Solution Overview

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Solution Description and Scope

The Cisco Gibabit-Ethernet Optimized Video Networking Solution for Cable, Release 3.0, encompasses major enhancements to existing video solutions in the areas of IP multicast (IPmc) distribution for analog and digital broadcast video services in an HFC infrastructure. This solution includes architectural components to support resilient IPmc forwarding over the existing IP transport network between the encoders/multiplexers, ad splicers and video groomers, and edge QAM (EQAM) devices.

Note Because ad splicers commonly integrate the video grooming function, the term “ad splicer” is understood here as incorporating that function.

The objective of the solution is to provide an architectural basis for the migration of digital and analog broadcast streams onto a converged IP transport network. This converged network includes transmission support for all services—VoD, digital and analog broadcast video, high-speed data (HSD), and VoIP.

The following improvements to the reference architecture are addressed:

- Maximizing service availability

  Includes consideration of source and path diversity, path resiliency, and control-plane rate limiting
- Optimizing video flows

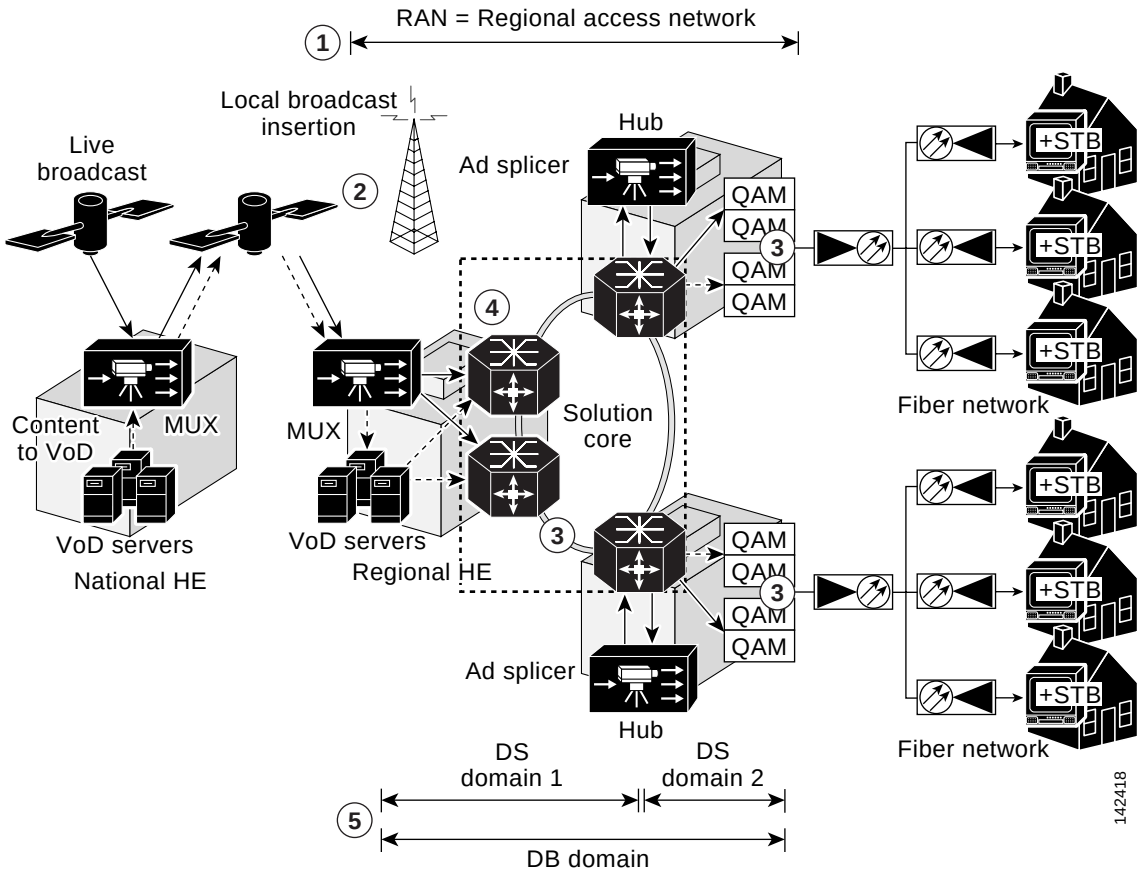
  Includes consideration of digital simulcast (DS) and digital broadcast (DB) flows and flow domains
- Optimizing quality of service (QoS)
- Upgrading the network

  Includes migrating from Any Source Multicast (ASM) to Source Specific Multicast (SSM)
- Using network management options
- Monitoring and troubleshooting

Generic Architecture and Scope

Figure 1-1 illustrates the reference architecture, a subset of a large network architecture as may be developed and maintained by a multiple services operator (MSO).

Figure 1-1 Reference Architecture



1. The focus of the solution is the regional access network (RAN), which serves a metropolitan area, and is made up of many market networks. A national headend (HE) pulls content from different sources and grooms traffic into transport streams for distribution (over satellite) to the regional headends.

   The solution focuses on the IP multicast (IPmc) distribution of digital simulcast (DS) and digital broadcast (DB) flows over the RAN.

   A single market network is depicted above. Each market network includes two aggregation routers (ARs) in the HE, with hub routers (HRs) in the hubs. Two source routers (SRs) (not shown) aggregate services that originate in the HE.

Note For simplicity, only one HR is shown in each hub. There are normally two HRs in a hub, to provide redundancy.

2. Regional headends in the RAN receive content from satellite and off-air antennas.

Multiple converged regional area networks (RANs) are connected to the Internet through peering points provided by an Internet service provider. RANs can be interconnected to each other, as well as to a national HE, through a QoS-enabled backbone.

A backbone can be used to interconnect RANs as well as other MSOs. The backbone makes it possible for the MSO to migrate off the satellite links and onto terrestrial network for transport stream distribution.

3. VoD and broadcast video traffic is switched or routed onto separate DWDM paths and to separate EQAM devices.
4. There are multiple sources for the broadcast and VoD traffic.
5. There are effectively three broadcast IPmc domains:

   Two DS domains:

   – One from the regional HE multiplexer to the ad splicer/groomer in the hub
   – One from the ad splicer in the hub to the EQAM devices

   One DB domain—from the regional HE to the EQAM devices

Because the regional HEs are dispersed throughout the RAN/market networks, and broadcast streams from each headend are forwarded across those networks, QoS is important to the delivery of the broadcast service.

Bidirectional 10-GE links are used for broadcast video, high-speed data (HSD), and VoIP services. These interconnects may consist of several 10-GE links bonded together by means of static portchannels or Layer 3 equal-cost multipath (ECMP) load balancing.

Note ECMP load balancing was not tested in this solution.

Separate links and routing protocols are used for VoD and broadcast services. Specifically, VoD uses dedicated 10-GE interfaces that are configured with static routing.

Solution Components

Cisco Equipment

The Cisco Gibabit-Ethernet Optimized Video Networking Solution for Cable, Release 3.0, consists of core Cisco components that are tested, documented, and fully supported by Cisco in the context of the solution. Table 1-1 on page 1-4 lists the Cisco hardware and software components that were tested.

Table 1-1 Cisco Hardware and Software Tested

Routers	Hardware	Software Release	Hardware Version
Cisco 7606, Cisco Catalyst 6509[1]	WS-SUP720	12.2(18)SXF	2.0, 2.3
	WS-SUP720-3BXL		4.3
	WS-SUP720-BASE		3.0
	WS-X6704-10GE		1.2, 2.2
	WS-X6724-SFP		2.2, 2.3
	WS-X6748-GE-TX		1.4, 2.1
	WS-F6700-DFC3A	N/A	2.1, 2.2
	WS-F6700-DFC3BXL		4.0, 5.0, 5.2
	WS-F6K-PFC3BXL		1.2, 1.6

1. In this solution, the Cisco 7600 series and the Cisco Catalyst 6500 series with the same supervisor engine function identically.

Third-Party Equipment

Third-party equipment is included to test the functionality of the Cisco routers/switches used in the solution. Table 1-1 on page 1-4 lists the third-party hardware and software components that were tested.

Note Cisco cannot guarantee support for the third-party equipment used in the solution.

Table 1-2 Third-Party Hardware and Software Tested

Component	Vendor and Model	Software Release	Hardware Release
Multiplexer, Ad splicer/groomer	Terayon DM 6400	netcp4.1 build 16	N/A
	BigBand Networks BMR1200	suite 2.11.1	
Edge QAM device	Motorola SEM v8	6.1.1	N/A