

Connecting Cisco SOHO Series, 800 Series, and 1700 Series Routers to Service Provider DSL Networks

Application Overview

Availability of broadband DSL has grown dramatically in the last few years and as the technology has matured, many of the initial interoperability issues between DSL hardware vendors have been addressed with standards-based architectures.

Previously, when ordering a DSL line from a service provider, a DSL modem was provided automatically as part of the monthly service. These DSL modems offered simple high-speed Internet access but allowed only single user access and provided no security capabilities. Business customers accustomed to using routers and requiring firewall and VPN protection were left looking for ways to leverage the speed and affordability of DSL but with equipment that provided the business class features they required.

Today, business customers and resellers who serve these customers have additional choices when using DSL lines for WAN access. They can choose to simply connect a Cisco Dual Ethernet router to the DSL modem or they simply forgo use of the DSL modem and deploy their own DSL router which has an integrated DSL interface acting as a modem. Many service providers call this type of service “Wires-Only” DSL where they simply provide the customer with the DSL line (or wires) and leave it up to the customer to choose and install their own DSL equipment. The Cisco SOHO,

800, and 1700 Series Routers provide options for either an integrated DSL interface for a wires-only service or models with an Ethernet WAN port to connect to an external DSL modem. With either type of solution, the Cisco SOHO, 800, and 1700 series routers provide multi-user access along with business class security, simplified set-up with a Web-based configuration tool, and the proven reliability and manageability of Cisco IOS® Software.

Users who obtain a DSL line and want to install the Cisco SOHO, 800, or 1700 series models should follow the steps below in order to successfully connect to the service providers DSL network.

1. Determine what DSL technology is offered by your DSL service provider
2. Determine if the service provider requires use of an approved DSL modem
3. Choose the correct Cisco DSL or Dual Ethernet Router
4. Use Cisco IOS Software or the Cisco Router Web Set Up (CRWS) tool to set up the connection

Once the connection is set up, Cisco IOS software provides a rich set of remote management and trouble shooting commands. These commands can help a network manager troubleshoot and isolate problems that may occur with the WAN



connection. Additionally, Cisco IOS can be used to update any modifications to firewall and VPN configurations. For non technical users, the CRWS tool available on Cisco SOHO and 800 routers provides basic monitoring and router status information that can help resolve connectivity problems.

Determine what DSL technology is offered by your DSL service provider

There are several DSL technologies that are currently deployed around the world. Below is a list of each technology and their features and benefits.

ADSL—Asymmetric Digital Subscriber Line. ADSL is designed to deliver more bandwidth downstream (from the central office to the customer site) than upstream. Downstream rates range from 1.5 to 9 Mbps, whereas upstream bandwidth ranges from 16 to 640 kbps. ADSL transmissions work at distances up to 18,000 feet (5,488 meters) over a single copper twisted pair and ADSL supports line sharing with the existing analog telephone service. A Cisco ADSL router can be directly connected to an ADSL line.

ADSL over ISDN—Same DSL technology as mentioned above but used where local loops support ISDN service. ADSL over ISDN is spectrally compatible with ISDN so there is not interference created with the frequencies of the existing ISDN lines. A Cisco ADSL over ISDN router such as a SOHO 76 router or 826 router can be directly connected to an ADSL line.

SDSL—Symmetrical Digital Subscriber Line – A proprietary DSL technology that provides symmetrical high-speed access. Because SDSL is proprietary, service providers are not rolling out new deployments of SDSL networks. There are however, many existing SDSL lines in place where an SDSL modem is deployed at the customer premise. Cisco does not have SDSL compatible equipment, so when only an SDSL line is provisioned, users would connect a Cisco Dual Ethernet router such as a Cisco 1710 Security Access router, SOHO 71 router or Cisco 806 router, to the SDSL modem.

G.SHDSL—Standards-based (ITU) Symmetrical DSL service adopted now by service providers to replace SDSL. G.SHDSL provides symmetrical data rates of up to 2.3 Mbps. G.SHDSL has a longer reach than ADSL with support for over 20,000 feet from the Central Office. A Cisco G.SHDSL router such as a Cisco SOHO 78 router, Cisco 828 router, or Cisco 1700 with G.SHDSL WIC can be connected directly to a G.SHDSL line.

Determine if the service provider requires use of an approved DSL modem

Not all service providers currently allow customers to connect their own DSL CPE to the DSL line. Some service providers require the use of a DSL modem that is certified with the DSL service. In these instances where a DSL router cannot be substituted, users can look to add a Cisco Dual Ethernet Router (Cisco SOHO 71, Cisco 806, or Cisco 1710 router) that simply connects through an Ethernet port to the approved DSL modem. If the service provider does not require the use of a specific DSL modem, users can look to use their own Cisco DSL router.

Choose the correct Cisco DSL or Dual Ethernet router

Choosing the correct model is critical in order to successfully connect to the service provider's DSL network. As mentioned above, if there are no options to replace the use of a DSL modem, users can add a Cisco Dual Ethernet Router. If a router with an integrated DSL interface or modem can be used, the following chart provides a listing of Cisco DSL Routers with the corresponding DSL technology and a comparison of key features.



DSL Technology	Cisco Router Model	Key Features	Target Customer
ADSL	SOHO 77-H	Multiuser access, packet filtering firewall, IPSec pass-through	Small business, teleworkers with PC VPN SW clients
	Cisco 827-H	Stateful Firewall, IPSec 3DES, IP Quality of Service (QoS)	Small remote offices and teleworkers
	Cisco 827-4V	Stateful Firewall, IPSec 3DES, IP QoS, voice over IP (VoIP) with 4 foreign exchange station (FXS) ports	Small remote offices and teleworkers
	Cisco 1700 with ADSL WIC	Modular routers with optional hardware-assist Virtual Private Network (VPN), Stateful Firewall, Intrusion Detection System (IDS)	Enterprise small branch office, small business
ADSL over ISDN	Cisco SOHO 76	Multiuser access, packet filtering firewall, IPSec pass-through	Small business, teleworkers with PC VPN SW clients
	Cisco 826	Stateful Firewall, IPSec 3DES, IP QoS	Small remote offices and teleworkers
G.SHDSL	Cisco SOHO 78	Multiuser access, packet filtering firewall, IPSec pass-through	Small business, teleworkers with PC VPN SW clients
	Cisco 828	Stateful Firewall, IPSec 3DES, IP QoS	Small remote offices and teleworkers
	Cisco 1700 with G.SHDSL WIC	Modular routers with optional hardware-assist VPN, Stateful Firewall, IDS	Enterprise small branch office, small business
Dual Ethernet	Cisco SOHO 71	Multiuser access, Stateful Firewall, IPSec pass-through	Small business, teleworkers with PC VPN SW clients
	Cisco 806	Stateful Firewall, IPSec 3DES, IP QoS	Small remote offices and teleworkers
	Cisco 1710	Integrated hardware-assist VPN, Stateful Firewall, IDS	Enterprise small branch office, small business



Use Cisco IOS Software or the CRWS tool to set up the connection

In order to connect one of the above routers to the DSL network, users can use one of the following options:

1. Use the default configuration—The Cisco DSL and Ethernet router ship from the factory with a default configuration that provides basic multiuser access. Users can simply connect the DSL line to the router, connect it to a PC, power the unit and attempt to access the Internet to determine if the default configuration is compatible with the service provider's network.
2. Use the CRWS on Cisco SOHO and 800 routers—When the default configuration does not work or more advanced features need to be activated, users can use the CRWS. CRWS is pre-installed on each Cisco SOHO and 800 DSL or Ethernet router listed above and users simply connect and power the router and point a Web browser to the router. Once connected, users can configure user name and password, network address translation (NAT), and activate the firewall or VPN capabilities. CRWS allows non technical users or users without knowledge of the command line interface of Cisco IOS Software to easily set up a Cisco 800 or SOHO series broadband router.
3. Use Cisco IOS Command Line Interface—When the default configuration does not work or more advanced features need to be activated, users can use the Cisco IOS command line interface to configure the routers. The Cisco IOS Software running on these routers is the same proven operating systems as the Cisco 2600 series and 3600 series routers.

Monitoring, managing, and troubleshooting

Once connected, Cisco IOS software provides very powerful monitoring and troubleshooting commands with specific DSL commands. The list below provides a partial list of commands that can be used to remotely manage and troubleshooting a DSL WAN connection.

Additionally, the CRWS tool on the SOHO and 800 routers provides several monitoring features that provide information on the status of the DSL line and the router interfaces.

Top Cisco IOS commands for monitoring and troubleshooting ADSL lines

The following Cisco IOS commands are powerful troubleshooting tools that can aid a service technician in identifying and analyzing problems with a DSL line that is connected to a Cisco IOS DSL router. The output of these commands can be used to determine the quality of the local loop and potentially find a solution to a problem without requiring a technician to be sent to the site. By utilizing debug and troubleshooting commands remotely, service providers can avoid the costs of on-site visits as well as quickly determine and resolve issues, increasing customer satisfaction.



1) Router (config)# Show DSL Interface ATM 0

This command shows all of the ADSL specific information for the ATM interface requested.

Example

```
router# show dsl int atm0
Alcatel 20150 chipset information
```

	ATU-R (DS)		ATU-C (US)	
Modem Status:	Showtime (DMTDSL_SHOWTIME)			
DSL Mode:	ITU G.992.1 (G.DMT)			
ITU STD NUM:	0x01		0x1	
Vendor ID:	'ALCB'		'ALCB'	
Vendor Specific:	0x0000		0x0000	
Vendor Country:	0x00		0x0F	
Capacity Used:	85%		98%	
Noise Margin:	13.5 dB		7.0 dB	
Output Power:	9.5 dBm		12.0 dBm	
Attenuation:	1.5 dB		3.5 dB	
Defect Status:	None		None	
Last Fail Code:	None			
Selftest Result:	0x00			
Subfunction:	0x15			
Interrupts:	5940 (0 spurious)			
PHY Access Err:	0			
Activations:	1			
SW Version:	3.670			
FW Version:	0x1A04			
	Interleave	Fast	Interleave	Fast
Speed (kbps):	0	8128	0	864
Reed-Solomon EC:	0	0	0	0
CRC Errors:	0	0	0	7
Header Errors:	0	0	0	2
Bit Errors:	0	0		
BER Valid sec:	0	0		
BER Invalid sec:	0	0		



DMT Bits Per Bin																
00:	0	0	0	0	0	0	0	7	6	7	9	A	B	C	C	C
10	C	C	C	C	C	C	B	B	B	B	A	9	A	9	0	0
20	0	0	0	0	0	0	2	2	3	4	4	5	6	6	7	7
30	7	8	8	8	9	9	9	A	A	A	A	A	A	B	B	B
40	B	B	B	B	B	B	B	B	B	B	B	B	A	B	B	B
50	B	B	B	B	B	B	B	B	B	B	B	B	2	B	B	B
60	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
70	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
80	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
90	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
A0:	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
B0	B	B	B	B	B	B	B	B	B	B	B	B	A	B	A	A
C0	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
D0	A	A	A	A	A	A	A	A	A	A	A	9	9	9	9	9
E0	9	9	9	9	9	9	9	9	9	9	9	9	8	8	8	8
F0	8	8	8	8	8	8	7	7	7	7	6	6	5	5	4	4

2) Router (config)# Debug ATM Events

This command displays ATM events that occur on the ATM interface processor and is useful for diagnosing problems in an ATM network. It provides an overall picture of the stability of the network.

If the interface is successfully communicating with the Digital Subscriber Line Access Multiplexer (DSLAM) at the telephone company, the modem state is 0x10. If the interface is not communicating with the DSLAM, the modem state is 0x8.

The following output indicates that the ADSL line is up and the AAL5 frames are being sent and received.

Example

Router#

```
01:21:19:c820_vc_tx_start:idb = 0x80CB3AC0, cos_queue = 0x80BBE614
```

```
01:21:19:c820_aal_send:pak = 0x80D4BA48, vc = 0d, q = 1c820_aal_send:pak_encntype=0
vcnum=1 encntype=0
```

```
01:21:19:pquicc_sar_pak2txring:nextTxBd = 0x80BBE3AC, ring = 0x80F050D0
```

```
01:21:19:pquicc_sar_add_pak_tx:packet TX=0x136DC78, len=108, oam?=0
```

```
01:21:19:PQUICC_SAR_INTERRUPT:status=800208C0
```

```
01:21:19:TX interrupt:conid 2, usedTxBd:Shadow 0x80BBE3AC, Real 0x80CE4F18
```

```
01:21:19:pquicc_sar_safe_start:vc = 1
```

```
01:21:19:PQUICC_SAR_INTERRUPT:status=800808C0
```

```
01:21:19:RX interrupt:conid = 2, rxBd = 0x80CE4540 length=108
```

```
01:21:19:process_receive_packet:vcnum=1 encntype=0
```



If the router has difficulty training, you can see the following:

```
17:25:02:DSL:SM:[DMTDSL_DLOAD_2 -> DMTDSL_DO_OPEN]
17:25:02:DSL:Send ADSL_OPEN command.
17:25:03:DSL:Using subfunction 0x2
17:25:03:DSL:Sent command 0x3
17:25:06:DSL:1:Modem state = 0x8
17:25:08:DSL:2:Modem state = 0x8
17:25:11:DSL:3:Modem state = 0x8
17:25:13:DSL:4:Modem state = 0x8
```

3) Router (config)# Show Controller ATM 0

In addition to the output of the above two commands, a more extensive set of details can be shown with the SHOW CONTROLLER ATM 0 command. For example, on the ATM layer, if no Virtual Circuits (VCs) have been configured, this debug can be used to identify the VPI/VCIs that have been configured at the central office, taking out the guesswork and need to synchronize with technicians at the corporate office from the service provider to understand if and how many additional VCs have been provisioned to the customer. In Cisco IOS Release 12.1.5yb, a feature was introduced that allows the router to sniff the cells and provide information about the encapsulation on the virtual circuit. The command shows a snapshot of the controller, and the SHOW DSL INTERFACE ATM 0 is a subset of this command.

4) Router (config)# Debug PPP Negotiation

Displays PPP packets transmitted during PPP startup, where PPP options are negotiated.

5) Router (config)# Debug PPP Authentication

Displays authentication protocol messages, including Challenge Authentication Protocol (CHAP) packet exchanges and Password Authentication Protocol (PAP) exchanges.

6) Router (config)# Show Interface ATM 0 or Show Interface Dialer or Show Interface BVI

Based on encapsulation, these commands show status and details of either the physical or the virtual interface. For example when the router is negotiating an IP address these commands show the address the router has obtained. After determining the WAN interface is correctly configured, PING and TRACE ROUTE commands can be used to check network connectivity.

7) Router (config)# Show Interface Ethernet 0

After troubleshooting the WAN connection, the SHOW INTERFACE ETHERNET 0 command can be used to determine status of the LAN interface. For example this command can show packet throughput, IP and MAC address information, etc.

8) Router (config)# Show ARP

This command can be used to determine if there is a conflict between the configuration of the users PC and the router. The ARP table shows successful access from the user PC to the router, and if the user's IP address is not in the ARP table it checks the IP stack of the PC.

9) Router (config)# Show IP NAT

This command shows if NAT is correctly configured on the router by showing successful address translations in the NAT table.

10) Router (config)# Show IP Route

After analyzing all interfaces and connections, the SHOW IP ROUTE command can be used to check if the static or dynamic route is correctly configured.

11) Router (config)# Show Tech

To display general information about the router when reporting a problem, use the SHOW TECH privileged EXEC command.



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