20
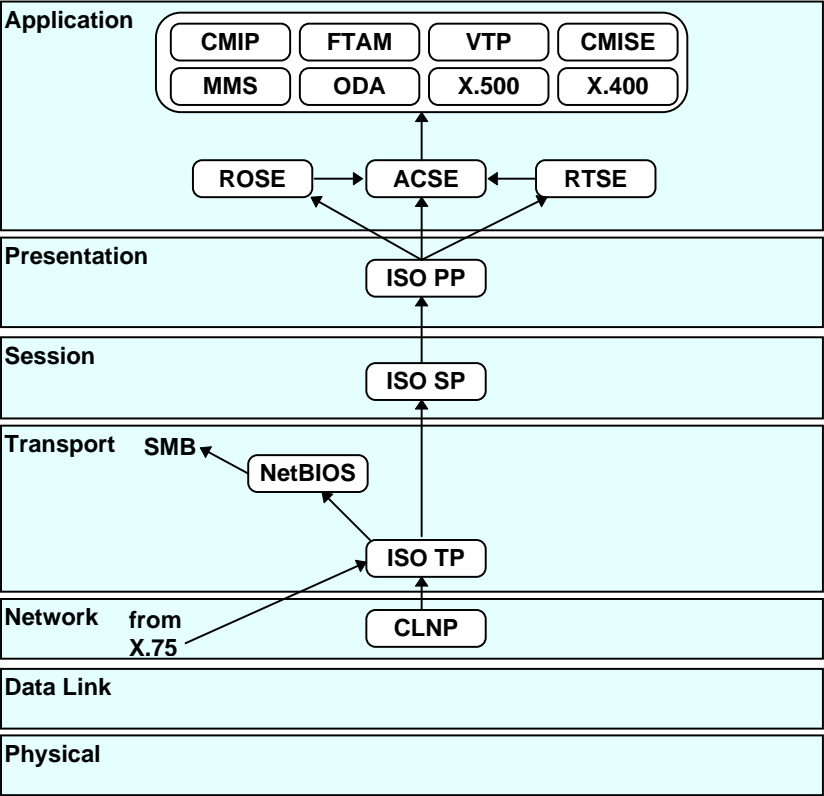
ISO Protocols

The Institute of Electrical and Electronic Engineers (IEEE) defines the International Standards Organization (ISO) protocols. The ISO protocol suite is a complete, seven-layer protocol conforming to the Open System Interconnection (OSI) networking model. The ISO protocol suite includes the following protocols:

- IS-IS: Intermediate System to Intermediate System.
- ES-IS: End-System to Intermediate System.
- ISO-IP: Internetworking Protocol.
- ISO-TP: Transport Protocol.
- ISO-SP: Session Protocol.
- ISO-PP: Presentation Protocol.
- ACSE: Application Control Service Element
- CCITT X.400: Consultative Committee Protocol.

The following diagram illustrates the ISO protocol suite in relation to the
OSI model:

ISO protocol suite in relation to the OSI model

IS-IS

ISO 10589

IS-IS (Intermediate System to Intermediate System) is a protocol of the network layer. It permits intermediate systems within a routing domain to exchange configuration and routing information to facilitate the operation of the routing and relaying functions of the network layer. IS-IS is designed to operate in close conjunction with ES-IS (ISO 9542) and CLNS (ISO 8473).

The format of the IS-IS header which is common to all PDUs is as follows:

8	7	6	5	4	3	2	1	Octet
Intradomain routing protocol discriminator								1
Length indicator								2
Version/protocol ID extension								3
ID length								4
R	R	R	PDU type					5
Version								6
Reserved								7
Maximum area addresses								8

IS-IS header structure

Intradomain routing protocol discriminator
Network layer protocol identifier assigned to this protocol (= 83 decimal).

Length indicator
Length of the fixed header in octets.

Version/protocol ID extension
Equal to 1.

ID length
Length of the ID field of NSAP addresses and NETs used in this routing domain.
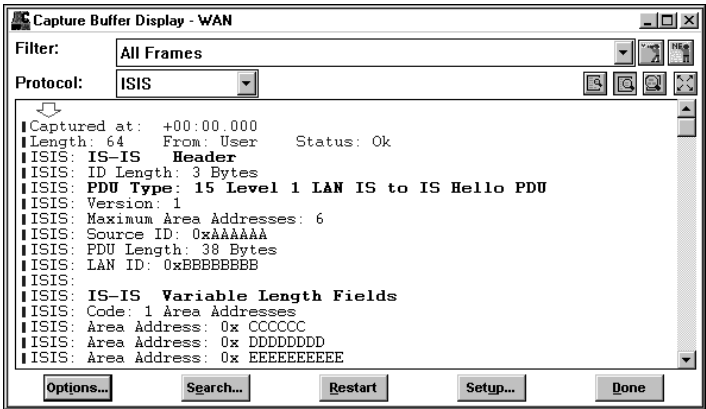
R
Reserved bits.

PDU type
Type of PDU. Bits 6, 7 and 8 are reserved.

Version
Equal to 1.

Maximum area addresses
Number of area addresses permitted for this intermediate system's area.

IS-IS decode

ES-IS

ISO 9542

The End System to Intermediate System (ES-IS) protocol distributes routing information among ISO hosts.

ISO-IP
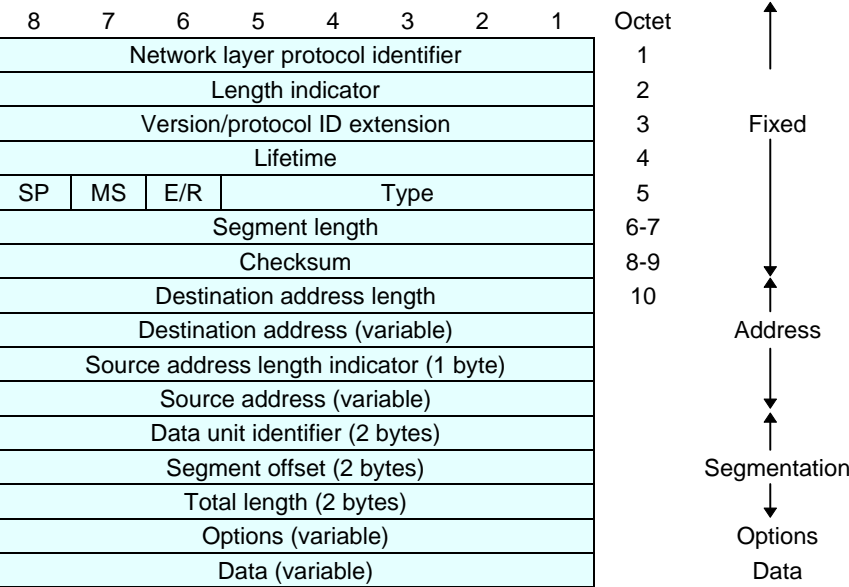
IETF RFC 1069 http://www.cis.ohio-state.edu/htbin/rfc/rfc1069.html

The ISO documents IS 8473 and IS 8348 define the ISO Internetworking Protocol (ISO-IP) or CLNP which includes built-in error signaling to aid in routing management. ISO-IP is intended to facilitate the interconnection of open systems. It is used in the network layer and provides connectionless-mode network service.

Each PDU contains the following, according to this order:
1. Fixed part
2. Address part
3. Segmentation part, if present
4. Options part, if present
5. Data part, if present

The ISO-IP PDU has the following format:

8	7	6	5	4	3	2	1	Octet	
Network layer protocol identifier								1	Fixed
Length indicator								2	
Version/protocol ID extension								3	
Lifetime								4	
SP	MS	E/R	Type					5	
Segment length								6-7	
Checksum								8-9	
Destination address length								10	Address
Destination address (variable)									
Source address length indicator (1 byte)									
Source address (variable)									
Data unit identifier (2 bytes)									Segmentation
Segment offset (2 bytes)									
Total length (2 bytes)									
Options (variable)									Options
Data (variable)									Data

ISO-IP PDU - fixed part

Fixed Part

The ISO-IP fixed part contains the following fields:

Network layer protocol identifier
Set to binary 1000 0001 to identify this network layer as CLNP. A value of 0000 0000 identifies the inactive network layer protocol subset.

Length indicator
Length of the header in octets.

Version/protocol ID extension
Value of binary 0000 0001 identifies the ISO 8473 standard.

Lifetime
Remaining lifetime of the PDU in units of 500 milliseconds.

SP
Segmentation permitted flag. Value of 1 indicates that segmentation is permitted. The value is determined by the originator of the PDU and cannot be changed by any other network entity for the lifetime of the initial PDU and any derived PDUs.

MS
More segments flag. Value of 1 indicates that segmentation has occurred and the last octet of the NSDU is not contained in this PDU.

E/R
Error report flag. A value of 1 indicates to generate an error report PDU according to the standard.

Type
Type code identifies the type of the protocol data unit: DT or ER.

Segment length
Length in octets of the PDU, including header and data.

Checksum
Checksum value computed on the entire PDU header. A value of 0 indicates that the checksum is to be ignored.

Address Part

The address part has the following parameters:

Destination
Destination network service access point address.

Source
Source network service access point address.

Segmentation Part

When the segmentation permitted flag (SP) is set, ISO-IP frames also include the following fields:

Data unit identifier
The sequence number used to identify the order of segments when fragmentation is enabled.

Segment offset
The offset in the original data unit where the segment is located.

Total length
The total length of the initial data unit before fragmentation.

Frame Options

The following options can be present in ISO-IP frames:

Source routing
Specifies the network path by providing a set of addresses that the frame must travel. The following parameters are present in frames with the source route option:

Type of routing	Represented as complete or partial.
NextNET	Next network entity title in the route list that is to be processed.

Record route

Causes each node encountered by the frame to record its network entity title in the frame. The following parameters are present in frames with the record route option:

Type of routing   Represented as complete or partial.
#NETs   Number of network entity titles currently in the route
                  listing.

Priority

Requested priority ranging from 0 to 14 with priority 14 being highest.

Padding

Number of pad bytes used to produce the desired frame alignment.

Security

A security format code and parameters which are displayed as (Code) Parameters. The parameters that follow the code indicate the security level.
1   Source address specific.
2   Destination address specific.
3   Globally unique.

QoS

Quality of Service requested for the connection as (Code) parameters. The parameters that follow the code indicate the Quality of Service.
1   Source address specific.
2   Destination address specific.
3   Globally unique.

Frame Error Messages

The following are possible error messages for ISO-IP frames:

Error Message	Description
{not specified}	Unknown error.
{protocol error}	Protocol procedure error.
{bad checksum}	Checksum is invalid.
{too congested}	Frame discarded due to congestion.
{bad PDU header}	PDU header syntax error.
{fragment needed}	Segmentation needed, but not permitted.
{incomplete PDU}	Incomplete PDU received.
{duplicate option}	Option already implemented.
{dest unreachable}	Destination IP address unreachable.

Error Message	Description
{destinat unknown}	Destination IP address unknown.
{unknown SR error}	Unknown source routing error.
{SR syntax error}	Syntax error in source routing field.
{bad SR address}	Unknown address in source routing field.
{bad SR path}	Source route path not acceptable.
{TTL expired}	Lifetime expired while in transit.
{reasmbly expired}	Lifetime expired during reassembly.
{bad option}	Specified option not supported.
{bad protocol ver}	Specified protocol version not supported.
{bad security opt}	Specified security option not supported.
{bad SR option}	Source routing option not supported.
{bad RR option}	Record routing option not supported.
{reassmbly failed}	Reassembly failed due to interference.

ISO-TP

ISO 8073

ISO-TP describes the TP (Transport Protocol). This protocol is intended to be simple but general enough to cater to the entire range of Network Service qualities possible, without restricting future extensions. It is structured to give rise to classes of protocols which are designed to minimize possible incompatibilities and implementation costs.

The format of the ISO-TP header is as follows:

LI	Fixed part	Variable part

ISO-TP header structure

LI is the length indicator field providing the length of the header in bytes. The format of the fixed part of non-data PDUs is as follows:

PDU type	DST-REF	SRC-REF	Variable
1 byte	2 bytes	2 bytes	1 byte

ISO-TP non-data PDU: fixed part

The PDU types are listed above. The meanings of DST-REF, SRC-REF and the last byte are related to the type of PDU. Refer to the ISO-TP standard for the exact structure for each PDU type.

ISO-SP

ISO/IEC 8327-1 09-1996; ITU-T X.225

The ISO-SP protocol specifies procedures for a single protocol for the transfer of data and control information from one session entity to a peer session entity.

The Session protocol data units are transferred using the Transport Data Transfer Service. The TSDU (Transport Service Data Unit) is comprised of a number of SPDU's (Session Protocol Data Units). There can be up to 4 SPDUs depending on the concatenation method that is being used (basic or extended) and on the SPDU type.

Each SPDU contains one or more octets. The SPDU structure is as follows:

SI	LI	Parameter field	User information field

SPDU structure

SI
SPDU indicator. This field indicates the type of SPDU.

LI
The length indicator signifies the length of the associated parameter field.

Parameter field
In the SPDU the parameter field contains the PGI or PI units defined for the SPDU.

The structure of a PGI unit is shown in the following illustration:

PGI	LI	Parameter field

Parameter field: PGI structure

The structure of the PI units is shown in the following illustration:

PI	LI	Parameter field

Parameter field: PI structure

PGI   Parameter group identifier. Identifies the parameter group.

PI   Parameter identifier. Indicates the type of information
                          contained in the parameter field.

Parameter field   In the PGI, the parameter field contains a single parameter
                          value, or one or more PI units. In the PI, the parameter
                          field contains the parameter value.

User information field
This contains segments of a segmented SSDU.

ISO-PP

ISO document IS 8823 defines the ISO Presentation Protocol (PP) which performs context negotiation and management between open systems.

Frames

PP frames may be one of the following commands:

[Connect Presentation]   Requests a presentation layer connection.
[Connect Presentation Accept]   Acknowledges the presentation connection.

Parameters

PP frames can contain the following parameter:

X.410 Mode {1984 X.400}

This frame is based on the CCITT Recommendation X.410. This usually means that the application is a CCITT 1984 X.400 Message Handling System.

ASCE

ITU-T Recommendation X.227

The Application Control Service Element (ACSE) protocol provides services for establishing and releasing application-associations. The ACSE protocol also includes two optional functional units. One functional unit supports the exchange of information in support of authentication during association establishment. The second functional unit supports the negotiation of application context during association establishment. The ACSE services apply to a wide range of application-process communications requirements.

CCITT X.400 Message Handling System

The International Telegraph and Telephone Consultative Committee (known as CCITT, after its French name) produced this standard for exchange of electronic mail between computers. The CCITT recommendations X.400 through X.430 define an application layer protocol and a minimal presentation layer protocol. CCITT X.400 uses the ISO Session Layer services and protocol, documented in ISO documents IS 8326 and IS 8327, respectively.

The CCITT X.400 standard describes message transfer agents (MTAs) that are responsible for delivery of electronic mail between computers. The MTAs use a protocol known as P1 to carry out transfer of message protocol data units (MPDUs). MTAs exchange two kinds of MPDUs: User and Service. User MPDUs contain messages, while Service MPDUs supply information about message transfers. Two kinds of Service MPDUs exist: Delivery Report and Probe.

X.400 frames can be one of the following types:

[User MPDU Message] Normal mail handling system (MHS) message.

[DeliveryReport MPDU] Sent to discover status of prior message.

[Probe MPDU] Sent to discover if the message was delivered.

Each CCITT X.400 frame contains the following parameter:

Protocol P1.