
**Information technology —
Telecommunications and information
exchange between systems — Private
Integrated Services Network — Mapping
functions for the tunnelling of QSIG
through IP networks**

*Technologies de l'information — Télécommunications et échange
d'information entre systèmes — Réseau privé à intégration de
services — Tracé de fonctions pour le «tunnelling» de QSIG par des
réseaux IP*

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Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Conformance	1
3 Normative references	1
4 Terms and definitions	2
4.1 External definitions	2
4.2 Other definitions	2
5 List of acronyms	3
6 Introduction	3
6.1 Reference configuration	3
6.2 Specific scenarios	4
7 Capabilities at the Q reference point	4
8 Capabilities at the C reference point	5
8.1 TCP connection	5
8.2 UDP streams	6
9 Mapping functions	6
9.1 Mapping the D _Q -channel	6
9.2 Mapping a U _Q -channel	6
10 IPC control functions	6
10.1 Procedure for U _Q -channel establishment	6
10.2 Procedure for U _Q -channel clearing	7
Annex A (informative) Implementation Conformance Statement (ICS) Proforma	8
A.1 Introduction	8
A.2 Instructions for completing the ICS proforma	8
A.2.1 General structure of the ICS proforma	8
A.2.2 Additional information	9
A.2.3 Exception information	9
A.3 ICS proforma for ISO/IEC 21992	10
A.3.1 Implementation identification	10
A.3.2 Implementation summary	10
A.4 General requirements	10
A.5 U _Q -channel bearer capabilities at the Q reference point	11
A.6 D _Q -channel capability at the Q reference point	11
A.7 Capabilities at the C reference point	11
A.8 Mapping functions	11
A.9 IPC control functions	12
A.10 Support of resource control information	12
A.10.1 Support of bearer capabilities information	12
A.10.2 Support of IP address type	12
Annex B (normative) Message syntax for Resource Control Information	13
B.1 Introduction	13
B.2 Message syntax	13
B.2.1 Resource control header	13
B.2.2 Protocol indicator	13
B.2.3 Resource control information	13

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 21992 was prepared by ECMA (as ECMA-336) and was adopted, under a special “fast-track procedure”, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

Introduction

This International Standard is one of a series of standards defining mapping functions in exchanges of Private Integrated Services Networks required for the utilization of intervening network scenarios. The series uses the ISDN concepts as developed by ITU-T (formerly CCITT) and is also within the framework of standards for open systems interconnection as defined by ISO/IEC.

This International Standard 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 JTC 1, ITU-T, ETSI and other international and national standardization bodies. It represents a pragmatic and widely based consensus.

Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Mapping functions for the tunnelling of QSIG through IP networks

1 Scope

This International Standard specifies functions for using a packet network that uses the Internet Protocol (IP) as its network layer protocol and UDP and TCP as its transport layer protocols, to interconnect two Private Integrated services Network eXchanges (PINXs) forming part of a Private Integrated Services Network (PISN). Interconnection is achieved by carrying the inter-PINX signalling protocol directly over the Transmission Control Protocol (TCP) and inter-PINX user information (e.g., voice) over the Real-time Transport Protocol (RTP), RTP being carried over the User Datagram Protocol (UDP). The inter-PINX signalling protocol is assumed to be QSIG, as specified in ISO/IEC 11572, ISO/IEC 11582 and other International Standards.

This International Standard provides for two types of interconnection:

- on-demand, where a separate TCP connection for QSIG is established at the start of each call and cleared down at the end of that call; and
- semi-permanent, where a single TCP connection with an indefinite lifetime carries QSIG on behalf of many single calls.

This International Standard is applicable to PINXs that can be interconnected to form a PISN using QSIG as the inter-PINX signalling protocol.

2 Conformance

In order to conform to this International Standard, a PINX shall satisfy the requirements identified in the Implementation Conformance Statement (ICS) proforma in Annex A.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 11572:2000, *Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Circuit mode bearer services — Inter-exchange signalling procedures and protocol*

ISO/IEC 11574:2000, *Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Circuit-mode 64 kbit/s bearer services — Service description, functional capabilities and information flows*

ISO/IEC 11579-1:1994, *Information technology — Telecommunications and information exchange between systems — Private integrated services network — Part 1: Reference configuration for PISN Exchanges (PINX)*

ISO/IEC 11582:2002, *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*

ITU-T Rec. I.112:1993, *Vocabulary of terms for ISDNs*

ITU-T Rec. I.210:1993, *Principles of telecommunication services supported by an ISDN and the means to describe them*

IETF RFC 760, *Internet Protocol*

IETF RFC 761, *Transmission Control Protocol*

IETF RFC 768, *User Datagram Protocol*

IETF RFC 1889, *RTP: A Transport Protocol for Real-Time Applications*

IETF RFC 2126, *ISO Transport Service on top of TCP (ITOT)*

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1 External definitions

This International Standard uses the following terms defined in other documents:

- IVN (ISO/IEC 11579-1)
- PINX (ISO/IEC 11579-1)
- PISN (ISO/IEC 11579-1)
- Service (ITU-T Rec. I.112)
- Signalling (ITU-T Rec. I.112)

4.2 Other definitions

4.2.1

Calling PINX

In the context of a call or call-independent signalling connection across an IPL, the PINX that transmits the QSIG SETUP message.

4.2.2

Called PINX

In the context of a call or call-independent signalling connection across an IPL, the PINX that receives the QSIG SETUP message.

4.2.3

Channel

A means of bi-directional transmission of user or signalling information between two points.

4.2.3.1

D_Q-Channel

A channel used to convey call control information between the Q reference points of two peer PINXs.

4.2.3.2

U_Q-Channel

A channel used to convey user information between the Q reference points of two peer PINXs.

4.2.4

Resource Control Information

Information exchanged between peer PINXs for the purpose of establishing UDP streams.

4.2.5

Inter-PINX Connection (IPC)

A connection provided by an IVN between two C reference points used to transport inter-PINX information from the PISN control plane and/or the PISN user plane.

4.2.6

QPKT

A packet format defined within this International Standard for conveying QSIG message and RCI (Resource Control Information).

5 List of acronyms

IP	Internet Protocol
IPC	Inter-PINX connection
IPL	Inter-PINX Link
IVN	InterVening Network
PINX	Private Integrated services Network eXchange
PISN	Private Integrated Services Network
QSIG	Signalling information flows at the Q reference point
RCI	Resource Control Information
RTCP	Realtime Transport Control Protocol
RTP	Realtime Transport Protocol
TCP	Transmission Control Protocol
UDP	User Datagram Protocol

6 Introduction

6.1 Reference configuration

ISO/IEC 11579-1 defines a reference configuration for a PINX. Logically the switching and call control functions of a PINX communicate over an instance of the Q reference point with a peer PINX. This communication is known as an Inter-PINX Link (IPL) and comprises a signalling channel, known as a D_Q-channel, and one or more user information channels, each known as a U_Q-channel; see Figure 1. One or more IPLs can be established between the same pair of PINXs.

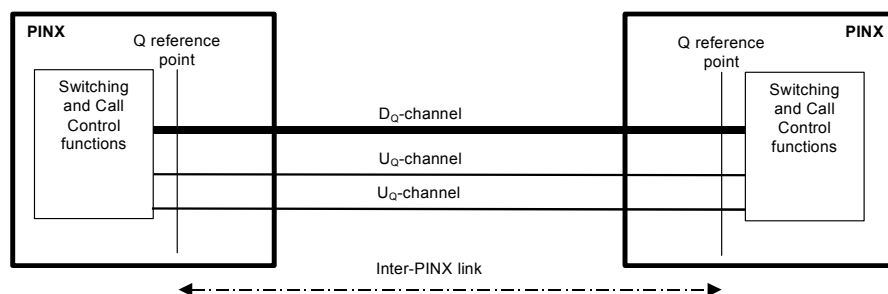


Figure 1 — IPL concept

There are many ways of implementing an IPL. In general, the IPL uses services of another network, known as an Intervening Network (IVN). A PINX interfaces to the IVN at the C reference point. The IVN provides

connections, known as Inter-PINX Connections (IPCs) between the C reference points of the peer PINXs. Mapping functions within each PINX map the D_Q -channel and the U_Q -channels at the Q reference point onto one or more IPCs at the C reference point.

6.2 Specific scenarios

This International Standard specifies mapping functions for use when the IVN is an IP-based network that is used to provide the following types of IPC:

- a TCP connection for carrying signalling information and Resource Control Information; and
- a pair of UDP streams, one stream in each direction, for carrying user information over RTP.

A single IPL requires a single TCP connection, for support of the D_Q -channel, and one pair of UDP streams per U_Q -channel. In addition to carrying the QSIG protocol, the TCP connection is also required to carry resource control information for establishing the UDP streams.

This International Standard supports two types of interconnection between peer PINXs:

- On-demand, where a single TCP connection for QSIG and a pair of UDP streams for user information are established at the start of each call and cleared down at the end of that call;
- Semi-permanent, where a single TCP connection with an indefinite lifetime carries QSIG on behalf of many calls.

In the semi-permanent case, the TCP connection can support zero, one or more than one call at the same time. A pair of UDP streams for user information is established at the start of each call and cleared down at the end of that call. Figure 2 illustrates these concepts.

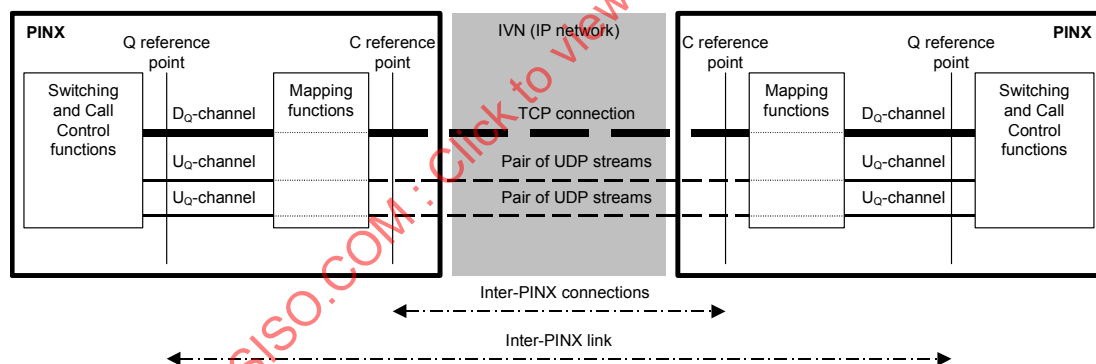


Figure 2 — IPC concept (Semi-permanent)

7 Capabilities at the Q reference point

For each instance of the Q reference point:

- one signalling channel (D_Q) for carrying the inter-PINX Layer 3 signalling protocol, and
- zero, one or more user channels (U_Q)

shall be provided.

NOTE In the special case of an on-demand interconnection used only for a call independent signalling connection, no U_Q -channels are provided.

For a U_Q -channel the following bearer capability shall be provided:

- transfer mode: circuit mode;
- information transfer rate: 64 kbit/s;
- information transfer capability: speech or 3,1 kHz audio;
- user information layer 1 protocol: G.711 A or μ law.

Other bearer capabilities are outside the scope of this International Standard.

For a D_Q -channel the following bearer capability shall be provided:

- transfer mode: packet mode;
- information transfer rate: implementation-dependent;
- information transfer capability: unrestricted digital information.

The functions to map D_Q - and U_Q -channels to an inter-PINX connection (IPC) at the C reference point are described in Clause 9.

8 Capabilities at the C reference point

The PINX mapping functions shall meet the following requirements.

8.1 TCP connection

A PINX shall support a packet network interface suitable for communication according to IETF RFC 761. The protocol stack used in this International Standard is described as Figure 3 below.

QSIG	RCI
QPKT	
TPKT	
TCP	
IP	

Figure 3 — Protocol stack for Mapping/IP-QSIG

The RCI provides information required to establish the media path(s).

A TPKT is a packet format as defined in IETF RFC 2126. It is used to delimit individual messages (PDUs) within the TCP stream, which itself provides a continuous stream of octets without explicit boundaries. A TPKT consists of a one octet version number field, followed by a one octet reserved field, followed by a two octet length field, followed by the actual data. The version number field shall contain the value "3", the reserved field shall contain the value "0". The length field shall contain the length of the entire packet including the version number, the reserved and the length fields as a 16-bit big-endian word.

A QPKT is a packet format as defined in Figure 4 below. A QPKT consists of a two octet length field, followed by a single QSIG message, followed by RCI. The first octet of the QSIG message shall be the octet immediately following the QPKT length field, the last octet shall be the octet immediately preceding the RCI. The length field indicates the length of the QSIG message and therefore indicates the start of the RCI.

len.	QSIG message	RCI
------	--------------	-----

Figure 4 — QPKT structure of Mapping/IP-QSIG

NOTE In most circumstances, the RCI field is omitted.

The D_Q-channel shall be mapped to the well-known TCP port (4029) or to a dynamically assigned port. RCI shall be in accordance with Annex B.

8.2 UDP streams

The U_Q-channel shall be mapped to a received UDP stream and a transmitted UDP stream, each carrying RTP packets. The received UDP stream shall be received at a local IP address and port as indicated in transmitted RCI and the transmitted UDP stream shall be transmitted to a remote IP address and port as indicated in received RCI.

NOTE If required, PINXs can use RTCP as defined in IETF RFC 1889 to monitor the quality of RTP carried over UDP streams.

9 Mapping functions

9.1 Mapping the D_Q-channel

For transmission, a complete QSIG message and RCI shall be embedded in a QPKT packet within a TPKT packet as defined in 8.1. The segmentation and reassembly procedures of ISO/IEC 11572 shall not be used.

The RCI implicitly refers to the call to which the QSIG message relates. It shall be included in the first forward and first backward message of each call, and shall not be included in subsequent messages. In addition, RCI shall not be included with call-independent messages.

9.2 Mapping a U_Q-channel

Each U_Q-channel shall be mapped to a pair of unidirectional UDP streams with suitable transport capabilities defined by the RCI. The mapping function is responsible for proper packetization, de-packetization, transcoding etc. of media data.

10 IPC control functions

To establish the IPC for the D_Q-channel, the PINX initiating the TCP connection needs to know the IP address of the other PINX. The means for determining the IP address is outside the scope of this International Standard.

For the on-demand scenario, the calling PINX shall establish a TCP connection for the D_Q-channel following the procedure specified in IETF RFC 761 whenever a call or call-independent signalling connection is to be established and shall clear down the TCP connection when the call or call-independent signalling connection has been cleared.

For the semi-permanent scenario, when a call or call independent signalling connection is to be established, if a D_Q-channel (TCP connection) exists between the peer-PINXs, the calling PINX shall use that D_Q-channel. If no D_Q-channel exists between the peer PINXs, the calling PINX shall establish a TCP connection for the D_Q-channel following the procedure specified in IETF RFC 761. It is an implementation matter when to clear the TCP connection, except that it shall not to be cleared while still being used for a call or call independent signalling connection.

For either scenario, U_Q-channel establishment and clear down shall be in accordance with 10.1 and 10.2 respectively.

10.1 Procedure for U_Q-channel establishment

U_Q-channel establishment shall occur whenever a call is established.

In order to establish the U_Q-channel, the calling PINX and the called PINX shall each transmit RCI in accordance with Annex B. The calling PINX shall transmit RCI in the same QPKT packet as the QSIG SETUP message.

The called PINX shall check that the received RCI information is acceptable and if so transmit RCI in the same QPKT packet as the QSIG SETUP ACKNOWLEDGE message or the QSIG CALL PROCEEDING message, whichever is transmitted first.

NOTE 1 ISO/IEC 11572 requires the Channel identification information element to be present in the QSIG SETUP message and in the QSIG SETUP ACKNOWLEDGE message or CALL PROCEEDING message, whichever is transmitted first. The contents of the Channel identification information element can be ignored on receipt.

NOTE 2 If the first response to the SETUP message is neither SETUP ACKNOWLEDGE nor CALL PROCEEDING (e.g., RELEASE COMPLETE), no RCI is returned.

After transmitting RCI, the calling PINX shall be prepared to receive RTP packets on the IP address and port as specified in the transmitted RCI.

The called PINX shall include in the transmitted RCI the same codec type and payload period as specified in the received RCI. After transmitting the RCI, the called PINX shall begin transmitting RTP packets to the IP address and port as specified in the received RCI in accordance with the codec type and payload period as specified in the received RCI as soon as media becomes available. The called PINX shall also be prepared to receive RTP packets on the IP address and port as specified in the transmitted RCI.

After having received RCI in the first response message and after having received the CONNECT message, the calling PINX shall begin transmitting RTP packets to the IP address and port in the received RCI in accordance with the codec type and payload period in the received RCI.

During the establishment of the U_Q -channel, if either the calling PINX or the called PINX receives unacceptable content in the RCI, that PINX shall behave as specified in ISO/IEC 11572 for the case where the content of the Channel identification information element is unacceptable.

10.2 Procedure for U_Q -channel clearing

Before transmitting a QSIG call clearing message (DISCONNECT, RELEASE or RELEASE COMPLETE), a PINX shall stop transmitting RTP packets and shall ignore the contents of any further received RTP packets.

After transmitting or receiving a QSIG RELEASE COMPLETE message, the PINX should release the resources associated with the U_Q -channel.

Annex A (informative)

Implementation Conformance Statement (ICS) Proforma

A.1 Introduction

The supplier of an implementation which is claimed to conform to this International Standard shall complete the following Implementation Conformance Statement (ICS) proforma.

A completed ICS proforma is the ICS for the implementation in question. The ICS is a statement of which capabilities and options of the International Standard have been implemented. The ICS can have a number of uses, including use:

- by the implementor, as a check-list to reduce the risk of failure to conform to the International Standard through oversight;
- by the supplier and acquirer, or potential acquirer, of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the International Standard's ICS proforma;
- by the user or potential user of the implementation, as a basis for initially checking the possibility of interworking with another implementation — while interworking can never be guaranteed, failure to interwork can often be predicted from incompatible ICSs.

A.2 Instructions for completing the ICS proforma

A.2.1 General structure of the ICS proforma

The ICS proforma is a fixed-format questionnaire divided into subclauses each containing a group of individual items. Each item is identified by an item number, the name of the item (question to be answered), and the reference(s) to the clause(s) that specifies (specify) the item in the main body of this International Standard.

The "Status" column indicates whether an item is applicable and if so whether support is mandatory or optional. The following terms are used:

m	mandatory (the capability is required for conformance to the International Standard);
o	optional (the capability is not required for conformance to the International Standard, but if the capability is implemented it is required to conform to the specifications);
o.<n>	optional, but support of at least one of the group of options labelled by the same numeral <n> is required;
x	prohibited;
<c.cond>	conditional requirement, depending on support for the item or items listed in condition <cond>;
<item>:m	simple conditional requirement, the capability being mandatory if item number <item> is supported, otherwise not applicable;
<item>:o	simple conditional requirement, the capability being optional if item number <item> is supported, otherwise not applicable.

Answers to the questionnaire items are to be provided either in the “Support” column, by simply marking an answer to indicate a restricted choice (Yes or No), or in the “Not Applicable” column (N/A).

A.2.2 Additional information

Items of additional information allow a supplier to provide further information intended to assist the interpretation of the ICS. It is not intended or expected that a large quantity will be supplied, and an ICS can be considered complete without any such information. Examples might be an outline of the ways in which a (single) implementation can be set up to operate in a variety of environments and configurations.

References to items of additional information may be entered next to any answer in the questionnaire, and may be included in items of exception information.

A.2.3 Exception information

It may occasionally happen that a supplier will wish to answer an item with mandatory or prohibited status (after any conditions have been applied) in a way that conflicts with the indicated requirement. No pre-printed answer will be found in the Support column for this. Instead, the supplier is required to write into the Support column an x.<i> reference to an item of exception information, and to provide the appropriate rationale in the exception item itself.

An implementation for which an exception item is required in this way does not conform to this International Standard. A possible reason for the situation described above is that a defect in this International Standard has been reported, a correction for which is expected to change the requirement not met by the implementation.

A.3 ICS proforma for ISO/IEC 21992

A.3.1 Implementation identification

Supplier	
Contact point for queries about the ICS	
Implementation name(s) and version(s)	
Other information necessary for full identification, e.g., name(s) and version(s) for machines and/or operating systems; system name(s)	

Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirement for full identification.

The terms name and version should be interpreted appropriately to correspond with a suppliers terminology (e.g. type, series, model).

A.3.2 Implementation summary

Implementation version	1.0
Addenda implemented (if applicable)	
Amendments implemented	
Have any exception items been required (see A.2.3)?	No <input type="checkbox"/> Yes <input type="checkbox"/> (The answer Yes means that the implementation does not conform to this International Standard)

Date of Statement	
-------------------	--

A.4 General requirements

Item	Question/feature	References	Status	N/A	Support
A1	Support of on-demand IPC		m		Yes <input type="checkbox"/>
A2	Support of semi-permanent IPC		o		Yes <input type="checkbox"/> No <input type="checkbox"/>

A.5 U_Q-channel bearer capabilities at the Q reference point

Item	Question/feature	References	Status	N/A	Support
B1	Support transfer mode as “circuit mode”	7	m		Yes []
B2	Support 64kbit/s information transfer rate	7	m		Yes []
B3	Support “speech” for information transfer capability	7	o.1		Yes [] No []
B4	Support “3.1kHz audio” for information transfer capability	7	o.1		Yes [] No []
B5	Support “G.711A-law” for user information layer 1 protocol	7	o.2		Yes [] No []
B6	Support “G.711 μ -law” for user information layer 1 protocol	7	o.2		Yes [] No []
B7	Support other user information layer 1 protocol (specify:)	7	o		Yes [] No []

A.6 D_Q-channel capability at the Q reference point

Item	Question/feature	References	Status	N/A	Support
C1	Support of “packet mode” as transfer mode	7	m		Yes []
C2	Support of “unrestricted digital information” for information transfer capability	7	m		Yes []

A.7 Capabilities at the C reference point

Item	Question/feature	References	Status	N/A	Support
D1	Support of QPKT packet structure	8.1	m		Yes []
D2	Support of well-know TCP port (4029) for D _Q -channel	8.1	m		Yes []
D3	Support of dynamically assigned TCP port for D _Q -channel	8.1	o		Yes [] No []
D4	Support of dynamically assigned UDP port as signalled by RCI	8.2	m		Yes []

A.8 Mapping functions

Item	Question/feature	References	Status	N/A	Support
E1	Support mapping of the D _Q -channel	9.1	m		Yes []
E2	Support mapping of the U _Q -channel	9.2	m		Yes []