TECHNICAL REPORT

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Information technology — Protocol identification in the network layer

Technologies de l'information — Identification du protocole dans la couche réseau

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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.

The main task of technical committees is to prepare International Standards. In exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/IEC TR 9577, which is a Technical Report of type 3, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.263.

This third edition cancels and replaces the second edition (ISO/IEC TR 9577:1993), which has been technically revised.

Introduction

Identifying protocols by information in a uniform part of the protocol control information fulfils two requirements:

a) It enables an entity to verify that the protocol received is of the type and kind expected; and

b) It permits an entity to discriminate among a number of different protocols (both OSI and non-OSI) that might co-exist in a common environment.

This Recommendation | Technical Report contains a description of the means used to identify protocols and where that information is located in a protocol, together with a record of those values of protocol identifiers which have been used by ITU-T and ISO/IEC, and by other authorities. This Recommendation | Technical Report does not attempt to provide any general architectural principles for the functions of protocol identification, nor does it attempt to provide judgements as to whether a protocol might have more than one value of protocol identifier.

By reference to this Recommendation | Technical Report, future protocols can be developed to include a protocol identifier and the values of such protocol identifiers can be chosen on a knowledgeable basis.

TECHNICAL REPORT

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – PROTOCOL IDENTIFICATION IN THE NETWORK LAYER

1 Scope

This Recommendation | Technical Report provides:

a) the description of a means to permit a protocol to be identified;

b) a record of the structure and allowable ranges of protocol identifier(s) which can be assigned by ITU-T, ISO/IEC and other authorities;

c) a record of the values of protocol identifiers used by OSI Network layer protocols and non-OSI protocols occupying a similar position; in particular, only protocols with protocol control information commencing in octet 1 of the protocol data unit are covered; and

d) a record of the values that are in use as protocol control information in non-Network layer protocols where they impact on Network layer protocol identification.

The application of this Recommendation | Technical Report is:

a) in the identification of internationally standardized Network layer protocols operating directly above the Data Link service;

b) in the identification of protocols used in conjunction with internationally standardized Network layer protocols that operate directly above the Data Link service; and

c) to distinguish between Internationally standardized Network layer protocols, and other internationally standardized protocols used in conjunction with internationally standardized Network layer protocols.

This Recommendation | Technical Report is for use by ITU-T Study Groups, ISO/IEC Technical Committees and other authorities in applying the principles contained in clause 4, and in selecting an unused value or values from the range of values permitted in clauses 5 or 6, as appropriate. When a new value is selected, that value and its usage should be brought to the attention of ITU-T Study Group 7 or ISO/IEC JTC 1 SC6 so that this Recommendation | Technical Report can be amended.

2 References

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | Technical Report. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | Technical Report are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.200 (1994) | ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model.*
- ITU-T Recommendation X.233 (1993) | ISO/IEC 8473-1:1994, *Information technology – Protocol for providing the connectionless-mode network service: Protocol specification.*
- ITU-T Recommendation X.273 (1994) | ISO/IEC 11577:1995, *Information technology – Open Systems Interconnection – Network layer security protocol.*
- ITU-T Recommendation X.633 (1996) | ISO/IEC 14700:1996, *Open Systems Interconnection – Network fast byte protocol.*
- ITU-T Recommendation X.634 (1996) | ISO/IEC 14699:1996, *Open Systems Interconnection – Transport fast byte protocol.*

2.2 Paired Recommendations | International Standards equivalent in technical content

- ITU-T Recommendation X.25 (1996), *Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit.*

  ISO/IEC 8208:1995, *Information technology – Data communications – X.25 Packet Layer Protocol for Data Terminal Equipment.*
- ITU-T Recommendation X.223 (1996), *Use of X.25 to provide the OSI connection-mode network service for ITU-T applications.*

  ISO/IEC 8878:1992, *Information technology – Telecommunications and information exchange between systems – Use of X.25 to provide the OSI Connection-mode Network Service.*
- ITU-T Recommendation X.224 (1993), *Protocol for providing the OSI connection-mode transport service.*

  ISO/IEC 8073:1992, *Information technology – Telecommunications and information exchange between systems – Open Systems Interconnection – Protocol for providing the connection-mode transport service.*
- ITU-T Recommendation X.264 (1993), *Transport protocol identification mechanism.*

  ISO/IEC 11570:1992, *Information technology – Telecommunications and information exchange between systems – Open Systems Interconnection – Transport protocol identification mechanism.*

2.3 Additional references

- CCITT Recommendation G.764 (1992), *Voice packetization – Packetized voice protocols.*
- ITU-T Recommendation Q.931 (1993), *Digital Subscriber Signalling System No. 1 (DSS 1) – ISDN user-network interface layer 3 specification for basic call control.*
- ITU-T Recommendation Q.932 (1993), *Digital Subscriber Signalling System No. 1 (DSS 1) – Generic procedures for the control of ISDN supplementary services.*
- ITU-T Recommendation Q.933 (1993), *Digital subscriber signalling system No. 1 (DSS 1) – Signalling specification for frame mode basic call control.*
- ITU-T Recommendation Q.2119 (1996), *B-ISDN ATM Adaptation layer protocols. Convergence function for SSCOP above the frame relay core service.*
- ITU-T Recommendation Q.2931 (1995), *Broadband Integrated Services Digital Network (B-ISDN) – Digital Subscriber Signalling System No. 2 (DSS 2) – User-Network Interface (UNI) layer 3 specification for basic call/connection control.*
- ITU-T Recommendation T.70 (1993), *Network-independent basic transport service for the telematic services.*
- ITU-T Recommendation X.29 (1993), *Procedures for the exchange of control information and user data between a Packet Assembly/Disassembly (PAD) facility and a packet mode DTE or another PAD.*

- ITU-T Recommendation X.36 (1995), *Interface between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for public data networks providing frame relay data transmission service by dedicated circuit.*
- ITU-T Recommendation X.37 (1995), *Encapsulation in X.25 packets of various protocols including frame relay.*
- ITU-T Recommendation X.39 (1996), *Procedures for the exchange of control information and user data between a Facsimile Packet Assembly/Disassembly (FPAD) facility and a packet mode Data Terminal Equipment (DTE) or another FPAD.*
- ITU-T Recommendation X.48 (1996), *Procedures for the provision of a basic multicast service for Data Terminating Equipments (DTEs) using Recommendation X.25.*
- ITU-T Recommendation X.49 (1996), *Procedures for the provision of an extended multicast service for Data Terminating Equipment (DTEs) using Recommendation X.25.*
- CCITT Recommendation X.610 (1992), *Provision and support of the OSI connection-mode network service.*
- ISO/IEC 9542:1988[1)], *Information processing systems – Telecommunications and information exchange between systems – End system to Intermediate system routeing exchange protocol for use in conjunction with the Protocol for providing the connectionless-mode network service (ISO 8473).*
- ISO/IEC 10030:1995, *Information technology – Telecommunications and information exchange between systems – End System Routeing Information Exchange Protocol for use in conjunction with ISO/IEC 8878.*
- ISO/IEC 10589:1992, *Information technology – Telecommunications and information exchange between systems – Intermediate system to Intermediate system intra-domain routeing information exchange protocol for use in conjunction with the protocol for providing the connectionless-mode Network Service (ISO/IEC 8473).*
- ISO/IEC 10747:1994, *Information technology – Telecommunications and information exchange between systems – Protocol for exchange of inter-domain routeing information among intermediate systems to support forwarding of ISO 8473 PDUs.*
- ISO/IEC 11572:1994[2)], *Information technology – Telecommunications and information exchange between systems – Private Integrated Services Network – Circuit mode bearer services – Inter-exchange signalling procedures and protocol.*
- ISO/IEC 11582:1995, *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.*
- ISO/IEC TR 13532:1995, *Information technology – Telecommunications and information exchange between systems – Protocol combinations to provide and support the OSI Network Service.*

3 Abbreviations

For the purposes of this Recommendation | Technical Report, the following abbreviations apply:

GFI	General Format Identifier
IPI	Initial Protocol Identifier
NCMS	Network Connection Management Subprotocol
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
SPI	Subsequent Protocol Identifier
TPDU	Transport Protocol Data Unit

1) Currently under revision.

4 Protocol identifiers

The protocol operating directly over the Data Link layer is termed the initial protocol and is identified by the Initial Protocol Identifier (IPI).

The protocol carried by the initial protocol is termed the subsequent protocol and is identified by a Subsequent Protocol Identifier (SPI).

The subsequent protocol can carry further subsequent protocols, identified by further SPIs, iteratively.

For the purposes of this Recommendation | Technical Report, the octets referred to as IPI and SPI are viewed as protocol identifiers. In some cases the protocol itself gives other names to these octets, and might also view the function of the octets as being distinct from protocol identification. ITU-T Rec. X.25 and ISO/IEC 8208 provide an example (see Annex A). It is possible to identify such protocols by the means described in this Recommendation | Technical Report. It is also possible for a given protocol to be identified in more than one way, in different contexts.

NOTE – Guidelines for the processing of protocol identifiers are given in Annex B.

5 Initial protocol identifier

5.1 General

The location of the IPI is the first octet of the protocol control information; this is depicted in Figure 1. The value of the IPI unambiguously identifies the initial protocol.

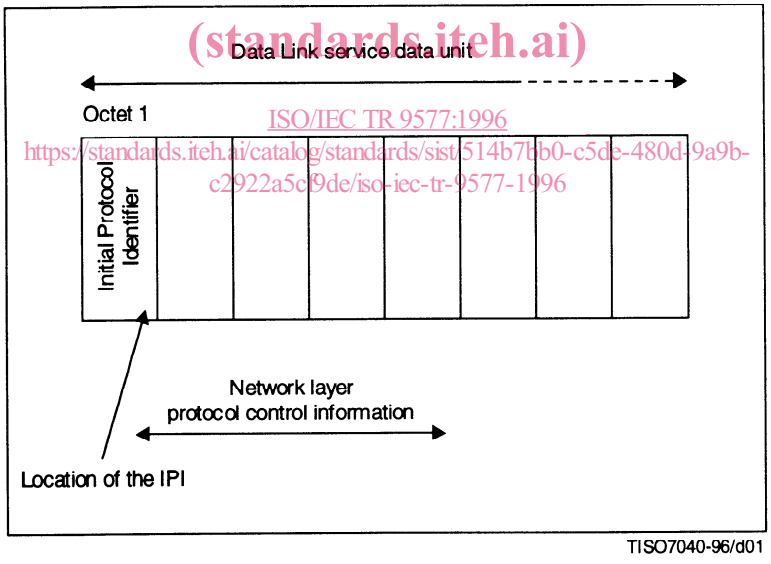


Figure 1 – Location of the IPI

5.2 Assignment structure

The structure applied to the values of the IPI is depicted in Table 1.

With the exception of protocol identifiers used by ITU-T Rec. X.25 and ISO/IEC 8208, bits 8, 7, 6, and 5 of the IPI indicate the administrative authority which is responsible for assigning a combination of the associated bits 4, 3, 2 and 1 to an initial protocol.

Table 1 – Structure of the IPI octet

Bit Pattern 8	7	6	5	4	3	2	1	Allocation Category
0	0	0	0	0	0	0	0	Allocation by ISO/IEC
0	0	0	0	0	0	0	1	
through to and including								Allocation by ITU-T
0	0	0	0	1	1	1	1	
x	x	0	1	x	x	x	x	ITU-T Rec. X.25, ISO/IEC 8208
x	x	1	0	x	x	x	x	ITU-T Rec. X.25, ISO/IEC 8208
0	0	1	1	x	x	x	x	ITU-T Rec. X.25, ISO/IEC 8208
0	1	0	0	0	0	x	x	Allocation by ISO/IEC
0	1	0	0	0	1	0	0	Allocation by ITU-T
0	1	0	0	0	1	0	1	
through to and including								Allocation by ISO/IEC
0	1	0	0	1	1	1	1	
0	1	1	1	x	x	x	x	Joint allocation by ITU-T and ISO/IEC
1	0	0	0	x	x	x	x	Allocation by ISO/IEC
1	0	1	1	x	x	x	x	Allocation by ITU-T
1	1	0	0	x	x	x	x	Not categorized by this Recommendation | Technical Report (see Note)
1	1	1	1	0	0	0	0	
through to and including								Joint Allocation by ITU-T and ISO/IEC
1	1	1	1	1	1	1	0	
1	1	1	1	1	1	1	1	Reserved for extension, see Table 2

NOTE – Although not categorized by this Recommendation | Technical Report, the codepoints 1100 1100 and 1100 1111 are in widespread use (see Table 2 and Annex C).

5.3 Values assigned to the IPI

Table 2 records the values that have been assigned to specific protocols. Values not recorded are reserved and available for allocation by the administrative authorities specified by the structure depicted in 5.2.

A specific value is reserved to indicate the null Network layer. One value is reserved for future extension to this Recommendation | Technical Report.

Table 2 – Values assigned to the IPI octet

Bit Pattern 8	7	6	5	4	3	2	1	Protocol
0	0	0	0	0	0	0	0	Null Network layer (see Note 1)
0	0	0	0	0	0	0	1	Rec. T.70 (Minimum Network layer functionality)
0	0	0	0	0	0	1	1	Rec. X.633 (Network layer fast-byte protocol)
0	0	0	0	1	0	0	0	Recs. Q.931, Q.932, Q.933, X.36, ISO/IEC 11572, ISO/IEC 11582
0	0	0	0	1	0	1	0	Rec. Q.2119
0	0	0	0	1	0	0	1	Rec. Q.2931 (Broadband ISDN Signalling protocol)
x	x	0	1	x	x	x	x	ITU-T Rec. X.25 and ISO/IEC 8208 – modulo 8
x	x	1	0	x	x	x	x	ITU-T Rec. X.25 and ISO/IEC 8208 – modulo 128
0	0	1	1	x	x	x	x	ITU-T Rec. X.25 and ISO/IEC 8208 – GFI extension
0	1	0	0	0	1	0	0	Rec. G.764
1	0	0	0	0	0	0	0	IEEE SNAP, see Annex D
1	0	0	0	0	0	0	1	ITU-T Rec. X.233 | ISO/IEC 8473-1 (excluding the inactive subset)
1	0	0	0	0	0	1	0	ISO/IEC 9542
1	0	0	0	0	0	1	1	ISO/IEC 10589
1	0	0	0	0	1	0	1	ISO/IEC 10747 (see Note 3)
1	0	0	0	1	0	1	0	ISO/IEC 10030
1	0	0	0	1	0	1	1	ITU-T Rec. X.273 | ISO/IEC 11577
1	0	1	1	0	0	0	0	Data compression protocol (see Note 4)
1	1	0	0	1	1	0	0	See Annex C
1	0	0	0	1	1	1	1	Private Network layer protocols
1	1	1	1	1	1	1	1	Reserved for extension (see Note 2).

NOTES

1 ITU-T Rec. X.233 | ISO/IEC 8473-1 uses this value for the inactive subset.

2 The extension mechanisms will be the subject of joint development between ITU-T and ISO/IEC.

3 IPI assigned but not currently used since current usage of ISO/IEC 10747 PDUs is covered by the ITU-T Rec. X.233 | ISO/IEC 8473-1 IPI.

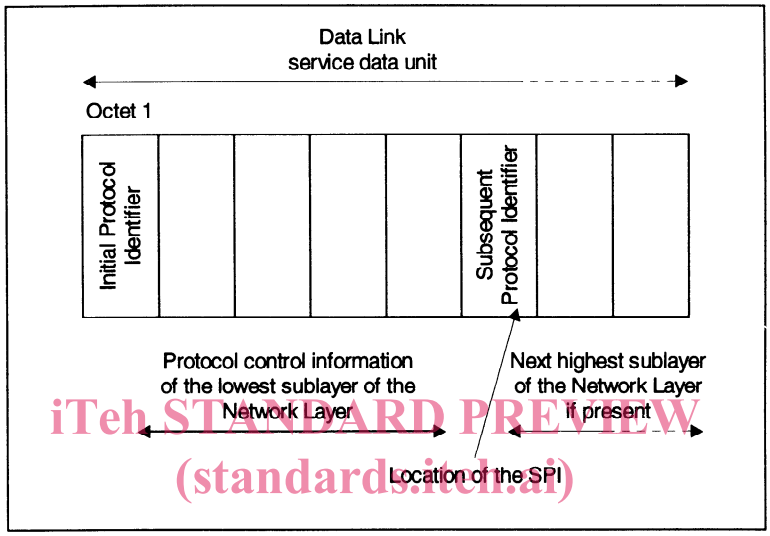
4 The first octet of the decompressed PDU, when the IPI indicated Data compression protocol, is itself an IPI octet.

6 Subsequent protocol identifier

6.1 General

An initial protocol can make provision for implicit or explicit mechanisms to list and/or negotiate the identity of subsequent protocols to be carried by it. In the case of an explicit mechanism, the identity of the subsequent protocol is given by the Subsequent Protocol Identifier (SPI).

For the purposes of this Recommendation | Technical Report, the SPI is the first octet of protocol control information in each instance of communication of the subsequent protocol. This is depicted in Figure 2 where a subsequent protocol is operating directly over the initial protocol.



NOTE – The term sublayer is used as defined in ITU-T Rec. X.200 | ISO/IEC 7498-1.

Figure 2 – Location of the SPI

The value of the SPI:

a) identifies another OSI Network layer protocol;

b) identifies some other non-OSI protocol;

c) identifies that a set of protocols is encapsulated within the initial protocol – the method for identification of the subsequent encapsulated protocol(s) is defined by the protocol associated with the SPI; or

d) is that which is in use by an OSI Transport layer protocol.

It should be noted that in some cases an SPI might not be present, for example see Figure A.3.

It should also be noted that in case c), for the purposes of the initial protocol, the single-octet SPI defined here can be separate from the mechanism used to identify subsequent protocols (in particular, that mechanism can use multi-octet protocol identifiers specified by the protocol associated with the SPI; for example, see Annex D).

6.2 Assignment structure

The structure applied to the SPI is depicted in Table 3.

Bits 8 and 7 of the SPI indicate the administrative authority (if any) which is responsible for assigning the associated bits 6, 5, 4, 3, 2, and 1 to a subsequent protocol.