

# OSI Model for the Cisco ICND1 Certification Exam

Cisco's ICND1 certification exam tests you heavily on the OSI model and the different protocols and devices that run at each layer of the OSI model. The following reviews the OSI model by giving you a description of each layer and examples of protocols and devices that run at each layer.

Layer	Description	Examples
7.Application	Responsible for initiating or services the request.	SMTP, DNS, HTTP, and Telnet
6.Presentation	Formats the information so that it is understood by the receiving system.	Compression and encryption depending on the implementation
5.Session	Responsible for establishing, managing, and terminating the session.	NetBIOS
4.Transport	Breaks information into segments and is responsible for connection and connectionless communication.	TCP and UDP
3.Network	Responsible for logical addressing and routing	IP, ICMP, ARP, RIP, IGRP, and routers
2.Data Link	Responsible for physical addressing, error correction, and preparing the information for the media	MAC address, CSMA/CD, switches, and bridges
1.Physical	Deals with the electrical signal.	Cables, connectors, hubs, and repeaters

## Network Cabling for the Cisco ICND1 Certification Exam

The ICND1 certification exam tests you on the different types of cabling that is used in different network scenarios. The following are some key points to remember about network cabling.

- **Rollover Cable:** A rollover cable is also known as a console cable and gets the name rollover because the order of the wires from one end of the cable to the other are totally reversed, or rolled over. The rollover/console cable is used to connect a computer to the console port or auxiliary port of the router for administration purposes.
- **Back-to-back Serial Cable:** The back-to-back serial cable is used to connect two Cisco routers directly together over a serial link. A back-to-back serial link will have one router act as the DCE device with the clock rate set and the other router act as the DTE device.
- **Straight-through Cable:** A straight-through cable is used to connect dissimilar devices together. Scenarios that use straight-through cables are computer-to-switch and switch-to-router.
- **Crossover Cable:** A crossover cable has wires 1 and 2 switch positions with wires 3 and 6 on one end and is used to connect similar devices together. Scenarios that use crossover cables are computer-to-computer, switch-to-switch, and computer-to-router (they are both hosts).

- **Coaxial Cable:** A network cable type used in old Ethernet environments such as 10Base2 and 10Base5. Coaxial cable is seen in high speed Internet connections with cable companies today.
- **Fiber Optic Cable:** A unique cable type that has a glass core which carries pulses of light as opposed to copper cable carrying electrical signals (coax and twisted pair cabling).

## ICND1 Certification Exam: Network Devices and Services

You can be sure to get a few questions on the Cisco ICND1 certification exam that tests your knowledge of types of devices and different network services. The following are some key points to remember about devices and services:

### Network devices

- **Hub:** A hub is a layer 1 device that is used to connect systems together. When a hub receives data in the form of an electrical signal it sends the data to all other ports in hopes the destination system is at one of those ports. All ports on the hub create a single collision domain and a single broadcast domain.
- **Repeater:** A repeater is a layer 1 device that is used to re-amplify the signal. As the signal travels along the network it gets weaker due to interference so the purpose of the repeater is to regenerate that signal so it can travel more distance.
- **Bridge:** A bridge is a layer-2 device that creates multiple network segments. The bridge maintains a table in memory of what systems reside on what segments by their MAC addresses. When data reaches the bridge, the bridge filters the traffic by only sending the data to the network segment that the destination system resides on.

The purpose of the bridge is that it filters traffic by only sending the data to the segment where the destination system resides. Each segment on the bridge creates a separate collision domain, but it is all one broadcast domain.

- **Switch:** The switch, another layer-2 device, is an improvement on a bridge in the sense that each port on the switch acts as a network segment. The switch filters traffic by only sending the data to the port on the switch where the destination MAC address resides. The switch stores each MAC address and the port the MAC address resides on in an area of memory known as the MAC address table. Each port on the switch creates a separate collision domains but all ports are part of the same broadcast domain.
- **Router:** A router is a layer-3 device that handles routing of data from one network to another network. The router stores a listing of destination network in the routing table which is found in memory on the router.

# Network services

- **DHCP:** The DHCP service is responsible for assigning IP addresses to hosts on the network. When a client boots up it sends a DHCP discover message, which is a broadcast message designed to locate a DHCP server. The DHCP server responds with a DHCP Offer — offering the client an IP address. The client then responds with a DHCP request message asking for the address before the server responds with a DHCP ACK to acknowledge that the address has been allocated to that client.
- **DNS:** The DNS service is responsible for converting the Fully Qualified Domain Name (FQDN) such as `www.gleneclarke.com` to an IP address.
- **NAT:** Network Address Translation is responsible for converting the internal address to a public address that is used to access the Internet. NAT offers the benefit of being able to only purchase one public IP addresses and have a number of clients on the network use that one IP address for Internet access.

NAT also offers the security benefit that the internal addresses are not used on the Internet - helping to keep the internal addresses unknown to the outside world. There are two types of NAT to know for the CCENT certification exam:

- **Static NAT:** Static NAT is the mapping of one internal address to one public address. With static NAT you will need multiple public addresses to allow internal clients to access the Internet.
  - **NAT Overloading:** A more popular form of NAT, NAT overloading is the concept that all internal addresses get translated to the one public address on the NAT device.
- **Web Services:** There are a number of web services you should be familiar with for the CCENT certification exam.

Consider the following:

- **POP3/IMAP4:** POP3 and IMAP4 are the Internet protocols for receiving email over the Internet.
  - **SMTP:** SMTP is the Internet protocol for sending email over the Internet. SMTP servers are also known as email servers.
  - **HTTP:** HTTP servers are also known as web servers, and are used to host websites. HTTP is a protocol that is used to send the web page from the web server to the web client.
  - **FTP:** FTP is an Internet protocol used to transfer files over the Internet. The files are hosted on FTP servers which are then downloaded to any clients on the Internet.

# Cisco IOS Basics for the ICND1 and ICND2 Certification Exams

The ICND1 and ICND2 certification exams will test you on the basics of the Cisco IOS (network infrastructure software) and how to configure the IOS. The following are some key points that summarize the IOS basics to remember for the CCENT certification exam:

- **Types of Memory:** There are different types of memory on a Cisco device:
  - **ROM:** The Read Only Memory (ROM) on a Cisco device is like the ROM on a computer in the sense that it stores the POST and the boot loader program. The boot loader program is responsible for locating the IOS.
  - **Flash:** The flash memory is memory that is used to store the Cisco IOS.
  - **RAM:** RAM is used to store things like the routing table on a router, or the MAC address table on a switch. It is also used to store the running-config. RAM is also known as volatile RAM, or VRAM.
  - **NVRAM:** Non-volatile RAM (NVRAM) is used to store the startup-config which is copied to the running-config on bootup after the IOS is loaded.
- **The Boot Process:** For the CCENT certification exam you need to know the high level steps that occur when a Cisco device startups up. The following is a quick review of the boot process of a Cisco router:

1. *POST:* The first thing that occurs when a Cisco device boots up is the POST routine which is responsible for performing a self diagnostic to verify everything is correctly functioning on the router or switch.

2. *Locate IOS:* After the POST the bootloader program, which is stored in ROM locates the IOS in flash memory and loads it into RAM.

3. *Startup-config Applied:* After the IOS is loaded into memory the bootloader program then locates the startup-config and applies it to the device.

- **Configuration Modes:** When making changes to the Cisco device there are a number of different configuration modes and each change is made in a specific configuration mode. The following summarizes the major configuration modes:
  - **User Exec:** When you connect to a Cisco device the default configuration mode is user exec mode. With user exec mode you can view the settings on the device but not make any changes. You know you are in user exec mode because the IOS prompt displays a ">".
  - **Priv Exec:** In order to make changes to the device you must navigate to priv exec mode where you may be required to input a password. Priv exec mode displays with a "#" in the prompt.
  - **Global Config:** Global configuration mode is where you go to make global changes to the router such as the hostname. To navigate to global configuration mode from priv exec mode, type config term where you will be placed at the (config)# prompt.
  - **Sub Prompts:** There are a number of different sub prompts from global configuration mode you can navigate to such as the interface prompts to modify settings on a specific interface, or the line prompts to modify the different ports on the device.

# Configuring Routing for the ICND1 and ICND2 Certification Exams

When you're preparing for the CCNA routing and switching certification exam, you'll need to be familiar with popular commands that deal with static routing and routing protocols, such as RIPv1 and RIPv2. Consider the following:

Command(s)	Result
Ip routing	Enables routing on the router. Should be on by default.
No ip routing	Disables routing on the router.
Show ip route	Displays the routing table.
Ip route 23.0.0.0 255.0.0.0 22.0.0.2	Adds a static route to the router for the 23.0.0.0 network and sends any data for that network to the 22.0.0.2 address (next hop).
No ip route 23.0.0.0 255.0.0.0 22.0.0.2	Deletes the static route from the routing table.
Ip route 0.0.0.0 0.0.0.0 22.0.0.2	Sets the gateway of last resort on the router to forward any packets with unknown destinations to the 22.0.0.2 address.
ROUTERB>enable ROUTERB#config term ROUTERB(config)#router rip ROUTERB(config-router)#network 26.0.0.0 ROUTERB(config-router)#network 27.0.0.0	Configures the router for RIPv1. RIP is a dynamic routing protocol that is used to share routing information with other routers running RIP. In this example, RIP will share knowledge of the 26.0.0.0 and the 27.0.0.0 networks.
ROUTERB>enable ROUTERB#config term ROUTERB(config)#router rip ROUTERB(config-router)#network 26.0.0.0 ROUTERB(config-router)#network 27.0.0.0 ROUTERB(config-router)#version 2	To configure the router for RIPv2 you use the same commands but add the "version 2" command at the end.
show ip protocols	Used to display what routing protocols are running on the router.
debug ip rip	Used to enable RIP debugging which will display RIP related messages on the screen as RIP related events occur (packets are sent and received).
No debug all	Turns off debugging once you are done troubleshooting RIP.

<pre>#configure the trunk link on switch interface fa0/4 switchport mode trunk  #configure router on stick interface fa0/0.20 encapsulation dot1q 20 ip address 192.168.20.1 255.255.255.0  interface fa0/0.10 encapsulation dot1q 10 ip address 192.168.10.1 255.255.255.0</pre>	<p>Configures router on a stick so that you can route traffic between systems connected to different VLANs on the same switch. High level steps are:</p> <ol style="list-style-type: none"> <li>1. Connect router to switch</li> <li>2. Configure port on switch as trunk port</li> <li>3. Configure Subinterfaces on the router, one per VLAN.</li> </ol>
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## Troubleshooting Commands for the ICND1 and ICND2 Certification Exams

When problems arise on a Cisco device there are a number of show commands you can use to help identify what the problem is. The following is a list of popular show commands you should know for both the ICND1 and ICND2 certification exams:

Command(s)	Result
Show running-config	Used to display the running configuration stored in VRAM.
Show startup-config	Used to display the startup configuration stored in NVRAM.
Show ip interface brief	Used to show a summary of the interfaces and their status.
Show interfaces	Used to display detailed information about each interface.
Show interface serial 0/0	Used to display detailed information about a specific interface.
Show ip route	Displays the routing table.
Show hosts	Displays the host name table.
Show controller serial0/1	Used to display whether the serial interface is a DCE or DTE device.
Show ip protocols	Used to display what routing protocols are loaded.
Show cdp neighbors	Used to display basic information about neighboring devices such as name, type of device, and model.
Show cdp neighbors detail	Used to display detailed information about neighboring devices such as name, type of device, model, and IP address.

# Security Best Practices for the ICND1 and ICND2 Certification Exams

One of the most important skills to have as you prepare for the Cisco ICND1 (and ICND2) exam is the capability of implementing basic security practices on your Cisco devices. The following are some key points to remember about securing devices when you take the ICND1 exam:

- **Secure Location:** Be sure to locate your Cisco routers and switches in a secure location - a locked room where limited access is permitted.
- **Disable Ports:** In high secure environments you should disable unused ports so that unauthorized systems cannot connect to the network.
- **Configure Port Security:** In order to control which systems can connect to the enable ports use port security to limit which MAC addresses can connect to which ports.
- **Set Passwords:** Be sure to configure passwords on the console port, auxiliary port, and the vty ports. Also configure the enable secret for access to priv exec mode.
- **Login Command:** Do not forget the login command after setting the password on the port. The login command tells the Cisco device that anyone connecting must login and forces the prompt for a password.
- **Login Local Command:** If you are looking to create user names and passwords for login then use the *login local* command to tell the Cisco device you wish to authenticate persons by the user names and password configured on the device.
- **Encrypt Passwords:** Be sure to encrypt all passwords in the configuration with the *service password-encryption* command!
- **Banners:** Be sure to configure banners that do not have the word "welcome" in the message or any other inviting phrases. You want to make sure that the banners indicate that unauthorized access is prohibited.
- **Secure Communication:** If you are looking to remotely manage the device look to using SSH instead of telnet as the communication is encrypted.