



This course features 16 hours of classroom lecture with an experienced FTTH instructor. Students will gain a broad base of knowledge and familiarity with FTTH architecture, network design, deployment technology, and operational skills. The course is intended for network designers, network planners, supervisors, and project managers that will be involved in deploying and maintaining FTTH and FTTB networks.

Prerequisites: Knowledge of fiber optic theory and terminology

Certification and Credits: Fiber Broadband Association Certified Fiber to the Home Professional (CFHP)
Light Brigade Certificate of Completion

Chapter 1 — Applications

- Planning and design of the FTTH network
- Fiber optic transmission
- Today's applications
- Fiber to the home
- Fiber to the business/building
- Business needs
- Drivers behind FTTx
- The evolution of FTTx
- TPON (telephony PON)
- Fiber to the curb
- Cable television
- Radio frequency over glass

Chapter 2 — Bandwidth Issues

- The demand for bandwidth
- Technology in transition
- Analog to digital video
- SDTV and HDTV
- Multimedia convergence for the IP network
- Over the top video
- Next generation 3D HDTV
- IP video delivery
- Telecommuting
- Interactive technologies
- High bandwidth users
- Cloud computing and storage
- Cell towers
- Smart grid and energy management
- Future trends
- ODN capabilities
- User density
- Solutions

Chapter 3 — Economics

- Defining CAPEX and OPEX
- FTTH and FTTB CAPEX items
- Design impacts
- Who's implementing FTTH?
- Triple play network characteristics
- Cost comparisons
- Migration path considerations
- FTTH and FTTB OPEX items
- Power
- Network management systems
- Mean time between failure
- Maintenance issues
- Operations software
- Interface software
- Quality of service
- OPEX and CAPEX costs

Chapter 4 — Theory and Fibers

- The three big issues
- Attenuation
- Causes for intrinsic and extrinsic losses
- Dispersion
- Fresnel reflection
- Lightwave transmission
- Single-mode fiber characteristics
- Single-mode fiber with laser source
- Mode field diameter
- ITU-T G.652 single-mode optical fiber
- ITU-T G.652D single-mode optical fiber
- ITU-T G.657 single-mode optical fiber
- ITU-T G.655 single-mode optical fiber

Chapter 5 — FTTH Standards

- System standards
- TCP/IP
- MPEG – IPTV
- Active Ethernet
- Full service access network
- PON standards
- Broadband PON
- Dynamic bandwidth allocation
- Asynchronous transfer mode (ATM)
- Gigabit PON
- Ethernet PON
- RF video overlay
- DOCSIS
- Radio frequency over glass
- Next generation networks
- 10G-PON and XG-PON
- IEEE 802.3av 10GEPON
- NG-PON2
- 40 GbE and 100 GbE
- Telcordia generic requirements
- Physical layer standards
- ITU-T G.652, G.655, and G.657
- ITU-T G.671
- Outside plant standards
- North American codes
- Proper aerial route planning and engineering
- TIA-568 and TIA-569
- POLAN

Chapter 6 — Network Topologies

- The physical topologies
- Point-to-point topologies
- Star topology
- PON star configurations
- Reach extender
- Route redundancy
- Ring, mesh, and bus topologies

Chapter 7 — Network components

- Fiber optic active devices
- Erbium-doped fiber amplifiers
- Photodetectors
- OLTs and ONTs
- Fiber optic passive devices
- WDMs and PON systems
- Coarse, wide, and dense WDM
- Filters and gratings
- Diplexers, triplexers, and quadplexers
- Splitters
- Planar lightwave circuits
- Optical bands and windows
- Wavelength allocations

Chapter 8 — Cables

- FTTx distribution and drop cables
- Outside plant cables
- High fiber count cables
- Aerial fiber optic cables
- FTTx drop cables
- Indoor/outdoor cables
- FTTB/MDU premises installations
- Distribution cables
- Plenum, riser, and LSZH cables
- Fiber optic cable cordage
- Fiber and buffer color codes
- Cable handling
- FTTx installation disciplines

Chapter 9 — Cable Management

- Fiber optic interconnect hardware
- Outside plant cable management
- Patch panels
- Splice panels
- Optical entrance enclosures
- Distribution panels
- Fiber distribution hubs
- Pedestals
- Vaults and handholes
- Splice closures
- Multiport service terminals
- Fiber transition terminals
- FTTB panels
- Cabinets for active Ethernet
- Cable storage methods
- Hardened connector slack storage
- Panel and closure issues

Chapter 10 — Cable and Fiber Termination

- Managing termination costs
- Splicing for the FTTx system
- Traditional splice scenarios
- Drop cable splicing
- Extrinsic splice and connection attenuation
- Fusion and mechanical splicing
- Ribbon splicing technology
- Pigtail splicing
- Splice protection
- Main connector components
- Fiber optic connector polishes
- Common FTTx connectors
- Hardened connectors
- Small form factor LC connectors
- Multifiber connectors
- Field terminable FTTH connectors
- Fiber optic cleaning methods
- Attenuators and terminators

Chapter 11 — Splitter Placement

- FTTH planning
- Take rate
- Growth strategies for PON
- Migration strategy
- Splitter flexibility
- Cable management
- FTTH design engineering
- Fiber management
- Rural applications
- Slack storage
- MDUs and MTUs
- Outdoor splitter and hub location

Chapter 12 — Network Design

- Designing FTTx systems
- Selecting transmission protocol
- Proper route planning and engineering
- Active Ethernet P2P networks
- Growth strategies
- Migration
- FTTH PON design engineering
- FTTH outside plant design
- Splitter location
- FTTH home run management
- FTTH centralized splitter management
- FTTH distributed topology
- Sales and construction planning
- Project chronology
- Writing OSP specifications
- Fiber management specifications
- Fiber cable management
- Cable mid-entry planning
- Specifying termination options

Chapter 13 — Fiber to the Building

- High-rise MDU/MTU
- Medium-rise MDU/MTU
- Low-rise MDU/MTU
- Horizontal MDU/MTU
- FTTB systems and design goals
- FTTB MDU existing infrastructure
- Telecommunications rooms and closets
- Telecommunications enclosure
- Backbone hierarchical star topology
- FTTB MDU installation and termination
- Cable structure and fiber counts
- FTTB using POLAN
- End user locations
- Cabling solutions
- Optical network terminals and access points
- Aesthetics
- Termination techniques

Chapter 14 — Loss Budgets

- Impacts on signal quality
- Loss budgets for FTTP networks
- Fiber, splitter, and WDM specifications
- Active components
- Active Ethernet
- PON classes
- Class B+ and C+ specifications
- Differential optical path loss
- PON loss budgets
- “Not to exceed” charts
- EPON specifications
- G-PON specifications
- XG-PON specifications
- 10GEPON specifications
- RFoG loss budgets
- Tapered loss budgets
- Reach extension

Chapter 15 — Test Disciplines

- FTTH testing and troubleshooting
- Network tests and equipment
- Testing active Ethernet
- Testing PON systems
- Testing FTTH/PON
- Optical loss test sets
- PON power meters
- Optical loss testing
- Optical power measurements
- OTDR testing
- Splitter signatures
- Reflection testing
- Visual inspection
- Documentation
- Visual laser testing requirements
- Troubleshooting with a visual fault locator
- Troubleshooting PON and AE systems
- System test points
- System related problems
- Eye diagrams
- Service activation testing