

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HUMAN SERVICES
INFORMATION TECHNOLOGY STANDARD

Name Of Standard: Fiber Optic Data Communications	Number: STD-ENSS009
Domain: Network	Category: Physical Media & Mechanisms / Fiber Optics
Date Issued: 05/09/2001	Issued By Direction Of: 
Date Revised: 03/08/2016	Clifton Van Scyoc, Chief Technology Officer

Abstract:

Fiber Optics emerged as a cost effective medium for voice and data communications as a result of the research performed by Bell Laboratories and Corning Glass in the late 1960's. Today, Fiber Optics is the preeminent technology used in long-haul communication systems as well as Wide Area Networking (WAN) and Metropolitan Area Networking (MAN). In many cases, it has also been deployed in Local Area Networking (LAN) environments because of its many benefits.

General:

Technology

The physics of Fiber Optic transmission is beyond the scope of this document, however, the basic technology is conceptually quite simple. Electrical impulses from a voice or data communication device are converted into equivalent pulses of light and are then "pumped" into the end of an extremely thin strand of high quality glass (the fiber). The pulses of light then reflect in an angular fashion through the length of the fiber strand until it reaches its destination point. The pulses of light are then converted back into electrical signals which drive the receiving voice or data device.

The benefits of optical fiber are many. Probably the most important one at DHS is that optical transmission has a very low signal loss, thus allowing the networking of facilities at much greater distances than when using copper cable. Another advantage is its immunity to electromagnetic and radio frequency interference (EMI/RFI). Still another benefit is that optical cable can transmit a much higher amount of information than copper wire, thus providing more bandwidth per connection.

Optical Fiber

There are actually *three* types of optical fiber, only two of which are certified for use at DHS. These include *Multimode glass*, *Single mode glass*, and *plastic*.

Plastic fiber is still in the experimental stage, and as such is not yet suitable for use in a production environment.

- *Multimode*

Multimode strands have a relatively high core diameter, 50-100 microns. This allows for multiple patterns of transmission through the fiber core, hence the term "Multi". Multimode fiber is "fired" with a Light Emitting Diode (LED). It is less expensive than single mode but has a limited range of 550 meters or 1,800 feet.

- *Singlemode*

Singlemode strands have a core diameter ranging from only 8.3 – 9.5 microns. This limits the transmission pattern to only one path, hence the description "Single". While Singlemode fiber can be fired with an LED, maximum performance is achieved by using a Laser light source. It is more expensive than Multimode, but has a range of 10 kilometers (6 miles) and higher bandwidth capabilities.

Standard:

Requirements for optical fiber cabling systems (cable and connectors)

Fiber optic cabling systems deployed at DHS shall be compliant with Industry Standard ***TIA/EIA-568-B.3***. This standard specifies maximum distance and signal loss parameters for fiber optic cable and proper termination techniques for optical fiber connectors.

Fiber optic connectors come in a variety of styles and sizes. Their most basic classification is that the connector housing is either *cylindrical* or *rectangular*. "ST" is the designator for a cylindrical body (Twist) and "SC" is the designator for a rectangular housing (Click). If the input and output strands are incorporated into the same housing, the connector is said to be "*Duplex*".

Square and round connectors can be interchanged at will; however, care should be taken that the end-to-end termination characteristics are the same. Most installations at DHS involve a cylindrical termination from the fiber tray to a rectangular connector at the end point (switch, router, etc.).

Standardized Protocols

The Department of Human Services (DHS) employs standardized protocols for the fiber optic cable on its network.

DHS uses Asynchronous Transfer Mode (ATM) for the metropolitan area network (MAN) protocol on the DHS network. A common high bandwidth (100 Mbps) fiber backbone interconnects most sites.

The Wide Area Network (WAN) protocol used by the network utilizes a T1 interface that provides a single, high-speed connection to each of DHS's networked facilities.

Glossary of Terms

The definitions in this section can be found in the *Microsoft Press Computer Dictionary, Third Edition*.

T1

T-1 n. A T-carrier that can handle 1.544 Mbps or 24 voice channels. Although originally designed by AT&T to carry voice calls, this high-bandwidth telephone line can also transmit text and images. T1 lines are commonly used by larger organizations for Internet connectivity.

Asynchronous Transfer Mode (ATM)

A network technology capable of transmitting data, voice, video, and frame relay traffic in real time. Data, including frame relay data, is broken into packets containing 53 bytes each, which are switched between any two nodes in the system at rates ranging from 1.5 Mbps to 622 Mbps. ATM is defined in the broadband ISDN protocol at the levels corresponding to levels 1 and 2 of the ISO/OSI model. It is currently used in local area networks involving workstations and personal computers, but it is expected to be adopted by the telephone companies, which will be able to charge customers for the data they transmit rather than for their connect time.

Frame Relay

A packet-switching protocol for use on wide area networks. Frame relay transmits variable-length packets at up to 1.544 Mbps. It is a variant of X.25 but dispenses with some of X.25's error detection for the sake of speed.

Exemptions from this Standard:

There will be no exemptions to this standard.

Refresh Schedule:

All standards and referenced documentation identified in this standard will be subject to review and possible revision annually or upon request by the DHS Information Technology Standards Team.

Standard Revision Log:

Change Date	Version	Change Description	Author and Organization
05/09/2001	1.0	Initial Creation	Deloitte Consulting
08/14/2002	1.1	Edited for style.	Beverly Shultz
12/30/2004	1.2	Updated to remove FDDI add T1	Jim Smith
02/10/2005	1.2	Reviewed content – No changes	Doug Rutter, DTE
09/09/2005	2.0	Updated standard	Doug Rutter, DTE
12/10/2007	2.1	Updated and edited style	Doug Rutter, DTE
09/24/2010	2.1	Reviewed content – No changes	Doug Rutter
02/17/2011	2.1	Reviewed content – No changes	Doug Rutter
11/12/2013	2.1	Reviewed content – No changes	Matthew Messinger
3/20/15	2.2	Changed DPW references to DHS	Bob Gordon, BIS-DTE
03/08/2016	2.2	Reviewed content – No changes	Aamir Qureshi BIS-DTE