

INTERNATIONAL STANDARD

ISO/IEC
9314-6

First edition
1998-08

Information technology – Fibre distributed data interface (FDDI) –

Part 6: Station Management (SMT)

© ISO/IEC 1998

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

ISO/IEC Copyright Office • Case postale 56 • CH-1211 Genève 20 • Switzerland



PRICE CODE **XC**

For price, see current catalogue

CONTENTS

	Page
FOREWORD	v
INTRODUCTION	vi
Clause	
1 Scope.....	1
2 Normative references	2
3 Definitions	2
4 Conventions and abbreviations	4
4.1 Conventions	4
4.1.1 State machines.....	5
4.1.2 Default and initial values	5
4.2 Abbreviations.....	6
5 General description.....	7
5.1 Definition of an FDDI node	7
5.2 Definition of an FDDI network	9
5.2.1 Physical topology	10
5.2.2 Logical topology	11
5.2.3 Physical media topology.....	11
5.2.4 FDDI connection rules.....	12
5.3 Overview of SMT functions	13
6 Services	13
6.1 SMT-to-MAC services	14
6.1.1 SM_MA_INITIALIZE_PROTOCOL.request	14
6.1.2 SM_MA_INITIALIZE_PROTOCOL.confirmation	15
6.1.3 SM_MA_CONTROL.request	15
6.1.4 SM_MA_STATUS.indication	16
6.1.5 SM_MA_UNITDATA.request	17
6.1.6 SM_MA_UNITDATA.indication	18
6.1.7 SM_MA_UNITDATA_STATUS.indication	19
6.1.8 SM_MA_TOKEN.request	19
6.2 SMT-to-PHY services.....	20
6.2.1 SM_PH_LINE-STATE.request	20
6.2.2 SM_PH_STATUS.indication.....	21
6.2.3 SM_PH_CONTROL.request	21
6.3 SMT-to-PMD services	22
6.3.1 SM_PM_CONTROL.request	22
6.3.2 SM_PM_BYPASS.request	22
6.3.3 SM_PM_SIGNAL.indication	23
6.4 SMT services to systems management	23
6.4.1 Overview of SMT management services	23
6.4.2 SMT-Management agent process local service primitives	24
6.4.3 Management information base (MIB) structure	24
6.4.4 Integrity of MIB state	25
6.4.5 Management information definitions	26
6.4.5.1 MIB summary.....	26
6.4.5.2 Managed object class templates.....	30
6.4.5.3 Attribute group templates	41
6.4.5.4 Attribute templates	44
6.4.5.5 Action templates	63
6.4.5.6 Notification templates.....	64
6.4.5.7 ASN.1 definitions	67
6.4.5.8 Name binding.....	78

7	Facilities.....	80
7.1	SMT frame format	80
7.1.1	SMT frame contents	80
7.1.2	SMT header.....	80
7.1.3	SMT InfoField	82
7.1.4	SMT encoding rules	83
7.1.5	Byte ordering in multibyte fields	85
7.1.6	Addressing	85
7.1.7	Frame validity	85
7.2	SMT frames.....	85
7.2.1	Neighbour Information Frame (NIF)	86
7.2.2	Status Information Frames (SIF).....	87
7.2.3	ECHO Frame (ECF)	88
7.2.4	Resource Allocation Frame (RAF) OPTIONAL	89
7.2.5	Request Denied Frame (RDF)	91
7.2.6	Extended Service Frame (ESF) OPTIONAL	91
7.2.7	Status Report Frame (SRF)	92
7.2.8	Parameter Management Frames (PMF)	92
7.3	SMT_Parameters	94
7.3.1	General parameters	94
8	Frame-based management protocols	102
8.1	Frame processing	102
8.1.1	Request–response protocols	102
8.1.2	Announcement protocols	103
8.1.3	SMT header processing.....	103
8.2	Neighbour Notification	104
8.2.1	Neighbour information polling.....	104
8.2.2	Facilities	104
8.2.3	Neighbour Notification transmitter operation	106
8.2.4	Neighbour Notification receiver operation	109
8.3	Status Report protocol.....	109
8.3.1	Overview	109
8.3.2	Facilities	111
8.3.3	Status Report transmitter operation	114
8.4	Parameter Management protocol.....	118
8.4.1	Overview	118
8.4.2	Operation.....	118
8.5	Station Status polling.....	121
8.5.1	Overview	121
8.5.2	Operation.....	121
8.6	Echo protocol	122
8.6.1	Overview	122
8.6.2	Operation.....	122
8.7	Synchronous Bandwidth Allocation.....	122
8.7.1	Overview	122
8.7.2	Operation.....	122
8.7.3	Synchronous bandwidth management process	125
8.8	Extended Service protocol OPTIONAL	126
9	Connection Management.....	126
9.1	Overview	126
9.2	Organization	127
9.3	Connection Management structure	127
9.4	Facilities	127
9.4.1	Variables	127
9.4.2	Signals.....	130
9.4.3	Flags.....	131
9.4.4	Timers	133
9.4.5	Line states	138
9.4.6	Link Confidence Test (LCT)	139

9.4.7	Link Error Monitor (LEM)	140
9.4.8	Path Test	142
9.4.9	Trace function	142
9.5	Entity Coordination Management (ECM)	143
9.5.1	ECM functional description	143
9.5.2	Detailed ECM description	143
9.6	Physical Connection Management (PCM)	147
9.6.1	PCM functional description	147
9.6.2	Detailed PCM description	151
9.6.3	PCM signalling	154
9.7	Configuration Management (CFM)	157
9.7.1	CFM functional description	157
9.7.2	Paths	157
9.7.3	Configuration Control Element (CCE)	165
9.7.4	Station and concentrator structure	166
9.7.5	Configuration element considerations	166
9.7.6	Detailed Configuration Management (CFM) description for Ports	170
9.7.7	Detailed Configuration Management (CFM) description for MACs	177
10	Ring Management	179
10.1	Concepts	179
10.2	Facilities	180
10.2.1	Flags	180
10.2.2	Timer	180
10.3	Operation	183
10.3.1	Overview	183
10.3.2	Detailed description	185

Tables

Table 1 – Summary of SMT frames	81
Table 2 – Station topology matrix	97

Figures

Figure 1 – Example Single Attachment Station (SAS)	8
Figure 2 – Example Dual Attachment Station (DAS)	9
Figure 3 – Example Dual Attachment Concentrator (DAC)	10
Figure 4 – Ring of trees topology	11
Figure 5 – SMT management model	24
Figure 6 – FDDI naming tree	79
Figure 7 – Neighbour Notification transmitter state diagram	108
Figure 8 – Status Report transmitter state diagram	116
Figure 9 – Connection Management structure	128
Figure 10 – Entity Coordination Management (ECM) state diagram	144
Figure 11 – Physical Connection Management (PCM) state diagram	148
Figure 12 – Configuration Control Element (CCE) interfaces	167
Figure 13 – DAS configuration examples	168
Figure 14 – Port Configuration Management (CFM)	172
Figure 15 – MAC Configuration Management (CFM)	178
Figure 16 – Ring Management (RMT) state diagram	188

Annex A (informative) Addressing	190
--	-----

FOREWORD

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

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 9314-6 was prepared by Joint Technical Committee ISO/IEC JTC 1 *Information technology*, Subcommittee SC 25, *Interconnection of information technology equipment*.

ISO/IEC 9314 consists of the following parts, under the general title *Information technology – Fibre Distributed Data Interface (FDDI)*:

- *Part 1: Token Ring Physical Layer Protocol (PHY) (1989)*
- *Part 2: Token Ring Media Access Control (MAC) (1989)*
- *Part 3: Physical Layer Medium Dependent (PMD) (1990)*
- *Part 4: Single Mode Fibre Physical Layer Medium Dependent (SMF-PMD) ¹⁾*
- *Part 5: Hybrid Ring Control (HRC) (1995)*
- *Part 6: Station Management (SMT)*
- *Part 7: Physical Layer Protocol (PHY-2)*
- *Part 8: Media Access Control-2 (MAC-2)*
- *Part 9: Low-Cost Fibre – Physical Medium Dependent (LCF-PMD) (under consideration)*
- *Part 10: Token Ring Twisted Pair Physical layer Medium Dependent (TP-PMD) (under consideration)*
- *Part 13: Conformance Test Protocol Implementation Conformance Statement Proforma (CT-PICS)*
- *Part 20: Physical Medium Dependent Conformance Testing (PMD-ATS) (under consideration)*
- *Part 21: Physical Layer Protocol Conformance Testing (PHY-ATS) (under consideration)*
- *Part 25: Abstract Test Suite for FDDI – Station Management Conformance Testing (SMT-ATS)*
- *Part 26: Media Access Control Conformance Testing (MAC-ATS) (under consideration)*

¹⁾ To be published.

INTRODUCTION

The Fibre Distributed Data Interface (FDDI), ISO/IEC 9314, is intended for use in a high-performance general purpose multi-node network and is designed for efficient operation with a peak data rate of 100 Mbit/s. It uses a Token Ring architecture with optical fibre as the transmission medium. FDDI provides for hundreds of nodes operating over an extent of tens of kilometres.

Station Management (SMT) specifies the local portion of the system management application process for FDDI, including the control required for proper operation of a node in an FDDI ring. SMT provides services such as connection management, station insertion and removal, station initialization, configuration management, fault isolation and recovery, communications protocol for external authority, scheduling policies, and collection of statistics.

When the set of basic FDDI standards, ISO/IEC 9314, is completed it will include the following standards:

- a) A Media Access Control (MAC), which specifies the lower sublayer of the Data Link Layer of ISO/IEC 9314,
- b) A Physical Layer Media Dependent (PMD), which specifies the lower sublayer of the Physical Layer of ISO/IEC 9314,
- c) A Physical Layer Protocol (PHY), which specifies the upper sublayer of the Physical Layer of ISO/IEC 9314.

A number of extensions to ISO/IEC 9314 are completed or in process. One extension, ISO/IEC 9314-5, for Hybrid Ring Control (HRC), commonly known as FDDI-II, extends the capability of FDDI to handle isochronous data streams at a multiplicity of data rates. Another extension, ISO/IEC 9314-4, provides for a single-mode optical fibre version of PMD (SMF-PMD) and will permit optical links of up to 60 km.

Other extensions, addressing alternate PMDs, will provide low-cost attachments for use in concentrator-to-workstation environments.

This part of ISO/IEC 9314 for SMT represents the final standard in the set of basic FDDI standards. SMT is a sophisticated document specifying many critical aspects of interoperability in a multi-vendor FDDI network and, as such, has proved to be by far the most difficult of the set of FDDI standards to complete. The successful completion of the work on SMT is the result of a high degree of cooperation between competing manufacturers of FDDI equipment.

INFORMATION TECHNOLOGY — FIBRE DISTRIBUTED DATA INTERFACE (FDDI) —

Part 6: Station Management (SMT)

1 Scope

This part of ISO/IEC 9314 specifies the Station Management (SMT) for the Fibre Distributed Data Interface (FDDI).

FDDI provides a high bandwidth (100 megabits per second) general purpose interconnection among computers and peripheral equipment using optical fibre as the transmission medium in a ring configuration. FDDI can be configured to support a sustained transfer rate of approximately 80 megabits (10 megabytes) per second. The use of dual attachment stations with dual MACs allows these rates to be doubled under the circumstance of a fault-free FDDI ring.

FDDI establishes the connection among many stations (nodes) distributed over distances of several kilometres in extent. Default values for FDDI were calculated on the basis of 1 000 physical connections and a total fibre path length of 200 km.

The FDDI consists of

- a) A Physical Layer (PL), which provides the medium, connectors, optical bypassing, and driver/receiver requirements. PL also defines encode/decode and clock requirements as required for framing the data for transmission on the medium or to the higher layers of the FDDI. For the purposes of this part of ISO/IEC 9314, references to the PL are made in terms of the Physical Layer protocol (PHY) and the Physical Layer Media Dependent (PMD) entities which are the upper and lower sublayers of PL, respectively.
- b) A Data Link Layer (DLL) which controls the accessing of the medium and the generation and verification of frame check sequences to assure the proper delivery of valid data to the higher layers. DLL also concerns itself with the generation and recognition of device addresses and the peer-to-peer associations within the FDDI network. For the purposes of this part of ISO/IEC 9314, references to the DLL are made in terms of the Media Access Control (MAC) entity which is the lowest sublayer of DLL.
- c) A Station Management (SMT) standard, this part of ISO/IEC 9314, which provides the control necessary at the station (node) level to manage the processes underway in the various FDDI layers such that a station may work cooperatively as a part of an FDDI network. SMT shall provide services such as connection management, station insertion and removal, station initialization, configuration management, fault isolation and recovery, communications protocol for external authority, scheduling policies, and collection of statistics.

The definition of SMT as contained herein includes the set of services that it provides for, and receives from, the other entities that are contained within a node. Within SMT resides both knowledge of the uniqueness of this node and the current network structure to the extent that this node's function is affected.

The set of International Standards for FDDI, ISO/IEC 9314, specifies the interfaces, functions and operations necessary to insure interoperability between conforming FDDI implementations. This part of ISO/IEC 9314 is a functional description. Conforming implementations may employ any design technique which does not violate interoperability.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 9314. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO/IEC 9314 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 7498-4(1989) *Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 4: Management framework*

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 TR3 8802-1(1997) *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 1: Overview of Local Area Network Standards*

ISO/IEC 8824: 1990, *Information technology – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN.1)*

ISO 8825: 1990, *Information technology – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)*

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