from the required destination of the QSIG call or call-independent signalling connection (as indicated in the Called party number information element of the QSIG SETUP message). The Request-URI can explicitly identify the egress gateway or it can simply identify the required destination. The first case is likely to require some sort of look-up capability in the ingress gateway, the configuration of which is outside the scope of the present document. For the latter case algorithmic mapping of the called party number to a Request-URI might be sufficient, but this delegates the task of selecting an appropriate egress gateway to SIP proxies.

An ingress gateway may determine from the required destination of a call or call-independent signalling connection that the destination is not reachable via QSIG tunnelling. In this case the QSIG gateway can either route the call or call-independent signalling connection onwards within the PISN or can route the call or call-independent signalling connection into the IP network using interworking as specified in [3]. How an ingress gateway determines that the destination is not reachable via QSIG tunnelling is outside the scope of the present document.

If an ingress gateway maps the QSIG called party number to a Request URI that does not explicitly identify a particular egress gateway, routing of the INVITE request is left to SIP proxies. A proxy might route the request to a UAS that is not an egress gateway to QSIG, in which case QSIG tunnelling will not be possible. Allowing the call or call-independent signalling connection to proceed in this situation is likely to be undesirable, since the ingress gateway expects to carry out QSIG tunnelling whereas interworking with SIP, as specified in [3], would be more appropriate. To cater for this situation, a mechanism is defined that causes an INVITE request containing tunnelled QSIG to be rejected by an egress gateway that does not support this capability.

NOTE: Allowing the INVITE request to be routed by proxies either to an egress gateway to QSIG or to some other UAS without the ability for the ingress gateway to choose in advance is undesirable. It implies that the ingress gateway maps the QSIG SETUP message to a SIP INVITE request in accordance with both the present document and [3] simultaneously. Although this may seem feasible superficially, architecturally it is dangerous because with QSIG tunnelling the ingress gateway should act as a QSIG Transit PINX whereas with interworking in accordance with [3] it should act as a QSIG Outgoing Gateway PINX. The ingress gateway will not know for certain which behaviour to adopt until a 200 OK arrives, and therefore in the meantime it will not know how to handle information relating to certain QSIG capabilities (supplementary services and additional network features) in the QSIG SETUP message. It is not clear whether this can be handled safely for all possible QSIG capabilities (including vendor-specific capabilities). For this reason, the present document and [3] require the ingress gateway to make a decision between tunnelling and interworking respectively.

5.3 QSIG connectionless transport

When a gateway (the ingress gateway) receives a QSIG connectionless FACILITY message from the PISN, it needs to generate a SIP INVITE request using a Request-URI that will route the request to an appropriate egress gateway. The Request-URI must be derived in some way from the required destination of the QSIG FACILITY message (as indicated in the Called party number information element of the QSIG SETUP message). Techniques similar to those used for QSIG SETUP messages can be used.

An ingress gateway may determine from the required destination of a QSIG connectionless FACILITY message that the destination is not reachable via QSIG tunnelling. In this case the QSIG gateway can either route the message onwards within the PISN or discard the message.

5.4 Late availability of SDP parameters at the egress gateway

In conjunction with certain gateway architectures (e.g. decomposed gateways comprising a separate signalling gateway and media gateway), valid SDP parameters might not be available to the egress gateway (e.g. the signalling gateway part of a decomposed gateway) at the time when an SDP answer to the initial SDP offer needs to be sent. In this case the egress gateway will have to send a dummy SDP answer. The final SDP parameters need to be agreed upon during a later phase of the QSIG call establishment.

In order to achieve identical signalling procedures between ingress gateway and egress gateway irrespective of the gateway architecture, the ingress gateway starts SDP re-negotiation immediately after confirmation of the SIP dialog provided that both gateways support the changed procedures. This mandatory re-negotiation during QSIG call establishment is redundant in the case of an integrated gateway that can provide valid parameters for an SDP answer at the time of the first SDP negotiation, but is still employed in the interests of a single solution that works for all gateway architectures. In the case of decomposed gateways, the solution allows the SDP offer-answer cycle to be conducted end-to-end between the ingress and egress media gateways, with only minimal intervention by the intermediate signalling gateways.

6 Procedures

6.1 General

A gateway SHALL behave as a QSIG Transit PINX as specified in [1] and modified as specified below.

6.2 Encapsulation of QSIG messages in SIP messages

When encapsulating a QSIG message inside a SIP message, a gateway SHALL include the QSIG message in a MIME body of the SIP request or response in accordance with [8] using media type application/QSIG. QSIG segmentation SHALL NOT apply.

If any other MIME body is to be included (e.g. SDP), the gateway SHALL use multi-part MIME.