TECHNICAL REPORT

ISO/IEC TR 8802-1

Second edition
1997-03-15

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Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements —

Part 1:
Overview of Local Area Network Standards

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Réseaux locaux et métropolitains — Exigences spécifiques —

Partie 1: Vue d'ensemble des normes de réseaux locaux

Reference number
ISO/IEC TR 8802-1:1997(E)

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Printed in Switzerland

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Foreword

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

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

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

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

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

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

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 Technical Reports of type 3 do not necessarily have to be reviewed until data they provide are considered to be no longer valid or useful.

ISO/IEC TR 8802-1, which is a Technical Report of type 3, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

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Introduction

This Technical Report introduces the set of International Standards produced to facilitate the interconnection of information processing systems connected to a Local Area Network (LAN). The LAN is a peer-to-peer communications network provided by a single broadcast domain that enables all end stations to exchange information. As a consequence it does not inherently provide privacy. A LAN is in general owned, used, and operated by a single organisation and falls within a single administrative domain.

This Technical Report provides a source of reference to all International Standards that relate to local area networks; specifically the ISO/IEC 8802 technologies and FDDI.

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Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 1: Overview of Local Area Network Standards

1 Scope

This Technical Report provides an introduction to the set of International Standards which describe local area networks, specifically those which make use of the 48-bit address format.

The technologies described in this Technical Report have in common the ability to provide sufficient capability to support the MAC Service which is defined in ISO/IEC 15802-1.

The scope of this Technical Report is therefore limited to those International Standards which describe processes and procedures resident in the Data Link and Physical Layers of the OSI Basic Reference Model and can be said to relate to local area networks.

This Technical Report does not itself describe new Service or Protocol definitions. Its intent is to set the context for local area networks which include both the International Standards describing FDDI and the technologies described by the set of ISO/IEC 8802 International Standards.

2 References

NOTE It was agreed in October 1993 to revise the existing numbering scheme of LAN/MAN International Standards within ISO/IEC JTC 1 to provide alignment with the numbering scheme used by IEEE for their LAN/MAN Standards. The process of introducing the new scheme for new International Standards and the re-numbering of existing International Standards is on-going. Annex A describes the new numbering scheme in detail and indicates how its implementation will proceed.

ISO/IEC 7498-1: 1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model.*

ISO 7498-3: 1989, *Information processing systems – Open Systems Interconnection – Part 3: Naming and addressing.*

ISO/IEC 8802-2: 1994, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical link control.*

ISO/IEC 8802-3: 1996, *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.*

ISO/IEC 8802-4: 1990, *Information processing systems – Local area networks – Part 4: Token-passing bus access method and physical layer specifications.*

ISO/IEC 8802-5: 1995, *Information technology – Local and metropolitan area networks – Specific requirements – Part 5: Token ring access method and physical layer specifications.*

ISO/IEC 8802-6: 1994, *Information technology – Local and metropolitan area networks – Specific requirements – Part 6 Distributed Queue Dual Bus (DQDB) access method and physical layer specifications.*

ISO/IEC 8802-9: 1996, *Information technology – Local and metropolitan area networks – Specific requirements – Part 9: Integrated Services (IS) LAN Interface at the Medium Access Control (MAC) and Physical (PHY) Layers.*

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ISO/IEC 8802-12:—[1], *Information technology – Local and metropolitan area networks – Specific requirements – Part 12: Demand priority access method, physical layer and repeater specifications.*

ISO/IEC 8886: 1996 | ITU-T Recommendation X.212 (1995), *Information technology – Open Systems Interconnection – Data link service definition.*

ISO 9314-1: 1989, *Information processing systems – Fibre Distributed Data Interface (FDDI) – Part 1: Token Ring Physical Layer Protocol (PHY).*

ISO 9314-2: 1989, *Information processing systems – Fibre Distributed Data Interface (FDDI) – Part 2: Token Ring Media Access Control (MAC).*

ISO/IEC 9314-3: 1990, *Information processing systems – Fibre Distributed Data Interface (FDDI) – Part 3: Physical Layer Medium Dependent (PMD).*

ISO/IEC 9314-6:—[1], *Information technology – Fibre Distributed Data Interface (FDDI) – Part 6: Station Management (SMT).*

ISO/IEC TR 9577: 1996, *Information technology – Protocol identification in the network layer.*

ISO/IEC 10038: 1993, *Information technology – Telecommunications and information exchange between systems – Local area networks – Media access control (MAC) bridges.* (In the future to be published as ISO/IEC 15802-3.)

ISO/IEC 10165-4: 1992, *Information technology – Open Systems Interconnection – Structure of management information – Part 4: Guidelines for the definition of management objects.*

ISO/IEC 10742: 1994, *Information technology – Telecommunications and information exchange between systems – Elements of management information related to OSI Data Link Layer standards.*

ISO/IEC 11575: 1995, *Information technology – Telecommunications and information exchange between systems – Provision and mappings for the OSI Data Link service.*

ISO/IEC 11801: 1995, *Information technology – Generic cabling for customer premises.*

ISO/IEC TR 11802-1: 1997, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Technical reports and guidelines – Part 1: The structure and coding of Logical Link Control addresses in Local Area Networks.* (Formerly published as ISO/IEC TR 10178.)

ISO/IEC TR 11802-2: 1996, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Technical reports and guidelines – Part 2: Standard Group MAC Addresses.* (Formerly published as ISO/IEC TR 10735.)

ISO/IEC 15802-1: 1995, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Common specifications – Part 1: Medium Access Control (MAC) service definition.* (Formerly published as ISO/IEC 10039.)

ISO/IEC 15802-4: 1994, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Common specifications – Part 4: System load protocol.*

ISO/IEC 15802-5:—[1], *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Common specifications – Part 5: Remote MAC bridging.*

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1) To be published.

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3 Abbreviations

The following abbreviations are used in this Technical Report.

CSMA/CD Carrier Sense Multiple Access with Collision Detection

DLS Data Link Service

DQDB Distributed Queue Dual Bus

DSAP Destination Service Access Point

FDDI Fibre Distributed Data Interface

LAN Local Area Network

LLC Logical Link Control

MAC Media Access Control

MAN Metropolitan Area Network

MCS Management Conformance Summary

MICS Management Information Conformance Statement

MOCS Managed Object Conformance Statement

MRCS Managed Relationship Conformance Statement

PHY Physical Layer

PICS Protocol Implementation Conformance Statement

PMD Physical Layer Medium Dependent

SMT Station Management

SNAP Sub-network Access Protocol

SSAP Source Service Access Point

4 Local Area Network Technologies

4.1 Introduction

The local area network technologies considered in this Technical Report are shown in Table 1.

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Table 1 — Local area network technologies and their related International Standards

LAN Technology	Data Transmission Rate	International Standard
CSMA/CD	10Mbit/s / 100Mbit/s	ISO/IEC 8802-3
Token-passing Bus	5Mbit/s / 10Mbit/s	ISO/IEC 8802-4
Token-passing Ring	4Mbit/s / 16Mbit/s	ISO/IEC 8802-5
DQDB	no upper limit defined	ISO/IEC 8802-6
Demand Priority	100Mbit/s	ISO/IEC 8802-12
Integrated Services	up to 20.48Mbit/s	ISO/IEC 8802-9
FDDI	100Mbit/s	ISO/IEC 9314 -1 -2 -3 (-6)

These International Standards are organised along the architectural lines of the OSI Basic Reference model, and in the case of the 8802 LANs into the medium-dependent aspects of the Physical Layer (PHY) and the formats and protocols used by the particular media access control sublayer (MAC).

Figure 1 shows the relationship and dependencies of the various technologies within this overall architecture. This family of International Standards deals with the physical and data link layers as defined by the Open Systems Interconnection Reference Model. It comprises a set of medium access technologies and associated physical media, each appropriate for particular applications or system objectives.

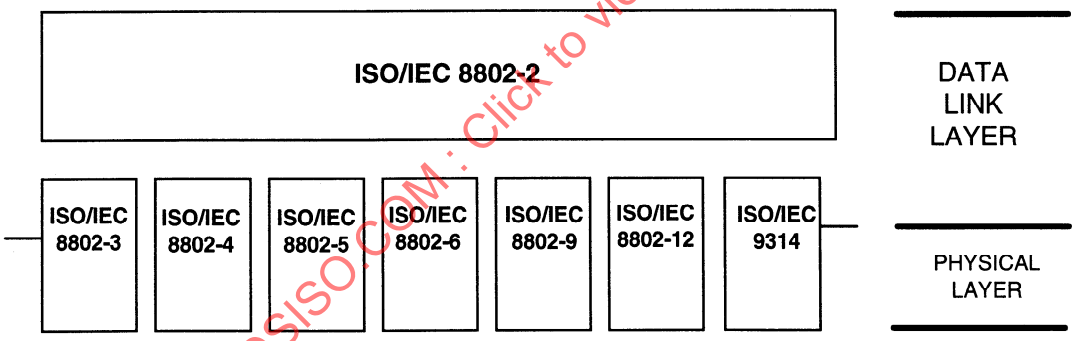

Figure 1 — Relationship of family of International Standards for Local Area Networks

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4.2 The LAN Technologies

LANs cover a wide variety of Physical Layer International Standards, physical media, and methods of media access control. The following is a brief synopsis for each of the LAN technologies identified in Table 1, however the reader is referred to the International Standard documents (see Clause 2) for the precise detail for each of the LAN technologies.

4.2.1 CSMA/CD

This form of LAN technology, Carrier Sense Multiple Access with Collision Detection, controls access to the medium by means by which two or more stations share a common transmission medium. To transmit, a station waits

(defers) for a quiet period on the medium (that is, no other station is transmitting) and then sends the intended message in bit-serial form. If, after initiating a transmission, the message collides with that of another station, then each transmitting station intentionally sends a few additional bytes to ensure propagation of the collision throughout the system. The station then remains silent for a random amount of time (backoff) before attempting to transmit again. The CSMA/CD LAN technology is defined for use on 50 ohm coaxial cable (10BASE5 and 10BASE2), on unshielded twisted pair (10BASE-T), and on fibre optic cable (FOIRL and 10BASE-F). 100BASE-T couples the ISO/IEC 8802-3 CSMA/CD MAC with a family of 100 Mbit/s physical layers. While the MAC is readily scaled to the new performance levels, new physical layer standards are required for 100 Mbit/s operation and these include 100BASE-T4, 100BASE-TX and 100BASE-FX.

4.2.2 Token-passing Bus

This form of LAN technology controls access to the medium through the use of a bus transmitted token which allows the holder to transmit information onto the bus. The token bus LAN technology is defined for use on broadband coaxial cable, on baseband coaxial cable, and on fibre optic cable.

4.2.3 Token-passing Ring

In a token-passing ring, stations are serially connected to form a logical ring over which data and control information is transmitted and received.

Access to this ring is controlled by a signalling sequence referred to as the "token" which circulates around the ring from station to station.

A station desiring to transmit waits until it receives a token. The station changes the token to a start-of-message, transmits its message and, upon completion of the message, releases a new token for use by other stations on the ring.

Token ring is defined for operation on shielded and unshielded twisted pair medium at data rates of 4 and 16 Mbit/s. In addition, token ring may operate using fibre optic cable.

4.2.4 Distributed Queue Dual Bus

DQDB is defined to have the capability to work over the local area and to interoperate with the other local area network technologies. In particular DQDB has the capability to use the 48-bit MAC address format and for that reason it is included in this Overview.

However, DQDB is more often encountered in the Metropolitan Area and it introduces the concept of the Metropolitan Area Network (MAN) where the development of a high speed technology to support connectionless data services is required. Because of the differing environments in which the DQDB MAN will be utilised, a variety of Physical Layer protocols are required. Physical Layer protocols which make use of existing underlying transmission standards have been defined. However it is intended that all Physical Layer specifications (PHY) will be based upon a common framework.

4.2.5 Demand Priority

A Demand Priority LAN comprises three principal components; the end nodes, the repeaters, and the network links. End nodes are typically personal or larger computers but may be special devices, for example bridges. Repeaters are the network controllers which manage the Demand Priority Access Method. The link segments provide the interconnection between a repeater and its connected end nodes or other repeaters.

Demand priority access is a priority-based, round-robin arbitration method where the central network controller (the repeater) regularly polls its connected ports to determine which have transmission requests pending, and whether the transmission request is normal priority (e.g. for data files) or high priority (e.g. for real time voice, video or data).

The medium access protocol provides a means by which stations (end nodes) can communicate with each other over a centrally controlled LAN that offers a choice of several different link media including 100 Ohm balanced cable (4-UTP and 2-TP), 150 Ohm shielded balanced cable (STP), and optical fibre.

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4.2.6 Integrated Services LAN Interface

The ISLAN interface is an integrated voice, data and video interface that provides packet service and isochronous digital channels on a full duplex interface to the desktop over unshielded telephone twisted pairs (UTP). The integrated service is provided to the terminal equipment across an interface called an access unit (AU). The AU accommodates two fundamentally different application topologies; firstly the interface may be to a stand-alone LAN where the AU provides the complete pathway; and secondly the ISLAN serves as an access interface that feeds into a backbone comprising an ISO/IEC 8802-x LAN, an FDDI, or an integrated services digital network.

The connection between the AU and the terminal equipment is a set of point-to-point links in a star topology. Carried over these links is a multiplexed bit stream of packet data, voice, wideband data and other services such as facsimile, image or video delivered over isochronous channels.

This specification is capable of supporting information transfer rates that are multiples of 4.096 Mbit/s in isochronous frames delivered at 8 kHz with specifications provided for the use of 4.096 Mbit/s and 20.48 Mbit/s time division multiplexed bearers with 64 and 320 slots each comprising one octet.

4.2.7 Fibre Distributed Data Interface

The Physical Medium Dependent (PMD) provides the digital baseband channel for point to point communication between nodes on the FDDI network. It provides all services necessary to transport a suitably coded digital bit stream. The specific definition and characterisation may be found in ISO/IEC 9314-3.

The Physical Layer Protocol (PHY) provides the connection between the PMD and the Data Link Layer (the MAC). It provides clock synchronisation with the upstream data stream and provides the encoding and decoding of symbols, and the delineation of symbol boundaries as required for the transmission of information to or from higher layers. The specific definitions and characterisations may be found in ISO 9314-1.

4.3 Cabling Aspects

For the implementation of the LAN applications mentioned in Table 1, an application independent solution has been developed in ISO/IEC 11801. The document provides for the generic cabling of customer premises, supporting all major applications. The specific definitions and characterisations may be found in this document.

5 Data Link Layer

5.1 Introduction

For the specification of ISO/IEC 8802 Local Area Networks, the separation of the Data Link Layer of the OSI Basic Reference Model into two sublayers is of benefit. The Data Link Layer is therefore refined to show a Logical Link Control Sublayer and a Medium Access Control Sublayer.

5.2 Provision and Support of the Data Link Layer Service

ISO/IEC 8886 | ITU-T Recommendation X.212 contains the generic Data Link Service (DLS) definition for OSI and, as such, the elements of service definition within LLC can be regarded as a subset of this generic service definition. The OSI DLS definition describes the properties of individual instances of Data Link communication between pairs of DLS users. It is expressed abstractly in terms of primitives and parameters exchanged, at the Data Link service access points, between each DLS user and a single DLS provider. In this respect the service definition contained in LLC is no different.

ISO/IEC 11575 seeks to unify the generic DLS definition with the specific instances of Data Link layer service, e.g. LLC, and includes mapping the OSI DLS for LLC Types 1 and 2. The fundamental objective is to achieve such a mapping without requiring any change to the protocols themselves; further it is specifically not the intent to restrict the development of new protocols. It accepts that the service definitions contained in ISO/IEC 8802-2 for LLC Types 1 and 2 while performing a similar function to the OSI DLS differ in some points of detail. It attempts to identify places where there is a possible impact of mapping the DLS to the text of ISO/IEC 8802-2 and to indicate how the

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text would need to change if the DLS mapping were to be incorporated into ISO/IEC 8802-2 as a replacement for the existing LLC service definition.

6 Medium Access Control Sublayer

6.1 Introduction

The development of the concepts associated with the MAC sublayer have been intimately related to the development of the different LAN technologies. Indeed each LAN Standard describes the MAC Service interface for its particular requirements. A great deal of commonality exists in these definitions, to the extent that a definition of a single generic MAC Service description was considered appropriate and has been standardised as ISO/IEC 15802-1. A number of differences are apparent in particular with regard to ISO/IEC 8802-4, the Token-passing bus specification and these issues are dealt with below.

6.2 Provision and Support of the MAC Service

6.2.1 Connectionless-mode Service

ISO/IEC 15802-1 defines the MAC Service (the connectionless-mode service) found in local area network architecture. This service is defined in terms of the primitive actions and events of the service together with the parameters associated with each primitive action and event, their inter-relationship and valid sequences. Its intent is to specify the characteristics of a conceptual service and to provide guidance for the development of MAC protocols and OSI protocols that make use of the MAC Service.

The MAC Service provides for the transparent transfer of data between MAC service users and makes invisible the way in which supporting communications resources are utilised. In particular the MAC Service provides independence of the underlying MAC and Physical Layer to the MAC Service user and transparency of transferred information by providing no restriction on the content, format or coding of the information beyond the maximum number of octets of MAC Service user data that can be supplied in a user/provider interaction.

ISO/IEC 15802-1 introduces and discusses the quality of this service and classifies the parameters in terms of MAC Service performance and other MAC service characteristics. Within each class examples of the quality of service parameters are given and defined. These include,

- transit delay;
- residual error rate;
- probability of lost information;
- priority.

The subject of the quality of the MAC Service is more fully discussed in ISO/IEC 10038 and includes those parameters listed above together with the following additional parameters,

- service availability;
- frame mis-ordering;
- frame duplication;
- frame lifetime;
- maximum service data unit size supported;
- throughput.

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Taken together this provides an exhaustive examination of the parameters of quality of the MAC Service within the context of quality of service maintenance.

6.2.2 Acknowledged Connectionless-mode Service

ISO/IEC 8802-4, the Token-passing Bus protocol provides an acknowledged connectionless service to its user making use of primitive actions and events which do not exist within ISO/IEC 15802-1. In particular it describes primitive actions that support the local acknowledgement of requests passed across the service boundary. No distinct definition currently exists to describe the acknowledged connectionless MAC Service - the definition is integral with the protocol specification in ISO/IEC 8802-4.

6.3 48-Bit MAC Address Format

The network technologies described in this Technical Report all make use of the 48-bit MAC address format. Such addresses are universally applicable and provide unique identification. The registration authority for the Universally administered address is the American National Standards Institute Accredited Standards Committee, IEEE Standards Board.

The precise detail of address format and usage together with the definition of their representation in hexadecimal is described within ISO/IEC 15802-1. The Hexadecimal Representation of the 48-bit MAC address is used at the MAC service boundary to de-couple the specific requirements of the various MAC technologies.

The 48 bits are divided into two parts; the first 24 bits correspond to the Organisationally Unique Identifier as assigned by the IEEE Standards Board[2)], excepting that the assignee may choose between group addressing or individual addressing by modification of the Individual/Group Address bit. The second 24 bits of the address is administered locally by the assignee to provide uniqueness.

The address format additionally allows for local administration of addresses by modification of the Universally/Locally Administered Address bit.

6.4 Standard Group MAC Addresses

Group MAC addresses which form a part of the operation of a published Standard protocol exist (e.g. ISO/IEC 10038 spanning tree bridge protocol data units; ISO/IEC 10589 All Level 1 Intermediate Systems Address). It was realised that there would be benefit if such group addresses were allocated from an approved, assigned group MAC address block. ISO/IEC TR 11802-2 provides a record of the approved assignments from this Standard group MAC address block and a record of group MAC addresses in use in Standards which are not part of the Standard group MAC address block.

NOTE Group MAC addresses for vendor specific proprietary protocols are not covered by this Technical Report; such addresses should be assigned out of the vendor's universally administered address block.

7 Logical Link Control Sublayer

7.1 Provision and Support of the LLC Services

ISO/IEC 8802-2 (LLC) contains both the service description and the elements of protocol which realise the functions, features, protocol and services of the Logical Link Control sublayer. This sublayer definition is interposed between the MAC sublayer of the Data Link layer and the Network layer. The service definition is provided in terms of primitives that represent the logical exchange of information and control, in an abstract manner. It provides a description of the peer-to-peer protocol procedures that are defined for the transfer of information and control between any pair of data link layer service access points. These procedures are independent of the particular technology of the LAN as they themselves make use of the underlying generic MAC Service.

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2) IEEE Registration Authority, Standards Department, 445 Hoes Lane, P.O. Box 1331, Piscataway NJ 08855-1331, USA.

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LLC Types 1 and 2 provide services which map well to the generic OSI Data Link Service (ISO/IEC 8886). ISO/IEC 11575 specifies the general principles for the mapping between the OSI Data Link service and the main features of the mapping for LLC Types 1 and 2. LLC Type 3 is able to make use of local acknowledgement and this service definition is currently absent from the Data Link Service described above.

In their turn the protocol data units exchanged by LLC make use of the MAC sublayer service. LLC Types 1 and 2 map directly to the connectionless-mode MAC Service defined in ISO/IEC 15802-1; LLC Type 3 is able to make use of local acknowledgement, a service currently not described in ISO/IEC 15802-1 but described by the service primitives in ISO/IEC 8802-4, the Token-passing bus.

7.1.1 LLC Type 1 Connectionless-mode Operation

LLC Type 1 provides a data link connectionless-mode service with the minimum of protocol complexity, so that any required recovery mechanism or sequencing services must be provided elsewhere. With this type of service there can be no guarantee of delivery of each transmitted data link layer frame. This style of operation exists without the need to establish a data link connection and there are no acknowledgement mechanisms, flow control or error recovery procedures provided by this service.

7.1.2 LLC Type 2 Connection-mode Operation

LLC Type 2 provides a data link connection-mode service across a LAN and is comparable to existing non-LAN data link control procedures (e.g. ISO/IEC 7776, LAPB). The service includes support of sequenced delivery together with a comprehensive set of data link layer error recovery techniques. With this operation, a data link connection is established prior to the exchange of information. Whilst information is being exchanged, frames acknowledging receipt are passed in the opposite direction.

7.1.3 LLC Type 3 Acknowledged Connectionless-mode Operation

LLC Type 3 operations are described in ISO/IEC 8802-2 where a service is described which provides acknowledgement of transmitted information while retaining the simplicity of protocol of LLC Type 1. The acknowledgement scheme allows only the acknowledgement of a single frame at a time; mechanisms for ensuring sequencing are minimal, and a basic mechanism for re-transmission is provided. Additionally Type 3 operations allow one end system to poll another for data. ISO/IEC 8802-2 recognises that the completeness and adequateness of the service definition is in doubt and that this remains a subject for future study.

7.2 Logical Link Control Addresses

LLC protocol data units contain addressing information which comprise the Destination Service Access Point (DSAP) and the Source Service Access Point (SSAP). Each of these fields is further sub-divided; the DSAP into the *address type designation bit* and the *actual address* and the SSAP into the *command/response identifier bit* and the *actual address* . In the general case, an individual *actual address* identifies a protocol or set of protocols operating above the LLC sublayer.

The addressing terminology and conventions of LLC are introduced and defined in ISO/IEC 8802-2. ISO/IEC TR 11802-1 deals comprehensively with the subject and includes a tabulation of current LLC address assignments for both individual and group address values. Private and proprietary protocols do not qualify for inclusion within ISO/IEC TR 11802-1 but, within the LAN environment, the use of SNAP encoding is recognised and it is described within an Annex to that Technical Report.

In the case of the Network Layer protocols operating in the environment above the LLC sublayer, complete protocol identification may require the application of ISO/IEC TR 9577 which comprehensively deals with the subject of protocol identification in the Network Layer.

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8 Internetworking

8.1 Transparent Bridging

ISO/IEC 10038 describes and defines the mechanisms whereby 8802 LANs of all type may be connected together with MAC bridges. Each LAN has its own independent MAC, however the use of bridges allows the interconnection of end systems attached to separate LANs as if they were attached to a single LAN.

A bridge operates below the MAC Service boundary and is transparent to protocols operating above this boundary. A bridge is not directly addressed by communicating end systems, except by an end system for the purposes of management. Within the LAN environment frames transmitted between end systems carry the MAC address of the peer-end system in their Destination address field, not the MAC address of the bridge.

The operation of a bridge is dependent upon the existence and operation of an internal sublayer service provided by each MAC entity to the central MAC relay entity within the bridge. The bridge will observe the appropriate MAC procedures and protocol for each LAN to which it is connected. A mapping of the internal sublayer service to the specific MAC procedures of each of the 8802 MAC types and the FDDI MAC type is defined.

A bridge has three principle elements of operation; the ability to relay and filter frames, the maintenance of information required to make frame filtering and relaying decisions and the provision of management of the above.

ISO/IEC 11802-5 describes the problems of interoperability between end systems that exist in mixed environments that include Ethernet V2.0 in addition to ISO/IEC 8802-3 conformant end systems and any other OSI-based LAN technology, and in addition provides the accepted solution.

ISO/IEC 15802-5 describes the operation of the Remote MAC bridge. The Remote MAC bridge is defined to interconnect a locally bridged local area network and the non-LAN communications equipment of one or more remotely bridged local area networks. In addition it provides MAC sublayer interworking between end stations attached to any of the LANs within this configuration.

8.2 Source Routing

A source routing bridge will build routes for end system communication and then route frames accordingly. The acquisition and discovery of routes involve communication processes in end systems and this marks the major distinction between transparent bridging and source routing. Source routing brings the benefit of a richer and more arbitrary active network topology when compared against the spanning tree of transparent bridging, with its single active route between any pair of LANs.

8.3 Source Routing Transparent Architecture

The source routing transparent bridge (SRT) architecture has been developed (ISO/IEC 10038 and ISO/IEC 8802-2/DAM 5[3)], *Bridged LAN source routeing operation by end systems*) to connect multiple network segments into a single bridged network. SRT bridging allows a source to specify the path (the bridged route) that a frame will take through the bridged network. Additionally this architecture allows end systems that need and use source routing, and those that do not, to coexist, interoperate and communicate on the bridged LAN.

A source-routing-transparent bridge is a MAC bridge which performs source routing when provided with routing information in the received frame and performs transparent bridging when no routing information is available in the frame.

9 System Load Protocol

ISO/IEC 15802-4 describes the services and procedures necessary remotely to load equipment within the LAN environment where that equipment is minimally configured. These procedures make use of LLC Type 1 operations

3) Unpublished Draft Amendment (incorporated in 1994 edition of ISO/IEC 8802-2).

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