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National Transportation Communications for ITS Protocol

Ethernet Subnetwork Profile

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- VHB

FOREWORD

This document uses only metric units.

This publication defines a subnetwork profile that is a combination of standards intended to meet specific requirements for subnetwork services in transportation devices and management centers in a networked environment. Its scope covers the data link and physical layers of the Open System Interconnect (OSI) Reference Model. The scope also references network layer interface requirements. It contains mandatory requirement statements that are applicable to all devices claiming conformance to this standard. It also contains optional and conditional requirements that may be applicable to a specific environment in which a device is used.

The text includes mandatory requirements in Annex A that are defined as normative.

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Approvals

This standards publication was separately balloted and approved by AASHTO, ITE, and NEMA after recommendation by the Joint Committee on the NTCIP. Each organization has approved this standard as the following standard type, as of the date:

AASHTO – Standard Specification; March 2003
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Compliant systems based on later, or higher, version numbers MAY NOT be compatible with compliant systems based on earlier, or lower, version numbers. Anyone using this document should also consult NTCIP 8004 for specific guidelines on compatibility.

INTRODUCTION

This publication defines a subnetwork profile that is a combination of standards intended to meet specific requirements for data transfers to and from roadside devices in either a networked or direct-connect environment. The objective is to facilitate the specification of ITS characterized by a high degree of interoperability and interchangeability of its components.

This standard defines a subnetwork profile that provides connection-oriented, acknowledged connectionless, and unacknowledged connectionless data link service. At the physical layer, it provides specifications for peer-to-peer access over coaxial cable, twisted pair wire, or fiber-optic medium. It is based upon the ISO/IEC 8802-2 and 8802-3 Standards.

Annex A is normative and contains a Profile Requirements List in the form of PICS proforma.

The following keywords apply to this document: AASHTO, ITE, NEMA, NTCIP, Profile, Subnetwork, Ethernet.

In 1992, the NEMA 3-TS Transportation Management Systems and Associated Control Devices Section began the effort to develop the NTCIP. Under the guidance of the Federal Highway Administration's NTCIP Steering Group, the NEMA effort was expanded to include the development of communications standards for all transportation field devices that could be used in an ITS network.

In September 1996, an agreement was executed among AASHTO, ITE, and NEMA to jointly develop, approve, and maintain the NTCIP standards. In August 1997, the Joint Committee on the NTCIP formed a new working group to develop a method for organizing class profiles. The Profiles WG first met in September 1997.

After research into how national and international standards organizations combine protocols and standards to address all seven layers of the OSI Basic Reference Model, the committee adopted the approach defined in the *NTCIP Profile Framework.* Following that approach, a complete protocol stack was specified by application, transport, and subnetwork profiles. An application profile addresses the application, presentation, and session layers. A transport profile addresses the transport and network layers. A subnetwork profile addresses the data link and physical layers. The *NTCIP - Ethernet Subnetwork Profile* is a subnetwork profile for use in center-to-field communications.

The Profiles Working Group is concerned with the methodology of defining profiles, and the definition and documentation of profiles in standards publications. This document is intended to provide a complete subnetwork profile (SP) that specifies the communications over an ISO/IEC 8802 "IEEE 802" type network. This subnetwork profile can be used with different transport profiles addressing the network and transport layer requirements. The objective is to facilitate the specification of ITS systems characterized by a high degree of interoperability and interchangeability of its components.

CONTENTS

Section 1
GENERAL

1.1 SCOPE

This standard is applicable to transportation devices and management systems that must operate in Intelligent Transportation Systems. It specifies a set of protocols and standards applicable to the data link and physical layers of the OSI Basic Reference Model. It specifies a combination of ISO/IEC Standards that collectively provide for connectionless and connection-oriented data link services on a common, shared media. Access to the media is through a process referred to as carrier sense multiple access with collision avoidance detection (CSMA/CD). It also defines the interface to and specification of the shared media.

Networks based upon this technique are often, but mistakenly, referred to as Ethernet-based Networks. This standard deals with IEEE 802 Networks that have additional functionality. Although similar to Ethernet based Networks, IEEE 802 Networks are distinguished by inclusion of Logical Link Control (LLC) and Media Access Control (MAC) layers.

1.2 PROFILE-PROTOCOL-LAYER RELATIONSHIPS

This subnetwork profile specifies the provisions for a connectionless and connection-oriented data link service and the physical interface between an end system and other compatible end systems. It has specific reference when these services are used through the Internet Protocol connectionless network service. The interoperable end system must use the same access methods contained within this Subnetwork Profile. An end system is compatible only if the sub-options (e.g., 10Base2) are compatible. A complete subnetwork profile requires knowledge of the subnetwork type, access method, circuit type, and service type. This profile deals primarily with subnetwork independent requirements that are independent of any transport profile. However, specific requirement related to interfacing specific transport profiles are presented. The layers, base standards, and profile taxonomy that make up this profile are shown in Figure 1-1.

<table>
<tr><th>ISO Layers</th><th colspan="2">Base Standards</th><th>Profile</th></tr>
<tr><td rowspan="2">NETWORK LAYER
(Interface)</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">IAB STD 3 (Internet Hosts)
IAB STD 43 (IP over IEEE 802)</td><td rowspan="4">SP-Ethernet
Subnetwork Profile</td></tr>
<tr><td rowspan="2">DATA LINK LAYER</td><td>LLC (ISO 8802-2)</td><td rowspan="2">IAB STD 50 (Ethernet-like MIB)</td></tr>
<tr><td>MAC (ISO 8802-3)</td></tr>
<tr><td>PHYSICAL LAYER</td><td colspan="2">PLS, AUI, MAU (ISO 8802-3)</td></tr>
</table>

Figure 1-1
SP-Ethernet - Subnetwork Profile Relationship

1.3 REFERENCES

For approved revisions and amendments, contact:

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For draft revisions of this document, which are under discussion by the relevant NTCIP Working Group, and recommended revisions of the NTCIP Joint Committee, visit the World Wide Web at http://www.ntcip.org.

The following standards (normative references) contain provisions, which, through reference in this text, constitute provisions of this standard. Other documents and standards (other references) are referenced in these documents, which might provide a complete understanding of the structure and use of profiles. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standard listed below.

1.3.1 Normative References

American National Standards Institute (ANSI)
11 West 42nd Street, 13th Floor
New York, NY 10036

ISO/IEC 8802-2: 1998 [ANSI/IEEE Std 802.2, 1998 Edition] *Information technology—Telecommunications and information exchange between systems—Local and Metropolitan area networks—Specific requirement—Part 2: Logical Link Control*

ISO/IEC 8802-3: 1996 [ANSI/IEEE Std 802.3, 1996 Edition] *Information technology —Telecommunications and information exchange between systems—Local and Metropolitan area networks — Specific requirements —Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

NTCIP 7001 *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL – Assigned Numbers – Part 1*

IAB STD 3 *(RFC 1122: 1989, Requirements for Internet Hosts —Communication Layers, RFC 1123: 1989, Requirements for Internet Hosts — Application and Support)*

IAB STD 43 *(RFC 1042: 1988, A Standard for the Transmission of IP Datagrams over IEEE 802 Networks)*

IAB STD 50 *(RFC 1643: 1994, Definitions of Managed Objects for the Ethernet-like Interface Types)*

1.3.2 Other References

Internet Architecture Board
http://www.ietf.org/rfc.html
http://www.rfc-editor.org/
http://www.rfc-editor.org/repositories.html

IAB STD 15 *(RFC 1157: 1990, Simple Network Management Protocol)*

IAB STD 16 *(RFC 1155: 1990, Structure and Identification of Management Information for TCP/IP-based Internets, RFC 1212: 1991, Concise MIB Definitions)*

IAB STD 17 *(RFC 1213: 1991, Management Information Base)*

IAB STD 37 *(RFC 826: 1982, An Ethernet Address Resolution Protocol)*

IAB STD 38 *(RFC 903:1984, A Reverse Address Resolution Protocol)*

IEEE 802.3r-1996 *Supplement to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications: Type 10Base5 Medium Attachment Unit (MAU) Protocol Implementation Conformance Statement (PICS) Performa (Subclause 8.8)*

National Electrical Manufacturers Association
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NTCIP 2201 *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL — Transportation Transport Profile*

NTCIP 7001 *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL — Assigned Numbers — Part 1*

Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112

TIA/EIA-568-A *Commercial Building Telecommunications Cabling Standard*, October, 1995

Internetworking Technology Overview, Ethernet, Transparent Bridging, et al.,
http://www.cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/index.htm

Structured Cabling Standards Guides, TIA/EIA-568A Standard,
http://www.anixter.com/techlib/standard/cabling/

1.4 TERMS

For the purposes of this standard, the following terms apply:

1Base5 A standard interface and cabling option that transmits baseband signals at 1 Mbps using standard telephone wiring. It uses a star topology and can consist of five hubs with 250-meter segments. Also known as StarLAN.

10Base5 A standard interface and cabling option that transmits baseband signals at 10 Mbps using 50-ohm (RG-8 or RG-11) coaxial cable. It uses a bus topology and can consist of five 500-meter segments for an overall length of 2500 meters. Also known as Thicknet.

10Base2: A standard interface and cabling option that transmits baseband signals at 10 Mbps using 75-ohm (RG-58) coaxial cable. It uses a bus topology and can consist of five 185-meter segments for an overall length of 925 meters. Also known as Thinnet.

10Base-T A standard interface and cabling option that transmits baseband signals at 10 Mbps. It uses unshielded twisted pair wiring in a star topology and can consist of five 100-meter segments for an overall length of 500 meters. This is sometimes referred to as Twisted Pair Ethernet.

10Base-F A standard interface with three cabling options that transmit baseband signals at 10 Mbps using fiber-optic cable. It uses a star or point-to-point topology with up to 1000 or 2000-meter segments. With repeaters, overall length can be up to of 2500 meters. This is sometimes referred to as Fiberoptic Interface.

10Broad36 A standard interface and cabling option that transmits broad signals at 10 Mbps using 75 ohm coaxial cable. It uses a bus topology and can consist of 1800-meter segments. This is sometimes referred to as Broadband.

100Base-T A standard interface and cabling option that transmits baseband signals at 10 and 100 Mbps. It uses shielded twisted pair wiring in a star topology. It has a maximum segment length of 100 meter and maximum network or end-to-end length of 200 meters. It is sometimes referred to as Fast Ethernet.

Application Layer That portion of the OSI Basic Reference Model (Layer 7) that provides access to the communications services.

data Information before it is interpreted.

Data Link Layer That portion of the OSI Basic Reference Model (Layer 2) responsible for flow control, framing, synchronization, and error control over a communications link.

datagram A self-contained unit of data transmitted independently of other datagrams.

end-application A process or program using the communications stack.

end system The source or destination of an information exchange.

Ethernet The original baseband standard developed by Xerox, Intel, and DEC, from which the IEEE 802.2 and 802.3 Standards and then the ISO/IEC 8802-2 and 8802-3 Standards evolved. While similar, the ISO/IEC 8802-3 and the Ethernet 1.0 or 2.0 Standards are not the same.

host (Internet usage) The physical and/or logical part of the end-system's application. A computer attached to one or more networks that supports users and runs application programs.

IEEE 802 Networks A set of data link and physical layer standards dealing with Local and Metropolitan Area Networks. The networks all share a common upper level data link layer referred to as Logical Link Control Protocol (802.2). The lower data link

protocol consists of a Media Access Control that is specific to a media and how the media is accessed. The following are identifiers for various MAC specifications:

802.3 CSMA/CD - Media Access Control and Physical Layer Specifications
802.4 Token Bus - Media Access Control and Physical Layer Specifications
802.5 Token Ring - Media Access Control and Physical Layer Specifications
802.6 Metropolitan Area Networks - Media Access Control and Physical Layer Specifications
802.7 Recommendations for Broadband LANs
802.11 Wireless LANs - Media Access Control and Physical Layer Specifications
802.12 Demand-priority access method - Media Access Control and Physical LayerSpecifications

The various IEEE 802 standards are normally adopted by ISO / IEC and given the 8802 designation.

Intelligent Transportation Systems A major national initiative to apply information, communication, and control technologies in order to improve the efficiency of surface transportation.

intermediate system A system that participates in an information exchange but is not the source or destination of the exchange.

internet Any collection of connected networks where information can be passed from one network to another.

Internet A large collection of connected networks, primarily in the United States, running the Internet suite of protocols. Sometimes referred to as the *DARPA Internet, NSF/DARPA, Internet*, or the *Federal Research Internet.*

Internet Protocol (IP) The network protocol offering a connectionless mode network service in the Internet suite of protocols.

Internet suite of protocols A collection of computer-communication protocols originally developed under DARPA sponsorship.

internetwork: The ability of devices to communicate across multiple networks.

network A collection of subnetworks connected by intermediate systems and populated by end systems.

Network Layer That portion of an OSI Basic Reference Model (Layer 3) responsible for data transfer across the network, independent of both the media comprising the underlying subnetworks and the topology of those subnetworks.

network management The technology used to manage a network, usually referring to the management of devices that contain information about setup, control, and status of the layers in a communications stack. The term refers to all devices, both intermediate and end systems, that are present on the network or internetwork.

Open Systems Interconnection (OSI) An international effort to facilitate communications among computers of different manufacture and technology.

OSI Basic Reference Model A widely accepted structuring technique that provides an abstract representation of the communication process that is divided into seven basic, functional layers.

Physical Layer That portion of an OSI Basic Reference Model (Layer 1) responsible for the electrical and mechanical interface between communicating systems.

Presentation Layer That portion of an OSI Basic Reference Model (Layer 6) responsible for converting and organizing data from one format to another.

proforma A guide provided in advance to prescribe form or describe items.

Session Layer That portion of an OSI Basic Reference Model (Layer 5) which manages a series of data exchanges between end-system applications.

subnetwork A physical network within a network. All devices on a subnetwork share a common physical medium.

taxonomy A classification scheme for referencing profiles or sets of profiles unambiguously.

TCP/IP Reference Model An alternate to the OSI Basic Reference Model that organizes the communications process into 4 layers. It consists of host-to-network, Internet, transport, and application layers.

Transport Layer That portion of an OSI Basic Reference Model (Layer 4) which attempts to guarantee reliable data transfer between two end-systems, using flow control and error recovery, and may provide multiplexing.

transportation management Short for the management of networks of transportation devices and the network itself.

1.5 ABBREVIATIONS AND ACRONYMS

The abbreviations used in this standard publication are defined as follows:

AASHTO American Association of State Highway and Transportation Officials
AIU Attachment Unit Interface
ARP Address Resolution Protocol
CSMA/CD Carrier Sense Multiple Access with Collision Detection
CMIP Common Management Information Protocol
DSAP Destination Service Access Point
EIA Electronic Industries Association
FTP File Transfer Protocol
IAB STD Internet Architecture Board Standard
IEC International Electrotechnical Commission
IEEE Institute of Electrical and Electronics Engineers
IP Internet Protocol

ISO	International Organization for Standardization
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
LLC	Logical Link Control
MAC	Media Access Control
MAU	Media Access Unit
MTU	Maximum Transfer Unit
NEMA	National Electrical Manufacturers Association
NTCIP	National Transportation Communications for ITS Protocol
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
PLS	Physical Layer Signaling
PMA	Physical Medium Attachment
PRL	Profile Requirements List
RARP	Reverse Address Resolution Protocol
RFC	(Internet) Request for Comments
SNAP	Subnetwork Access Protocol
SNMP	Simple Network Management Protocol
SP	Subnetwork Profile
SSAP	Source Service Access Point
TCP	Transmission Control Protocol
TOS	Type of Service
TP	Transport profile
UDP	User Datagram Protocol

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Section 2
CONFORMANCE

2.1 GENERAL REQUIREMENTS

Implementations claiming conformance to the Ethernet Subnetwork Profile shall support the following elements as stated.

a. All requirements in the remainder of Section 2 of this profile.
b. All of the constraints specified in Annex A (normative) of this profile.
c. All mandatory requirements of the standards referenced by this profile.

2.2 DATA LINK LAYER REQUIREMENTS

A conforming implementation of this profile shall support the specific Logical Link Control requirements found in ISO/IEC 8802-2 and Media Access Control requirements found in ISO/IEC 8802-3.

The OSI Basic Reference Model provides an abstract representation of the communication process that is divided into seven basic, functional layers. In defining data link layer requirements for Local Area networks (LANs), the ISO/IEC 8802 Standards subdivide the layer into two sublayers: Logical Link Control (LLC), which covers the media independent requirements, and Media Access Control (MAC), which covers specific access method requirements and the associated media.

2.2.1 Logical Link Control Sublayer

The LLC is the top sublayer in the definition of a data link layer and is common to various medium access methods. It interfaces with the network layer, provides several types of network information delivery services, and defines a standard method for interfacing with medium specific access.

2.2.1.1 Network - LLC Interface

2.2.1.1.1 Internet Protocols to LLC Interface

A conforming implementation of this profile that interfaces with the Internet Protocols shall conform to Internet Architecture Board (IAB) Standard (STD) 43 (Request for Comment (RFC) 1042), which defines the method for encapsulating Internet Protocol (IP) datagrams and Address Resolution Protocol (ARP) and Reverse Address Resolution Protocol (RARP) requests and replies on IEEE 802 Networks.

Internet Protocol (IP) datagrams and ARP and RARP requests and replies shall be transmitted in a standard LLC Type 1 Unnumbered Information Protocol Data Unit (PDU) with the 8-bit Destination Service Access Point (DSAP) and the Source Service Access Point (SSAP) fields = 0xAA and with an 8-bit Control Field = 0x03. This shall be followed by a 5 byte SNAP header consisting of a 24-bit Organization Code Field = 0x000000 and a 16-bit Ether Type = Internet Assigned Numbers Authority value for the layer protocol. For example the Ether type codes for IP, ARP, RARP are 0x0800, 0x0806, and 0x0835, respectively.

IP Datagrams shall be transmitted over IEEE 802 Networks as a series of 8-bit octets in "big-endian" transmission order.

The packet receive interface between the IP layer and the link layer shall include a flag to indicate whether the incoming packet was addressed to a link-layer broadcast address.

The packet send interface between the IP and link layers shall include the 5-bit Type of Service (TOS) field.

The link layer shall not report a Destination Unreachable error to IP solely because there is no ARP cache entry for a destination.

The Maximum Transfer Unit (MTU) for an IEEE 802.3 Network shall be 1492 octets per RFC 1122 Section 2.3.3.

2.2.1.1.1.1 Address Mapping

The mapping of a 32-bit Internet address to the 48-bit IEEE 802.3 network address shall be done either by

a. the dynamic discovery procedure defined in ARP, or
b. static configuration

The mapping of the Internet broadcast address shall be mapped to the IEEE 802.3 network broadcast address.

2.2.1.1.2 Transportation Transport Profile to LLC Interface

NOTE – It is envisioned that most implementations will not be bandwidth constrained and will therefore use the Internet Transport Profile to be as consistent as possible with computer industry standards; however, the NTCIP 2201-TransportationTransport Profile interface is defined for completeness.

A conforming implementation of this profile that interfaces with the Transportation Transport Profile shall conform to the method for encapsulating as defined in subclause 2.2.1.1.1 but use the 16-bit Ether Type value of 0x01C1. This Ether Type number is assigned by IEEE as experimental and may be changed in the future.

The MTU for an IEEE 802.3 Network is defined as 1492 octets. Various Application Protocols and Profiles may impose more restrictive limitations on the frame size that they will accept.

The packet send interface between Transportation Transport Profile and the LLC shall include the 5-bit Type of Service (TOS) field. This field, however, shall always be set to 0x00.

Upper layer PDUs shall be transmitted over IEEE 802 Networks as a series of 8-bit octets in "big-endian" transmission order.

The packet receive interface between the Transportation Transport Profile and the LLC Interface shall include a flag to indicate whether the incoming packet was addressed to a link-layer broadcast address.

2.2.1.1.2.1 Address Mapping

The Transportation Transport Profile may provide a mapping of various Application Profile address families. The address families that need support are defined in NTCIP 7001 Assigned Numbers - Part 1. The mapping of any application layer address to the 48-bit IEEE 802.3 network address shall be done by static configuration.

The mapping of the any application layer broadcast address shall be mapped to the IEEE 802.3 network broadcast address.

2.2.1.2 Classes of Service

A conforming implementation of this profile shall support the Type 1 operations and services as defined in subclause 4.2.1 of ISO/IEC 8802-2.

ISO/IEC 8802-2 defines four classes of procedures based upon various combinations of three types of operations or services. The three types are unacknowledged connectionless (Type 1), connection (Type 2), and acknowledged connectionless (Type 3). Implementations conformant to Class I only support Type 1 operations. Implementations conformant to Class II only support Type 1 and Type 2 operations. Implementations conformant to Class III only support Type 1 and Type 3 operations. Implementations conformant to Class IV support all three types.

2.2.1.3 Source Routing and Route Determination

A conforming implementation of this profile is NOT required to support the optional Route Determining Entity functions as defined in Section 9 of ISO/IEC 8802-2. For use with the Internet Protocol, the Address Resolution Protocol shall be used.

2.2.1.4 Object Management

A conforming implementation of this profile is not required to support Object Management per Section 10 of ISO/IEC 8802-2. A conforming implementation of this profile may optionally support Object Management per IAB STD 50 (RFC 1643).

2.2.1.5 LLC - MAC Interface

An implementation conformant to this profile shall support the abstract service definition as defined in Clause 2 of ISO/IEC 8802-3.

The abstract service definition is a conceptual method for defining function calls, parameters, etc. that are not specific to any particular implementation.

2.2.2 Media Access Control Sublayer

The Media Access Control Sublayer of the data link layer manages protocol access to the physical network medium. The MAC specification defines MAC addresses, which enable multiple devices to uniquely identify one another at the data link layer.

2.2.2.1 Frame Structure

A conforming implementation shall support the MAC Frame Structure as defined in ISO/IEC 8802-3 Clause 3.2.

2.2.2.1.1 Address Fields

ISO/IEC 8802.3 Clause 3.2.3 allows an implementation to support either 16-bit or 48-bit address fields. For this profile, support of 48-bit address field is required.

2.2.2.2 Length Field

For use in the IP, and in the NTCIP 2201 Transportation Transport Profile, the length field as specified in ISO/IEC 8802-3 Clause 3.2.6 shall be used in the permitted manner to indicate a packet type or initial protocol identifier. For IP, the type code shall be 0x800. Additional Ether type codes may be found in NTCIP 7001 NTCIP Assigned Numbers - Part 1.

2.2.2.3 Access Method

The requirements for the CSMA/CD access method are defined in Clause 4.2 of ISO/IEC 8802.3 shall be supported.

2.2.2.4 Object Management

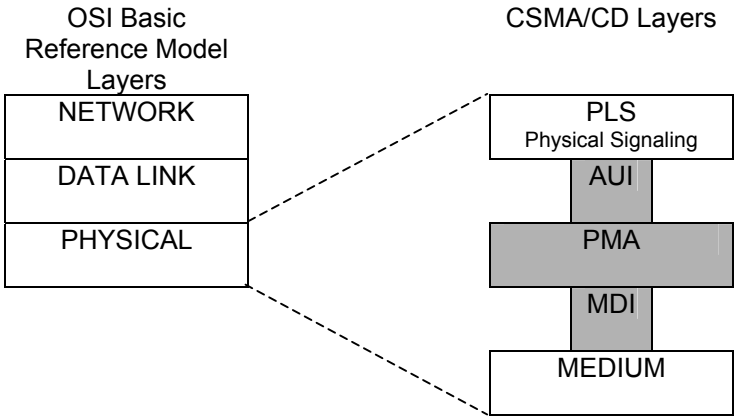
A conforming implementation of this profile is not required to support Object Management per Clause 5 of ISO/IEC 8802-3. A conforming implementation of this profile shall support Object Management per IAB STD 50 (RFC 1643).

2.3 PHYSICAL LAYER REQUIREMENTS

A conforming implementation of this profile shall conform to one of the physical layer specifications defined in ISO/IEC 8802-3:

a. 10Base5,
b. 10Base2,
c. 10Base-T, or
d. 10Base-F

In ISO/IEC 8802-3, the physical layers requirements are organized into 5 logical functions or services.



AUI = Attachment Unit Interface
PMA = Physical Medium Attachment
MDI = Medium Dependent Interface
MAU = Medium Attachment Unit (AUI, PMA, and MDI)

Figure 2-1
Physical Layer Functions / Services Organization

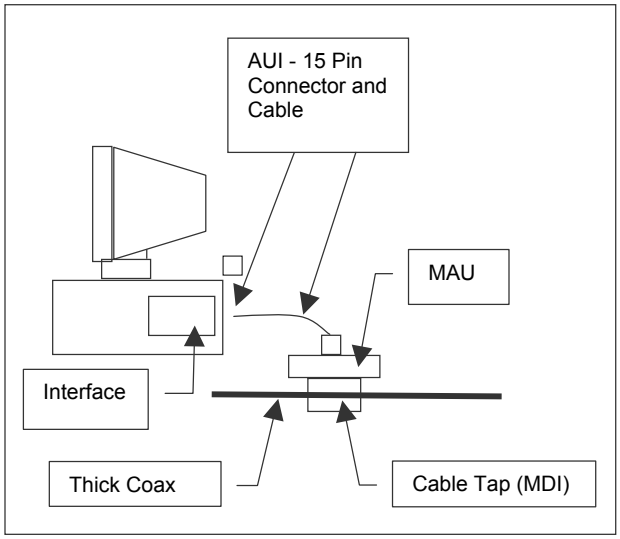


Figure 2-2
10Base5 Components

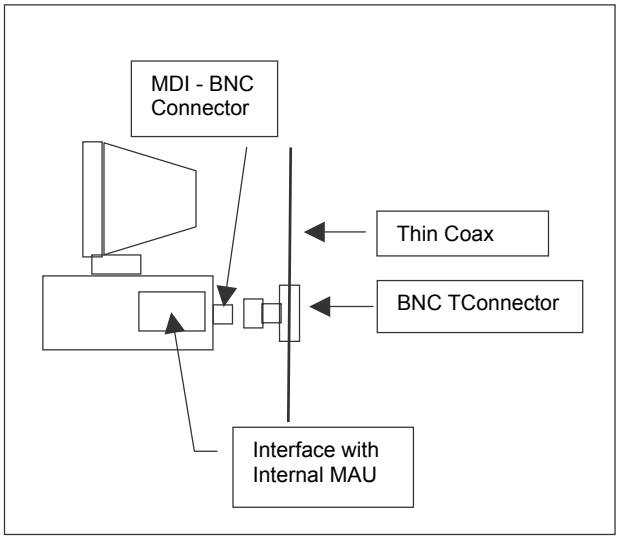


Figure 2-3
10Base2 Components

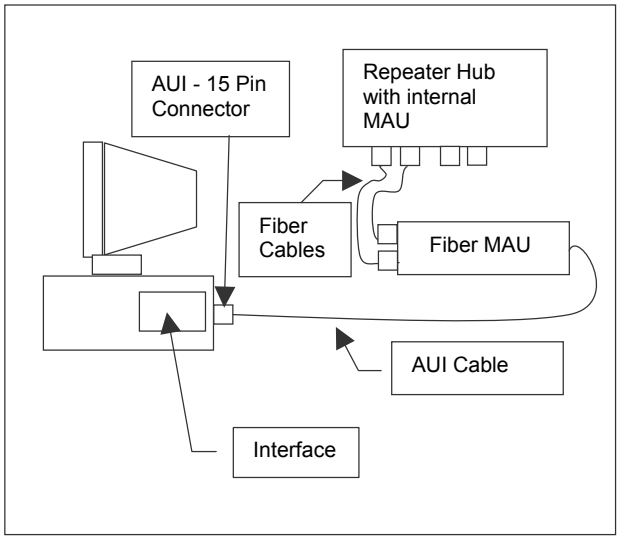


Figure 2-4
10BaseF Components

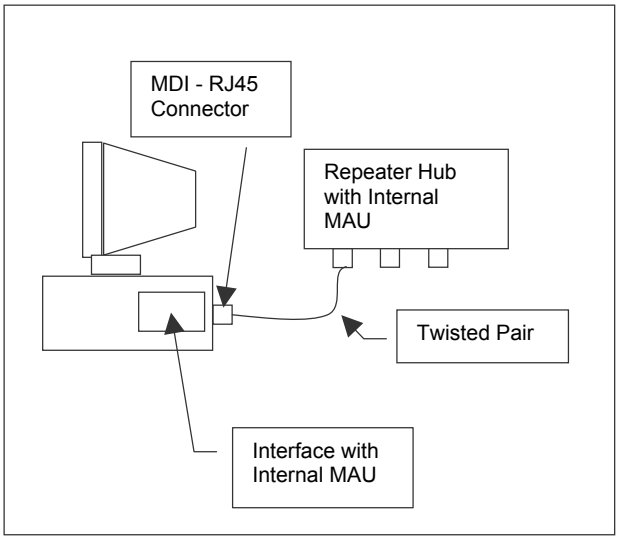


Figure 2-5
10BaseT Components

Figures 2-2, 2-3, 2-4, and 2-5 illustrate how the logic components relate to physical components. Physical Signaling Service Specifications cover the exchange of data between peer MAC entities. These requirements are always internal to a physical interface inside a computer. Attachment Unit Interface Specifications cover the electrical and mechanical characteristics of the connection from the Physical Signaling and the Medium Attachment Unit. In the typical 10Base2 or 10BaseT configuration, these are internal and not accessible. In the typical 10Base5 or 10BaseF configuration, these apply to external interface cable.

The Medium Attachment Unit Specifications cover the translation of the "high level" signals coming over the Attachment Unit Interface to the "low level" signals associated with the physical medium. The logical components of the Media Access Unit (MAU) are the Physical Medium Attachment Specifications and the Medium Dependent Interface. The PMA specifications cover the details of the translation and the MDI is, basically, the connector. In the typical 10Base2 or 10BaseT configuration, the MAU is internal and only the connector is accessible. In the typical 10Base5 or 10BaseF configuration, theses specifications apply to physical entities that are external.

2.3.1 Physical Signaling Services Requirements

All interfaces shall support the requirements for the interface between the MAC and the Physical Signaling entity. These requirements are defined in ISO/IEC 8802-3, Clause 6.3.

2.3.2 10Base5 Medium Attachment Unit and Medium Specifications

An implementation supporting the 10Base5 interface shall conform to the AUI requirements defined in ISO/ IEC 8802-3 Clause 7.2 - 7.6. The MAU requirements defined in ISO/ IEC 8802-3, Clauses 8.2 - 8.7 shall be supported.

IEEE 802.3r contains a PICS proforma that itemizes all mandatory and optional requirements can be obtained by contacting the NTCIP Coordinator.

2.3.3 10Base2 Medium Attachment Unit and Medium Specifications

An implementation supporting a 10Base2 interface shall conform to ISO/IEC 8802-3, Clauses 10.3 - 10.8 that cover the MAU and cabling requirements.

2.3.4 10Base-T Medium Attachment Unit and Medium Specifications

An implementation supporting a 10Base-T interface shall conform to the mandatory requirements defined in ISO/IEC 8802-3, Clauses 14.2 - 14.8. The requirements related to MAU - AUI characteristics defined in ISO/IEC 8802-3, Clauses 7.2 - 7.6 shall also be supported

ISO/IEC 8802-3, Clause 14.10 contains a PICS proforma that itemizes all mandatory and optional requirements. A copy of this PICS can be obtained by contacting the NTCIP Coordinator.

2.3.5 10Base-F Medium Attachment Units and Medium Specifications

An implementation supporting a 10Base-F interface shall conform to the mandatory requirements defined in ISO/IEC 8802-3, Clauses 15.2 - 15.6.

ISO/IEC 8802-3, Clause 15.8 contains a PICS proforma for all mandatory and optional requirements that are common to all fiber optic interfaces. A copy of this PICS can be obtained by contacting the NTCIP Coordinator.

2.3.6 10BaseFP Fiber Optic Passive Star and MAU Requirements

An implementation supporting a 10Base-FP interface configuration shall conform to the mandatory requirements defined in ISO/IEC 8802-3, Clauses 16.2 - 16.5.

ISO/IEC 8802-3, Clause 16.8 contains a PICS proforma for all mandatory and optional requirements that are applicable to 10Base-FP interfaces. A copy of this PICS can be obtained by contacting the NTCIP Coordinator.

2.3.7 10Base-FL Medium Attachment Unit

An implementation supporting a 10Base-FL interface configuration shall conform to the mandatory requirements defined in ISO/IEC 8802-3, Clauses 18.2 - 18.4.

ISO/IEC 8802-3, Clause 18.5 contains a PICS proforma for all mandatory and optional requirements that are applicable to 10Base-FL interfaces. A copy of this PICS can be obtained by contacting the NTCIP Coordinator.

2.4 LAYER MANAGEMENT

Implementation of Layer Management, as defined in ISO/IEC 8802-3 Clauses 5, 19, 20, and Annex H shall not be required. If Layer Management is implemented, it shall conform to IAB STD 15, 16, and 17. Implementations claiming conformance to this profile shall support the following as stated and constrained in the PICS Requirements List.

2.4.1 Interface Type

This profile shall be applicable to interfaces that have any of the following interface type value as defined in as specified in RFC 1643, Section 3.2.6:

a) iso880023-csmacd

2.4.2 Management Information Base

Implementations claiming conformance to this Ethernet Subnetwork Profile and SNMP shall support RFC 1643 - Definitions of Managed Objects for the Ethernet-like Interface Types as stated below and described in the PICS Requirements List.

2.4.2.1 The Ethernet-like Statistics group

An implementation shall support the Ethernet-like Statistics Group as specified in RFC 1643, Section 4.

2.4.2.2 The Ethernet-like Collision Statistics Group

Support for the Ethernet-like Collision Statistics group as specified in RFC 1643, Section 4, is optional.

2.4.2.3 The Ethernet-like Tests, Errors, and Chip Sets Groups

Support for the Test, Errors and Chip Set groups as specified in RFC 1643, Section 4, is optional.

2.5 SYSTEMS MANAGEMENT

ISO/IEC 8802-3 Annex F defines a number of requirements related to system management that are outside the scope of this profile and are not required.

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Annex A
ETHERNET SUBNETWORK PROFILE REQUIREMENTS LIST
(Normative)

A.1 INTRODUCTION

This annex provides the Profile Requirements List (PRL) for implementations of the Ethernet Subnetwork Profile in the form of a proforma. A Profile Implementation Conformance Specification (PICS) for an implementation is generated by an implementer or supplier by indicating the appropriate level of support provided by an implementation.

To claim conformance with this profile, an implementation shall satisfy the mandatory conformance requirements of this profile.

An implementation's completed PRL is called the PICS. The PICS states which capabilities and options of the protocol have been implemented. The following can use the PICS:

a. The protocol implementer, as a checklist to reduce the risk of failure to conform to the standard through oversight.

b. The supplier and user, as a detailed indication of the capabilities of the implementation.

c. The user, as a basis for initially checking the possibility of interworking with another implementation (note that, while interworking can never be guaranteed, failure to do so can often be predicted from incompatible PICSs).

d. A user, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A.1.1 Notation

The following notations and symbols are used to indicate status and conditional status in the PRL and PICS within all NTCIP standards. Not all of these notations and symbols may be used within this standard.

A.1.1.1 Status Symbols

The following symbols are used to indicate base standard and profile status:

m	mandatory
m.<n>	support of every item of the group labeled by the same numeral <n> required, but only one is active at time
o	optional
o.<n>	optional, but support of at least one of the group of options labeled by the same numeral <n> is required
c	conditional
n/a	not-applicable (i.e. logically impossible in the scope of the profile)
x	excluded or prohibited

The o.<n> notation is used to show a set of selectable options (i.e., one or more of the set must be implemented) with the same identifier <n>. Two character combinations are used for dynamic conformance requirements. In this case, the first character refers to the static (implementation) status, and the second refers to the dynamic (use); thus "mo" means "mandatory to be implemented, optional to be used." Base standard requirements are shown using the equivalent notations in upper case (e.g., M, O, X).

The classification of the requirements and options in Internet RFCs does not correspond to the convention described in above, and shall be mapped into the profile as follows:

RFC	Profile
MUST	Mandatory[1]
SHOULD	Mandatory[1]
MAY	Optional
SHOULD NOT	Prohibited
MUST NOT	Prohibited

A.1.1.2 Conditional Status Notation

The following predicate notations may be used:

<predicate>:	This notation introduces a single item that is conditional on the <predicate>.
<predicate>::	This notation introduces a table or a group of tables, all of which are conditional on the <predicate>.

The <predicate>: notation means that the status following it applies only when the PRL or PICS states that the feature or features identified by the predicate are supported. In the simplest case, <predicate> is the identifying tag of a single PICS item. The <predicate>:: notation may precede a table or group of tables in a clause or subclause. When the group predicate is true then the associated clause shall be completed. The symbol <predicate> also may be a Boolean expression composed of several indices. "AND," "OR," and "NOT" shall be used to indicate the Boolean logical operations.

A.1.1.3 Support Column Symbols

This profile is in the form of a PICS and, therefore, includes a support column. An implementer claims support of an item by circling the appropriate answer (Yes, No, or N/A) in the support column:

Yes	Supported by the implementation.
No	Not supported by the implementation.
N/A	Not applicable.

A.1.1.4 Footnotes

Footnotes to the proforma are indicated by superscript numerals. The footnote appears on the page of the first occurrence of the numeral. Subsequent occurrences of a numeral refer to the footnote of the first occurrence.

A.1.1.5 Instructions for Completing the PRL

[1] In the course of adapting communications industry standards to the transportation industry, there may be exceptions where specific mandatory requirements are not applicable to the new environment. Where these exceptions are made, a justification shall be provided.

A Profile implementer shows the extent of compliance to a Profile by completing the PRL. The implementer indicates whether mandatory requirements are complied with, and whether optional functions are supported. The resulting completed PRL is called a PICS. Where this profile refines the features of the base standards, the requirements expressed in this PRL shall be applied (as indicated in PRL items with no "Profile Support" column) to constrain the allowable responses in the base standard PICS proforma. When this profile makes additional requirements, the "Support" column for such PRLs shall be completed. In this column, each response shall be selected either from the indicated set of responses, or it shall comprise one or more parameter values as requested. If a conditional requirement is inapplicable, use the Not Applicable (NA) choice. If a mandatory requirement is not satisfied, exception information must be supplied by entering a reference Xi, where i is a unique identifier, to an accompanying rationale for the noncompliance. When the profile requirement is expressed as a two-character combination (as defined in A.1.1 above), the response shall address each element of the requirement; e.g., for the requirement "mo," the possible compliant responses are "yy" or "yn."

A.2 STANDARDS REFERENCED

This subnetwork profile specifies the provisions of IEEE 802 Network Interfaces, which are based upon the carrier sense multiple access with collision detection (CSMA/CD) access method. The environment in which this applies is assumed to include the NTCIP transport profiles. As such, it includes specific interface requirements for the Internet and Transportation Network Layer Protocols. It references the following standards:

IAB STD 3	(RFC 1122: 1989, Requirements for Internet Hosts - Communication Layers, RFC 1123: 1989, Requirements for Internet Hosts — Application and Support)
IAB STD 38	(RFC 903:1984, A Reverse Address Resolution Protocol)
IAB STD 43	(RFC 1042: 1993, Standard for transmission of IP datagrams over IEEE 802 Networks)
IAB STD 50	(RFC 1643: 1994, Definitions of Managed Objects for the Ethernet-like Interface Types.
ISO/IEC 8802-2	Local and Metropolitan area networks — Specific requirements — Part 2: Logical Link Control
ISO/IEC 8802-3	Local and Metropolitan area networks — Specific requirements — Part 3: CSMA/CD access method and physical layer specifications
NTCIP 2201	NTCIP Transportation Transport Profile

A.3 PICS REQUIREMENTS LIST

A.3.1 General Information

A.3.1.1 Implementation Identification

Ref	Question	Response
1	Supplier	
2	Contact point for queries about the profile	
3	Implementation Name(s) and Version(s)	
4	Date of statement	
5	Other Information: Machine Name, Operating Systems, System Name	
6	Amendments or revisions to the base standards or profiles that are applicable.	

A.3.1.2 Global Statement of Conformance

Are all mandatory requirements met for:

Ref	Standard	Response
1	IAB STD 3 (Internet Hosts) Interfacing	
2	IAB STD 43 (IP over IEEE 802 Networks) Interfacing	
3	NTCIP 2201 Transportation Transport Profile Interfacing	
4	ISO 8802-2 Logical Link Control	
5	ISO 8802-3 Media Access Control	
6	ISO 8802-3 Media Interfaces	
7	IAB STD 50 (RFC 1643) (Ethernet-like MIB)	

A.4 BASIC REQUIREMENTS

The following table lists the major requirements for an Ethernet implementation, and asks if the listed protocols, specifications, and object definition groups have been implemented:

Index	Protocol	Clause of Profile	Profile Status	Support
ULIR	Upper Layer Interface Requirements			
IP	Internet Protocol	2.2.1.1.1	o.1	Yes No
T2	Transportation Transport Profile	2.2.1.1.2	o.1	Yes No
ARP	Address Resolution Protocol	2.2.1.1.1	o	Yes No
RARP	Reverse Address Resolution Protocol	2.2.1.1.1	o	Yes No
LLC	Logical Link Control Protocol	2.2.1	m	Yes
MAC	Media Access Control Protocol	2.2.2	m	Yes
LLIR	Lower Layer Interface Requirements			
10b5	Does the system use a 10base5 (Thicknet) interface?	2.3	o.2	Yes No
10b2	Does the system use a 10base2 (Thinnet) interface?		o.2	Yes No
10bT	Does the system use a 10baseT (Twisted Pair) interface?		o.2	Yes No
10bF	Does the system use a 10baseF (Fiber Optic) interface?		o.2	Yes No
NIC	Does the system use another 8802.3 compliant interface?		o.2	Yes No
LM	Layer Management			
ISO	OSI Network Management	2.2.1.4,2.2.2.4, and 2.4	o.3	Yes No
SNMP	Internet Network Management		o.3	Yes No

A.5 UPPER LAYER INTERFACING

A.5.1 IP Encapsulation

IP::

The following table is to be completed if the above predicate evaluates to true.

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
TRE	Trailer Encapsulation Data Transfer	RFC 1122: 2.3.1	O	2.2.1.1.1	o	Yes No
NEG	Send Trailers without Negotiation	RFC 1122: 2.3.1	X		x	No
R2-ip	Receive RFC 1042 Encapsulation	RFC 1122: 2.3.3	M		m	Yes
S2-ip	Send RFC 1042 Encapsulation	RFC 1122: 2.3.3	M		m	Yes
ARP	Use ARP on IEEE Nets	RFC 1122: 2.3.3	M		o	Yes No
RBC-ip	Link Layer Reports Broadcasts to Network Layer	RFC 1122: 2.3.4	M		m	Yes
TOS-ip	Network Layer Passes TOS to Link Layer	RFC 1122: 2.3.4	M		m	Yes
UNR	No ARP Cache Entry Treated as Destination Unreachable	RFC 1122: 2.3.4	X		x	No
BRA-ip	Broadcast Address Map from IP to 802.2	RFC 1042: p.4	M		m	Yes
OCT-ip	IP Datagrams sent as Octets in Big Endian Bit Order	RFC 1042: p.4	M		m	Yes
MTU-ip	Maximum Transmission Unit for IP Datagrams over 802.3 equals 1492 Octets	RFC 1042: p.7	M		m	Yes

A.5.2 Address Resolution Protocol Capabilities

ARP::

The following table is to be completed if the above predicate evaluates to true.

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
FLSH	Flush Out-of-date ARP Cache Entries	RFC 1122: 2.3.2.1	M	2.2.1.1.1	m	Yes
FLD	Prevent ARP Floods	RFC 1122: 2.3.2.1	M		m	Yes
TOUT	Cache Timeout Configurable	RFC 1122: 2.3.2.1	MO		m o	Yes Yes No
SAVE	Save at least one (latest) Unresolved Packet	RFC 1122: 2.3.2.2	MO		m o	Yes Yes No

A.5.3 Reverse Address Resolution Protocol Capabilities

RARP::

The following table is to be completed if the above predicate evaluates to true.

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
RFMT	Packet Format for RARP	RFC 903: p.2	M	2.2.1.1.1	m	Yes
OPCD	Valid RARP Opcodes	RFC 903: p.3	M		m	Yes

A.5.3 Transportation Transport Profile Encapsulation

T2::

The following table is to be completed if the above predicate evaluates to true.

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
R2-T2	Send T2 Datagrams using RFC 1042 Encapsulation technique	N/A	N/A	2.2.1.1.2	m	Yes
S2-T2	Receive T2 Datagrams using RFC 1042 Encapsulation technique	N/A	N/A	2.2.1.1.2	m	No
NWA-T2	Mapping of T2 non-broadcast Address to 802.2	N/A	N/A	2.2.1.1.2.1	m	Yes
BCA-T2	Mapping of T2 Broadcast Address to 802.2	N/A	N/A	2.2.1.1.2.1	m	Yes
RBA-T2	Link Layer Reports Broadcasts to T2	N/A	N/A	2.2.1.1.2	m	Yes
TOS-T2	T2 Passes TOS to Link Layer	N/A	N/A	2.2.1.1.2	m	Yes
OCT-T2	T2 Datagrams sent as Octets in Big Endian Bit Order	N/A	N/A	2.2.1.1.2	m	Yes
MTU-T2	Maximum Transmission Unit for T2 Datagrams over 802.3 equals 1492 Octets	N/A	N/A	2.2.1.1.2	m	Yes

A.6 DATA LINK LAYER

A.6.1 Logical Link Control

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
CLS1a	Is Class I (Unacknowledged connectionless) LLC supported?	ISO 8802-2: 4.2.1	O.4	2.2.1.2	m	Yes
CLS1b	Are LLC Type 1 procedures supported?	ISO 8802-2: 6	M		m	Yes
CLS2a	Is Class II (Connection-oriented) LLC supported?	ISO 8802-2: 4.2.2	O.4		o	Yes No
CLS2b	Are LLC Type 1 and Type 2 procedures supported?	ISO 8802-2: 6 and 7	CLS2a: M		CLS2a: m	Yes No
CLS3a	Is Class III (Acknowledged connectionless service) LLC supported?	ISO 8802-2: 4.2.3	O.4		o	Yes No
CLS3b	Are LLC Type 1 and Type 3 procedures supported?	ISO 8802-2: 6 and 8	CLS3a: M		CLS3a: m	Yes No
CLS4a	Is Class IV LLC supported?	ISO 8802-2: 4.2.4	O.4		o	Yes No
CLS4b	Are LLC Type 1, Type 2, and Type 3 procedures supported?	ISO 8802-2: 6-8	CLS4a: M		CLS4a: m	Yes No
RDE	Is Route Determination supported?	ISO 8802-2: 9	O	2.2.1.3	o	Yes No

A.6.1.1 Mode Operations

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
Type1 PDUs	Are the mandatory requirements for Type 1 PDU Types, Transmitted and Received PDU Parameters, and PDU Length, DSAP and SSAP addressing, P-bit, and address checking met?	ISO 8802-2: 5.4, 6.1 -6.3, 6.5 - 6.7, and 6.9	M	2.2.1.2	m	Yes
Type2 PDUs	Are the mandatory requirements for Type 2 PDU Types, Transmitted and Received PDU Parameters, Procedures, PDU Length and duplicate PDUs, and Protocol Parameters met?	ISO 8802-2: 3.2-3.4., 5.4, 7.4, 7.5, 7.8, and Annex B	CLS2a or CLS4a :M		m	Yes
Type3 PDUs	Are the mandatory requirements for Type 3 PDU Types, Transmitted PDU, Received PDU, Procedures, PDU Length, DSAP and SSAP addressing, and address checking, and Protocol Parameters met?	ISO 8802-2: 8.1-8.7, 3.3, and 5.4	CLS3a or CLS4a :M		m	Yes

A.6.1.2 Object Management

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
LLC int	Does the implementation support object management according to IAB STD 50	RFC 1643	M	2.4.2	SNMP: m	Yes No

A.6.2 Media Access Control Protocol

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
MAC ser	Are the mandatory requirements for MAC Service specification, Frame Structure, and Functional Specifications met?	ISO 8802-3: 2-4	M	2.2.2	m	Yes
MAC Int	Does the implementation support object management according to IAB STD 50 (RFC 1643)	RFC 1643	M	2.4.2	SNMP: m	Yes No

A.7 PHYSICAL LAYER

A.7.1 Physical Signaling Services

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
PLS req	Does the MAC - PLS interface conform to the abstract service primitives for PLS_DATA.request and.indication, PLS_CARRIER.indication, and PLS_Signal.indication	IEEE 8802-3: 6.3	M	2.3.1	m	Yes

A.7.2 Media Access Unit (10Base5)

10b5::

The following tables are to be completed if the above predicate evaluates to true.

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
10b5-aui	Are the mandatory functional, signaling, electrical characteristics, interchange circuits, and mechanical requirements for the AUI met?	ISO/IEC 8802-3: 7.2 - 7.6	M	2.3.2	m	Yes
10b5-mau	Are the mandatory requirements for the MAU met?	ISO/IEC 8802-3: 8.2 -, 8.3, 8.5, 8.6.3, 8.7, and 8.8	M		m	Yes
10b5-cable	Are the mandatory requirements for 10base5 Coaxial Cable met?	ISO/IEC 8802-3: 8.4 and 8.5	M		m	Yes

A.7.3 Media Access Unit (10Base2)

10b2::

The following table is to be completed if the above predicate evaluates to true.

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
10b2 fsec	Are the mandatory requirements for the MAU Functions Specifications and Electrical Characteristics met?	ISO/IEC 8802-3: 10.3-10.4	M	2.3.3	m	Yes
10b2 cable	Are the mandatory requirements for 10base2 Coaxial Cable and Connectors met?	ISO/IEC 8802-3:10.5-0.6	M		m	Yes
10b2 tsys	Are the mandatory requirements for Transmission System met?	ISO/IEC 8802-3: 10.7	M		m	Yes

A.7.4 Media Access Unit (10BaseT)

10bT::

The following table is to be completed if the above predicate evaluates to true.

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
10bT mau	Are the mandatory requirements for the MAU and AUI met?	ISO 8802.3: 7.3-7.6, 14.2, 14.3, 14.5, 14.7, and 14.8	M	2.3.4	m	Yes
10bT cable	Are the mandatory requirements for the characteristics of the Twisted Pair Cable met?	ISO 8802.3: 14.4, 14.5, and 14.7	M		m	Yes

A.7.5 Media Access Unit (10BaseF)

10bF::

The following table is to be completed if the above predicate evaluates to true.

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
10bF-ada	Are the mandatory requirements for the MAU, MDI, and AUI met?	ISO 8802.3: 15.1 - 15.6	M	2.3.5	m	Yes
10bF cable	Are the mandatory requirements for 10baseF Fiber Optic Cable met?	ISO 8802.3: 15.3	M		m	Yes
10bFP	Is a 10base-FP Interface used?	ISO 8802.3: 15.8.5	O.4	2.3.6	o.4	Yes No
10bFPa	Does the 10base-FP Interface meet the mandatory requirements for interconnecting DTEs and repeaters in a passive star system?	ISO 8802.3: 16	10bFP: M		10bFP: m	Yes No
10bFL	Is a 10base-FL Implementation used?	ISO 8802.3: 15.8.5	O.4	2.3.7	o.4	Yes No
10bFLa	Does the 10base-FL Interface meet the mandatory requirements for interconnecting DTEs and repeaters?	ISO 8802.3: 18	10bFL:M		10bFP: m	Yes No

A.8 MANAGEMENT INFORMATION BASE

SNMP::

The following table is to be completed if the above predicate evaluates to true.

Item	Group	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
Statistics	Ethernet-like Statistics	RFC 1643: 4	M	2.4.2.1	m	Yes
Collide	Ethernet-like Collision Statistics	RFC 1643:4	O	2.4.2.2	o	Yes No
Tests	Test, Errors, and Chip Sets	RFC 1643:4	O	2.4.2.3	o	Yes No

A.8.1 Ethernet-like Statistics Group

Statistics::

The following table is to be completed if the above predicate evaluates to true.

Item	Object Definition			Base Standard		Profile		Support
	Object	Syntax	Access	Reference	Status	Clause	Status	
Stats Table	dotStatsTable	SEQUENCE OF Dots3StatsEntry	not-accessible	RFC 1643: 4	M	2.4.2.1	m	Yes
Stats Entry	dot3Stats Entry	Dots3StatsEntry	not-accessible	RFC 1643: 4	M		m	Yes
Stats Entry1	dot3Stats Index	Integer	read-only	RFC 1643: 4	M		m	Yes
Stats Entry2	dot3Stats Alignment Errors	Counter	read-only	RFC 1643: 4	M		m	Yes
Stats Entry2	dot3Stats FCSErrors	Counter	read-only	RFC 1643: 4	M		m	Yes
Stats Entry3	dot3Stats SingleCollision Frames	Counter	read-only	RFC 1643: 4	M		m	Yes
Stats Entry4	dot3Stats Multiple Collision Frames	Counter	read-only	RFC 1643: 4	M		m	Yes
Stats Entry5	dot3Stats SQTest Errors	Counter	read-only	RFC 1643: 4	M		m	Yes
Stats Entry6	dot3Stats Deferred Transmissions	Counter	read-only	RFC 1643: 4	M		m	Yes
Stats Entry7	dot3StatsLate Collisions	Counter	read-only	RFC 1643: 4	M		m	Yes
Stats Entry8	dot3Stats Excessive Collisions	Counter	read-only	RFC 1643: 4	M		m	Yes

Item	Object Definition			Base Standard		Profile		Support
	Object	Syntax	Access	Reference	Status	Clause	Status	
Stats Entry9	dot3Stats Internal MACTransit Errors	Counter	read-only	RFC 1643: 4	M		m	Yes
Stats Entry10	dot3Stats Carrier SenseErrors	Counter	read-only	RFC 1643: 4	M		m	Yes
Stats Entry11	dot3Stats Frame TooLongs	Counter	read-only	RFC 1643: 4	M		m	Yes
Stats Entry12	dot3Stats InternalMac ReceiveErrors	Counter	read-only	RFC 1643: 4	M		m	Yes
Stats Entry13	dot3Stats Ether ChipSet	OBJECT IDENTIFIER	read-only	RFC 1643: 4	M		m	Yes

A.8.2 Ethernet-like Collision Statistics Group

Collide::

The following table is to be completed if the above predicate evaluates to true.

Item	Object Definition			Base Standard		Profile		Support
	Object	Syntax	Access	Reference	Status	Clause	Status	
Collide Table	dot3CollTable	SEQUENCE OF Dots3CollEntry	not-accessible	RFC 1643: 4	M	2.4.2.2	m	Yes
Collide Entry	dot3CollEntry	Dots3CollEntry	not-accessible	RFC 1643: 4	M		m	Yes
Collide Entry1	dot3CollCount	Integer	not-accessible	RFC 1643: 4	M		m	Yes
Collide Entry2	dot3Coll Frequencies	Counter	read-only	RFC 1643: 4	M		m	Yes

A.8.3 Test, Errors, and Chip Set Group

Tests::

The following table is to be completed if the above predicate evaluates to true.

Item	Object Definition			Base Standard		Profile		Support
	Object	Syntax	Access	Reference	Status	Clause	Status	
Tests	dot3Tests	OBJECT IDENTIFIER	read-only	RFC 1643: 4	O	2.4.2.3	o	Yes No
Tests1	dot3TestTdr	OBJECT IDENTIFIER	read-only	RFC 1643: 4	O		o	Yes No
Tests2	dot3Test LoopBack	OBJECT IDENTIFIER	read-only	RFC 1643: 4	O		o	Yes No
Errors	dots3Errors	OBJECT IDENTIFIER	read-only	RFC 1643: 4	O		o	Yes No
Errors1	dot3Error InitError	OBJECT IDENTIFIER	read-only	RFC 1643: 4	O		o	Yes No
Errors2	dot3Error Loopback Error	OBJECT IDENTIFIER	read-only	RFC 1643: 4	O		o	Yes No
Chips	dots3ChipSets	OBJECT IDENTIFIER	read-only	RFC 1643: 4	O		o	Yes No

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