

# Set Up Your Home Router Lab! Part 1 - Archive

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<webadmin - this is a very old article I found however the premise is still applicable for todays home lab. The reason I posted this was I was hoping this would give some insight into how to setup a serial to serial connection in a home lab. If you look it is fun to see that we can now purchase a 2600 router on eBay for about \$20.00 - The article was published in January 2000 and at that time the cost was considerably higher than \$20.00! >

To really learn routing and demonstrate the full power of IOS and the operation of routing protocols on a simulated wide area network (WAN), you'll need at least two routers connected together. Many production Cisco installations around the world use routers as the building blocks of their wide area networks. Common configurations such as a hub and spoke configuration include a headquarters and one or more branch offices, which is worthwhile to simulate on your lab. Most Cisco routers are equipped with one or more LAN ports and serial connections. Normally, the serial ports go to DSU/CSU (Data and Channel Service Units), which in turn connect service provider wan links.

For the purposes of a home lab, you can connect serial interfaces with what is known as a "back to back cable assembly." You can connect Ethernet interfaces via a hub or crossover cable, but most of the available router models have only one Ethernet interface, and you don't get to work with serial interfaces, which you'll find in the exam requirements.

To connect serial interfaces, you need a DCE cable on one router and a DTE on another. The most common serial router cables are equipped with V.35 connectors -- female for DCE, and male for DTE. The routers themselves have one of two kinds of female jacks for serial interfaces -- a mini-DB60 on the new models and a larger, DB50 jack on the older models. Make certain you have the right types of cables and that you're careful with the pins on these cables, as they're delicate. (It's actually possible to connect the DB60 connectors upside down!) Most router cables aren't found in local computer stores, so you'll need to buy the official Cisco proprietary cables at around \$100 each new. The used price is about half that.

One important note on connecting routers via back-to-back cables: At least one router must support clocking (DCE) -- the IOS "clockrate" command. The 2500, 3104, and 4000 serial interfaces do, but some older 3000 and IGS models don't. Let's look at some of the new router models that can be used in a home certification lab:

- 600, 700, and 800 Series -- These routers fall into the category of SOHO (Small Office-Home Office) and should only be used to augment a home lab. They can be useful for practicing dial technologies such as ISDN and DSL, and they're inexpensive. Unfortunately, SOHO routers run a limited IOS release, (the 700s are non-IOS) and most models aren't suitable for back-to-back connection.

- 1000, 1600 Series -- These run IOS; you can get serial/Ethernet models; but you won't find on these several advanced routing protocols and legacy desktop protocols you might find on an exam.

- 1700 Series -- This new series has a lot of available security and encryption extensions to IOS, but are limited on routing and desktop protocol support.

- 2500 Series -- These are the first of the "enterprise" routers in the current Cisco line. You can run the latest full IOS on these, including virtually all the available features and routing protocols. They're around \$1,800 new depending on the model you select and can be upgraded with up to 16M of flash memory and 16M or 18M of RAM. The most popular certification box, the 2501, supports two serial ports (DB60), Ethernet, and DCE clocking. Some of the latest security features on the IOS firewall are starting to require a faster processor than the 68030 in the 2500.

- 2600, 3600 and up -- Modular routers intended as an eventual replacement to the 2500 and 4000 series routers, they may be overkill for a certification lab, but you get a lot of nice features: full IOS support, quiet fans, lots of memory expansion, and fast processors.

### **Used Routers**

Since you're looking at the need to support the full IOS protocol and feature range for the exams, one good choice is to pick up used enterprise-grade routers. Cisco hardware is rock-solid. So if you buy a unit that's working, the fact that a system isn't supported by Cisco

any more should not be a major worry. (When Cisco says a router has reached "end of support," you can't buy a service contract or get factory-supplied support or parts any more.)

Some of these models aren't Y2K certified, although this has much to do with the IOS version you're running. Cisco routers have real time clocks, but these don't seem to be critical to the operation of the routers.

Watch for "Cisco Pro"/"White Box" models of many routers advertised. These were the result of a temporary experiment by Cisco in selling software feature-limited routers via resellers and dealers. This experiment has ended, and you can upgrade these routers in software and firmware to look like a normal router of the same model. Cisco Pro models sell for less in the used market.

Token ring models are available, and tend to be cheaper in the used market. The serial ports work the same; and you can find back-to-back cables, so you could connect servers to the token ring interface without an external MAU hub unit.

**Tip:** *If you are planning to advance along the CCIE certification track, you'll want to have access to at least one token ring router. There you'll encounter emphasis on IBM protocols such as SNA and ring technologies such as Source route bridging and DLSW+.*

The used market takes several forms. eBay.com and other auction sites bring together buyers and sellers. At any given moment, eBay usually has 400 or so Cisco listings, many labeled with "perfect for CCNA." (Be a bit careful when you buy this way that you truly know what you're getting.) Cisco resellers are another source -- some will work with home lab customers, though most seem to prefer high-volume commercial customers. You can also buy routers from ads in newsgroups, such as the ISP equipment list.

We've seen a demand for used Cisco routers pick up in the last year, due to certification testing needs and because of a Cisco trade-in program that's on-going. Series 3000s are desirable for labs, but rare in the used market; they can be worth a lot in trade on new Cisco routers.

Memory for upgrading routers is widely available. You can buy actual Cisco-boxed and branded upgrades for many models, but these can be costly. Dealers will sell "Cisco Approved" memory

for less, and you can find various types of generic memory chips for even less, such as on the auction sites. Cisco allows the use of certain other brands of approved memory even under their service contracts. Each model has complicated memory-related upgrade rules, so read the CCO memory upgrade articles carefully. You usually need a bare minimum of 4M of RAM (used for buffers and table storage) and 4M of flash (used to store IOS for booting) to run a Y2K-compliant (and exam-friendly) 11.x level of IOS.

**Tip:** *Remember that boot ROM upgrades for out of support older routers aren't available any more.*

### Used Models

- 2500 series, especially the 2501. These are the most popular certification routers and are fully supported by Cisco. Used prices start around \$800 for Ethernet models. You can buy a SmartNet hardware/software contract on these for around \$280 annually and get free upgraded boot ROMs, access to the "customer" sections of the Cisco Web site (including updated IOS downloads), access to the Cisco Technical Assistance Center, and hardware repair. Make sure you get a "console cable kit" for a 2500 -- these have an RJ45 serial console connector than requires a reversed RJ45 cable and a special series of connectors to adapt to the RS232 port on your PC or terminal as a console. You'll need RJ45-to-AUI Ethernet transceivers on the 2500, 3000, and IGS models to adapt to newer 10BaseT wiring and hubs. These are around \$30 new or used.

- 3000 Series. These models preceded the 2500 series and, as far as IOS is concerned, look identical. They're no longer supported; but several models can be upgraded to 8M of flash, and 16M of RAM. The most popular is the 3102, (\$300), which supports an Ethernet and serial port (no DCE clocking, so you must connect to a router with clocking). It uses standard Cisco flash memory (up to 8M) and supports old PC type 30-pin SIMM memory up to 16M. The 3104 (\$500) is nice if you can find one with one or two serial ports (plus DCE clocking), one Ethernet port, plus a bonus ISDN BRI. The 3104 uses modern 2500-type RAM and flash memory. Several token ring models are available, but read up on these before buying them to make sure you can upgrade them. All 3000s use the old-style 50-pin serial cables and have AUI Ethernet connectors. You can use a short AUI cable or just remove the mounting studs near the Ethernet jack to fit the transceiver on these models.

- IGS Series. These come in one Ethernet/one serial models (no DCE) called the IGS/R, a dual Ethernet model (IGS/L), and a token ring model (1S/1TR) called the IGS/TR. The IOS (usually an older 8.x or 9.1 release) comes on eight ROM chips (no flash), and IOS upgrades aren't available from Cisco any more (though rarely you can find them used on eBay). These are older, cost around \$100 on auction sites, and have noisy fans that sound like vacuum cleaners. netbooting on most routers lets you run a reasonably recent (full-featured) version of IOS in RAM. (See "netbooting" later in this article.) IGS routers use the same cabling for the most part as the 3000s.

- 2000 Series. These are rare, cost \$120, and are like an IGS/R that was designed to be upgradeable to a 3000. The upgrade kits are no longer available.

- AGS Series. These were formerly top-of-the-line Cisco routers. You can get many interfaces and run a reasonably recent IOS on these. They're big, power-hungry, hot and noisy, and have exotic serial connectors that are hard to find cables for. They sell for around \$500 on eBay.

- Older 4000 models. The 4000s are a family of medium-sized modular routers with three interface bays. You can plug in a combination of Ethernet, serial ports and other interfaces. New 4500 and 4700 models are still being sold, and the older models, such as the "classic" 4000 can be bought used (chassis only) for around \$500. Interface cards, "blades" as they're sometimes called, are about \$500 each. The older 4000s start at 4M of flash (usually enough, but hard to upgrade via a costly kit) and can be easily upgraded to 16M of RAM, which will run the latest IOS (some protocol-rich versions may require more flash). You can use a 4000 to build a really nice core router with dual or quad serial cards and an Ethernet card.

Our advice? We'd get a 2501 (a Pro model if you want to save a little and aren't worried about resale) along with a SmartNet contract to get CCO access and the ROM and IOS software upgrades you may need. We'd bring it up to 8M of flash, and at least 6M of RAM. For your second router, another 2501 or a 4000 would be ideal, or, for those on a budget, a 3102. The cheapest possible lab would be a 3104/3102 or 3104/IGS combination, but you wouldn't be able to buy a software or hardware contract for these.

In Part Two, we'll cover setting up your lab.