PREPARING YOUR WORKFORCE FOR GIGABIT INTERNET

September 7, 2017
OUR MISSION

Providing technical leadership for the telecommunications industry and serving its members through excellence in professional development, standards, certification and information.
• Gigabit Internet

• Technologies Driving Gigabit

• How do we prepare the workforce?
Gigabit Internet

Industry activities and deployments around gigabit Internet
What is gigabit Internet?

- One gigabit per second (Gbps) is a 1,000 megabits per second (Mbps) connection – which is 10 times faster than the Internet connection that most American households have today!
- A Pew Research Center study released in May of 2017 estimated 18 percent of American households are “hyper-connected”, meaning they have 10 or more connected devices.
  - 39 percent of households, the study found, contain at least one streaming media device.
- 1 Gbps+ is available over Wi-Fi and MoCA.
- 1 and 10 Gbps options are available in DOCSIS 3.1, SCTE·ISBE RFoG and PONs.
- 40 and 100 Gbps PON options are being tested!
AT&T - Pricing for AT&T’s GigaPower service starts at $70 per month for 1 Gbps speeds. 38 additional cities coming soon. 8/17 5G hits blistering 10 Gbps in lab tests.

TDS Telecom fiber take rates are exceeding expectations in the 28 markets where the company has deployed fiber to support broadband service at rates up to 1 Gbps.

Chattanooga is the first city in the Western Hemisphere to offer 10 Gbps fiber Internet service to all residents and businesses.

LightSpeed has a mission of connecting you to the Internet with insanely fast Gigabit speeds at affordable prices, Lansing, Michigan.

NATCO Communications is now offering FTTH technology in Bull Shoals and Diamond City, Arkansas.

Verizon finally jumps into the $70 a-month 1 Gbps fiber broadband game. 4/17

Google Fiber makes expansion plans for $60 wireless gigabit service. 2/17
What's the current situation?

- MSOs under strong pressure to deploy new technologies
- Driven by strong competition (FTTH, E/GPON, VDSL2 Vectoring, etc.) → get more spectral efficiency out of the existing coaxial network
- Rapid deployment of DOCSIS 3.1 and Fiber in the US-market, PNM is a big part of this new standard
- DOCSIS 3.1 is fundamentally different to earlier versions of DOCSIS → adding a new PHY-layer
- Fiber Deep, Remote PHY and wireless in the access networks are different than traditional HFC
- Engineers and technicians need to get trained on these new standards ... FAST!
- Demand for solid training by MSOs, MSOs are leveraging SCTE-ISBE boot camp series.
What’s the current situation?

Dial-Up

- DOCSIS 1.0 – 2.0
- DOCSIS 3.0
- DOCSIS 3.1/FTTx

Maximum speeds today

- 10 Gbps
- 5 Gbps
- 1 Gbps
- 400 Gbps

Next Gen

- 100 Gbps
- 200 Gbps
- 2022
- 2026
- 2030
What are the operators doing?

MIMO Trial Yields Up to 5x Wi-Fi Bandwidth Boost!

General Manager Jack Capparell said the company offers residential customers speeds up to 330 megabits per second. In addition, he said, Service Electric has been testing the DOCSIS 3.1 platform since January, so the company could roll out faster internet speeds when the Lehigh Valley market demands it.
What are the operators doing?

Madison's **Fiber To The Home (FTTH)** service has started and will continue to progress to 1 Gbps.

WOW is using the “Gigtopia” brand for its new, speedier offering, and has launched a website where customers can register to be alerted when 1-Gig becomes available to them delivered over **DOCSIS 3.1**.

CableOne offering GigaONE, initially powered by **DOCSIS 3.0**, the platform that fellow mid-sized MSOs, Suddenlink Communications and Mediacom Communications, used for their respective 1-Gig residential services.
What are the operators doing?

Using the **DOCSIS 3.1** platform, to roll out a 1-gigabit service to many of its markets.

Mediacom was the first major U.S. cable company to fully transition to the **DOCSIS 3.1** “Gigasphere” platform, the latest generation of broadband technology.

**Expanded availability of its ultra-fast 1 gigabit per second High-Speed Internet service to homes in the Hawai‘i Island’s, using **Fiber-to-the-Premise (FTTP)** technology.**
Technologies
DOCSIS 3.0 Bonding, DOCSIS 3.1, Remote PHY, Fiber Deep / FTTx, Wi-Fi and MoCA
• DOCSIS 3.0 is fundamentally different, provides bonding of channels to achieve greater speeds than earlier versions of DOCSIS

• DOCSIS 3.0 leverages a new version of IP called IPv6, SCTE·ISBE delivered IPv6 training to the leading MSOs deploying IPv6 like Comcast, Cox, etc.

• SCTE·ISBE DOCSIS Engineering Professional Program boot camp and certification delivered to the team a Suddenlink to deploy ‘GigaSpeed’ program
  • Altice expands Suddenlink’s ‘GigaSpeed’
• Cable engineers often very experienced on what they do (DOCSIS 1.1, 2.0, 3.0).

• DOCSIS 3.1 is fundamentally different, not comparable to differences between earlier versions of DOCSIS.

• DOCSIS 3.1 poses challenges to even the most experienced engineers at first.

• Demand for a specially tailored training approach to get engineers and techs up to speed on the new standard to be able to apply it.

• SCTE·ISBE DOCSIS 3.1 Boot Camp.

• Need for training best emphasized by giving a quick outline of DOCSIS 3.1 features.
Major Updates in DOCSIS 3.1

1. Higher Orders of Modulation & Multiple Modulation Profiles (MMP)

2. Better and more efficient Forward Error Correction called Low Density Parity Check (LDPC)

3. Wider Channels, 96 MHz and 192 MHz

4. Network Expansion in Frequency to 1.7 GHz

5. Orthogonal Frequency Division Multiplexing (OFDM) / Orthogonal Frequency Division Multiple Access (OFDMA)

6. Adaptive Bit-Loading (feature of OFDM to change modulations)

7. Integrated Proactive Network Maintenance

8. Energy Management at MAC Layer
Remote PHY

- Remote PHY is a distributed access architecture (DAA) approach shifting physical layer dense equipment into the access network requiring engineering changes to the access network.

- Remote PHY is fundamentally different, not comparable to differences between earlier versions of HFC.

- Trials of remote PHY gear taking place in both North America and Europe.

- Demand for a specially tailored training approach to get engineers and technicians up to speed on the new standard to be able to apply it.

- Remote PHY will increase network capacity without increasing headend/hub space and power requirements.

- SCTE·ISBE CableTec Expo Remote PHY Seminar October 17th.
• Engineers and Technicians are not experienced with new ODN and Fiber Deep Architectures and frequencies.

• PONs like GPON and EPON initialize and provision different than DOCSIS.

• Traditional coax technicians lack proper knowledge for deploying, verifying and testing fiber optics.

• SCTE·ISBE Fiber Deep/FTTx Boot Camp and FTTx/FTTP Installation online.
### Fiber Deep / FTTx

- **Node + 0 / Mother Node Architecture**
- **Mid-Split RF Design**
- **Smaller coaxial plant without amplifiers and line extenders**

### Shared Media Standards

#### EPON (IEEE 802.3ah)
- 1 Gbps Symmetrical

#### 10G-EPON (IEEE 802.3av)
- Define Backward Compatibility with EPON
- 1 Gbit/s Symmetrical
- 10 Gbit/s down and 1 Gbps upstream
- 10 Gbit/s Symmetrical

#### NG-EPON (Next Generation EPON)
- Studies underway to increase capacity

#### IEEE Point-to-Point Standards
- 1 Gbit/s Optical Ethernet (IEEE802.3z)
- 10 Gbit/s Optical Ethernet (IEEE802.3ae)
- 40 Gbit/s Optical Ethernet (IEEE802.3ba)
- Scaling tools CWDM, DWDM, and AWG

### Radio Frequency over Glass (RFoG) SCTE 174 2010
- RFoG is a media conversion PON technology
- DOCSIS is the data technology
- Supports existing cable practices, systems
- Coexists with data/IP PON technologies e.g., EPON, GPON

### GPON (ITU-T G.984)
- 2.488 Gbps down and 1.244 Gbps upstream
- G.984.6 adds reach extension (up to 60 km)

#### XG-PON1 (ITU-T G.987)
- Not backward compatible with GPON
- WDM Coexistence (parallel networks)
- 10 Gbit/s down and 2.4 Gbit/s upstream

#### NG-PON2 (ITU-T G.989)
- Not backward compatible (GPON or XG-PON1)
- 2.4G x 2.4G, 10G x 2.4G, 10G x 10 Gbps
- Time and wavelength division multiplexed passive optical network (TWDM-PON)
- Defines use of 4 or 8 wavelengths

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*Source: M. Emmendorfer, “Comparing IEEE EPON & FSAN / ITU-T GPON Family of Technologies,” SCTE Cable-Tec Expo*

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• Technicians not experienced with new wireless carrier grade technologies (802.11ac, 802.11ad)
• Technician lack proper knowledge in RF operation and band coverage
• 802.11ac requires different operating metrics for MCS, S/N, RSSI, etc.
• SCTE·ISBE BWS Boot Camp
• SCTE·ISBE is a CWNP Partner!
  • CWTS/CWNA training
Major Updates in Wi-Fi

1. Higher Orders of Modulation
2. Improve modulation and coding schemes (MCS)
3. 5 GHz Spectrum and Channels
4. Channel Bonding up to 160 MHz
5. Antenna operation with MU-MIMO and beamforming
• Speeds up to 2.5 Gbps with MoCA v2.5 with new features like MoCA protected setup.

• SCTE·ISBE 235 developed allowing MoCA and DOCSIS 3.1 to operate simultaneously
  • We are working with the MoCA folks

• New SCTE·ISBE MoCA half day camp

• New SCTE·ISBE MoCA online course
THE NEXT BIG...

DEAL • CONNECTION • INNOVATION • TECHNOLOGY • LEADER • NETWORK

KEYNOTE SPEAKERS

Michael Fries
Chief Executive Officer,
Liberty Global

Tom Rutledge
Chairman &
Chief Executive Officer,
Charter
Communications

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Our online courses can be taken on your own schedule and at your own pace, without disrupting your day-to-day work schedule. Find out more today!

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Preparing the Industry’s Workforce for What’s next and Driving Business Results
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- MoCA
- Fiber
- Broadband Premises Installer for installers and/or engineers
- Wi-Fi

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VirtuLearn

The latest in adult learning to improve knowledge transfer, recall and on the job performance.
STEP 1: What is it and why is it important?
Select the link below to launch the introduction for the module. PDFs of the presentation are available in the Reference Materials block on the right side of the screen. Note that completion of the quizzes is not required in order to get a final grade for the course.

STEP 2: How does it work and why?
Select the link below to launch the training module. PDFs of the presentation are available in the Reference Materials block on the right side of the screen. Note that completion of the quizzes is not required in order to get a final grade for the course.

STEP 3: Try it out—in 3D!
Complete the module test to assess your knowledge. The test is open book so you can use your course materials, references, and the Internet but you should not consult other individuals. A passing score is 80%. You are not required to pass the test, but if you do not pass it you suggest you review the course materials before moving on to the next module or course final test.

STEP 4: Remember the architectures?
Please complete this brief evaluation of the module. Your feedback is important and will help SCTE enhance our program to better serve you and the telecommunications industry. These responses do NOT affect your score on this assessment.
Awareness in 10 mins. or less

Understanding Cable Technology

DOCSIS 3.1 Installation

Broadband Wireless Specialist

Fiber to the X / Fiber Deep
Understanding Cable Technology
“Cable 101”

John Watson Sr., from Mahanoy City, Pennsylvania, is recognized by the U.S. Congress and the National Cable Television Association (NCTA) as having invented cable television (TV) in the spring of 1948. Watson operated an appliance store that sold television sets. However, OTA reception was very poor in his area. In June of 1948, Watson placed an antenna at a high location to provide signals for the entire community. This CATV system, operated by Mr. Watson’s Service Electric Company, initially connected only 3 analog channels to his Main and Pine Street store and a few homes. In the following decades, Service Electric grew to serve many tens of thousands of cable subscribers. Service Electric is still in operation today and offers the advanced services typical of modern broadband cable systems.

FTTx

Broadband Wireless Specialist

Radio Frequency Signal Properties

- RF transmits many channels such as phones, music, audio etc. and utilizes downstream and upstream signals. RF is “multiplexed” - meaning you can’t see it. RF devices are regulated in terms of how much power they can generate. In the United States, the FCC manages compliance. The amount of RF power used for these signals should be limited to a basic service. Each antenna and radio system is subjected to work in specific frequency ranges.

- In critical and fundamental to any technology, radio waves are transmitted through the air, carrier to other RF transmitters and receivers for the end user. Technically, RF is a high-frequency alternating current (AC) passing over a cable connected to an antenna. The distance a radio signal will travel is determined by radio frequency propagation coverage.

Installation

A wireless gateway router or Wi-Fi gateway allows the customer to connect multiple computing devices to the Internet and to form a home network for sharing files and printers. The router may be wired using twisted pair or IEEE 802.11 wireless.

General installation steps are summarized below. These correspond to the numbers in Figure 3.2B - Connecting a Router.

1. Identify the location for the Wi-Fi near the cable modem or eMTA.
2. If the router is wired, ensure you have:
   - one Ethernet cable for each PC, to be connected to the router, or have a wireless card if the computer is wireless.
   - one Ethernet cable for the cable modem or eMTA to the Wi-Fi. Connect one end of a cable to the “WAN” or Internet port on the Modem and the other end to the cable modem.
3. Connect cables from the remaining numbered ports to each computing device or printer on the network.

TIP

The router may be wired using twisted pair or IEEE 802.11 wireless.
STB Installation

Outside Plant

Signal Level Meters

Routers, Switches and Wireless
**VirtuGame**

**Reinforce key concepts**

**Lingo-TV:**  
Question & Answer Game

**SETI:** Search for Extra Technical Intelligence  
Jeopardy Game

**Nuts’r Cuts:** Visualization Game used to identify architectures, etc...

**Troubleshooting:**  
Investigate, identify root cause, solve problems
New Courses 2017

- Broadband Wireless Specialist (BWS)
- FTTx Installation
- DOCSIS 3.1 Installation
- Introduction to Networks v6
- Routing and Switching Essentials v6
- Introduction to Internet of Things (IoT)
- Scaling Networks v6

- Mobility Fundamentals
- Multimedia over Coax Alliance
- Optical Fiber Construction
- Introduction to Cybersecurity
- Digital Home Lifestyle and Home Security
- RF System Theory

http://www.scte.org/courses

ALL Ready NOW!
Onsite Boot Camps

CableLabs PNM Program Included and Offered as a separate training.

Navigating the Fiber to the X Roadmap for Engineers

Online FTTx installation course offered for Field Operations. FTTx SCTE/ISBE Standard #174 for RFOG Included.

SCTE FTTx Certification being explored with the MSOs

Online Wireless course offered for Field Operations. Get SCTE Wireless certified too!
Certification

Leading industry certifications for all areas of the cable workforce.
Industry Certification Progression

BWS is new for 2017.
BPI was updated for 2017.
CWNP, Cisco, CompTIA are SCTE ISBE Academies. SMPTE and SCTE ISBE are training partners.
New/Updated Certifications for 2017

- **Broadband Premises Installation / Technician (BPI/BPT) Updated**
  - 4k, DOCSIS 3.0/3.1 and Wireless
  - Customer service
  - Triple Play Install / Troubleshoot

- **Broadband Wireless Specialist (BWS)**
  - Wireless Networks (Wi-Fi, IoT, ZigBee, Z-wave, etc.)
  - Wireless RF Fundamentals
  - Installing and Troubleshooting Broadband Wireless Networks

- **DOCSIS Engineering Professional (DEP) 3.1**
  - New DOCSIS 3.1 Features such as OFDM/OFDMA, NCP, MAC and PHY
  - Network Readiness
  - DOCSIS 3.1 Installation and Troubleshooting including plant issues
  - Proactive Network Maintenance
  - Monitoring a DOCSIS 3.1 Network

- **FTTx / Fiber Deep (Exploring w/ the MSOs)**
  - FTTx and Fiber Deep Networks
  - Planning, Deployment, Design and Architecture
  - Installing and Troubleshooting FTTx / Fiber Deep Networks

Ready NOW!
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Thank You!
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