

Cisco HFC Access Bandwidth Capacity Planner

This powerful online Cisco® tool allows you to look five years into the future to help match your HFC network’s growth and evolution with your plans for expanded services and the bandwidth and equipment you’ll need to support them.

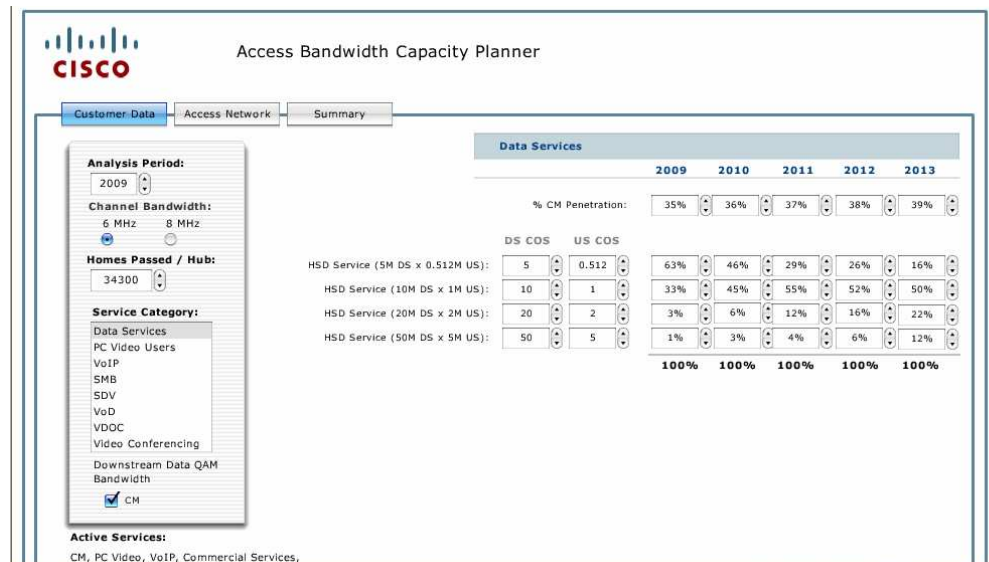
The planner includes three sections that you access using the tabs in the upper-left portion of the tool (Figure 1):

Customer Data: Enter current or projected customer data for market penetration of households for video on demand (VoD), voice over IP, data, and other services.

Access Network: Define your access network’s bit rates and the number of MPEG-2 and MPEG-4 SD and HD channels desired, and your upstream and downstream spectrum allocations.

Summary: The planner creates a five-year, forward-looking summary of downstream and upstream network capacity that matches your plans.

Figure 1 Cisco HFC Access Bandwidth Capacity Planner Starting Page



Entering Customer Data

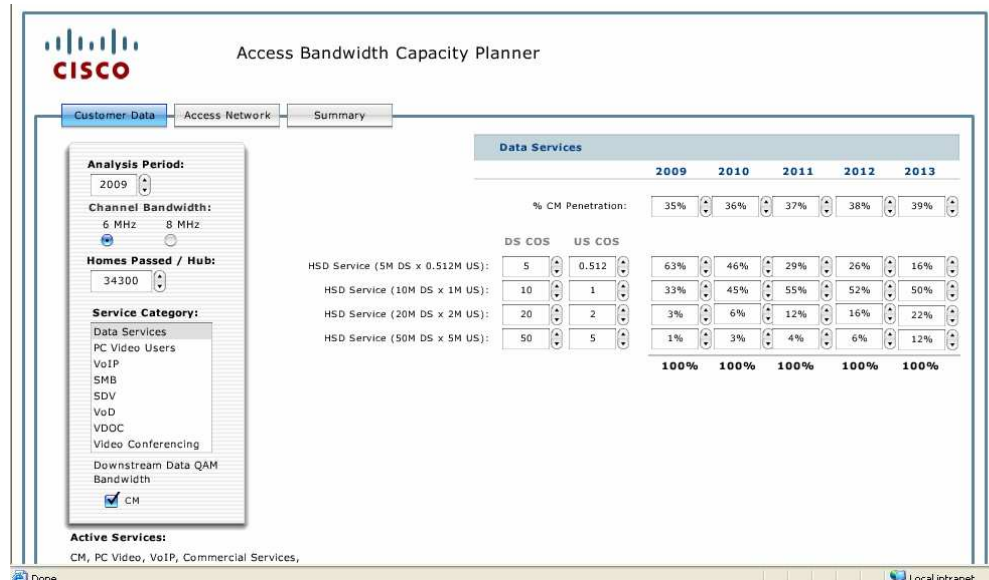
The following sections provide step-by-step instructions for filling in the Customer Data fields.

Analysis Period, Service Category, and Other Basic Customer Data

With the Customer Data tab selected, enter the following data in the panel on the left (Figure 2):

- Select the year for the **Analysis Period** start date. You can select a past year and use actual data, or select a future year and use projected data.
- Select the 6-MHz (North America) or 8-MHz (Europe) channel width.
- Select your **Homes Passed/Hub**.
- Select a **Service Category** from the list and enter the appropriate data in the fields on the right, which change depending on which Service Category you select. The following sections explain the data you enter for each Service Category.
- On each **Service Category** page, you can turn off the page by unchecking the box at the bottom of the left column if you don't want that particular category to impact your final summary.

Figure 2 Entering the Analysis Period and Other Basic Customer Data

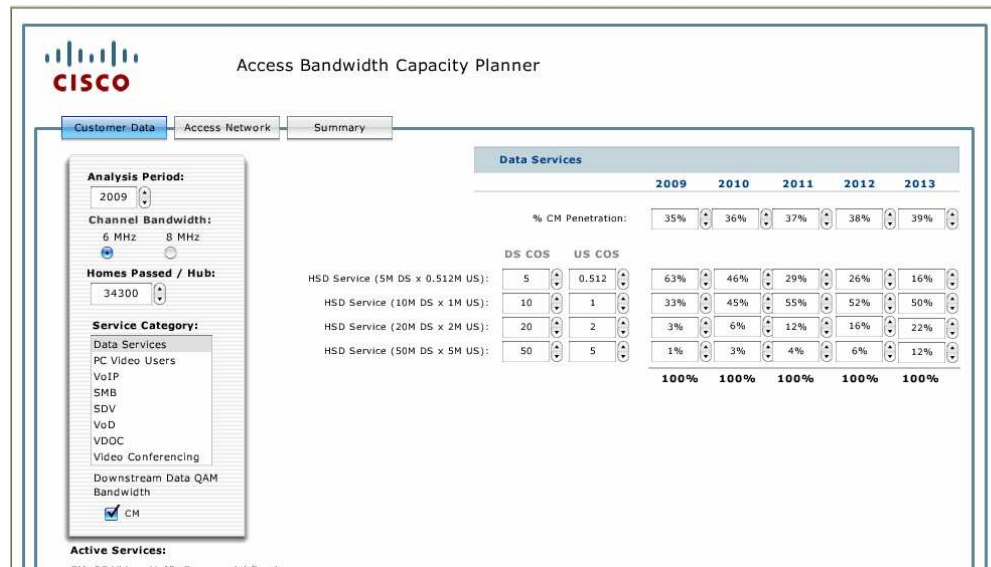


Data Services Service Category

Here you will enter cable modem (CM) penetration and anticipated penetration growth, tiers/class of service, and the mix of customers you think will subscribe to a particular service. See Figure 3 and follow these steps:

- Enter your **% of CM Penetration** per year.
- Enter the downstream and upstream Class of Service (COS)— that is, the maximum data rate for each of your high-speed data (HSD) tiers in the designated DS COS and US COS area
- Enter the percent take rate of each HSD tier for each year of the analysis period.
- As you enter data for the Downstream Class of Service (**DS COS**) and Upstream Class of Service (**US COS**), the planner will assume that any entry above 38 Mbps is DOCSIS 3.0 service.
- You may want to enter data for DOCSIS 1.1 and 2.0 services on this page and use the **SMB Service Category** later to include DOCSIS 3.0 service.

Figure 3 Entering Data for the Data Services Category



PC Video Users Service Category

This Service Category page is preloaded with YouTube traffic data based on In-Stat and Kagan research, and the page is locked. YouTube video traffic is one of the best indicators of the demand placed on networks by PC Video Users, and using this data allows us to separate video traffic from more traditional data traffic. The planner automatically adds these average kilobits of internet video streaming overhead to every high-speed data user to include the impact that the projected growth of Over The Top (OTT) PC video will have over time on your network.

VoIP Service Category

Most hybrid fiber-coaxial (HFC) systems will be configured for a 100 kilobit signal so you may not need to change anything on this page. The **VoIP Penetration** percentages represent the percent of your data subscribers who subscribe for VoIP. You can move penetration rates up and down.

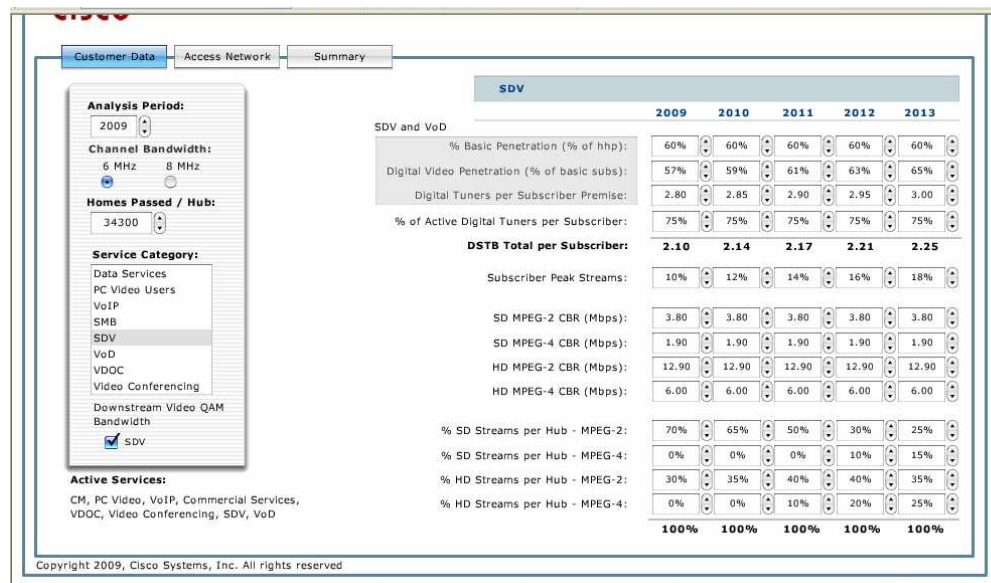
SMB Service Category

This Service Category provides an opportunity to define small and medium-sized business (SMB) or any high-speed DOCSIS 3.0 users. Based on the DS COS and US COS rates you enter, you can include DOCSIS 1, 2, or 3 in this category. Your **% of Commercial Premises in Hub Site Area** could also be residential households passed.

SDV Service Category

Even if you have not implemented switched digital video (SDV), you still need to enter data in the top, shaded area of this page because this data also applies to the VoD Service Category on the next page. Figure 4 shows the fields on the SDV page.

Figure 4 Entering Data for the SDV Service Category



- **% Basic Penetration (% of hhp)** is the percent of the homes passed that are video subscribers.
- **Digital Video Penetration (% of basic subs)** is the percent of the basic video penetration percentage that are digital video homes.
- **Digital Tuners per Subscriber Premise** allows you to account for the potential video streams a household may demand, i.e. two DVR set-tops represents four tuners.
- Based on your **% of Active Digital Tuners per Subscriber** entry, the planner will calculate the **DSTB (Digital Set-Top) Total per Subscriber**.
- **Subscriber Peak Streams** can be retrieved from your set-top controller. It will tell you the busiest times on your network, i.e. the peak number of tuners that are receiving video streams. This is why the **DSTB Total per Subscriber** number is important.
- Requirements such as the SD and HD data rates for MPEG-2 and MPEG-4 typically stay the same across the years, as does the penetration for each type of stream. You can adjust the numbers here to see how replacing your MPEG-2 set-tops with MPEG-4 set-tops helps to predict when you'll migrate to MPEG-4 and what your CapEx impact will be.

VoD Service Category

The upper section of the video-on-demand (**VoD**) Service Category page will be populated with the numbers you entered on the SDV page. Since video-on-demand content is often different from SDV, you may need to adjust compression ratios and the streaming settings, and so on. Also, the **Subscriber Peak Streams** entries will probably be lower than for SDV.

VDOC Service Category

This section is used for analyzing the impact of IP video over DOCSIS (**VDOC**) services. By entering VDOC data, you will predict how many times somebody will download an SD program or HD program that streams over the cable modem termination system (CMTS) through the DOCSIS pipe. This service is more future oriented and can most likely be turned off. Use the check box at the bottom of the **Service Category** column to disable this page.

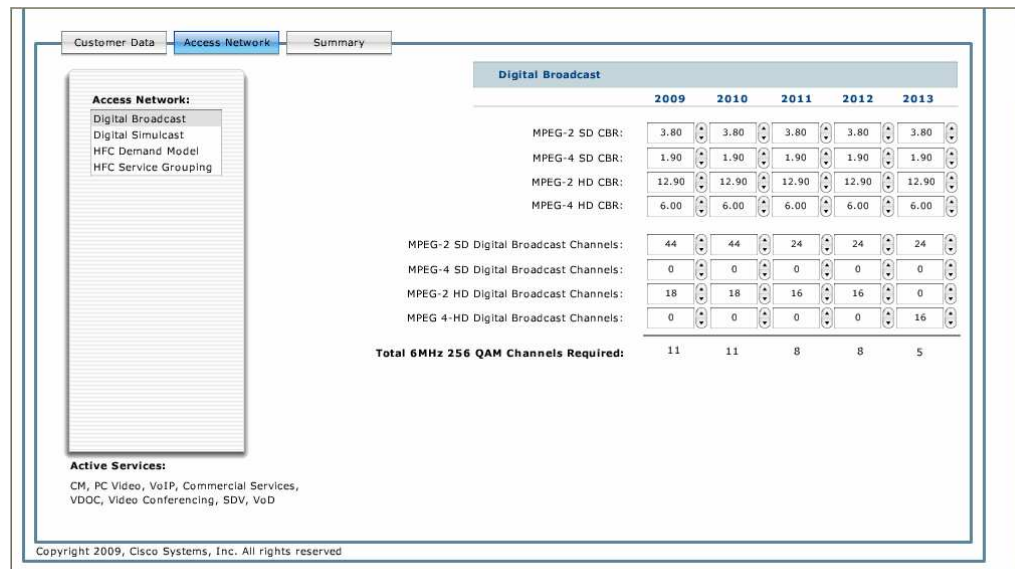
Video Conferencing Service Category

Video Conferencing can be simple talking heads or a Cisco TelePresence™ session. Low-bandwidth entries would be for a webcam on a PC at approximately .3 or .4 Mbps, but Cisco TelePresence requires 4 Mbps. Like VDOC, this page will have more application in the future and can be turned off using the check box at the bottom of the **Service Category** column.

Entering Access Network Data

Figure 5 shows the main Access Networks page. The sections that follow explain the data required for each of the four Access Network types in the Access Network list.

Figure 5 Access Networks Page



Digital Broadcast Data

First, enter the MPEG-2 and MPEG-4 compression ratios to establish the Constant Bit Rate (CBR) requirements for SC and HD video. Then, define the number of broadcast channels you desire for each year. As you enter the bit rate and channel data, the planner begins calculating your required quadrature amplitude modulation (QAM) channels to arrive at a total number needed for each year to support your plan.

Digital Simulcast Data

Your entries for Digital Simulcast allow you to define how many of the total analog channels you deliver will also be simulcast on your digital tier. Typically, the analog and digital simulcast channel numbers are the same, but if there are some low-demand channels that will not be included, you can adjust for that reduction here. Once the date is entered, the planner tells you how many QAM channels you need to support your Digital Simulcast plan.

HFC Demand Model Data

The HFC Demand Model (Figure 6) data allows you to “define” your HFC system. Is it 750 MHz, 860 MHz or 1 GHz? What are your upstream and downstream spectrum ranges? Then you enter the A channels that are in the FM band; some systems use them and some don't. A-1 and A-2 are outside the FM band, and A-3, A-4, and A-5 are in the FM band so the number here could be from 0 to 5.

Next, enter how many analog channels you plan to use. The planner identifies how many channels are left based on what frequency you picked. Then, since there are both Residential and Commercial entry possibilities, you can account for DOCSIS 1.1 and 2.0 services modulation and channel width in the Residential entries and higher-speed Residential or Commercial DOCSIS 3.0 services in the commercial entries if you currently have or plan to offer that service. For both Residential and Commercial entries, select thereverse/upstream channel modulation type and channel width being used.

Figure 6 Entering Data for the HFC Demand Model

Access Bandwidth Capacity Planner

Customer Data | **Access Network** | Summary

HFC Demand Model

	2009	2010	2011	2012	2013
Downstream Spectrum:	750 MHz	750 MHz	750 MHz	750 MHz	750 MHz
Upstream Spectrum:	5-40 MHz	5-40 MHz	5-40 MHz	5-40 MHz	5-40 MHz
# of Active A-Channels (A-1 to A-5):	2	2	2	2	2
Maximum Channels 50-550 MHz:	79	79	79	79	79
Current Channel Loading 50-550 MHz:	72	68	64	64	64
Additional Available Channels:	40	44	48	48	48
Residential Upstream Modulation:	QPSK	16 QAM	64 QAM	64 QAM	64 QAM
Residential Upstream Carrier BW:	1.6 MHz	3.2 MHz	6.4 MHz	6.4 MHz	6.4 MHz
Commercial Upstream Modulation:	QPSK	16 QAM	32 QAM	32 QAM	64 QAM
Commercial Upstream Carrier BW:	1.6 MHz	3.2 MHz	3.2 MHz	3.2 MHz	6.4 MHz

Active Services:
 CM, PC Video, VoIP, Commercial Services, VOD, Video Conferencing, SDV, VoD

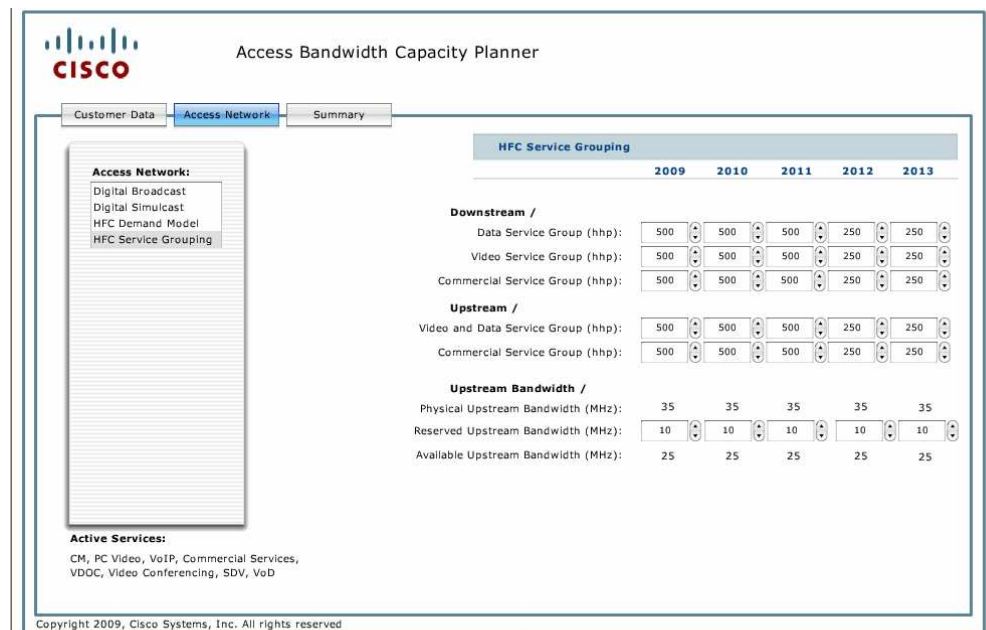
Copyright 2009, Cisco Systems, Inc. All rights reserved

HFC Service Grouping Data

As Figure 7 shows, entries on this page begin with the **Downstream** information for the **Data Service Group**, which identifies how many households passed (**hhp**) a CMTS serves. Next, enter the hhp value for your **Video Service Group** (SDV and VoD), and then enter corresponding data for the **Commercial Service Group** for your small or medium-sized business service group if that is different from residential. In most cases, the residential and commercial service groups will be the same.

The **Upstream** and **Upstream Bandwidth** calculations tell you how much of the **Physical Upstream Bandwidth** is usable. Usually in a reverse system, the transmission quality available in the 5- to 15-MHz range is not suitable for video, voice, or data services. This bandwidth may be used for home security or meter-reading applications. Once you identify the frequencies you can't use in the **Reserved Upstream Bandwidth** fields, the planner calculates your **Available Upstream Bandwidth**.

Figure 7 Entering HFC Service Grouping Data

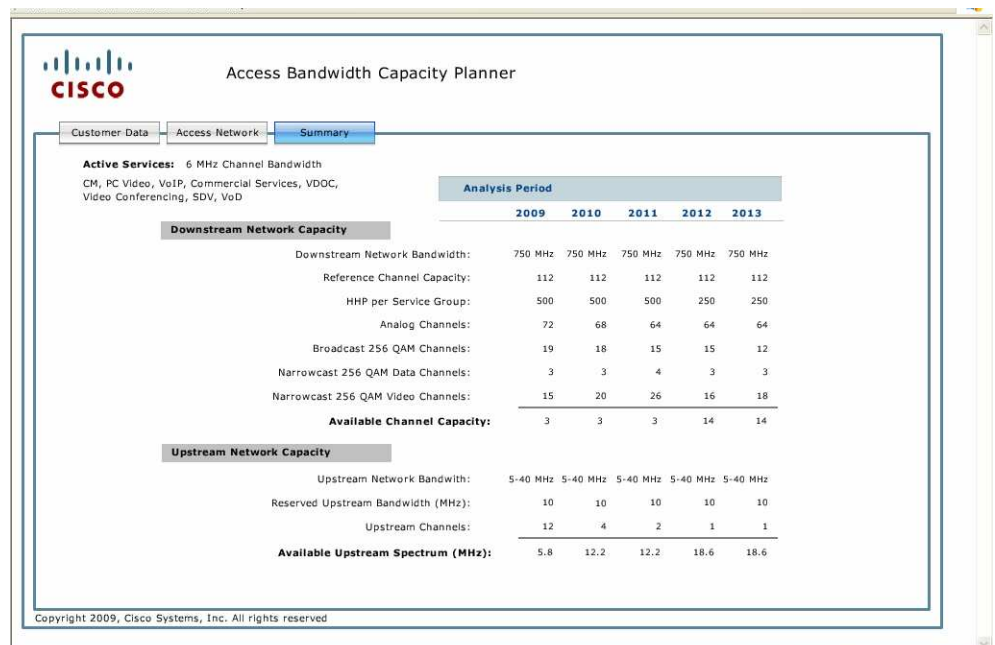


Summary

Based on the **Service Categories** you have selected for data entry, the **Summary** provides **Downstream Network Capacity** and **Upstream Network Capacity** (see Figure 8). **Downstream Network Capacity** provides how many channel slots you have, the number of households in a service group, the number of analog channels you want to support, your broadcast QAM video channels, narrowcast QAM video and data, and how many channels are still available after supporting your desired levels of service. A number in red indicates that your network can't support some areas of your plan, while a green number indicates you still have channel capacity for possible use for additional, future services.

Similarly, the **Upstream Network Capacity** summary looks at the reverse side of your network and calculates how much frequency is used and how much is left for possible support of additional services.

Figure 8 Summary



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV
Amsterdam, The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at www.cisco.com/go/offices.

CCDE, CCENT, Cisco Eos, Cisco Lumin, Cisco Nexus, Cisco StadiumVision, the Cisco logo, DCE, and Welcome to the Human Network are trademarks. Changing the Way We Work, Live, Play, and Learn is a service mark; and Access Registrar, Aironet, AsyncOS, Bringing the Meeting To You, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, CCSP, CCVP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Collaboration Without Limitation, EtherFast, EtherSwitch, Event Center, Fast Step, Follow Me Browsing, FormShare, GigaDrive, HomeLink, Internet Quotient, IOS, iPhone, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, iQuick Study, IronPort, the IronPort logo, LightStream, Linksys, MediaTone, MeetingPlace, MGX, Networkers, Networking Academy, Network Registrar, PCNow, PIX, PowerPanels, ProConnect, ScriptShare, SenderBase, SMARTnet, Spectrum Expert, StackWise, The Fastest Way to Increase Your Internet Quotient, TransPath, WebEx, and the WebEx logo are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0805R)