IPTV Set-Top Bandwidth Utilization Configuration Guide

Overview

Introduction

During the installation and operation of set-tops, the amount of network bandwidth that is used and the number of multicasts that are joined can vary significantly. To properly configure devices on your network and within the subscriber's home, a better understanding of theses variances is required.

This document covers the sequence of events and the relationships between the set-tops and the ISDP server during the various stages of booting, operating, and upgrading the set-top.

Set-top operation differs in environments that use the bandwidth management feature software and those that do not. For more information on bandwidth management, refer to the *Configuring ISDP Bandwidth Management User Guide* (part number 4029936). This document includes sections covering both environments.

Purpose

To provide reliable service to customers on networks supporting ISDP, understanding the amount of bandwidth used and the maximum number of multicasts that can be streamed to a set-top at a given time is crucial. This document provides information to help ensure the reliable operation and correct configuration of your IPTV set-top network.

Audience

This guide is written for system operators, network planners, installers, and sales engineers who are responsible for the initial installation and management of networks supporting the ISDP.

Document Version

This is the second formal release of this document.

Bandwidth Utilization

During boot-up and during normal operation, set-tops on a network that support ISDP will access a number of different multicasts and as a result place differing demands for bandwidth on the network. The number of processes on the set-top that attempt to get information over the network determines the total number of multicasts and the total amount of bandwidth needed.

Competitors for Bandwidth

The following table describes the potential competitors for bandwidth at any time and the set-top response. This table shows the trigger events outside of the typical boot process. These events use bandwidth when a flow is rejoined, and you must account for this bandwidth usage.

Note: All data rates and data carousel settings shown are per the recommendations in Appendix A of *Cisco CDA Visual Quality Experience Application User Guide, Release 3.5,* part number OL-14115-08.

Data Carousel Flow	Trigger Event	Multicast Type and Bandwidth Required	Set-Top Response
VQE Repair Unicast (VQE Client)	Repair Burst or Channel Change on VQE or Video Channel	Varies (1+E*) x Bandwidth of Channel * E = E factor from VQE server settings Average 3.7-6.0 kbps; Max 1.2 Mbps	For any packet that is dropped, the set-top sends a request to the VQE server to repair the dropped packet on the set-top.
VQE Configuration Change	VQE Configuration Change	BFS, 1 Mb	Set-top joins to read the new configuration file and then leaves.
IPG Data Carousel Day 1 File	IPG Data Collector **Important**: Run collector during a maintenance window.	1 Mb* * The 430 can store information on its hard drive. As a result, the 330 can use more bandwidth than the 430 because of more frequent network reads.	Set-top joins each carousel in sequence and then leaves.

Data Carousel Flow	Trigger Event	Multicast Type and Bandwidth Required	Set-Top Response
Day 2 File	IPG Data Collector **Important**: Run collector during a maintenance window.	1 Mb* * The 430 can store information on its hard drive. As a result, the 330 can use more bandwidth than the 430 because of more frequent network reads.	Set-top joins each carousel in sequence and then leaves.
Day 3 File	IPG Data Collector **Important**: Run collector during a maintenance window.	1 Mb* * The 430 can store information on its hard drive. As a result, the 330 can use more bandwidth than the 430 because of more frequent network reads.	Set-top joins each carousel in sequence and then leaves.
Day 4 File	IPG Data Collector **Important**: Run collector during a maintenance window.	1 Mb* * The 430 can store information on its hard drive. As a result, the 330 can use more bandwidth than the 430 because of more frequent network reads.	Set-top joins each carousel in sequence and then leaves.
Day 5 File	IPG Data Collector **Important**: Run collector during a maintenance window.	1 Mb* * The 430 can store information on its hard drive. As a result, the 330 can use more bandwidth than the 430 because of more frequent network reads.	Set-top joins each carousel in sequence and then leaves.

Data Carousel Flow	Trigger Event	Multicast Type and Bandwidth Required	Set-Top Response
Day 6 File	IPG Data Collector **Important**: Run collector during a maintenance window.	1 Mb* * The 430 can store information on its hard drive. As a result, the 330 can use more bandwidth than the 430 because of more frequent network reads.	Set-top joins each carousel in sequence and then leaves.
Day 7 File	IPG Data Collector **Important**: Run collector during a maintenance window.	1 Mb* * The 430 can store information on its hard drive. As a result, the 330 can use more bandwidth than the 430 because of more frequent network reads.	Set-top joins each carousel in sequence and then leaves.
SAM Data Carousel	Add/Modify/Delete a Service	BFS, 1 Mb	Set-top joins to read the new configuration file and then leaves.
Hub flow (SI)	Add/Modify/Delete a Source	20 Kb	Set-top joins at boot or after receiving a trigger event and remains joined during operation.
Cluster flow	Passthru triggers	20 Kb	Set-top joins when receiving Entitlements/ Authorizations /Time/ EAS triggers and remains joined during operation.
EAS Files - Audio File (MMM_OOB)	EAS Alert	BFS, 1 Mb	Set-top joins during an EAS alert and remains joined until it has completed reading the EAS message and then leaves.

Data Carousel Flow	Trigger Event	Multicast Type and Bandwidth Required	Set-Top Response
System Wide flow (Well Known Multicast)	Always Joined	1 Kb	Set-top joins at boot and remains joined. System wide flow is the first flow that the set-top will join after boot-up. The system wide flow identifies the hub flow and cluster flow that the set-top should join.
Video Multicast	Channel Change/Record	Varies based on source content	Set-top joins when the service is selected or while DVR recordings are in progress.
Download Carousel (bootloaderMcast)	Associate new set-top software image	3 to 5 Mb	Set-top reboots and leaves all other flows. (See the sequence diagrams later in this document.)
System Carousel	BFSdir Update	1 Mb	Set-top joins after dir updates are received from BFS.
CAM_OOB	Conditional Access Tables	1 Mb	Set-top joins to read the new configuration file and then leaves.
In_Band	Custom Client Skins; Custom Client Settings	1 Mb	Set-top joins at boot if custom settings are defined and if customer selects a custom skin from client menus.
Out_of_Band	Custom Client Settings	.5 Mb	Set-top joins at boot if custom settings are defined.

As noted in the table, the multicasts for the video services being viewed or recorded by the set-top do account for the most bandwidth, but do not account for all the multicasts that an individual set-top may join at any point in time. Even when not watching video, the set-top remains joined to the "well known multicast" and the hub and cluster flows. For example, after a new service is added or during an EAS alert, the set-top could be joined to as many as three additional multicasts plus those it joined to receive video services.

CAUTION:

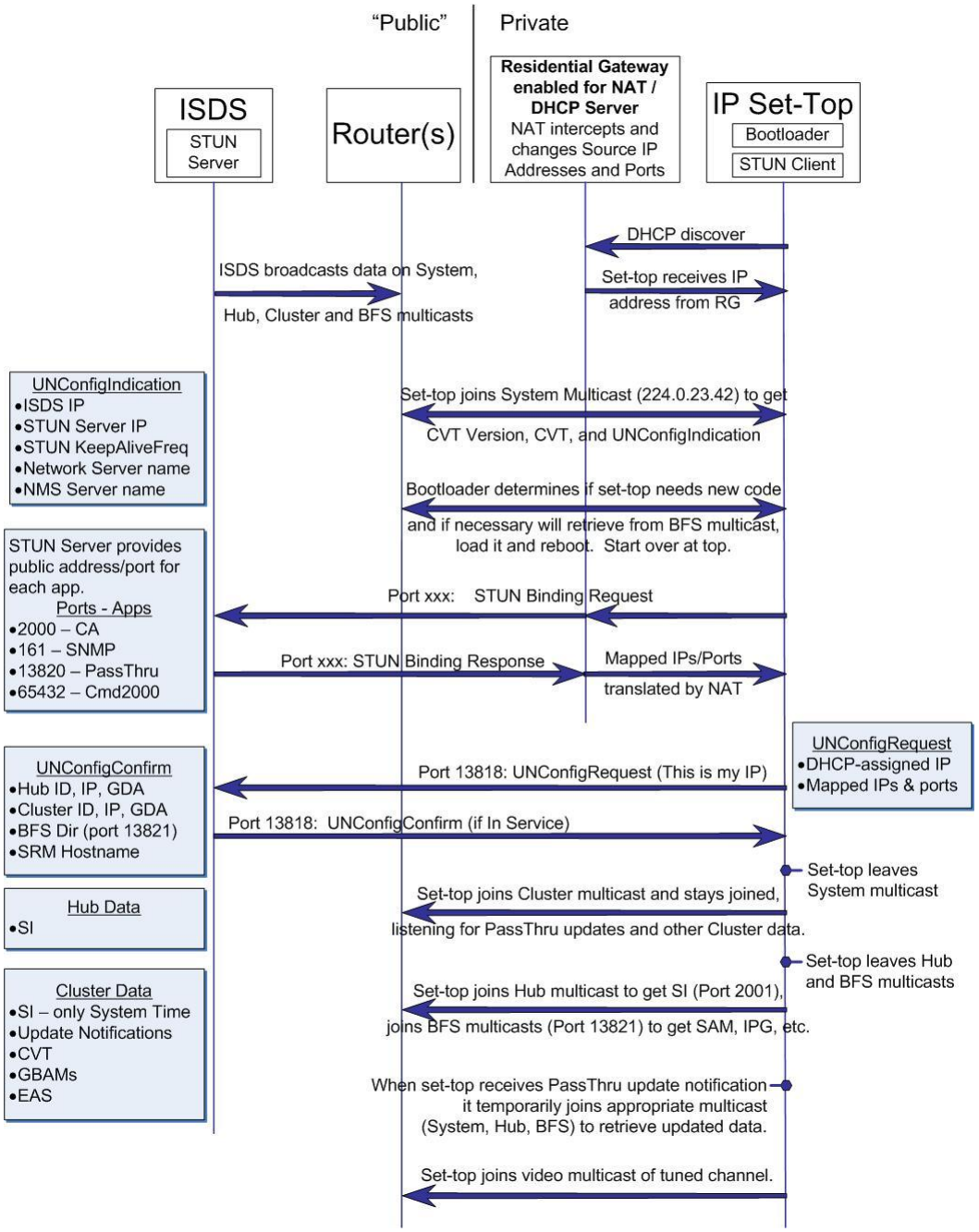
Without bandwidth management enabled, the set-top could, in a theoretical worst case, be joined to six or more multicasts at once and be using over 16 Mb of bandwidth. (This scenario assumes the set-top is joined to two HD services as well as the command and control related multicasts.) Failure to configure the network to allow for this worst case utilization will result in unpredictable set-top operation.

Boot Sequence Diagram with Residential Gateway

The following boot sequence diagram shows the interaction between the client and headend when a residential gateway is installed. This diagram shows the boot-up and sign-on process through displaying video on the screen. After the set-top has completed the sign-on process as shown in this diagram, one of the following will occur:

- If the dl-config setting on the Broadcast File Server for power on at bootup is set, the set-top will be in a powered-on state, and video will appear on the screen along with the bandwidth utilized to display that video.
- If the dl-config setting on the ISDS is defined to not boot to a powered on state, then no video or bandwidth is displayed on the screen.

Boot Sequence Diagram with Residential Gateway

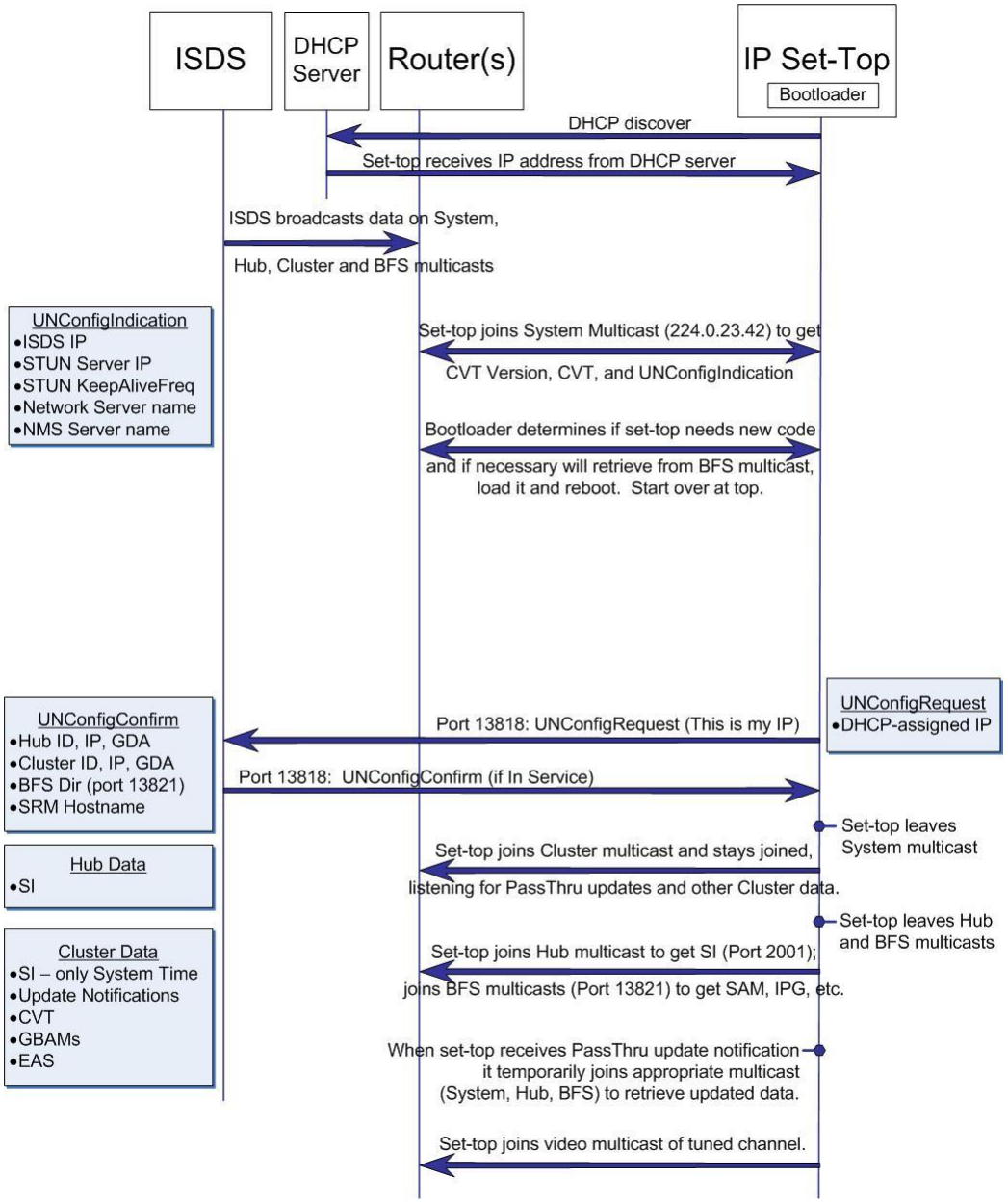


Boot Sequence Diagram Without a Residential Gateway in Place

The following boot sequence diagram shows the interaction between the client and headend when a residential gateway is not installed. This diagram shows the boot-up and sign-on process through displaying video on the screen. After the set-top has completed the sign-on process as shown in this diagram, one of the following will occur:

- If the dl-config setting on the Broadcast File Server for power on at bootup is set, the set-top will be in a powered-on state, and video will appear on the screen along with the bandwidth utilized to display that video.
- If the dl-config setting on the ISDS is defined to not boot to a powered on state, then no video or bandwidth is displayed on the screen.

Boot Sequence Diagram Without a Residential Gateway in Place



Typical BFS Setup

The following graphic shows a typical BFS table.

Note: The following BFS carousels are not currently used in ISDP implementation:

- PPV_IB
- PPV_IB2
- PPV_OOB
- POD_Channels
- CAM_IB

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BFS Carousel and OSM Sessions Status (IP)
=========================================================
                                                =Datarate=   =KBytes=   =Intrvl= =Enabled=  =ACCT=
OK: System_Carousel....232.0.3.200     s(   0) up     1.00 Mbps      6.963        100     Yes       0:00
OK: Out_of_Band........232.0.3.201     s(   1) up      .05 Mbps      0.655        100     Yes       0:00
OK: In_Band............232.0.3.202     s(   2) up     1.00 Mbps    275.309        100     Yes       0:02
OK: CAM_OOB............232.0.3.203     s(   3) up     1.00 Mbps      3.466        100     Yes       0:00
OK: CAM_IB.............232.0.3.204     s(   4) up      .50 Mbps          0        100     Yes       0:00
OK: IPG_OOB............232.0.3.205     s(   5) up     1.00 Mbps    995.828        200     Yes       0:08
OK: IPG1_IB............232.0.3.206     s(   6) up     1.00 Mbps    492.468        100     Yes       0:04
OK: PPV_OOB............232.0.3.207     s(   7) up      .10 Mbps          0        200     Yes       0:00
OK: PPV_IB.............                s(   8) ----   1.00 Mbps          0        100      No       0:00
OK: SAM................232.0.3.209     s(   9) up     1.00 Mbps     10.810        100     Yes       0:00
OK: IPG2_IB............232.0.3.210     s(  10) up     1.00 Mbps    476.632        100     Yes       0:04
OK: POD_CHANNELS.......232.0.3.211     s(  11) up     1.00 Mbps      6.971        100     Yes       0:00
OK: IPG3_IB............232.0.3.212     s(  12) up     1.00 Mbps    473.046        100     Yes       0:04
OK: IPG4_IB............232.0.3.214     s(  14) up     1.00 Mbps    451.354        100     Yes       0:04
OK: IPG5_IB............232.0.3.216     s(  16) up     1.00 Mbps    447.206        100     Yes       0:04
OK: IPG6_IB............232.0.3.218     s(  18) up     1.00 Mbps    499.562        100     Yes       0:04
OK: IPG7_IB............232.0.3.220     s(  20) up     1.00 Mbps    486.748        100     Yes       0:04
OK: MMM_OOB............232.0.3.221     s(  21) up     1.00 Mbps          0        100     Yes       0:00
OK: PPV_IB2............232.0.3.222     s(  22) up      .10 Mbps          0        100     Yes       0:00
OK: VQE_Client.........232.0.3.181     s( 181) up     1.00 Mbps    377.710        100     Yes       0:03
OK: bootloaderMcast....232.0.3.198     s( 198) up     4.00 Mbps  85308.196        100     Yes       3:11

Aggregate Carousel Datarate            =  19.75 Mbps
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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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