



Configuring the DHCP Server and QPSK Modulator for an FTTP System Installation Instructions

Overview

Cable service providers have searched for a cost effective way to provide very high-speed broadband access and triple-play services (voice, video, and data) to residential and small business communities for decades. Fiber-to-the-Premises (FTTP) is the answer. Deploying FTTP will help to eliminate the bandwidth limitations of deployed copper in the loop and surpass the capacity of the current broadband access alternatives.

This document describes the requirements for Cisco systems software operating in an FTTP environment. In this case, systems software includes the System Release (SR), Operating System (OS), and Cisco Resident Application (SARA).

To help you understand an FTTP system, this document compares the HFC architecture to the FTTP architecture. For step-by-step instructions, this document focuses only on configuring the Quadrature Phase-Shift Keying (QPSK) modulator and the third-party Dynamic Host Configuration Protocol (DHCP) server required to support an FTTP system. Instructions are also provided for enabling DAVIC Express as the Digital Home Communications Terminal (DHCT) Communication Mode (DCM) for the QPSK modulator.

Purpose

This document provides the software and hardware requirements for implementing FTTP as well as the required system settings. Instructions for configuring the QPSK modulator and DHCP server are provided.

Audience

This document is intended for system operators of the Cisco Digital Broadband Delivery System (DBDS) who use SARA and want to implement an FTTP system. Cisco field service engineers who help system operators manage their systems will also find the contents of this technical bulletin useful.

Qualified Personnel

Only appropriately qualified and skilled service personnel should attempt to install, operate, maintain, and service this product.



WARNING:

Allow only qualified and skilled personnel to install, operate, maintain, and service this product. Otherwise, personal injury or equipment damage may occur.

Related Publications

You may find the following publications useful as you implement the procedures in this document.

- *Fiber to the Premises (FTTP) Single Wire Return Device (SWRD) Installation Instructions*, part number 4006217
- *Digital Network Control System Online Help (PC) Version 3.5.0.3* (part number 4002881)*
- *Fiber to the Premises (FTTP) Single Wire Return Device (SWRD) with Power-over-Data (PoD) Installation Instructions*, part number 4007948
- *Application Server 3.1.2 User's Guide* (part number 749606)
- *Digital Network Control System User's Guide For System Releases 2.1, 3.0, and Later* (part number 749605)
- *H-ONT Installation Practices Alcatel*, part number 7340 FTTU FGU1.1 (published September 2003*)
- *Model D9482 DAVIC QPSK Modulator* (part number 545607)

* The Digital Network Control System Online Help for System Release 2.5/3.5 (UNIX Version) should already be installed on your DNCS. The PC version is a separate CD that allows you to view the same online Help on a PC separate from the DNCS workstation.

Document Version

This is the third release of this document, which is based on *Configuring the DHCP Server and QPSK Modulator for an FTTP System Installation Instructions*, part number 4001384. In addition to minor text and graphic changes, the following table provides the technical changes to this document.

Page	Description
General	Reformatted document to conform to style standards.

Page	Description
14-17	Expanded procedures for configuring DHCP server for SWRD communication and SWRD software upgrades.
17	Updated FTP server user login and password information.

Key Terms

The following terms are used in the FTTP discussions throughout this document. Please become familiar with these terms to help you better understand the FTTP concepts presented.

B-RAS

Broadband Remote Access Server. A B-RAS is a specialized router used in FTTP networks.

CA

Conditional Access. Consists of the system, software, and components necessary to provide for selective access or denial of specific services in a network. Establishes means by which a cable service provider can collect subscriptions or other payments for services received.

DAVIC

Digital Audio Visual Council. DAVIC is becoming the industry standard for end-to-end interoperability of broadcast and interactive digital audio-visual information, and of multimedia communication

DBDS

Digital Broadband Delivery System. The entire network architecture of Cisco's digital system that ultimately provides signal to and from a subscriber DHCT. The DBDS consists of five areas: sources, headend, transport network, hub, and access network.

DHCP

Dynamic Host Configuration Protocol. DHCP is an Internet protocol for automating the configuration of computers that use TCP/IP. DHCP can be used to automatically assign IP addresses, to deliver TCP/IP stack configuration parameters, such as the subnet mask and default router.

DHCT

Digital Home Communications Terminal. Cisco's digital set-top converter that is two-way capable for interactive services.

DOCSIS®

Data Over Cable Service Interface Specification. This specification defines interface requirements for cable modems involved in high-speed data distribution over cable television system networks. This standard was developed by CableLabs in North America and approved by the International Telecommunication Union (ITU).

HFC

Hybrid Fiber Coax. Consists of fiber optic transmission systems extending from a hub to HFC nodes, and a coax bus network extending from the HFC nodes to the set-tops within the subscriber's home.

OLT

Optical Line Termination. An optoelectronic device in the central office (CO) or headend. This device connects to multiple ONTs through an optical network. Both OLTs and ONTs convert optical signals to a standard network interface, such as Ethernet or ATM. The illustration in *Digital Video System in an FTTP Network* (on page 11) shows how the OLT fits into a digital video system.

ONT

Optical Network Termination. An optoelectronic device installed in or near each home or business site. The ONT connects to the OLT through an optical network. The ONT connects to the OLT through an optical network. Both OLTs and ONTs convert optical signals to a standard network interface, such as Ethernet or ATM. The illustration in *Digital Video System in an FTTP Network* (on page 11) shows how the ONT fits into a digital video system.

PON

Passive Optical Network. A system that brings optical fiber cabling and signals all or most of the way to the end user.

PID

Packet Identifier. A number assigned to MPEG transport packets to identify the contents of the data and the information stream to which they belong. The 13-bit PID number is assigned in the MPEG-2 transport packet headers. All packets from the same stream have the same PID number. The PID is also referred to as a Program Identifier.

SI

System Information. Required to map from services to frequencies and program IDs.

VCI

Virtual Channel Identifier. A 16-bit field in the header of an ATM cell, the value of which uniquely identifies a specific virtual circuit on a network. A VCI is used together with a Virtual Path Identifier (VPI) to identify the next destination of a cell as it passes through a series of ATM switches on the way to its destination.

What Do I Need for FTTP?

This section describes the software and hardware that may be used to support FTTP. This list of software and hardware is not intended to be an all-inclusive list. Rather, it is provided as a guideline for deploying such a system.

Required Software and Hardware

Software

In addition to the software required for a typical HFC system, the following software would be required to support an FTTP system:

- System Release 3.5 with DOCSIS® enabled
- Digital Network Control System (DNCS) 3.5.0.2
- SARA – Use the version of SARA that is compatible with System Release 3.5
- PowerTV® Operating System – Check with your installation personnel to determine the latest OS code that supports DAVIC Express

Hardware

In addition to the hardware required for a typical HFC system, the following hardware would be required to support an FTTP system:

- Single Wire Return Device (SWRD)
- DHCP Server on the Ethernet network. The DHCP server must be compliant with Request for Comments (RFC) 2131 and support options 43 and 60 as described in RFC 2132. You can use your FTP server as the DHCP server.
- Broadband Remote Access Server (B-RAS)
- Passive Optical Network (PON)
- Explorer® Set-Top that supports DAVIC Express

Traditional HFC vs. FTTP Architecture

The FTTP architecture can be better understood by first looking at the traditional HFC architecture. This section provides information on a typical HFC system, and then describes the FTTP system. Illustrations are provided to show an HFC environment before and after an FTTP installation.

Typical HFC System

In an HFC architecture, the set-tops receive data from the QPSK modulator and send data to the QPSK demodulator using the Digital Audio Video Interactive Council (DAVIC) protocol. All communication to the set-tops over the RF plant uses ATM cells. IP packets from the digital headend control servers, destined for set-tops, are routed to the QPSK modulator Ethernet interface through the customer's private IP network. The QPSK modulator segments IP packets into ATM cells; assigns them the appropriate virtual channel identifier (VCI); and then modulates and forwards the data out the RF interface, where it is received by the set-tops.

On the upstream path, the set-top transmits both DAVIC control messages and IP packets using a QPSK modulated signal, which is received and demodulated by a QPSK demodulator. The QPSK demodulator performs error correction and transmits the packet to the QPSK modulator over its ATM-25 interface. The QPSK demodulator also measures the received power and timing offsets and passes this information to the QPSK modulator. This communication provides accurate timing offsets for ranging. The QPSK modulator has eight ATM-25 interfaces to support a total of eight QPSK demodulators.

An example of a DAVIC control message is "Ranging and Power Calibration." The QPSK modulator will send a "Ranging and Power Calibration" DAVIC message to the set-top over its RF interface if the measured values are outside the desired windows. The set-top adjusts its output accordingly for its next upstream message to the QPSK demodulator. We recommend that you set the output level to set-tops to 53 dBmV.

The traditional Cisco television systems use an RF return channel. Set-tops send and receive IP data using either the DAVIC or DOCSIS protocol to the headend equipment. All data communication to and from the set-top is over the RF connector.

This communication is comprised of both inband and out-of-band data. The inband downstream communication signals include analog video, digital video, audio services, Conditional Access (CA) encryption, System Information (SI), DAVIC/DOCSIS control information, and set-top operating systems and applications. The out-of-band downstream data includes CAS, SI, DAVIC/DOCSIS control information and the general purpose IP packets to the set-top. The upstream data includes DAVIC/DOCSIS control information and the IP data from the set-top to the DNCS.

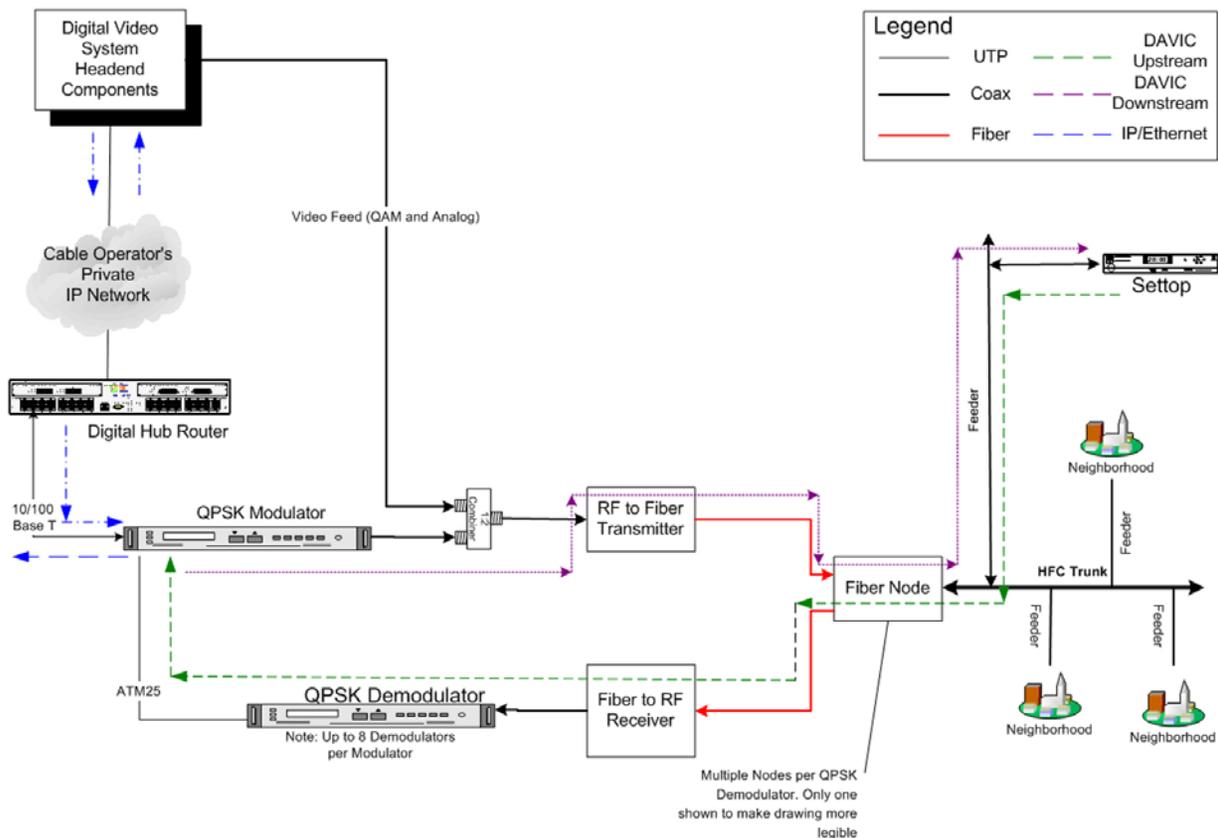
Traditional HFC vs. FTTP Architecture

Upstream IP packets are handled differently from DAVIC control messages. If the QPSK modulator receives an IP packet from the QPSK demodulator, it reassembles the ATM cells into an IP packet, and then forwards the IP packet out its Ethernet interface. All IP packets generated by the QPSK modulator are sent to its default gateway router, which is determined at boot time and periodically revalidated. The default gateway forwards the IP packet to its destination in the digital headend through the customer's private IP network.

Status, Monitoring and Control (SMC) messages are also exchanged between the QPSK modulator and demodulator on the ATM-25 link. The QPSK modulator and demodulator make a tightly coupled system that is linked by the ATM-25 Interface.

Digital Video System in an HFC Network

The following illustration shows a portion of a digital video system using an HFC network to provide connectivity to the set-tops. The illustration focuses on the relationship between the set-tops and the QPSK modulator/demodulator located at the digital hubs. This relationship is the primary difference between the HFC architecture and the FTTP/PON architecture.



FTTP System

The FTTP architecture includes technology developed by Cisco to provide two-way interactive digital video services over an FTTP architecture in a way that is convenient for end users and cost effective for cable service providers.

The first set-tops supporting FTTP require the end user to provide a CAT 5 UTP cable for each set-top for data transmission to and from the digital headend in addition to the coaxial cable needed to provide a one-way path for digital video transmission and out-of-band (OOB) control messages. The requirement for additional CAT 5 wiring is burdensome to end users and inhibits large-scale deployment by cable service providers.

To remove the CAT 5 cable requirement for FTTP systems, Cisco has developed the Single Wire Return Device (SWRD). The SWRD is a separate device installed at the home between the Passive Optical Network (PON) customer premise equipment and the set-top. This device enables the set-top to receive two-way digital video services over a single coaxial cable in the FTTP architecture.

As in a traditional HFC architecture, the set-top in an FTTP system transmits data on its RF interface using QPSK modulation. But unlike the HFC system, the QPSK demodulator function is now incorporated in the SWRD at the customer premises, rather than in the digital hub in the HFC network. In an FTTP system, there is no longer any communication, including timing offsets and received power values, between the QPSK modulator and demodulator functions.

The major ramifications of the differences between an HFC and FTTP system are as follows:

- The set-top does not perform a DAVIC power/ranging cycle. Its close proximity to the QPSK demodulator located in the SWRD removes the need to perform power/ranging.
- Set-top IP packets travel upstream using the PON and are terminated by a Broadband Remote Access Server (B-RAS). Set-top IP packets and out-of-band control packets continue to travel downstream using the QPSK modulator. This communication results in an asymmetric data path for set-top IP packets.
- The SWRD requires an IP address to forward the set-top IP packets upstream.

The SWRD obtains an IP address and its default gateway from a DHCP server managed by the access provider. Like the set-tops, a private IP address is assigned because there is no need for the SWRD to communicate outside the access provider IP network. In addition, the DHCP server must support standard options vendor class identifier options 43 and 60. These identifiers ensure that the SWRD accepts only those DHCP responses from the intended DHCP server.

After the SWRD has obtained its IP address, it then resolves the MAC address of its default gateway using Address Resolution Protocol (ARP). The default gateway of the SWRD is the B-RAS.

Traditional HFC vs. FTTP Architecture

For the upstream data flow, the set-top transmits IP packets to the SWRD over a QPSK modulated signal. The SWRD demodulates the QPSK signal and reassembles incoming ATM cells into the original IP packet. The SWRD then forwards the packet to the Optical Network Terminal (ONT) in an Ethernet frame. The ONT forwards the frame to the B-RAS through the PON. The B-RAS then forwards the packet using the access provider's IP network to the digital headend.

The downstream flow of set-top IP packets is nearly the same as the HFC architecture. The main difference is the components that the data travels through. The differences pertain only to the physical layer. It is sufficient to state that the set-top receives this data on its RF coaxial cable in the same way that it receives this data on an HFC network.

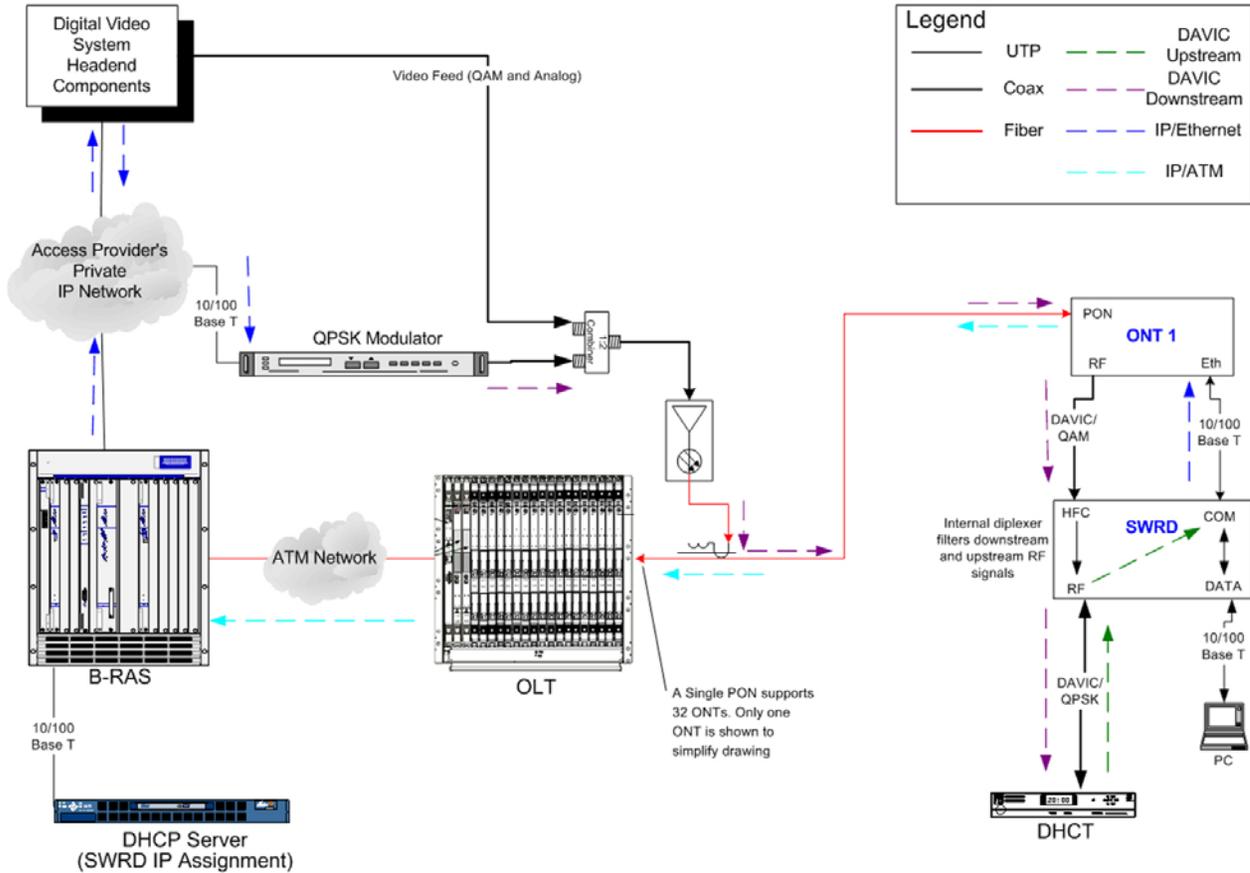
The SWRD system uses a standard Ethernet port to send standard IP data to and from the headend equipment. The intervening IP data network is transparent to the operation of this system. Cisco has integrated with several PONs to provide IP connectivity using the ITU - FSAN - G983.3 compliant ATM based PON (APON) system. The set-top uses normal IP data carried by the APON to communicate with the headend systems.

The inband downstream data in the SWRD system is identical to the inband downstream data on the DAVIC system. As in a DAVIC system, the inband downstream data in the SWRD system includes analog video, digital video, audio services, CA encryption, SI, DAVIC/DOCSIS control information, and downloadable code. The out-of-band downstream data includes CA encryption, SI, and DAVIC control information.

In an FTTP system, the IP data is physically segregated from all other data on the RF connector and is placed on the CAT 5 connector. Moving the IP data frees up additional bandwidth on the RF connector for other communication signals, such as video. All of the broadcast information, including data, audio, and video, is sent in the spectrum from 55 MHz to 780 MHz. The IP path is only used for true IP data, thus making better use of the bandwidth on all channels.

Digital Video System in an FTTP Network

The FTTP/PON architecture necessitates decoupling the QPSK modulator from the demodulator. The following illustration shows a digital video system that incorporates a PON and a SWRD to provide a two-way digital interactive channel to the set-tops.



What Is the Correct Order for Installing FTTP?

This section describes the correct order for installing software and hardware for the FTTP system.

Installing FTTP Software and Hardware

Install the FTTP software and hardware in the following order.

- 1 Install the downstream RF network. Refer to the *Model D9482 DAVIC QPSK Modulator* (part number 545607). Ignore all references to the demodulator. Configure the QPSK output for a combining RF network.
- 2 Install the upstream data network, including the PON and the Broadband Remote Access Server (B-RAS). For installing the PON, refer to the manual that came with the PON. For installing the Broadband Remote Access Server, see the user's guide that came with your server and *Configuring the DHCP Server for SWRD Communication* (on page 14).
- 3 Install the SWRD. Refer to the *Fiber to the Premises (FTTP) Single Wire Return Device (SWRD) with Power-over-Data (PoD) Installation Instructions*, part number 4007948.
- 4 Configure the DHCP server. See *Configuring the DHCP Server for SWRD Communication* (on page 14).
- 5 Install and configure the DNCS and Application Server. Refer to the *Application Server 3.1.2 User's Guide* (part number 749606), the *Digital Network Control System User's Guide For System Releases 2.1, 3.0, and Later* (part number 749605), and the *Digital Network Control System Online Help (PC) Version 3.5.0.3* (part number 4002881)*.
 - a For the QPSK mode, select DAVIC Express for any components communicating with the SWRD. For detailed instructions, see *Configuring the QPSK Modulator for FTTP* (on page 19).
 - b For the QPSK mode, select DAVIC for any components communicating outside of the SWRD environment. For detailed instructions, see *Configuring the QPSK Modulator for FTTP* (on page 19).
 - c For the QPSK demodulator frequency, select 18.5 MHz. (The demodulator for an FTTP system is built into the SWRD.) For detailed instructions, see *Configuring the QPSK Modulator for FTTP* (on page 19).
 - d Use the vi editor to set the following environment variable in the .profile file: DAVIC_LITE_ACTIVE=1. For detailed instructions, see *Enabling DAVIC Express* (on page 22).
 - e Set the power level for the set-top. For detailed instructions see *Setting the Power Level for the Set-Top* (on page 23).
- 6 Reboot the DNCS.

What Is the Correct Order for Installing FTTP?

Important! If you do not reboot the DNCS, the settings will not take effect for FTTP.

- 7 Install the Explorer set-top that supports DAVIC Express. Refer to the user's guide that came with your set-top.

Configuring the DHCP Server for SWRD Communication

In an FTTP environment, the DHCP server provides each SWRD with an IP address, a netmask, and the IP address of the gateway (a B-RAS in this case). The SWRD uses this information to establish basic communication with the network and receive software updates, when available. The DHCP server must be configured to provide this information to the SWRD.

This section describes the communication process and lists the steps needed to configure the DHCP server to support SWRD communication. For further details on SWRD software upgrades, see *Configuring the DHCP Server for SWRD Software Upgrades* (on page 16).

SWRD Communication Overview

When a SWRD is first powered on, it requests an IP address from the DHCP server. The highly recommended method of specifying the gateway IP address is to use the router option (RFC 2132, option 3). If this option is not set, the SWRD uses the giaddr field in the DHCP response as the gateway IP address.

Important! Using the giaddr field for the SWRD is a violation of RFC 1542.

The SWRD identifies itself to the DHCP server by setting the vendor class identifier option (RFC 2132, option 60) to "SWR." This option will only contain the three characters. There will not be a terminating null character. The DHCP server can use this vendor class identifier to identify the SWRD devices and assign them addresses from a specific pool of addresses. This identifier also helps to set the options needed to support remote software upgrades.

To Configure the DHCP Server for SWRD Communication

Note: The following steps provide general instruction. Procedural details will vary depending on the operating system.

Complete the following steps to configure the DHCP server for basic SWRD communication.

- 1 Create a DHCP configuration file suitable for your network environment that includes the following:
 - A command to set the vendor specific information option (RFC 2132) to **SWRD**.
 - Definitions for suitable default, minimum, and maximum DHCP server lease times.
 - IP addresses for the DHCP server subnet mask, broadcast address, and routers.
- 2 Save the configuration file and upload it to the DHCP server.

Configuring the DHCP Server for SWRD Communication

After completing these steps, all SWRDs in the network should communicate properly. For coding examples, see *Sample DHCP Configuration File* (on page 18).

Configuring the DHCP Server for SWRD Software Upgrades

In addition to enabling communication between each SWRD and the network, the DHCP server provides settings that enable each SWRD to check for and install software upgrades.

Support for SWRD software upgrades also requires the presence of a read-only FTP server in the network. The FTP server may be implemented on the same physical hardware as the DHCP server. The FTP server must store the SWRD software binary file (bootfile), and unless an anonymous FTP server is used, must be configured to recognize SWRD-specific login information.

This section describes the steps needed to configure the DHCP server to support SWRD software upgrades. For further details on basic SWRD communication, see *Configuring the DHCP Server for SWRD Communication* (on page 14).

SWRD Software Upgrade Overview

After basic communication is established at power-up, the SWRD checks for software upgrades by obtaining the IP address of a network FTP server from the DHCP server and reading the name of the bootfile currently stored on the FTP server. The bootfile name begins with either SWRDAppVer or SWRDAppFORCEVer, and includes a three-digit number indicating the software version. This information will dictate one of three possible actions:

- If the file name begins with SWRDAppFORCEVer, the SWRD performs a software upgrade regardless of the version number.
- If the file name begins with SWRDAppVer and the version number is higher than that of the bootfile in SWRD flash memory, it performs the upgrade.
- If the file name begins with SWRDAppVer and the version number is the same or lower than that of the bootfile in SWRD flash memory, it does not perform the upgrade.

If the upgrade is performed, the SWRD runs the upgraded software for 20 minutes to verify that it is stable before storing it in flash memory. If the software runs for 20 minutes, it is considered stable.

If the upgrade is not performed, cannot be successfully downloaded, or is not stable, the SWRD will use the software previously stored in its flash memory.

To Configure the DHCP Server for SWRD Software Upgrades

Note: The following steps provide general instruction. Procedural details will vary depending on the operating system.

Complete the following steps to configure the DHCP server to support SWRD software upgrades.

- 1 Obtain the current SWRD bootfile from Cisco Services and load it on the designated FTP server.
- 2 Configure the designated FTP server to recognize the following SWRD login information:
 - User name: **usrswrd**
 - Password: **usr#swrd1**

Notes:

- This step is not required when using an anonymous FTP server.
 - The user name and password shown above are SWRD default values, which can be changed.
- 3 Open the DHCP configuration file created in *Configuring the DHCP Server for SWRD Communication* (on page 14) and add the following information:
 - The IP address of the FTP server on which the bootfile is located.
 - The name of the SWRD bootfile. The bootfile name:
 - Must begin with "SWRDAppVer" or "SWRDAppFORCEVer" and end with ".bin."
 - Must include a 3-digit version number located immediately before ".bin."
 - May include path information; for example, "/pub/swrd/SWRDAppVer002.bin" and "/pub/swrd/SWRDAppFORCEVer001.bin."

Important! If the file name begins with "SWRDAppFORCEVer," the SWRD will load and store the new bootfile even if the numeric revision of the file is lower than what is currently stored in flash. If the file name begins with "SWRDAppVer," the SWRD will only upgrade if the numeric revision is higher.

- 4 Save the configuration file and upload it to the DHCP server.

After completing these steps, all SWRDs in the network should upgrade their software as needed. The total time required for all SWRDs to upgrade will be 24 hours plus the maximum DHCP lease time, which typically adds another 24 hours. Actual DHCP lease times are specified (in seconds) in the DHCP configuration file. For coding examples, see *Sample DHCP Configuration File* (on page 18).

Sample DHCP Configuration File

This section provides a sample `dhcpd.conf` file for an Internet Systems Consortium (ISC) server.

In this example:

- The read-only FTP server is named `<"your ftp server name">`.
- The read-only FTP server has an IP address of **172.18.12.211**.
- The bootfile name is `/pub/swrd_release/SWRDAppVer004.bin`.

Sample File

```
ddns-update-style none;

always-broadcast on;
not authoritative;
log-facility local6;

subnet 172.18.12.192 netmask 255.255.255.224 {
    default-lease-time 14400;
    min-lease-time 40;
    max-lease-time 86400;

    option subnet-mask          255.255.255.0;
    option broadcast-address    172.18.12.255;
    option routers              172.18.12.254;

    # SWRDs with unrecognized MACs
    class "SWRD_clients" {
        match if substring(option vendor-class-identifier, 0, 3) = "SWR";
        option vendor-class-identifier "SWR";
    }

    pool {
        range 172.18.12.194 172.18.12.199;
        filename "/pub/swrd_release/SWRDAppVer004.bin";
        next-server 172.18.12.211;
        option vendor-encapsulated-options "SWRD";
        option routers 172.18.12.254;
        option host-name "<your ftp server name>";
        ping-check TRUE;
        allow members of "SWRD_clients";
    }
}
```

Configuring the QPSK Modulator for FTTP

The first step in setting up the two-way communication path for your network is to add a QPSK modulator. For example, a QPSK modulator takes programming data for a PPV event from the DNCS, processes it onto an RF signal, and then sends it to the set-tops. When a subscriber chooses to buy that event by using their remote control to send a signal to the set-top, the set-top passes that signal back to the DNCS, first through a QPSK demodulator, and then through a QPSK modulator.

For more information on QPSK modulators, see the *Model D9482 DAVIC QPSK Modulator* (part number 545607).

To communicate to set-tops in an FTTP environment, the QPSK must be in DAVIC Express mode and the frequency must be at 18.5 MHz. This section provides instructions for configuring a QPSK modulator for FTTP.

To Configure the QPSK Modulator for FTTP

Complete the following steps to set up a QPSK for FTTP.

Before You Begin

Before you begin, you must have your network map. If you cannot locate your network map, contact Cisco Services. You must also have the following information:

- IP address for the QPSK modulator
- MAC address for the QPSK modulator
- Subnet mask for the QPSK modulator
- IP address of the default router associated with the modulator
- Base IP address for all set-tops within the domain of the modulator
- Subnet mask for all set-tops within the domain of the modulator
- RF output frequency assigned to this modulator

Note: All of this information should be recorded on your network map. However, if it is not, contact your system administrator to obtain the information.

Process Overview

To add a QPSK modulator to the DNCS, you must complete the following tasks:

- Set up the QPSK modulator basic parameters.
- Set up the QPSK modulator advanced parameters.

Configuring the QPSK Modulator for FTTP

Note: Configuring the QPSK modulator should take approximately 10 minutes if you have already located your network map and the other items you need from **Before You Begin** earlier in this section. If you have not located this information, it will take longer.

Set Up QPSK Modulator Basic Parameters

The first step in adding a QPSK modulator to the DNCS is to complete these steps to set up the QPSK modulator basic parameters.

- 1 On the DNCS Administrative Console, click the **DNCS** tab.
- 2 Click the **Element Provisioning** tab.
- 3 Click **QPSK/CMTS**. The QPSK/CMTS List window opens.
- 4 Click **File > New > QPSK**. The Set Up QPSK modulator window opens with the Basic Parameters tab in the forefront.
- 5 Click the **Hub Name** arrow and select the hub associated with this modulator.
- 6 Click in the **Name** field and type the name of this modulator (for example, **HE1hub1QPSKMod1**). You can use up to 15 alphanumeric characters.
- 7 Click in the **IP Address** field and type the IP address for this modulator. Be careful to properly place the dots (.) between numbers.
- 8 Click in the **Physical Address** field and type the MAC address for this modulator.
- 9 Click in the **Subnet Mask** field and type the number for the subnet mask where this modulator resides.
- 10 Click in the **Default Router** field and type the IP address for the router associated with this modulator. Be careful to properly place the dots (.) between numbers.
- 11 Click in the **DHCT Base IP Address** field and type the base IP address for all set-tops within the domain of this modulator.
- 12 Click in the **DHCT Subnet Mask** field and type the subnet mask for all set-tops within the domain of this modulator.
- 13 Click in the **Frequency** field and type the RF output frequency assigned to this modulator. This value can be from 70 MHz to 130 MHz in increments of 0.25 MHz.
- 14 At the **DCM (DHCT Communications Mode)** field, click to select **DAVIC Express**.
- 15 Your next step is to set up the advanced parameters for the QPSK modulator. Go to **Set Up QPSK Modulator Advanced Parameters**, next in this section.

Set Up QPSK Modulator Advanced Parameters

After you set up the basic parameters for the QPSK modulator, complete these steps to set up the QPSK modulator advanced parameters.

- 1 On the Set Up QPSK modulator window, click the **Advanced Parameters** tab. The Advanced Parameters window opens.

- 2 In general, the system sets up the QPSK modulator advanced parameters automatically, and you should not change them. However, if you need to change any of these parameters, refer to the following guidelines:
 - If you change any of the default parameters, you must stay within the signal capacity of your plant design. Otherwise, the set-tops may not be able to communicate with the Digital Broadband Delivery System (DBDS). In addition, you must reboot the QPSK modulator and wait for all corresponding set-tops to sign on again before any changes will take effect.
 - Do not change the Configuration File Name parameter without first consulting Cisco Services.
 - For the Service Channel Frequency parameter, enter a value of **18.5 MHz**. This parameter establishes the frequency that the set-tops use to broadcast to the demodulators on this hub.
 - If you are not using a backup service channel, enter the same value for the **Backup Service Channel Frequency** parameter that you entered for the Service Channel Frequency parameter.

Important! Cisco recommends that you not use a backup service channel. The backup service channel is used when the service channel fails. All reverse channel messaging is sent over the channel on which the set-top achieves initial sign-on. If a backup service channel is in use, the set-top may not be able to achieve initial sign-on.
 - For the **Tuner Input Attenuator** parameter, select the set-top calibration setting based on the design targets of your RF plant and the combining networks. The system will not connect to any levels that are in the fail range. We recommend a setting of **53 dBmV**.
- 3 Click **Save**. The system saves the advanced parameters for this modulator in the DNCS database and closes the Set Up QPSK Modulator window. The QPSK List window updates to include the new QPSK modulator.
- 4 Add the new QPSK modulator to your network map as specified in the CCM process.
- 5 Do you need to add another QPSK modulator?
 - If yes, go back to **Set Up QPSK Modulator Basic Parameters**.
 - If no, go to *Enabling DAVIC Express* (on page 22).

Enabling DAVIC Express

DAVIC Express is a communication mode that tells the set-top to use a subset of DAVIC. To use DAVIC Express, you must enable an environment variable in the DNCS.

To Enable DAVIC Express

Complete the following steps to enable DAVIC Express.

- 1 If necessary, open an xterm window on the DNCS.
- 2 Type **vi .profile** and then press **Enter**. The .profile file opens using the UNIX vi editor.
- 3 Add the following environment variable:
`export DAVIC_LITE_ACTIVE=1`
- 4 Save the .profile file and close the vi editor.
- 5 Close any other windows.
- 6 Log out of the DNCS and then log back on. The DAVIC Express mode is enabled.

The next step is to set the power level for the set-top. Go to *Setting the Power Level for the Set-Top* (on page 23).

Setting the Power Level for the Set-Top

In an FTTP system, we recommend that you set the power level for the set-top lower than you would in an HFC system.

The data sheet for the SWRD recommends that you set the upstream RF input level into the SWRD at a maximum of +51 dBmV and at a minimum of +31 dBmV. The set-top QPSK TX level and the in-premises signal loss (primarily splitter loss) must result in a signal level that falls within this range. A +53 dBmV power level setting for the set-top is appropriate for a typical home installation.

We recommend that you set the QPSK TX level that best fits your typical SWRD installations.

To Set the Power Level for the Set-Top

Complete the following steps to set the power level for the set-top in an FTTP system.

- 1 On the DNCS Administrative Console, click the **DNCS** tab.
- 2 Click the **Element Provisioning** tab.
- 3 Click **QPSK/CMTS**. The QPSK/CMTS List window opens.
- 4 Click **File > New > QPSK**. The Set Up QPSK modulator window opens with the Basic Parameters tab in the forefront.
- 5 Click the **Advanced Parameters** tab.
- 6 Select the QPSK for the set-top.
- 7 Click **File** and then select **Open**. The Set Up QPSK Modulator window opens.

Setting the Power Level for the Set-Top

- To set the power level for the set-top, type **53** in the **Max DHCT Power Level** field.

The screenshot shows the 'Set Up QPSK Modulator' window with the 'Advanced Parameters' tab active. The 'Max DHCT Power Level' field is circled in red and contains the value '53'. The 'Configuration File Name' is set to '/tftpboot/qpskt3.config'. Other parameters include 'Min DHCT Power Level' at 0 dBmV, 'Max Contention Access Message Length' at 32 ATM Cells, 'Max Reservation Access Message Length' at 32 ATM Cells, 'Idle Interval' at 30 seconds, 'Service Channel Frequency' at 20.00 MHz, 'Slot Tolerance' at 2.2 usec, 'Backup Service Channel Frequency' at 20.00 MHz, 'Sign On Retry Count' at 2, 'Tuner Input Attenuator' at 3 (3 to 19 dBmV), 'Max Acceptable Power Level' at 15 dBmV, 'Max Target Power Level' at 14 dBmV, 'Min Target Power Level' at 8 dBmV, and 'Min Acceptable Power Level' at 7 dBmV. The 'Save', 'Cancel', and 'Help' buttons are visible at the bottom.

For Information

If You Have Questions

If you have technical questions, call Cisco Services for assistance. Follow the menu options to speak with a service engineer.



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