**COMMONWEALTH OF PENNSYLVANIA HEALTH & HUMAN SERVICES DELIVERY CENTER**

INFORMATION TECHNOLOGY STANDARD

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| Name of Standard: | Number: |
| **Fiber Optic Data Communications** | **STD-ENSS009** |
| Domain: | Category: |
| **Network** | **Physical Media & Mechanisms / Fiber Optics** |
| Date Issued: | Issued by Direction Of: |
| **05/09/2001** |  |
| Date Revised: |  |
| **07/28/2020** | **Jon Arnold, Chief Technology Officer** **Health & Human Services Delivery Center**  |

# Abstract:

The Health and Human Services Delivery Center (HHS DC) supports the Departments of Health (DOH), Human Services (DHS), Aging (PDA), Drug and Alcohol Programs (DDAP) and Military and Veterans Affairs (DMVA).

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 HHS DC is that optical transmission has a very low signal loss, thus allowing the networking of facilities at much greater distances then 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 threetypes of optical fiber, only two of which are certified for use at HHS DC. 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 HHS DC 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*”. “LC” connectors are in use in most HHS sites today. LC fiber head connectors are rectangular and have a smaller form factor than SC connectors.

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 HHS DC involve a cylindrical termination from the fiber tray to a rectangular connector at the end point (switch, router, etc.).

## Standardized Protocols

The Health & Human Services Delivery Center (HHS DC) employs standardized protocols for the fiber optic cable on its network.

HHS DC uses Ethernet circuits for the metropolitan area network (MAN) protocol on the HHS DC network. A common high bandwidth (1 Gbps) fiber backbone interconnects most MAN sites such as the Commonwealth Technology Center, Willow Oak Bldg and Rachel Carson Bldg.

The Wide Area Network (WAN) protocol used by the network utilizes an Ethernet circuit interface that provides a single, high-speed connection to each of HHS DC’s networked facilities, such as County Assistance Offices.

HHS DC uses Ethernet circuits for the metropolitan area network (MAN) connections among switches and routers on the HHS DC network. A common high bandwidth (10 to 1000 Mbps) fiber backbone interconnects most sites.

The Wide Area Network (WAN) protocol used by the network utilizes a Gigabit Ethernet interface that provides a single, high-speed connection to each of HHS DC’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.

### Ethernet Circuit

An Ethernet Circuit is high-speed (IEEE standard 802.3 Ethernet) carrier of 1Mbps to 10Gbps delivered as Ethernet over fiber, Ethernet over DS3, Ethernet over T1, or Ethernet over copper phone lines. Ethernet circuits are used by businesses to provide reliable, dedicated Ethernet connection for Internet access as well as other applications including email, file sharing, web hosting, data backup, video, or VPN access. Ethernet access is superior to cable or DSL Internet access because it offers higher Ethernet bandwidth speeds, lower equipment costs (Ethernet line handoff), and a Service Level Agreement with guarantees on Ethernet service, performance, uptime, and repair. An Ethernet Internet connection is available in 10Mbps Ethernet, 100Mbps Fast Ethernet, 1Gbps Gigabit Ethernet, or 10Gbps Gigabit Ethernet handoffs.

# 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 HHS Delivery Center Domain Leads.

# 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 |
| 07/20/2020 | 2.3 | Content changes, Organization Name Change | Bob Gordon, HHS Network |
| 07/28/2020 | 2.3 | Signature removed | M Koerber, HHS TSO |