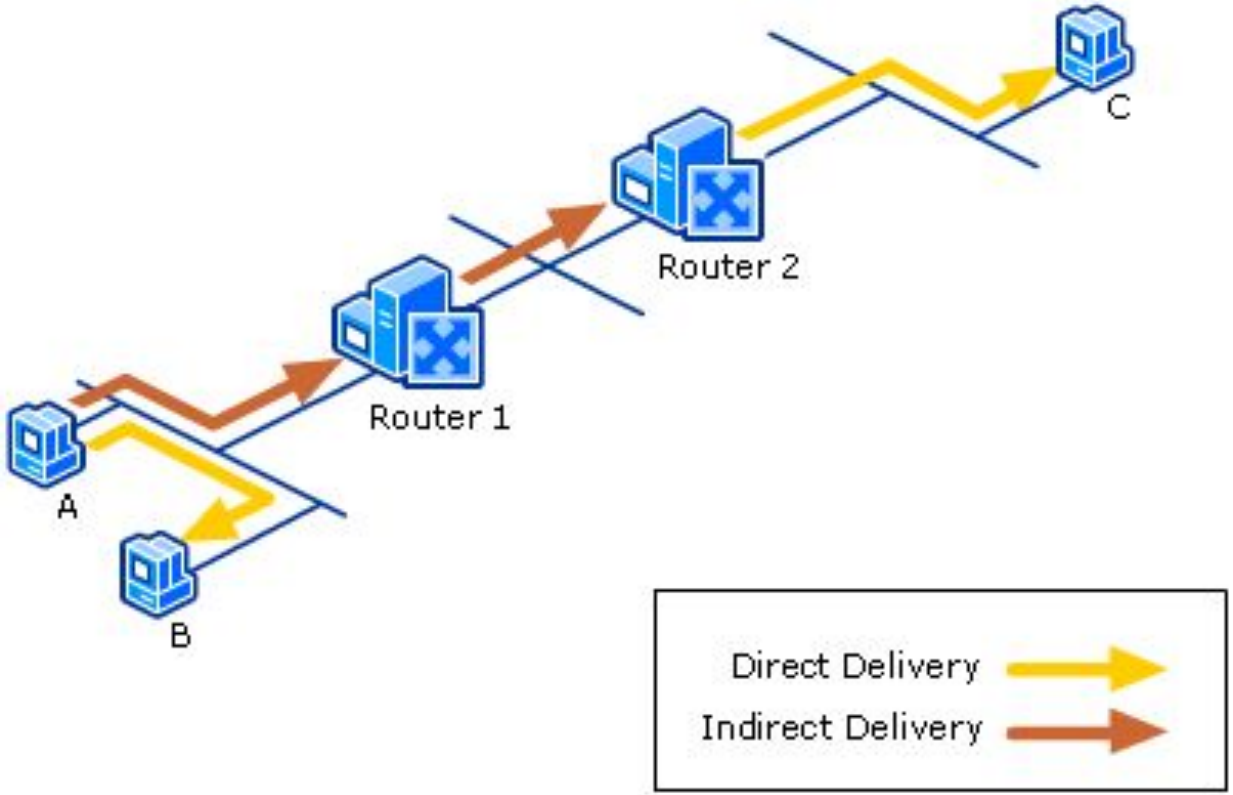
IP ROUTING

How the originating host chooses where to send the packet, as well as how routers choose where to route or forward packets to the final destination.

Prof. Ashwini Mathur



IP Routing Overview

Host Routing

Hosts actually use some simple routing logic when choosing where to send a packet. This two-step logic is as follows:

Step 1: If the destination IP address is in the same subnet, send the packet directly to that destination host.

Step 2: If the destination IP address is not in the same subnet, send the

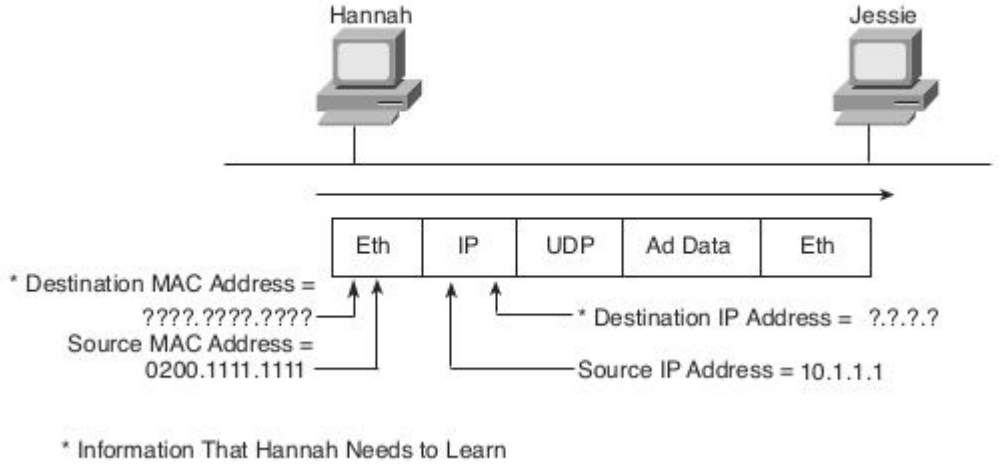
packet to my default gateway (a router's Ethernet interface on the subnet).

Understanding with reference to Example

Hannah needs to communicate with a server on PC Jessie. Hannah knows her own name, IP address, and MAC address. What Hannah does not know are Jessie's IP and MAC addresses.

To find the two missing facts, **Hannah uses DNS to find Jessie's IP address** and **ARP to find Jessie's MAC address**.

Figure 5-12 *Hannah Knows Jessie's Name, Needs IP Address and MAC Address*

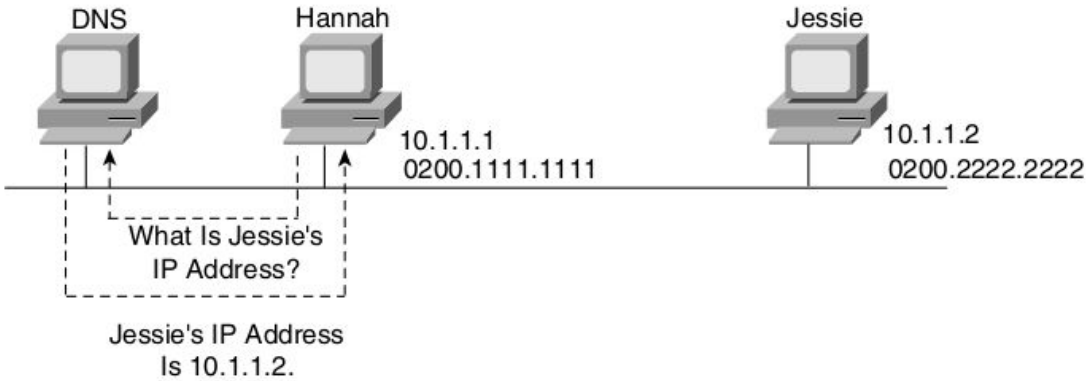


* Information That Hannah Needs to Learn

DNS Name Resolution

Hannah knows the IP address of a DNS server because the address was either preconfigured on Hannah's machine or was learned with DHCP, as covered later in this chapter. As soon as Hannah somehow identifies the name of the other computer (for example, jessie.example.com), she sends a *DNS request* to the DNS, asking for Jessie's IP address. The DNS replies with the address, 10.1.1.2. Figure 5-13 shows the simple process.

Figure 5-13 *DNS Request and Reply*



Hannah simply sends a DNS request to the server, supplying the name jessie, or jessie.example.com, and the DNS replies with the IP address (10.1.1.2 in this case). Effectively, the same thing happens when you surf the Internet and connect to any website. Your PC sends a request, just like Hannah's request for Jessie, asking the DNS to resolve the name into an IP address. After that happens, your PC can start requesting that the web page be sent.

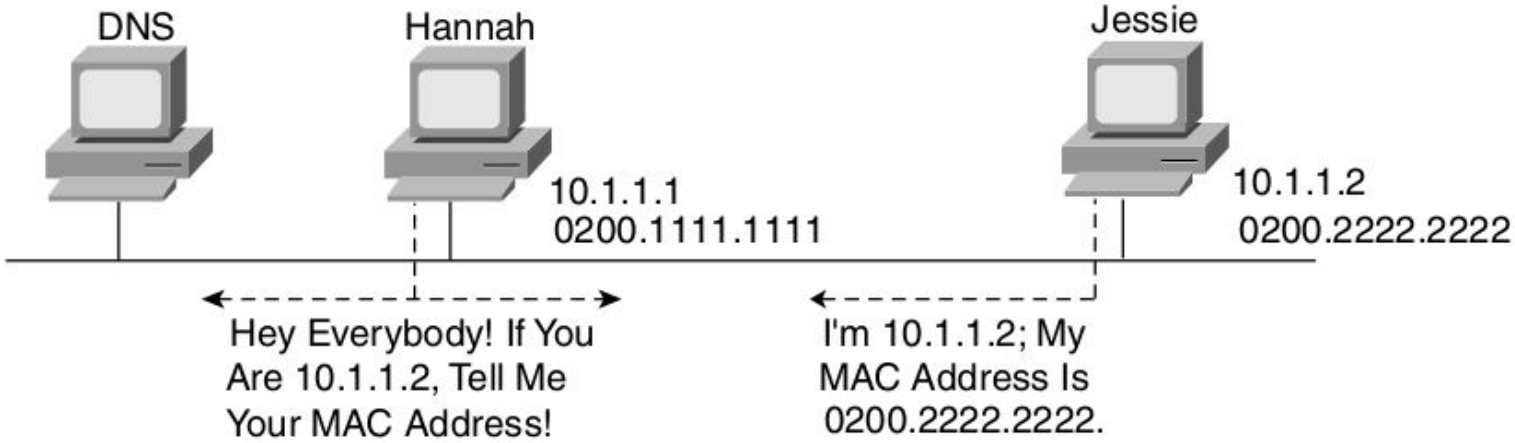
The ARP Process

As soon as a **host knows the IP address of the other host**, the sending host may need to know the MAC address used by the other computer.

For example, **Hannah still needs to know the Ethernet MAC address used by 10.1.1.2**, so Hannah issues something called an ARP Network Layer Utilities broadcast. broadcast.

An **ARP broadcast is sent to a broadcast Ethernet address**, so everyone on the LAN receives it. Because Jessie is on the same LAN, she receives the ARP broadcast. Because Jessie's IP address is 10.1.1.2 and the ARP broadcast is looking for the MAC address associated with 10.1.1.2, Jessie replies with her own MAC address.

Figure 5-14 *Sample ARP Process*



NOTE: You can see the contents of the **ARP cache** on most PC Operating Systems by using the **arp -a** command from a command prompt.

Address Assignment and DHCP

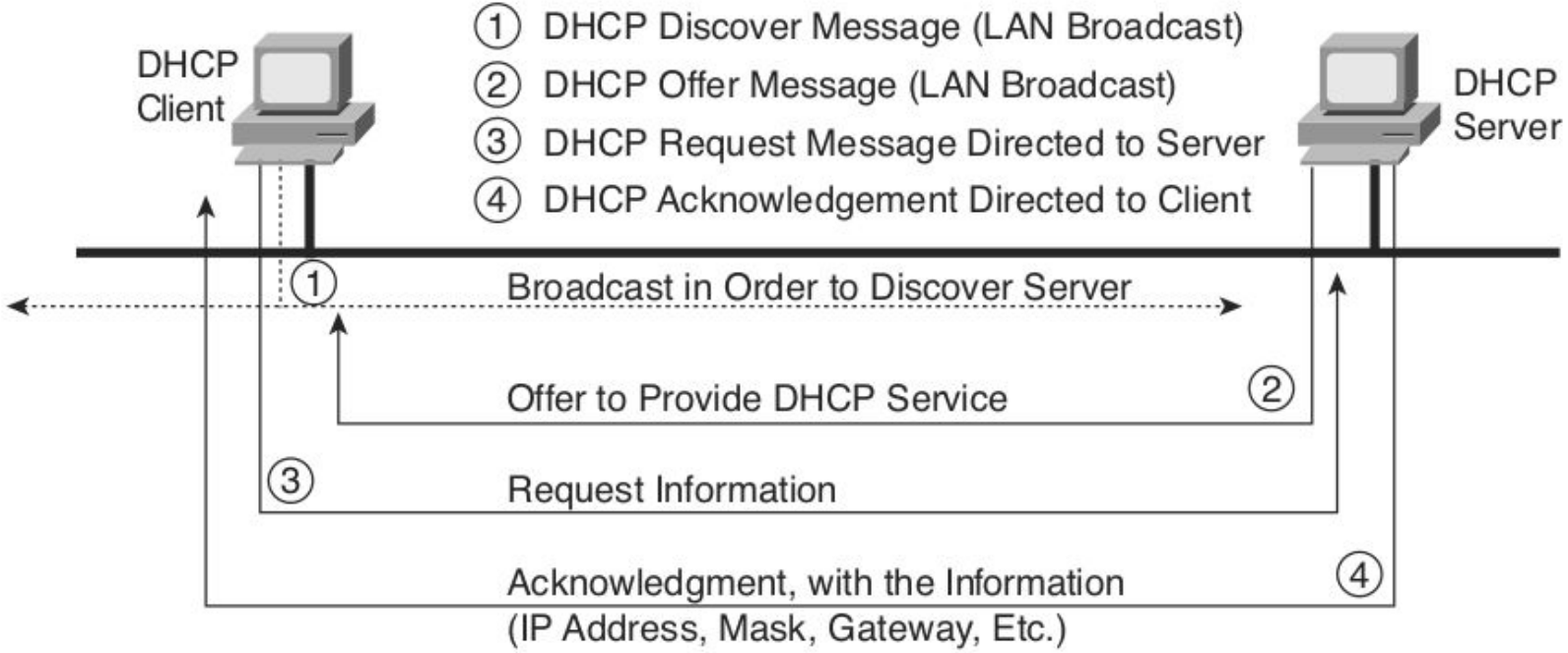
Every interface on every device that uses TCP/IP— needs a valid IP address.

DHCP defines the protocols used to allow computers to request a lease of an IP address.

DHCP uses a server, with the server keeping a list of pools of IP addresses available in each subnet. ------- **DHCP clients can send the DHCP server a message, asking to borrow or lease an IP address.**

The server then suggests an IP address. If accepted, the server notes that the address is no longer available for assignment to any other hosts, and the client has an IP address to use.

Figure 5-15 *DHCP Messages to Acquire an IP Address*



DHCP has become a prolific protocol. Most end-user hosts on LANs in corporate networks get their IP addresses and other basic configuration via DHCP.

Information Supplies by DHCP

DHCP supplies IP addresses to clients, and it also supplies other information.

For example, hosts need to know their **IP address**, plus the **subnet mask** to use, plus what **default gateway** to use, as well as the **IP address(es) of any DNS servers**.

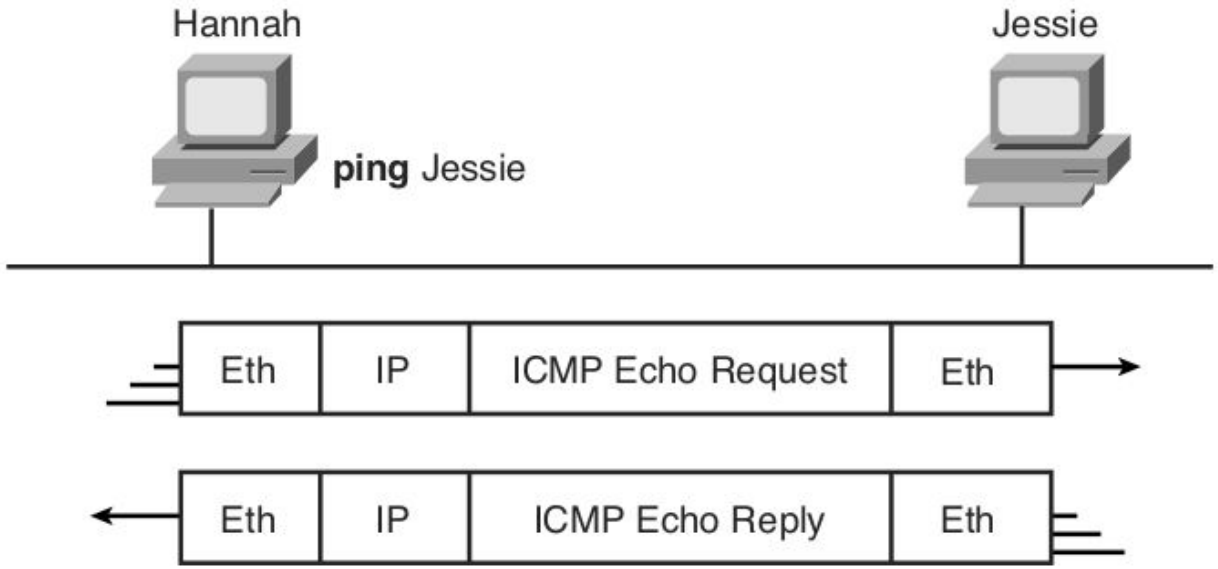
In most networks today, **DHCP supplies all these facts to a typical end-user host.**

ICMP Echo and the ping Command

WHY PING COMMAND ? To test basic IP connectivity without relying on any applications to be working.

The primary tool for **testing basic network connectivity** is the ping command. ping (**Packet Internet Groper**) uses the Internet Control Message Protocol (**ICMP**), sending a message called an ICMP echo request to another IP address.

Figure 5-16 *Sample Network,* **ping** *Command*



Revision:

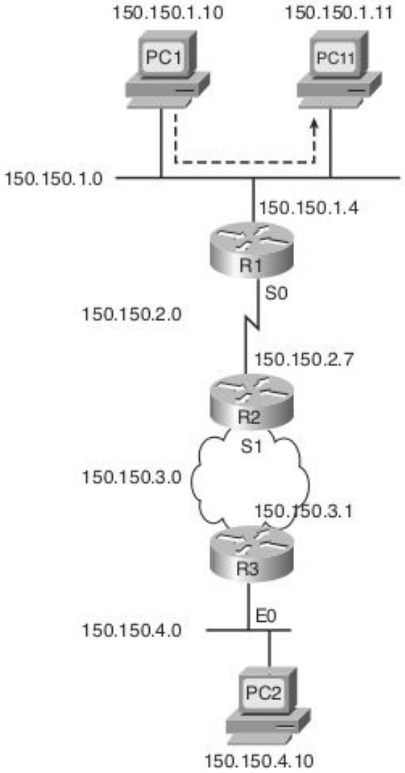
Definitions of Key Terms

Define the following key terms from this chapter, and check your answers in the glossary:

ARP, default gateway/default router, DHCP, DNS, host part, IP address, logical address, network broadcast address, network number/network address, network part, routing table, subnet broadcast address, subnet number/subnet address, subnet part.

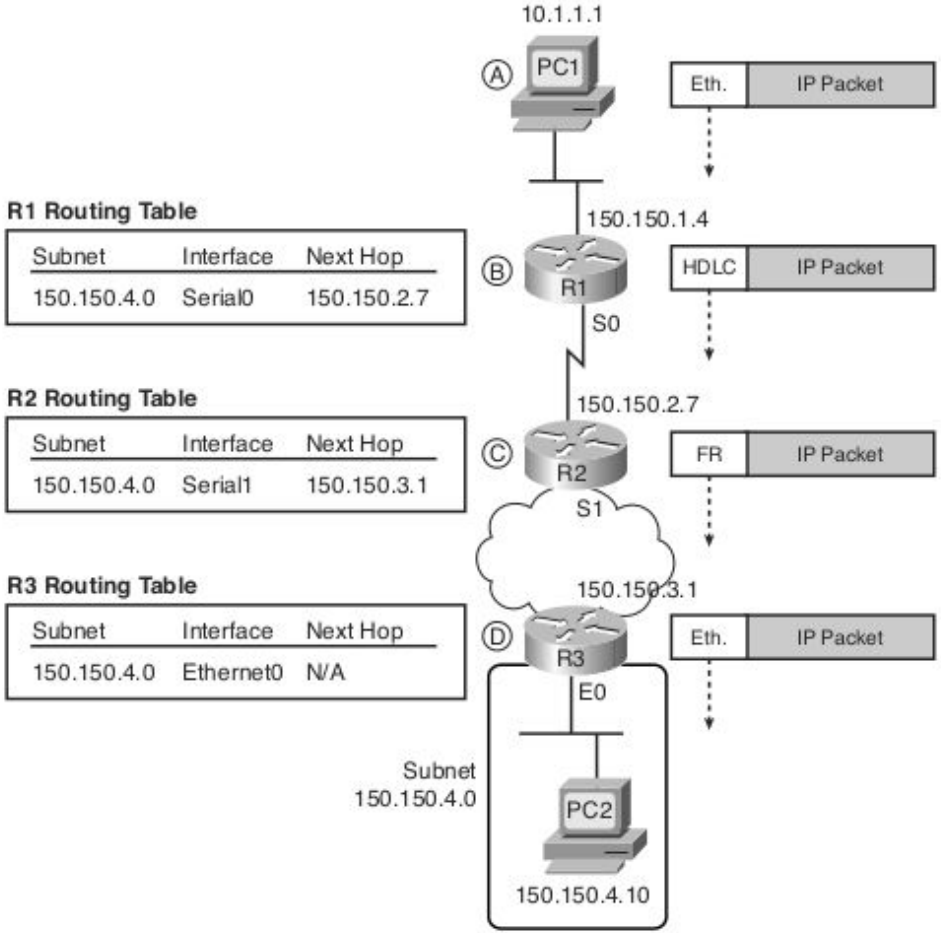
Refrence Example of Routing Packets

Figure 5-9 *Host Routing Alternatives*



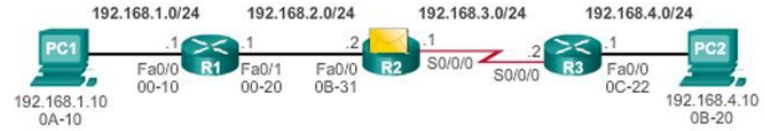
Alternatively, when PC1 sends a packet to PC2 (150.150.4.10), PC1 forwards the packet to its default gateway of 150.150.1.4, which is R1's Ethernet interface IP address according to Step 2 in the host routing logic. The next section describes an example in which PC1 uses its default gateway.

Figure 5-10 *Simple Routing Example, with IP Subnets*



Packet Routing

R2 Forwards the Packet to R3



R2's Routing Table

Network	Hops	Next-hop-IP	Exit Interface
192.168.1.0/24	1	192.168.3.1	Fa/0/0
192.168.2.0/24	0	Dir. Connect.	Fa/0/0
192.168.3.0/24	0	Dir. Connect.	S0/0/0
192.168.4.0/24	1	192.162.3.2	S0/0/0

4.2.1.4

Do animation on 4.2.1.4

Packet Routing