



AEROSPACE INFORMATION REPORT

AIR6004™

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Optical Networking Terminology

RATIONALE

The aerospace industry requires precise standards for avionics system design. To ensure that the aerospace fiber optics industry also adopts these same high standards, it is essential that a common set of fiber optic system procedures be established. This document provides reference for common technical terms in support of the procedures.

1. INTRODUCTION

This document is a glossary of terms about optical networking. The purpose is to introduce terms and their definitions which may be used consistently across the industry. In specific this document establishes terminology for use in connection with SAE activities specific to optical networking.

2. REFERENCES

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of the other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

- | | |
|---------|--|
| AIR6005 | General Requirements for Wavelength Division Multiplexed (WDM) Backbone Networks. |
| AIR6006 | Modeling and Simulation Capabilities for Aerospace WDM LAN Applications. |
| AS5603 | Digital Fiber Optic Loss Budget Methodology for Aerospace Platforms |
| AIR5667 | Fiber Optic Wavelength Division Multiplexed (WDM) Single Mode Interconnect and Component Standards Mapping for Aerospace Applications – Device Level Specification |

2.2 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI / TIA-440-B-2004 Fiber Optic Terminology

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3. TERM DEFINITIONS

AVIONICS FULL DUPLEX SWITCHED ETHERNET (AFDX) - AFDX is a deterministic protocol for real time application on Ethernet media, and is intended for aircraft flight critical interfaces such as engines, flight controls, and navigation systems. AFDX is also known as ARINC 664 Part 7. AFDX is a trademark of Airbus S.A.S.

AGGREGATION - multiplexing of signals from their associated sources into a composite signal.

AIRCRAFT NETWORK ELEMENT (ANE) - the ANE is comprised of the Client Adaptation Element (CAE) and the Optical Network Element (ONE). The ANE functions between the Client Access Interface (CAI), which connects to client applications, and the Backbone Network Interface (BNI) which connects to other BNIs.

AMPLIFIED SPONTANEOUS EMISSION (ASE) - spurious in-band optical noise emitted from doped optical amplifiers.

ARCHITECTURE - the design, physical, functional structure, and interfaces of a network.

AIRBORNE ANTI SUBMARINE WARFARE / INTELLIGENCE, SURVEILLANCE and RECONNAISSANCE (ASW / ISR) – gathering, processing and use of information for detection, location, tracking, and remediation of enemy submarines. This is a key area of defense which involves naval platforms.

BACKBONE NETWORK INTERFACE (BNI) - an interface that is a component part of an Optical Network Element (ONE) which interfaces with another ONE within the Optical Backbone Network (OBN). The connection between adjacent ONES is typically an Optical Fiber Interconnect (OFI). A BNI can be a unidirectional multi-wavelength interface (typically) or a bidirectional multi-wavelength interface.

BANDWIDTH - information carrying capacity of a system. Bandwidth can also refer to the highest analog frequency that can be transmitted by a system.

BIT ERROR RATIO (BER) - fraction of incorrectly transmitted bits.

BROADCAST - a type of transmitted signal from one source or network element to all destinations or all other network elements.

BUILT-IN-TEST (BIT) - part of a health monitoring approach where diagnostics are performed during system operation.

BUS ARCHITECTURE - a network topology in which all elements are connected to a common medium which has two end points.

CABLE PLANT - the physical part of a network or system consisting of the aggregate of Optical Fiber Interconnects (OFIs), which is the cabling and interconnections (connectors, splices). This part of the network is the most difficult to replace because it is installed within the mechanical structure, i.e. the airframe.

CLIENT ADAPTATION ELEMENT (CAE) - the CAE is the part of the WDM LAN between the Client Access Interface (CAI) and the Network Access Interface (NAI). The CAE contains all of the processes which convert client information into digital form, aggregate them with other client signals as necessary, and convert them into optical channel signals ready for transport.

CLIENT ACCES INTERFACE (CAI) - client signals access the WDM LAN through the CAI. The client signals are electrical and are typically in the form of an aerospace protocol such as MIL-STD-1553, MIL-STD-1760, ARINC 429, ARINC 629, ACSB, Fibre Channel, Ethernet, ITU OTN, IEEE 1394, etc. The physical form of the CAI is an electrical connector that is compatible with transport of the client signal.

COARSE WAVELENGTH DIVISION MULTIPLEXING (CWDM) - multi-channel spectrum used for WDM using minimum 20 nm spaced channels between 1310 nm and 1610 nm. The wide channel spacing of the CWDM spectrum is amenable for using low cost components.

CONTROL PLANE DATA COMMUNICATIONS NETWORK (CPDCN) - a control network that connects all Optical Network Elements (ONEs) using standard interfaces. Network Management and Control (NM & C) at level four requires the use of a CPDCN. A CPDCN may be included within a Network Management Data Communications Network (NMDCN).

CROSS PHASE MODULATION (XPM) - distortion in the phase of an optical signal due to the aggregate effects of all signals upon the refractive index of the transmission medium.

DEMULTIPLEXER - a component which splits (demultiplexes) a multi-channel signal into its components, usually versus wavelength or channel.

DENSE WAVELENGTH DIVISION MULTIPLEXING (DWDM) - refers to a multiplexing technique that uses a spectrum of tightly spaced channels, according to the ITU Grid at 100 GHz (0.8 nm) intervals or less, to combine signals in WDM networks. The tight spacing of the DWDM spectrum is amenable for use of erbium doped optical fiber amplifiers, which can cover the C-band (1525-1565 nm) or L-band (1570 -1610 nm).

ELECTRICAL TO OPTICAL CONVERSION (EO Conversion) - conversion of an electrical signal to an optical signal. For example, EO conversion can be performed by a light emitting diode (LED) or a laser diode. The converse is Optical to Electrical Conversion, or OE Conversion, which can be performed by a photodetector.

ELECTRICAL SIGNAL ADAPTATION LAYER (ESAL) - client signals which cross the Client Access Interface (CAI) are processed by the ESAL. The ESAL contains the hardware and software functions that prepare the client signal for further processing within the WDM LAN.

ELEMENT MANAGEMENT SYSTEM (EMS) - a system that provides network element management functions within a single Optical Network Element (ONE) or a group of ONEs. An EMS may be proprietary as part of an ONE design, but must use standard interfaces to the Network Management System (NMS).

ETHERNET - a widely used network concept based on computers communicating over electrical cable or optical fiber. The Ethernet is a widely used data communications protocol defined by the IEEE 802.3 standard series. This series of standards has been consistently upgraded from 1 Mb/s to 10 Gb/s to facilitate the evolution of transmission rates.

FAULT, CONFIGURATION, ADMINISTRATION, PERFORMANCE, and SECURITY (FCAPS) - part of the Open Systems Interconnect (OSI) model that ISO uses to describe the standard basic tasks of network management. FCAPS is defined in ISO 10040.

FIBER CROSS CONNECT (FCC) - a type of optical cross connect in which the ports are fibers. This type of cross connect is transparent; by connecting an "input" fiber port to an "output" fiber port the FCC enables transmission of multiple wavelengths and protocols.

FIBER OPTIC TRANSMITTER - an active component which sources or originates modulated optical signals. The transmitter input is electronic and the output is optical; hence a transmitter contains an EO conversion.

FIBER OPTIC RECEIVER - an active component which receives an optical signal. The receiver input is optical and the output is electronic; hence a receiver contains an OE conversion.

FIBER OPTIC COUPLER - a general passive component which splits or combines optical signals. Types of optical couplers are:

- Bandsplitter.
- Combiner.
- WDM.
- Interleaver.
- Splitter.
- Tap.