



Configuring ISDP Bandwidth Management

Please Read

Important

Please read this entire guide. If this guide provides installation or operation instructions, give particular attention to all safety statements included in this guide.

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About This Guide

Purpose

Bandwidth management is a key feature of the the IPTV Services Delivery System (ISDS). This guide provides recommendations and steps for configuring bandwidth management in your system.

Audience

This guide is written for system operators and installers who are responsible for the initial installation and upgrades of the ISDS. Network designers and sales engineers may also find this information helpful.

Document Version

This is the third formal release of this document. In addition to minor text and graphic changes, the following table provides the technical changes to this document.

Description	See Topic
Alerted users that all services must have guide data for bandwidth management to operate properly.	<i>Determining Bandwidth Requirements</i> (on page 6)
Provided instructions for confirming that all services have guide data.	<i>Confirm IPG Data for All Services</i> (on page 15)

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Why Bandwidth Management?

In the era of triple and quad play with services competing for bandwidth, bandwidth management has become an imperative. The primary objectives that a robust bandwidth management scheme should achieve are as follows:

- Optimize video bandwidth by prioritizing downstream home traffic
- Prevent oversubscription of the link
- Prevent lower-priority applications from starving higher-priority ones
- Reallocate bandwidth intelligently among services (high-speed data, VoIP, over-the-top, and video) according to the user's needs
- Enable subscribers to use bandwidth efficiently across services (high-speed data, VoIP, and video)
- Provide subscribers with useful feedback when bandwidth limits are reached

This document provides guidelines that allow you to ensure that you configure bandwidth management to best meet your business objectives.

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Provisioning the ISDS for Bandwidth Management

Introduction

This chapter describes how to provision the ISDS for bandwidth management.

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Bandwidth Sharing and Network Requirements

To manage bandwidth effectively, you must first understand the bandwidth restrictions placed on set-tops and understand the way set-tops share video bandwidth with other set-tops. The rules differ for homes with a single set-top and homes with multiple set-tops (or IPN603 set-tops that act in the home as three set-tops). You must also understand the network requirements for bandwidth management.

Homes with a Single Set-Top

A single set-top in a home will never join a service that requires more bandwidth than the set-top is authorized for. A single set-top follows this process for obtaining bandwidth.

- 1 The subscriber attempts to tune to a channel.
- 2 The set-top checks the SI table for the bandwidth needed to display the program on this channel.
- 3 The set-top compares the bandwidth required by that channel to the amount of bandwidth allocated to the set-top by the bandwidth profile as follows:
 - If the channel requires less bandwidth than is assigned to the set-top, the set-top displays the channel.
 - If the channel requires more bandwidth than is assigned to the set-top, then the set-top displays a message that the channel cannot be displayed.

Homes with Multiple Set-Tops or IPN603 Set-Tops

In homes with multiple set-tops or with an IPN603 set-top that acts like three set-tops, active set-tops will never use more bandwidth than has been allocated to the home by the bandwidth business rule. Only one bandwidth business rule is assigned to all set-tops in a home. A set-top in a multiple set-top environment follows this process for obtaining bandwidth.

- 1 The set-tops periodically register with each other using 233.126.125.17 for the multicast address and 4900 for the multicast port. The multicast address and port shown here are the default values. If you need to use a different address and port, use the ALBMP Multicast GDA and ALBMP Multicast Port fields on the System-Wide parameters window for bandwidth management. See the field descriptions for ALBMP Multicast GDA and ALBMP Multicast Port in *Configuring the Set-Top Control Class Bandwidth* (on page 9).
- 2 The subscriber attempts to tune to a channel.
- 3 The set-top checks the bandwidth currently being used by the other set-tops in the home and checks the SI table for the bandwidth needed to display this program and calculates the total.

- 4 The set-top compares the bandwidth required by that channel to the total amount of bandwidth allocated to the set-tops by the business rule that is assigned as follows:
 - If the channel requires less bandwidth than is currently available to the set-tops, the set-top displays the channel.
 - If the channel requires more bandwidth than is currently available to the set-tops, then the set-top displays a message that the channel cannot be displayed.

Note: If the set-tops are configured to automatically power on after bootup, subscribers are more likely to encounter bandwidth conflicts because all boxes will be actively receiving multicast streams. For this reason, we recommend that the set-tops be set to remain off until powered on by the subscriber.

Network Requirements

The following network requirements must be in place to successfully manage bandwidth in the home network:

- All set-tops on the home network must be able to communicate with each other over the ALBMP multicast address.
- The multicast traffic between set-tops in the subscriber's home must be confined to the home network and not allowed to access networks outside the home. Work with the supplier of your access network equipment to confirm that the equipment is configured correctly to meet this requirement.

Determining Bandwidth Requirements

Now that you understand the bandwidth restrictions for set-tops and the way set-tops share bandwidth, you must determine how you will manage the bandwidth using a multi-step process.

1. Review Your Environment for Bandwidth Requirements

Your first step in managing bandwidth is to identify how much bandwidth is available to a typical home. From this analysis you should see patterns emerge where a few distinct groups have the same available bandwidth. You can use this information to create bandwidth business rules that accommodate the typical bandwidth usage in your network. If each home has the same amount of bandwidth available, you need only one bandwidth business rule. In the more likely event that the total available bandwidth differs across your network, you must determine how many bandwidth business rules you need. For example, you could configure your system with 10 Mb, 15 Mb, 20 Mb, and 25 Mb business rules.

2. Configure Bandwidth for Set-Top Control Class Data and Video

The second step is to look at the services and sources of traffic that compete for bandwidth and determine how to allocate the bandwidth. The typical competitors for bandwidth are high-speed data, VoIP, set-top control class data, and video services. Set-top control class data and video services both represent bandwidth used by the set-tops.

Set-Top Control Class Data Bandwidth

The set-top control class data is used for communication between the ISDS and the set-top. You must allocate a certain amount of bandwidth for set-top control class data to ensure that the ISDS can always communicate with the set-tops. The bandwidth reserved for set-top control class data is shared by all set-tops in the home. For information on configuring set-top control class data, see *Configuring the Set-Top Control Class Bandwidth* (on page 9).

Video Bandwidth

The video bandwidth used by set-tops can vary and is directly related to the number of set-tops and the services being accessed. The amount of video bandwidth required increases based on the number of services being accessed simultaneously. To illustrate this point, we provide an example where we assume that all video services use 3 Mb of bandwidth. In the real world, the amount of bandwidth used by services will vary. For our example, assume you have two set-tops in the home both accessing HBO. In this scenario, only 3 Mb of bandwidth is used for video. In another scenario, assume you have two set-tops in the home where one is accessing HBO while the other is accessing Showtime simultaneously. In this scenario, 6 Mb of bandwidth (3 Mb for each service) is required. As another example, if you have a DVR that is recording HBO while also accessing Showtime, then 6 Mb of bandwidth is required. Thus, the amount of bandwidth you need for video is based on the number of services being accessed simultaneously.

3. Determine the Bandwidth Business Rules Required

The next step is to determine the bandwidth business rules you need. Start by determining how much total bandwidth is available to the home. Then, subtract the amount of bandwidth used by the other services (high-speed data, VoIP, and set-top control class data) from the total amount available. The amount of bandwidth left over is used for broadcast video and for priority Broadcast File Server (BFS) traffic. For each unique amount of bandwidth left for video, you need a business rule. In the following table, we show four home environments ranging from 10 Mb to 25 Mb of bandwidth available. In this table, notice that the 25 Mb home allocates 8 Mb of bandwidth to high-speed data, and the 20 Mb home allocates only 3 Mb of bandwidth to high-speed data, while leaving both homes with 15.5 Mb for video. In this example, you need three business rules for 5.5 Mb, 10.5 Mb, and 15.5 Mb of available bandwidth for video.

Total Bandwidth for Home	10 Mb	15 Mb	20 Mb	25 Mb
High-Speed Data	3 Mb	3 Mb	3 Mb	8 Mb
VoIP	.5 Mb	.5 Mb	.5 Mb	.5 Mb
Set-Top Control Class Data	1 Mb	1 Mb	1 Mb	1 Mb
Bandwidth Left Over for Video and Priority BFS Traffic	5.5 Mb	10.5 Mb	15.5 Mb	15.5 Mb

4. Create Bandwidth Packages

The fourth step in bandwidth management is to create a package that your billing system and system operators can use to assign a business rule to the set-top(s). The package name that you use on the ISDS *must* match the package name in the billing system. Cisco recommends that you use package names that clearly identify the bandwidth business rules. For example, you could use 5.5 Mb, 10.5 Mb, and 15.5 Mb for package names. For more information, see *Creating Bandwidth Packages* (on page 12).

5. Create Bandwidth Management Business Rules

The fifth step is to create bandwidth management business rules and assign the allotment of bandwidth for each business rule. You can then assign a business rule to a set-top using a package. For more information, see *Creating, Modifying, or Deleting Bandwidth Management Business Rules* (on page 13).

6. Confirm All Services Have Guide Data

For bandwidth management to operate properly, the set-top needs to not only determine the amount of bandwidth a service uses but also the duration of each program currently being viewed. Looking at the duration of a program allows DVRs to determine if tuning to a program will conflict with currently scheduled DVR events. For more information, see *Confirm IPG Data for All Services* (on page 15).



CAUTION:

Services without IPG data will appear as black screens on the set-top when bandwidth management is enabled.

7. Authorize Set-Tops for Bandwidth

The last step in bandwidth management is authorizing set-tops for bandwidth by assigning packages. We recommend that you have the billing system assign the bandwidth management package to set-tops. If you want to test your bandwidth management configuration, you can manually assign a bandwidth management package to a set-top(s) and test the configuration. See *Test the Bandwidth Management Configuration* (on page 16).

Configuring the Set-Top Control Class Bandwidth

To configure the set-top control class bandwidth for your system, you must define some system-wide parameters, the minimum overhead bandwidth, the maximum control class traffic, and the multicast address and port that will be used by the set-tops to communicate with each other. To configure the set-top control class bandwidth for your system, complete the following steps.

- 1 From the ISDS Administrative Console, select **Sys Config** to display the ISDS System Configuration window.

ISDS System Configuration

DSM-CC | InstaStaging | ISDS | **Bandwidth Mgmt**

DHCT Session Signaling Parameters

Send 'Session In Progress' Every: minutes

Retry Requests Up To: times

Stop Waiting For Network Response After: seconds

Network Session Signaling Parameters

Send 'Setup Proceeding' Every: seconds

Retry Requests Up To: times

Stop Waiting For User Response After: seconds

Highest Program Bandwidth: Mbps

Reuse Expired Session IDs After: seconds

Save Cancel Help

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- Click the **Bandwidth Mgmt** tab to display the System-Wide Parameters window for bandwidth management.

ISDS System Configuration

DSM-CC | ISDS | **Bandwidth Mgmt**

System-Wide Parameters

Video Class DSCP Control Class DSCP

Minimum Bandwidth Overhead for ISDS (bps)

Maximum Control Class Traffic per STB (Kbps)

ISDS

CDS

MIDAS

Widevine

SRM

ALBMP Configuration Parameters

ALBMP Multicast GDA

ALBMP Multicast Port

- From the System-Wide Parameters window, complete the following fields. The data that you enter on this window populates fields on the Bandwidth Management Business Rules window as indicated in the table below.

Field	Description
Video Class DSCP	The Video Class Differentiated Services Code Point (DSCP) is a 5-digit value that the originator of the traffic encodes in the 8-bit TOS field of an IP header to classify the traffic. All video class traffic to set-tops is DSCP-marked and routers are configured to handle congestion based on DSCP markings of traffic. Routers use this DSCP value to discriminate the type of traffic and assign a priority to the traffic. For example, VoIP traffic is given a higher priority than video class traffic. When a router sees an IP header with a DSCP value for VoIP, that data is given a higher priority than an IP header with a DSCP value for video class traffic. Default Value: 0x20
Control Class DSCP	The Control Class DSCP is a 5-digit value that the originator of the traffic encodes in the 8-bit TOS field of an IP header to classify the traffic. All control traffic to set-tops is DSCP-marked and routers are configured to handle congestion based on DSCP markings of traffic. Routers use this DSCP value to discriminate the type of traffic and assign a priority to the traffic. For example, video traffic with a DSCP value of 0x20 is given a higher priority than control class traffic with a DSCP value of 0x18. Default Value: 0x18

Configuring the Set-Top Control Class Bandwidth

Field	Description
Minimum Bandwidth Overhead for ISDS (bps)	The minimum bandwidth overhead for ISDS (Priority Video Class). Enter 525288 bps in this field. (This is equivalent to 1 Mbps with current load) This bandwidth is reserved for BFS, cluster flow data, such as EAS messages, and other important data that you want to ensure gets delivered. This bandwidth is reserved for BFS, cluster flow data, such as EAS messages, and other important data that you want to ensure gets delivered
Maximum Control Class Traffic per STB (Kbps)	The maximum control class traffic bandwidth that you allot for the various types of control class data: ■ ISDS - Control class traffic from the ISDS to the set-top (for all set-tops). Enter 1024 in this field. ■ CDS - Reserved for future use. ■ MIDAS - Reserved for future use. ■ Widevine - Reserved for future use. ■ SRM - VOD back office. - Reserved for future use. We currently recommend that you set this value to 0. The sum of the values that you enter for Maximum Control Class Traffic per STB (Kbps) populates the Control Class BW (Mbps) field on the Bandwidth Management Business Rules screen.
ALBMP Multicast GDA	Application Layer Bandwidth Management Protocol (ALBMP) Multicast Group Destination Address (GDA). The multicast destination address used for set-tops to communicate within the home LAN. Default Value: 233.126.125.17 Note: We recommend you use the default value.
ALBMP Multicast Port	ALBMP Multicast Port. The port number used by ALBMP multicast traffic for set-tops to communicate within the home LAN. Default Value: 4900 Note: We recommend you use the default value.

- 4 Click **Save**.
- 5 Your next step is to create packages for the bandwidth business rules.

Creating Bandwidth Packages

After you configure the set-top control class bandwidth, the next step is to create bandwidth packages that will be used to assign the appropriate business rule to the set-tops in your network.

If you need only one bandwidth package, you can use any package that is assigned to all set-tops, for example the Basic Service package. You can skip this step, and go to *Creating, Modifying, or Deleting Bandwidth Management Business Rules* (on page 13). But, in the more likely event that you will need several bandwidth packages, use this procedure to create bandwidth packages.

To create a bandwidth package, complete the following steps.

- 1 On the ISDS Administrative Console, click the **ISDS** tab.
- 2 Click the **System Provisioning** tab.
- 3 Click **Package**. The Package List window opens.
- 4 Click **File** and select **New**. The Set Up Package window opens.
- 5 Click in the **Package Name** field and type the name you will use to identify this package. You can use up to 20 alphanumeric characters.

Note: The package name must match the packages in the billing system that will be used to assign bandwidth business rules. Cisco recommends that you use names that clearly identify the bandwidth business rules. For example, 10 Mb, 15 Mb, and 20 Mb bandwidth packages. Refer to your billing system documentation for instructions and specific information.

- 6 Select **Unlimited** for the Duration field.
- 7 Click **Save**.

Results:

- The ISDS saves the package information in the ISDS database and closes the Set Up Package window.
- The Package List updates to include the new package.

An asterisk (*) appears next to this package, indicating that it is a default staging package.

Creating, Modifying, or Deleting Bandwidth Management Business Rules

Now that you have created the bandwidth packages you need, the next step is to create bandwidth management business rules and assign the allotment of bandwidth for that business rule. To create, modify, or delete business rules for bandwidth management, complete the following steps.

- 1 From the ISDS Administrative Console, click **Bandwidth Mgmt**. The Bandwidth Management Business Rules window opens.

Select	BW Package Name	BW Group ID	Video Prog BW (Mbps)	Minimum ISDS Video BW (Mbps)	Control Class BW (Mbps)	Home BW Budget (Mbps)
☐	5.5 Mb	1	8.5	0.525288	1.024	8.049288
☐	10.5 Mb	2	11.5	0.525288	1.024	13.049288
☐	15.5 Mb	3	16.5	0.525288	1.024	18.049288

Buttons: New, Save, Delete

- 2 Choose one of the following options:
 - To add a business rule, click **New** to add a new row. Go to step 4.
 - To modify a business rule, select the row that has the business rule you want to modify. Go to step 3.
 - To delete a business rule, select the row that has the business rule you want to delete, and click **Delete**.
- 3 Select the bandwidth package to which you want to assign bandwidth. The row highlights to show that it is selected. Go to step 4.
- 4 In the BW Package Name column, use the drop-down list to select the package that will be used to identify this business rule. The row highlights to show that it is selected and a bandwidth group ID is assigned.
- 5 In the Video Prog BW (Mbps) field, enter the amount of bandwidth you want for video plus add 1 Mb. The additional 1 Mb of bandwidth ensures that the system provides the adequate amount of bandwidth for video while still accounting for the 1 Mb previously reserved for priority BFS traffic. For example, if you always want 4.5 Mb available for video services, you must enter 5.5 Mb in the Video Prog BW (Mbps) field.

Chapter 2 Provisioning the ISDS for Bandwidth Management

Note: ISDS release 2.2.0.2p2ep2 calculates the Home BW Budget (Mbps) incorrectly by adding the Minimum ISDS Video BW (Mbps) into the overall calculation. As a result, the values shown on the ISDS will not match those calculated during the "Determine the Bandwidth Business Rules Required" part of the bandwidth management configuration instructions.

- 6 Click **Save**.
- 7 Repeat steps 2 through 6 for each business rule you want to use in your network.

Confirm IPG Data for All Services

To ensure that bandwidth management functions properly, all services must contain IPG data. To confirm if your services have IPG data, scroll through the program guide. If you find services that have "No Information Available" displayed, you must contact your IPG content provider and ask them to provide data for these services. In the case of a channel that does not have regularly scheduled programs, such as local access channels, ask your IPG content provider to define one event per day with a 24-hour duration. We recommend using a generic description for the event, such as local access channel, to be used in the guide.

Test the Bandwidth Management Configuration

Now that you have created the bandwidth packages and assigned business rules, you may want to test your bandwidth management configuration. You can test the configuration by setting up an environment that is similar to a home with set-tops configured so that they are competing for bandwidth.

Before You Begin

The amount of bandwidth available in the test environment must exceed the bandwidth required for the various business rules you want to test. For example, if you test the scenario described in *Determining Bandwidth Requirements* (on page 6), the amount of bandwidth available must exceed 25 Mb. To complete your test, you must also be familiar with how much bandwidth is required for the various services. Having this information will ensure that you conduct a test that emulates what your subscribers will experience.

Configure Your Set-Tops

Complete the following instructions to test your bandwidth management configuration.

- 1 Set up a group of set-tops and configure them as if they are in a home environment competing for bandwidth.
- 2 On the ISDS Administrative Console, click the **ISDS** tab.
- 3 Click the **Home Element Provisioning** tab and then click **DHCT**. The DHCT Provisioning window opens.
- 4 Click **Open** and select one of the following options:
 - **By MAC Address**: Enter the MAC address for the set-top.
 - **By IP Address**: Enter the IP address for the set-top.
 - **By Serial Number**: Enter the serial number for the set-top.
- 5 Click **Continue**. The Set Up DHCT window opens for the test DHCT.

6 Click the **Secure Services** tab.

- 7 Scroll through the **Available** field in the Packages area of the window and click to select the bandwidth package that you want the set-top to use.
- 8 Click **Add**. The package name you selected moves into the Selected field.
- 9 Click **Save**.
- 10 Repeat steps 2-9 for all set-tops that you want to test.

Test Your Configuration

To ensure that your bandwidth management configuration is functioning as you intend, we recommend that you test different scenarios. In the first scenario, you want to verify that your set-tops can access the services using the bandwidth for which their bandwidth business rules allow. In this case, must make sure that your test does not exceed the bandwidth for which the set-tops in your test environment are authorized. For more information, see *Subscriber Observed Behaviors* (on page 19).

In a second scenario, you want to exceed the bandwidth allocation for your test environment to verify that the correct conflict messages are displayed.

Chapter 2 Provisioning the ISDS for Bandwidth Management

To test your bandwidth management configuration, complete the following steps.

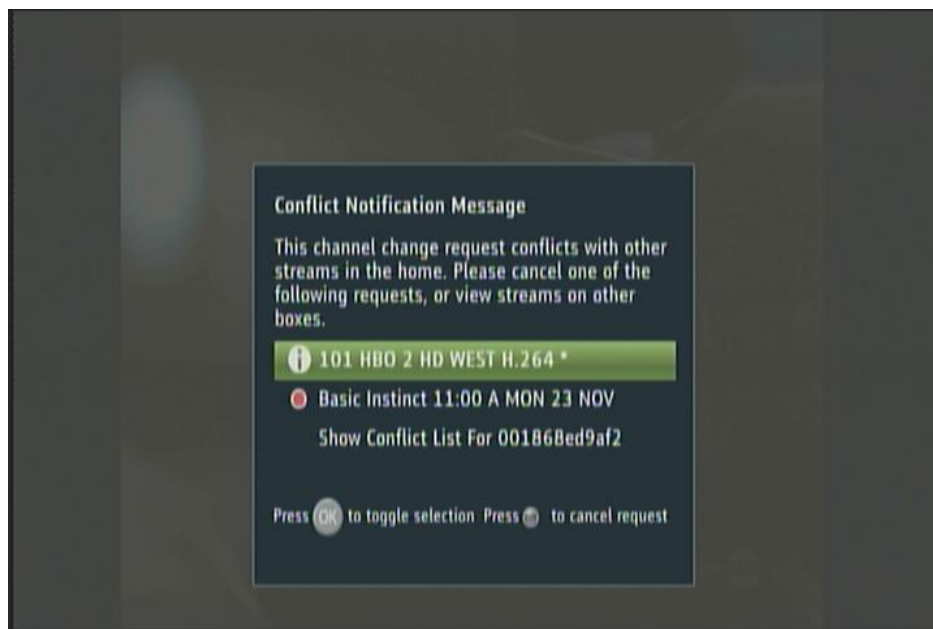
- 1 Start accessing services. Make sure that the set-top can access as many services as the assigned business rule allows. If no conflict messages appear, you have configured your bandwidth correctly. If conflict messages appear, make sure that you have configured the business rules properly and that you have selected the appropriate package for the set-top.
- 2 Access as many services as required to exceed the bandwidth allocation for the home. When the bandwidth allocation for your test environment is exceeded, you want to make sure that the correct bandwidth management conflict message appears.

Subscriber Observed Behaviors

When set-tops compete for bandwidth, conflicts will arise. This section illustrates the various scenarios that occur when bandwidth allocations are exceeded and provides examples of the conflict messages that subscribers may observe.

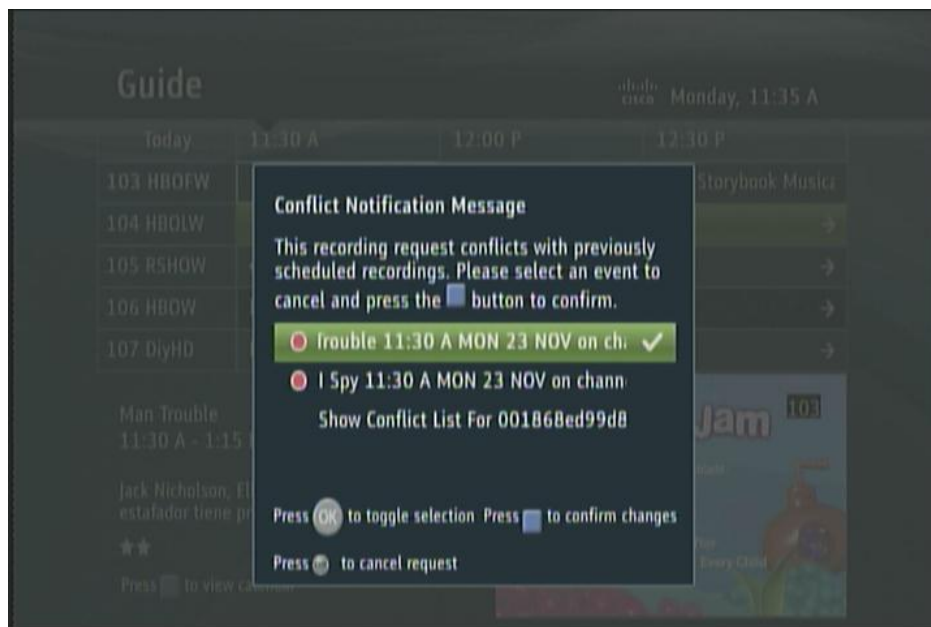
Subscriber Attempts to Access a Program that Requires More Bandwidth than Is Available

In this scenario, the subscriber has several set-tops in the home. The set-top in the family room is recording a program while a set-top in the playroom is accessing another program at the same time. When the third set-top in the home attempts to access a program, the following message appears.



Subscriber Attempts to Record a Program that Requires More Bandwidth than Is Available

In this scenario, the subscriber has several set-tops in the home. The set-top in the family room is recording a program while a set-top in the playroom is accessing another program at the same time. When the third set-top in the home attempts to record a program, the following message appears.



Subscriber Observed Behaviors

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Customer 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.

Access your company's extranet site to view or order additional technical publications. For accessing instructions, contact the representative who handles your account. Check your extranet site often as the information is updated frequently.



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