TECHNICAL REPORT

ISO/IEC TR 9577

Fourth edition
1999-12-15

Information technology — Protocol identification in the network layer

Technologies de l'information — Identification des protocoles dans la couche réseau

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Foreword

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In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. 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.

In exceptional circumstances, 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), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this Technical Report 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 TR 9577 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 Rec. X.263.

This fourth edition cancels and replaces the third edition (ISO/IEC TR 9577:1996), which has been technically revised.

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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.

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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, protocols with protocol control information commencing in octet 1 of the protocol data unit (header-oriented protocols), and protocols with protocol control information commencing in the final octet of the protocol data unit (trailer-oriented protocols), 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.

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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.224 (1995) | ISO/IEC 8073:1997, *Information technology – Open Systems Interconnection – Protocol for providing the connection-mode transport service.*

– 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.260 (1996) | ISO/IEC 14765:1997, *Information technology – Framework for protocol identification and encapsulation.*

– 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 14700:1997, *Information technology – Open Systems Interconnection – Network Fast Byte Protocol*.

– ITU-T Recommendation X.634 (1996) | ISO/IEC 14699:1997, *Information technology – Open Systems Interconnection – Transport Fast Byte Protocol*.

2.2 Paired Recommendations | International Standards equivalent in technical content

– ITU-T Recommendation X.223 (1993), *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.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 (1990), *Voice packetization – Packetized voice protocols*.

– ITU-T Recommendation I.365.2 (1995), *B-ISDN ATM adaptation layer sublayers: Service specific coordination function to provide the connection-oriented network service*.

– ITU-T Recommendation I.365.3 (1995), *B-ISDN ATM adaptation layer sublayers: Service specific coordination function to provide the connection-oriented transport service*.

– ITU-T Recommendation Q.931 (1993), *ISDN user-network interface layer 3 specification for basic call control.*

– ITU-T Recommendation Q.932 (1993), *Generic procedures for the control of ISDN supplementary services.*

– ITU-T Recommendation Q.933 (1995), *Signalling specifications for frame mode switched and permanent virtual connection control and status monotoring*.

– ITU-T Recommendation Q.2119 (1996), *B-ISDN ATM adaptation layer – Convergence function for SSCOP above the frame relay core service*.

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- ITU-T Recommendation Q.2931 (1995), *Digital Subscriber Signalling System No. 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.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.*
- 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.45 (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, designed for efficiency at higher speeds.*
- ITU-T Recommendation X.48 (1996), *Procedures for the provision of a basic multicast service for Data Terminal Equipments (DTEs) using Recommendation X.25.*
- ITU-T Recommendation X.49 (1996), *Procedures for the provision of an extended multicast service for Data Terminal Equipments (DTEs) using Recommendation X.25.*
- CCITT Recommendation X.610 (1992), *Provision and support of the OSI connection-mode network service.*
- ISO/IEC 8208:1995, *Information technology – Data communications – X.25 Packet Layer Protocol for Data Terminal Equipment.*
- ISO/IEC 8802 (All parts), *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks.*
- ISO 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 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 11572:1997, *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*.

1) Currently under revision.

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- ISO/IEC TR 13532:1995, *Information technology – Telecommunications and information exchange between systems – Protocol combinations to provide and support the OSI Network Service*.
- RFC 791, *Internet Protocol. J. Postel* (September 1981).
- RFC 1548, *The Point-to-Point Protocol (PPP). W. Simpson* (December 1993).
- RFC 2460, *Internet Protocol, Version 6 (IPv6) Specification* (December 1998).
- FRF.9 (Frame Relay Forum), *Data Compression over Frame Relay Implementation Agreement* (January 1996).
- FRF.12 (Frame Relay Forum), *Fragmentation over Frame Relay Implementation Agreement* (December 1997).
- FRF.priv (Frame Relay Forum), *Frame Relay Privacy Implementation Agreement*.
- FRF.OA&M (Frame Relay Forum), *Frame Relay Operations, Administration and Maintenance (OA&M) Protocol and Procedures Implementation Agreement*.

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

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.

ITU-T Rec. X.260 | ISO/IEC 14765 contains a more detailed specification of the framework for protocol identification on which the above concepts are based.

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

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5 Initial protocol identifier

5.1 General

The location of the IPI for a header-oriented protocol 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 within the set of header-oriented protocols.

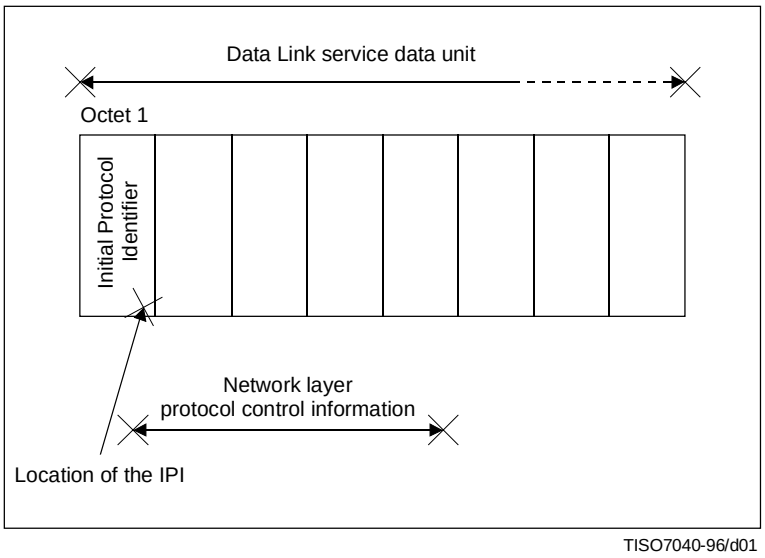

Figure 1 – Location of the IPI

The location of the IPI for a trailer-oriented protocol is the final octet of the protocol control information; this is depicted in Figure 2. The value of the IPI unambiguously identifies the initial protocol within the set of trailer-oriented protocols.

It is not possible in general to mix header-oriented and trailer-oriented protocols on the same data link: *a priori* knowledge is needed of the nature of the protocols to be received at a particular Data Link service access point.

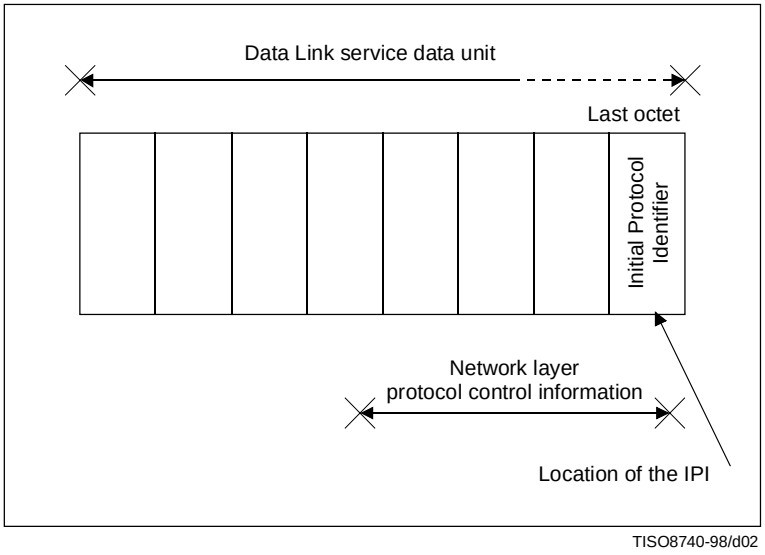

Figure 2 – Location of the IPI for trailer-oriented protocols

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5.2 Assignment structure for header-oriented protocols

The structure applied to the values of the IPI for header-oriented protocols 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 for header-oriented protocols

Bit pattern								Allocation category
8	7	6	5	4	3	2	1	
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 and ISO/IEC 8208
x	x	1	0	x	x	x	x	ITU-T Rec. X.25 and ISO/IEC 8208
0	0	1	1	x	x	x	x	ITU-T Rec. X.25 and 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 (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 for header-oriented protocols

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.

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Table 2 – Values assigned to the IPI octet for header-oriented protocols

Bit pattern								Protocol
8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Null Network layer (Note 1)
0	0	0	0	0	0	0	1	ITU-T Rec. T.70 (Minimum Network layer functionality)
0	0	0	0	0	0	1	1	ITU-T Rec. X.633 (Network layer fast-byte protocol)
0	0	0	0	1	0	0	0	ITU-T Recs. Q.931, Q.932, Q.933, X.36, ISO/IEC 11572, ISO/IEC 11582
0	0	0	0	1	0	1	0	ITU-T Rec. Q.2119
0	0	0	0	1	0	0	1	ITU-T 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	0	0	1	0	ITU-T Rec. X.45
0	0	1	1	x	x	x	x	ITU-T Rec. X.25 and ISO/IEC 8208 – GFI extension (except value 0011 0010)
0	1	0	0	0	1	0	0	ITU-T 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 9542
1	0	0	0	0	0	1	1	ISO/IEC 10589
1	0	0	0	0	1	0	1	ISO/IEC 10747 (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	0	0	1	1	1	0	RFC 2460 (see Annex C)
1	0	1	1	0	0	0	0	FRF.9 (Note 4)
1	0	1	1	0	0	0	1	FRF.12 (Note 4)
1	0	1	1	0	0	1	0	FRF.OA&M
1	0	1	1	0	0	1	1	FRF.priv (Note 5)
1	1	0	0	1	1	0	0	RFC 791 (see Annex C)
1	1	0	0	1	1	1	1	RFC 1548 (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 (Note 2).

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

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

NOTE 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.

NOTE 4 – The first octet of the decompressed PDU, when the IPI indicates Data compression protocol, or of the reassembled PDU, when the IPI indicates Fragmentation protocol, is itself an IPI octet.

NOTE 5 – Depending upon the protocol(s) that use it, this IPI may be followed by another IPI, an SPI or no Protocol Identifier at all.

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5.4 Assignment structure for trailer-oriented protocols

The structure applied to the values of the IPI for trailer-oriented protocols is depicted in Table 3.

Bits 8, 7, and 6 of the IPI indicate the administrative authority which is responsible for assigning a combination of the associated bits 5, 4, 3, 2 and 1 to an initial protocol.

Table 3 – Structure of the IPI octet for trailer-oriented protocols

Bit pattern								Allocation category
8	7	6	5	4	3	2	1	
0	0	x	x	x	x	x	x	Allocation by ITU-T
0	1	x	x	x	x	x	x	Reserved for future assignment to ITU-T and/or ISO/IEC
1	0	0	x	x	x	x	x	Allocation by ISO/IEC
1	0	1	x	x	x	x	x	Allocation by ITU-T
1	1	0	0	0	0	0	0	
through to and including								Not categorized by this Recommendation | Technical Report
1	1	1	1	1	1	1	0	
1	1	1	1	1	1	1	1	Reserved for extension, see Table 4

5.5 Values assigned to the IPI for trailer-oriented protocols

Table 4 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 5.4.

One value is reserved for future extension to this Recommendation | Technical Report.

Table 4 – Values assigned to the IPI octet for trailer-oriented protocols

Bit pattern								Protocol
8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	ITU-T Recs. I.365.2 and I.365.3
1	1	1	1	1	1	1	1	Reserved for extension (Note).
NOTE – The extension mechanisms will be the subject of joint development between ITU-T and ISO/IEC.								

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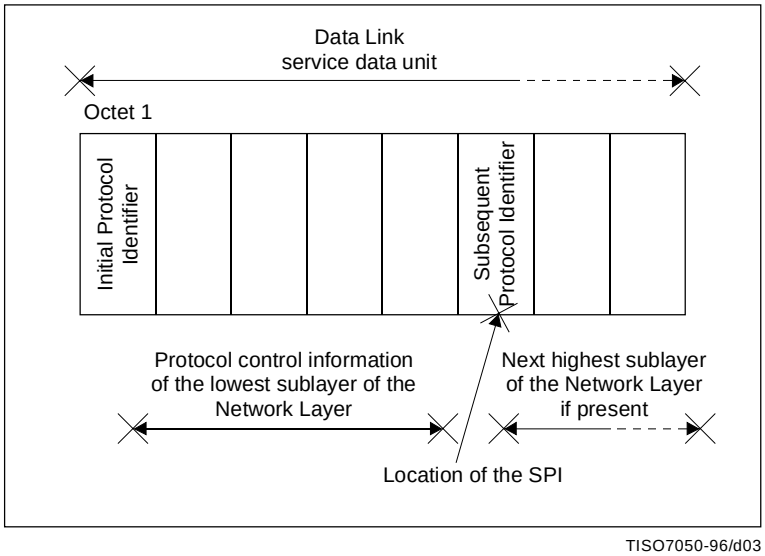
6 Subsequent protocol identifier

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 3 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 3 – 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).

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6.2 Assignment structure for header-oriented protocols

The structure applied to the SPI is depicted in Table 5.

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.

Table 5 – Structure of the SPI octet for header-oriented protocols

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

NOTE 1 – The general principle of bits 8 and 7 identifying the administrative authority is used by this Recommendation | Technical Report. Where bits 8 and 7 are 00 this identifies ITU-T. However, it has been necessary for ISO/IEC to use the particular value 0000 0000 as an SPI for a certain protocol. This is not expected to cause interworking problems.

NOTE 2 – The allocation of SPIs by ISO/IEC National Bodies should be done with extreme care as it is possible that different National Bodies could allocate the same identifier to different protocols, or different identifiers to the same protocols. In such cases interworking problems may result.

NOTE 3 – Although not categorized by this Recommendation | Technical Report, the codepoints 1100 1100 and 1100 1111 are in widespread use (see Table 6 and Annex C).

6.3 Values assigned to the SPI for header-oriented protocols

Table 6 records the values that have been assigned to specific protocols which operate over the initial protocol. Values not recorded are reserved and available for allocation by the administrative authorities specified by the structure depicted in 6.2.

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Table 6 – Values assigned to the SPI octet for header-oriented protocols

Bit pattern								Protocol
8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	ITU-T Rec. X.233 | ISO/IEC 8473-1 Inactive subset, ITU-T Rec. X.37 multi-protocol encapsulation (Note 1)
0	0	0	0	0	0	0	1	ITU-T Rec. X.29
0	0	0	0	0	0	1	0	ITU-T Rec. T.70 Transport layer procedure (Note 2).
0	0	0	0	0	0	1	1	
through to and including								Reserved – in use by ITU-T Rec. X.224 | ISO/IEC 8073, Annex B and ITU-T Rec. X.264 and ISO/IEC 11570 (Notes 2 and 3)
0	0	1	1	1	1	1	1	
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 9542
1	0	0	0	0	0	1	1	ISO/IEC 10589
1	0	0	0	0	1	0	0	ISO/IEC 8878, Annex A
1	0	0	0	0	1	0	1	ISO/IEC 10747
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	0	0	1	1	1	0	RFC 2460 (see Annex C)
1	0	0	0	1	1	1	1	Private Network layer protocols
1	0	1	0	0	0	0	0	ITU-T Rec. X.37, identification by other means
1	0	1	0	0	0	0	1	ITU-T Rec. X.39
1	0	1	0	0	0	1	0	ITU-T Rec. X.634 | ISO/IEC 14699 (Note 2)
1	0	1	0	0	1	0	0	ITU-T Recs. X.48 and X.49
1	0	1	0	1	0	0	0	ITU-T Rec. X.37, encapsulation of frame relay
1	0	1	1	0	0	0	0	FRF.9 (see Annex E)
1	0	1	1	0	0	0	1	FRF.12 (see Annex E)
1	0	1	1	0	0	1	0	FRF.OA&M (see Annex E)
1	0	1	1	0	0	1	1	FRF.priv (see Annex E)
1	1	0	0	1	1	0	0	RFC 791 (see Annex C)
1	1	0	0	1	1	1	1	RFC 1548 (see Annex C)
1	1	1	1	1	1	1	1	Reserved for extension (Note 4).

NOTE 1 – No interworking problems are likely to arise from the (apparent) conflict of assignment for the SPI value 0000 0000. It is not expected that the inactive subset of ITU-T Rec. X.233 | ISO/IEC 8473-1 will be conveyed using ITU-T Rec. X.37 in a way that would cause this SPI value identifying the inactive subset to occur.

NOTE 2 – These are not Network layer protocol identifiers. The values shown are used by the respective higher layer protocol; they are not used for higher layer protocol identification.

NOTE 3 – These values are not used for identification. However, the receipt of these values confirms the use of the Transport layer protocol identification mechanism as defined in ITU-T Rec. X.264 and ISO/IEC 11570 and ITU-T Rec. X.224 | ISO/IEC 8073, Annex B (known *a priori*).

NOTE 4 – The extension mechanisms will be the subject of joint development between ITU-T and ISO/IEC.

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6.4 Assignment structure for trailer-oriented protocols

The structure applied to the SPI for trailer-oriented protocols is identical to that for the IPI, depicted in Table 3.

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

6.5 Values assigned to the SPI for trailer-oriented protocols

Table 7 records the values that have been assigned to specific protocols which operate over the initial protocol. Values not recorded are reserved and available for allocation by the administrative authorities specified by the structure depicted in Table 3.

Table 7 – Values assigned to the SPI octet for trailer-oriented protocols

Bit pattern								Protocol
8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	ITU-T Recs. I.365.2 and I.365.3
1	1	1	1	1	1	1	1	Reserved for extension (Note).
NOTE – The extension mechanisms will be the subject of joint development between ITU-T and ISO/IEC.								

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Annex A

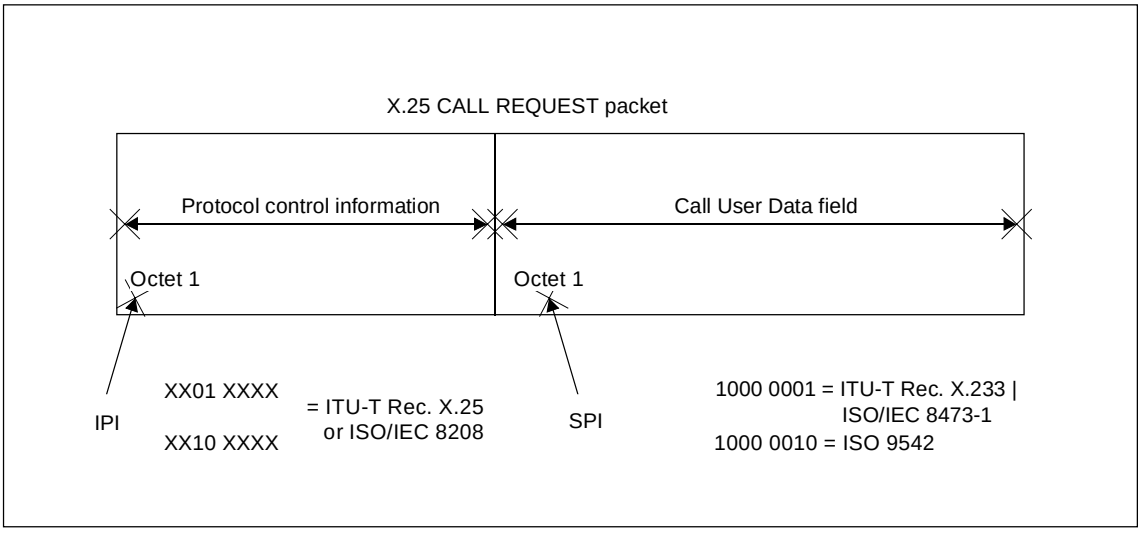
The location and use of protocol identifiers in X.25 Packet Layer Protocol

(This annex forms an integral part of this Recommendation | Technical Report)

This annex shows examples of protocol identifiers when the X.25 Packet Layer Protocol specified in ITU-T Rec. X.25 and/or ISO/IEC 8208 is used as the initial protocol in various situations. These examples assume that the systems operate in an OSI environment, and that the X.25 or ISO/IEC 8208 protocol is operating in modulo 8 or modulo 128.

NOTE 1 – In modulo 8 or modulo 128 operation of ITU-T Rec. X.25 and ISO/IEC 8208, the first octet consists of the General Format Identifier (GFI) and the upper four bits of the logical channel identifier. This first octet also serves as the Initial Protocol Identifier (IPI). In modulo 32 768 operation, the first octet is an IPI and is separate from the GFI and the upper four bits of the logical channel identifier (which are in the second octet). This is not shown in the examples below.

NOTE 2 – In the case of ITU-T Rec. X.25 and ISO/IEC 8208 CALL REQUEST/INCOMING CALL packets, bit 8 might be set to 1 to indicate alternative address formats and bit 7 might be set to 1 to indicate desire to use the delivery confirmation procedure.



NOTE – When a virtual call is set up to carry connectionless PDUs as shown above, the subsequent DATA packets may carry ITU-T Rec. X.233 | ISO/IEC 8473-1 PDUs, or ISO 9542 PDUs, each PDU being identified by its respective SPI value as indicated in Table 4.

Figure A.1 – IPI and SPI when ITU-T Rec. X.233 | ISO/IEC 8473-1 or ISO 9542 is operated over ITU-T Rec. X.25 and/or ISO/IEC 8208

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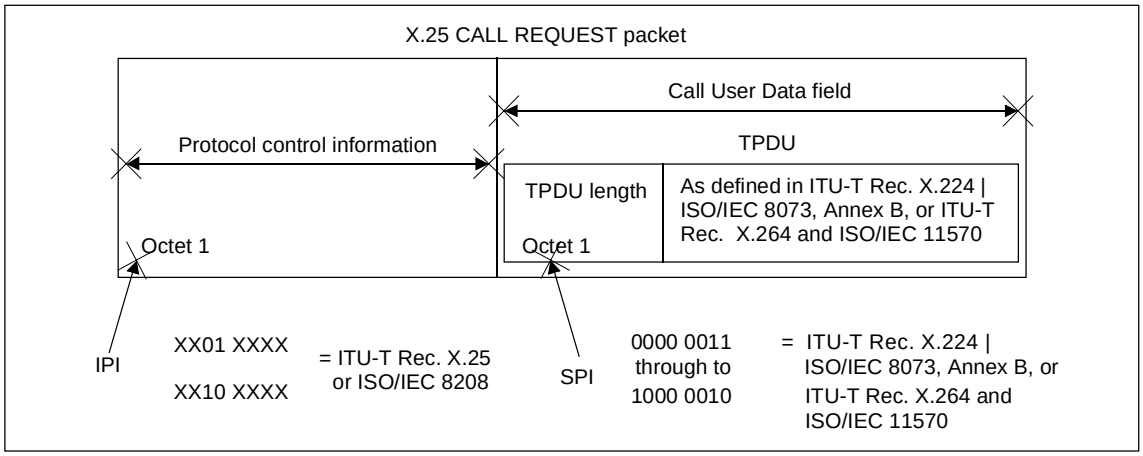


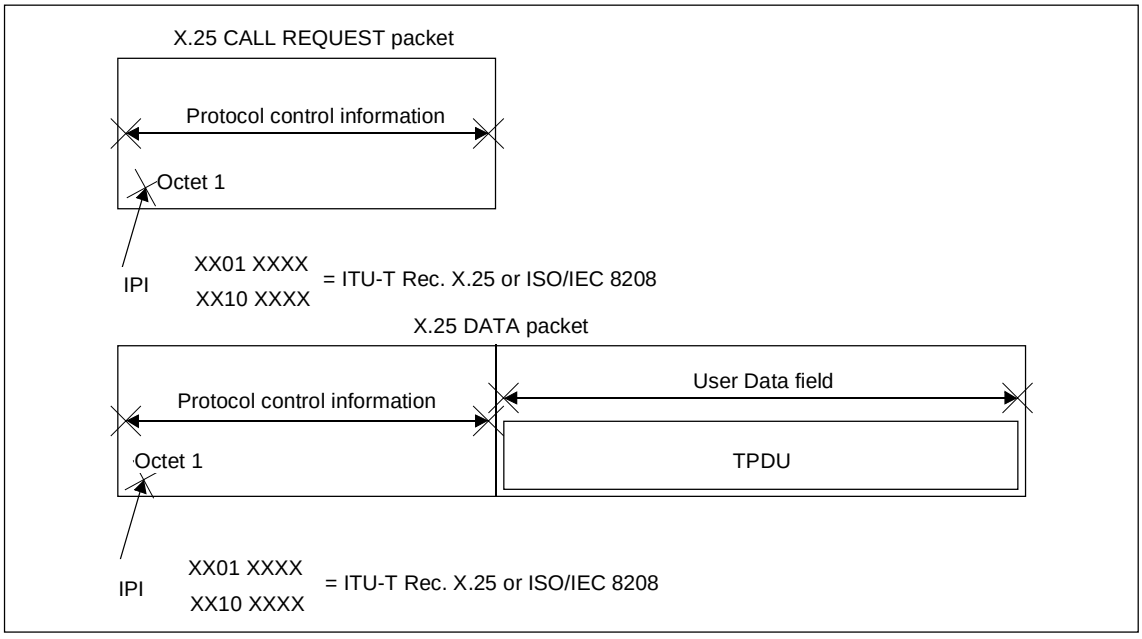
TISO7070-96/d05

NOTE 1 – The SPI is the ITU-T Rec. X.224 | ISO/IEC 8073, Annex B or ITU-T Rec. X.264 and ISO/IEC 11570 UN TPDU Length indicator.

NOTE 2 – The Transport layer is accessed by the called Network Address (N-address) conveyed in the X.25 protocol control information.

NOTE 3 – These values are not used for identification, however, the receipt of these values confirms the use of ITU-T Rec. X.224 | ISO/IEC 8073, Annex B or ITU-T Rec. X.264 and ISO/IEC 11570 (known *a priori*).

Figure A.2 – IPI and SPI when ITU-T Rec. X.224 | ISO/IEC 8073, Annex B or ITU-T Rec. X.264 and ISO/IEC 11570 explicit identification is operated over ITU-T Rec. X.25 and/or ISO/IEC 8208



TISO7080-96/d06

NOTE 1 – In an OSI environment where default identification is used, the ITU-T Rec. X.224 | ISO/IEC 8073 protocol is carried in X.25 DATA packets and an SPI does not exist.

NOTE 2 – The Transport layer is accessed by the called Network Address (N-address) conveyed in the X.25 protocol control information.

NOTE 3 – ITU-T Rec. X.224 | ISO/IEC 8073 is implicitly identified in this case and the receipt of TPDUs is expected on an *a priori* basis.

Figure A.3 – Location of IPI and SPI when ITU-T Rec. X.264 and ISO/IEC 11570 default identification is used over ITU-T Rec. X.25 and/or ISO/IEC 8208

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Annex B

Guidelines on the processing of protocol identifiers

(This annex forms an integral part of this Recommendation | Technical Report)

B.1 Originating systems

The use of particular protocols depends upon the capabilities of both the originating and destination systems. This Recommendation | Technical Report does not provide mechanisms for the selection of specific protocols. It notes that the selection could be, for example, by *a priori* knowledge, by directories, or by some other means. It is also noted that CCITT Rec. X.610 and ISO/IEC TR 13532 define protocol combinations to support the connection-mode Network service, and ISO/IEC TR 13532 also defines protocol combinations to support the connectionless-mode Network service.

B.2 Destination systems

This Recommendation | Technical Report describes a means by which a system can identify the protocols recorded in Tables 2 and 6. Following an examination of the IPI, PDUs can be directed to the correct protocol entity for further processing. In this regard the IPI is a preprocessing selector (see Figure B.1).

The destination system might also need to examine the SPI in order to determine what other protocols are being received. For example, ISO/IEC 8208 can support both the Connection-mode and the Connectionless-mode Network services. In an OSI environment an examination of the SPI will reveal, for example, whether the ITU-T Rec. X.233 | ISO/IEC 8473-1 protocol is in use (see Table 6). Note that if the SPI indicates a subsequent protocol that cannot be processed, ISO/IEC 8208 includes a diagnostic code (number 249) which indicates "unrecognizable protocol in user data" and this can be used in a CLEAR REQUEST packet to reject a virtual call.

Figures B.1 and B.2 show the use of the IPI and SPI respectively in their roles as protocol identifiers. The representation used in these figures is as an aid to understanding and it does not prescribe a method of implementation. Details regarding the specific operation of protocols, and their use of particular Data Link services, are excluded from Figures B.1 and B.2.

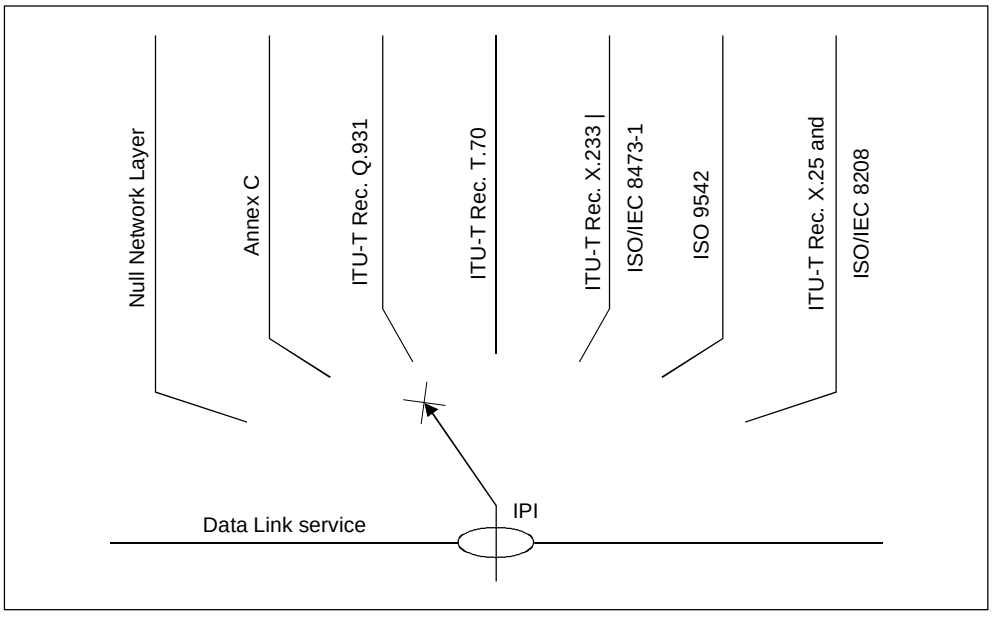

Figure B.1 – Selection of the initial protocol

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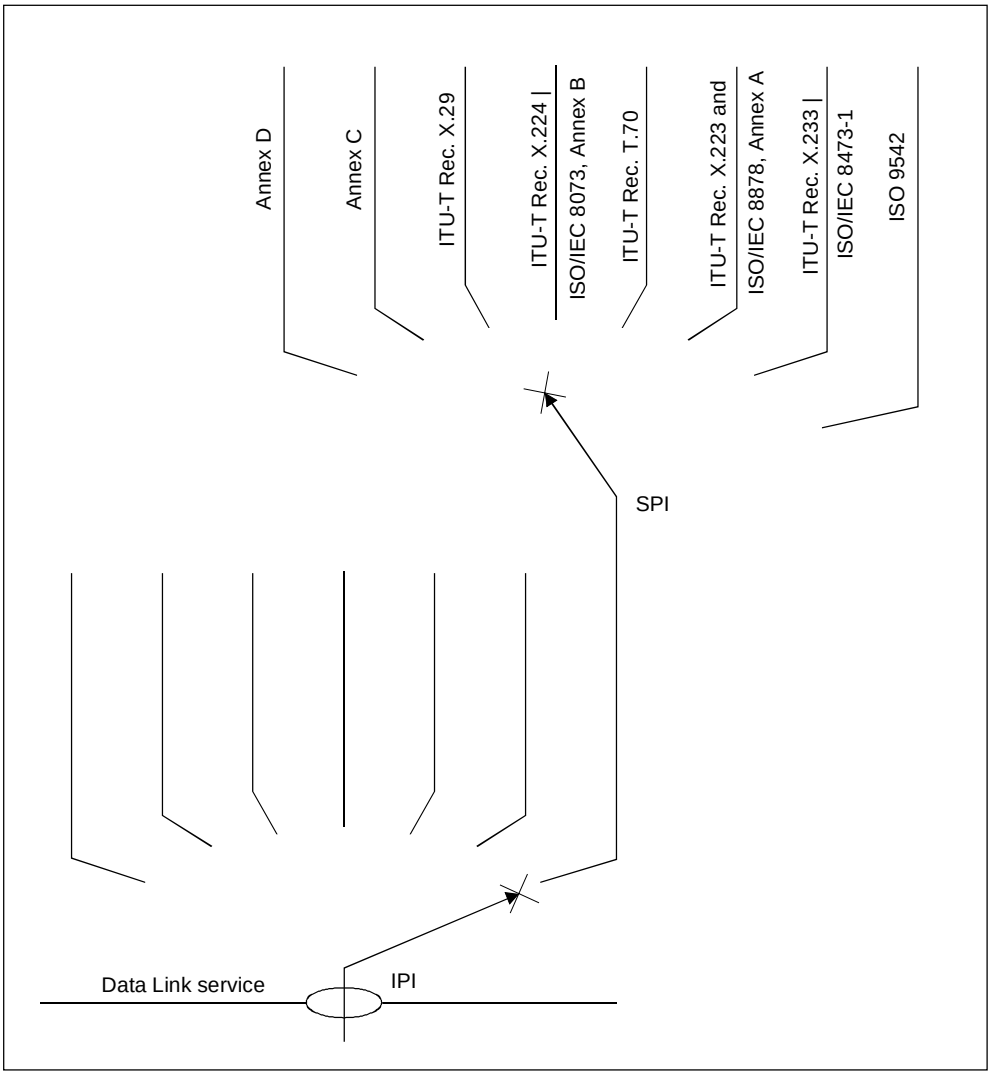

Figure B.2 – Selection of the subsequent protocol

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Annex C

Identification of Internet protocols

(This annex forms an integral part of this Recommendation | Technical Report)

The Internet Engineering Task Force (IETF) has established a set of standards for the protocols that are used in "The Internet" – the internationally distributed collection of systems and networks that follow what is customarily called the "TCP/IP protocol suite". These standards are published as part of a series of documents called "Requests for Comments" (RFCs). The standards are widely used and non-proprietary, although they are not considered to be part of OSI; the specifications (RFCs) are freely and readily available throughout the world, although they are not distributed by ITU-T or ISO/IEC.

This Recommendation | Technical Report promotes the goal of non-interference between OSI and non-OSI protocols in this case by reserving:

a) the IPI and SPI value 1100 1100 to identify the "Internet Protocol" which is the TCP/IP protocol that would, in OSI, be a Network layer protocol;

b) the IPI and SPI value 1000 1110 to identify the "Internet Protocol Version 6 (IPv6)"; and

c) the IPI and SPI value 1100 1111 to identify the "Point-to-Point Protocol" (PPP) which is widely used to convey connectionless-mode PDUs over point-to-point links.

The Internet Protocol is defined by RFC 791, and is recognized as a mandatory standard for the TCP/IP Internet community. The Internet Protocol Version 6 (IPv6) is defined by RFC 2460. The Point-to-Point Protocol is defined in RFC 1548.

The reservation of these IPI/SPI values for non-ISO, non-ITU-T protocols is justified by the otherwise real probability of interference between the Internet Protocol or Point-to-Point Protocol and OSI Network layer protocols in what are expected to be very common multi-protocol network configurations. It does not create a general precedent for the reservation of protocol identification values for non-ISO, non-ITU-T protocols, which must be justified individually on the merits of a particular case.

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Annex D

Identification of protocols that are discriminated according to the IEEE-defined SNAP convention

(This annex forms an integral part of this Recommendation | Technical Report)

The IEEE has defined a convention for discriminating among proprietary protocols that are collectively referred to as "subnetwork access protocols" (SNAPs). According to this convention, protocol data units arriving at an LSAP with an IEEE-reserved value are identified by examination of the first five octets of the link service data unit. The values of this five-octet SNAP identifier are registered by IEEE. This convention permits proprietary, non-proprietary, and standard protocols to co-exist in a common underlying data link environment.

This Recommendation | Technical Report promotes the goal of non-interference between OSI and non-OSI protocols in this case by reserving the SPI value 1000 0000 to identify the convention defined by IEEE. This permits SNAP-identified protocols to be carried by Network layer initial protocols identified according to this Recommendation | Technical Report as well as directly over an ISO/IEC 8802 (IEEE 802) data link.

The reservation of this SPI value for non-ISO, non-ITU-T protocols is justified by the otherwise very strong probability of interference between SNAP-identified protocols and protocols identified according to this Recommendation | Technical Report, in what are expected to be very common multi-protocol network configurations. It does not create a general precedent for the reservation of protocol identifier values for non-ISO, non-ITU-T protocols, which must be justified individually on the merits of a particular case.

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Annex E

Identification of protocols specified by the Frame Relay Forum

(This annex forms an integral part of this Recommendation | Technical Report)

The Frame Relay Forum has specified a number of implementation agreements pertaining to Frame Relay. These implementation agreements are widely used and non-proprietary, although they are not considered to be part of OSI. The implementation agreements are readily available throughout the world, although they are not distributed by ITU-T or ISO/IEC.

This Recommendation | Technical Report promotes the goal of non-interference between OSI and non-OSI protocols, in this case by reserving:

a) the IPI and SPI value 1011 0000 to identify the Data compression protocol which is set forth in FRF.9;

b) the IPI and SPI value 1011 0001 to identify the Fragmentation protocol which is set forth in FRF.12;

c) the IPI value 1011 0010 to identify the operations, administration and maintenance (OA&M) protocol which is set forth in FRF.OA&M;

d) the IPI value 1011 0011 to identify the privacy protocol which is set forth in FRF.priv.

The reservation of these IPI/SPI values for non-ISO, non-ITU-T protocols is justified by the otherwise real probability of interference between these protocols and OSI Network layer protocols. It does not create a general precedent for the reservation of protocol identification values for non-ISO, non-ITU-T protocols, which must be justified individually on the merits of a particular case.

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