

DOCSIS 3.1 Boot Camp for Engineers

Course Description:

The SCTE-ISBE DOCSIS® 3.1 boot camp is for engineers to gain a solid understanding of the circumstances involved with deploying DOCSIS 3.1 in broadband networks. The blended learning program begins with a pre-test, allowing learners to assess their existing DOCSIS knowledge. The pre-test results will point learners to eLearning modules to address gaps in knowledge, allowing learners to have a solid foundation and background for the actual boot camp training. The boot camp is focused on application exercises to ensure that learners walk away, not just with conceptual knowledge, but with the ability to immediately apply their practical skills on the job. The engineering focused program will be delivered in conjunction with two brief eLearning modules for the field.

Topics covered in the DOCSIS 3.1 boot camp include the following:

The first section contains a primer on DOCSIS 3.1 and fundamentals of DOCSIS 3.1 downstream operation. Should learners not successfully complete the pre-test at this stage, they are offered mini courses to give them a background on the physical (PHY) layer, on PHY modulation and multiple access technology, MAC data-link layer and modem initialization.

The second section of the DOCSIS boot camp consists of a deep dive in the classroom portion of the boot camp. Herein the following topics are covered: deploying DOCSIS 3.1, detailed initialization procedures, the end-to-end process with respect to DOCSIS 3.1, new frequency plan enhancements, next code-word pointers (NCP) and changes with respect to service groups, MAC domains, profiles, ranging and probing and initialization steps. In addition, orthogonal frequency division multiplexing (OFDM) in action, PHY/OFDM plant testing, spectrum analysis, OFDM generated by test equipment vendors, demonstration of OFDM testing, overall DOCSIS 3.1 testing, explaining advanced troubleshooting, aggregated routing, capacity, hardware and DOCSIS 3.1 installation. Finally, the boot camp classroom covers deployment, modem provisioning, cable modem termination system (CMTS) configuration, show commands of CMTS vendor platforms, network maintenance and proactive network maintenance (PNM) in DOCSIS 3.1, troubleshooting network and plant issues using new DOCSIS 3.1 tools, monitoring and testing approaches.

The classroom portion of the class is followed by a third section including follow-up activities and digital games emphasizing key points to remember, data input/command examples, implementation and troubleshooting tips and opportunities to follow-up with the course presenters in threaded discussions and webinars.

Prerequisite:

- High-level understanding of HFC access networks
- Basic understanding of previous versions of DOCSIS PHY and MAC

Target Audience:

- DOCSIS Engineers
- Network Operation Engineers
- Network Designers
- Network Operation Center (NOC) Personnel
- Headend/Hub Personnel
- Engineering Managers

Requirements for Successful Course Completion:

- Module quizzes 80% or higher
- Course final test 80% or higher

Format and Schedule:

The course is delivered as an onsite boot camp course. In addition, participants will view interactive eLearning materials and complete assessments (quizzes) at a time that is convenient for them.

Pre-work Modules:

- D31-99.1 DOCSIS 3.1 Primer
- D31-100.1 DOCSIS 3.1 Explainer Fundamentals
- D31-102.5 DOCSIS 3.1 Overview
- D31-104.1 PHY Background
- D31-104.2 PHY Multiplexing and Multiple Access Technologies
- D31-105.1 Data Link Layer
- D31-203.1 DS 1.0-3.0 Cable Modem Initialization Part 1
- D31-203.2 DS 1.0-3.0 Cable Modem Initialization Part 2

Upon Successful Course Completion Participants will receive:

- SCTE-ISBE Course Completion Certificate
- Recertification Units (RUs) toward SCTE-ISBE certification renewal

Course Objectives:**Module 01:** *D31-104.6 DOCSIS 3.1 Enhancements and Benefits*

- Explain how DOCSIS 3.1 provides a migration platform for operators to continue to use current DOCSIS networks into the future.
 - Explain the reasons for the changes in DOCSIS 3.1
 - Describe DOCSIS 3.1 Frequency Plans
 - Discuss the benefits of orthogonal frequency division multiplexing or OFDM
 - Describe low-density parity check (LDPC)
 - Explain how DOCSIS 3.1 enables higher order QAM than previous versions

Module 02: *D31-205.1 OFDM in Action*

- Explain how OFDM operates when it is deployed and activated in a cable network.
 - Define OFDM as a basis of DOCSIS 3.1
 - Identify the distinct aspects of OFDM that add to flexibility and robustness of the network
 - Explain upstream and downstream characteristics in a DOCSIS 3.1 network
 - Outline aspect of measurements in DOCSIS 3.1 networks

Module 03: *D31-202.5 Deployment*

- Anticipate and prepare for the operational challenges involved in deploying DOCSIS 3.1 within your HFC network
 - Identify the motivation for the deployment of DOCSIS 3.1
 - Describe the challenges of deploying DOCSIS 3.1
 - Identify possible approaches to the deployment of DOCSIS 3.1

Module 04: *D31-303.1 DOCSIS 3.1 Proactive Network Maintenance (PNM)*

- Illustrate the benefits of DOCSIS 3.1 PNM in the cable network.
 - Define DOCSIS PNM
 - Describe how to use DOCSIS pre-equalization to identify plant impairments
 - Outline the benefits of using PNM
 - Identify the technical requirements of DOCSIS PNM

Module 05: *D31-304.1 Troubleshooting*

- Recognize logical troubleshooting steps that can be taken to isolate problems in voice and data services.
 - Explain problems associated with the downstream QAM signals
 - Characterize the upstream transmission environment
 - Describe various DOCSIS upstream and downstream corrective techniques
 - Identify the possible back office problems that cause failures in voice and data service

Module 06: *D31-202-2 Impact Map*

- Identify several areas of concern for DOCSIS 3.1 installation and development.
 - Identify how DOCSIS 3.1 will impact key installation and deployment areas
 - Develop action plans for installation and deployment
 - Create a list of impact-related issues to take back to your team to address

Module 07: *D31-100-1 Explainer Advanced Troubleshooting*

- Anticipate and prepare for the operational challenges involved in troubleshooting DOCSIS 3.1 and optimizing the HFC access network, including common issues, the root causes as well as how to detect, fix and prevent those issues in the future

Module 08: *D31-204.1 Initialization Steps*

- Contrast existing cable modem initialization steps with the initialization of a DOCSIS 3.1 modem.
 - Describe DOCSIS 3.1 cable modem initialization
 - Explain the upstream transmission convergence
 - Describe how profiles are used to configure downstream and upstream signaling

Module 09: *D31-204.2 MAC DOCSIS 3.1 Ranging and Probing*

- Illustrate the details of the ranging and probing process and the new aspects found in DOCSIS 3.1.
 - Describe the DOCSIS 3.1 cable modem ranging and probing
 - Discuss the purpose of the upstream channel descriptor (UCD)
 - Describe how channel maps are used in DOCSIS 3.1
 - Explain how channel bonding is accomplished with a combination of single channel QAMs and OFDM

Module 10: *D31-201.2 NCP (Service Groups, MAC Domains and Profiles)*

- State the purpose and function of the different next codeword pointer or NCP features.
 - Describe NCP and how forward error correction (FEC) is used in relation to NCP
 - List the DOCSIS 3.1 changes in the MAC layer
 - Explain how OFDM requirements are supported by the MAC layer
 - Describe DOCSIS 3.1 MAC management messages (MMM)
 - Explain MAC domains and service groups
 - Recognize some of the additional key features of the MAC layer such as load balancing

Module 11: *D31-206.1 CMTS Configuration*

- Perform CMTS configuration with respect to DOCSIS 3.1.
- Describe CMTS evolution
- Differentiate DOCSIS 3.1 profiles
- Describe channel bonding
- Recognize the parameters for the CMTS
- Outline the configuration of different CMTS

Vendor DEMO: *CMTS Configuration and Show Commands Hands-on*

Vendor DEMO: *OFDM Testing and Troubleshooting Hands-on*

FINAL EXAM