Internet: Provisioning

The Internet is NOT the same thing as the Web. The World Wide Web is simply an application-level protocol that works over TCP/IP; we will study it later.

The Internet is a system for connecting hosts anywhere in the world.
Good resource on details: Internetworking_Technology_Handbook (Cisco DocWiki) (http://docwiki.cisco.com/wiki/Internetworking_Technology_Handbook)

"An internetwork is a collection of individual networks, connected by intermediate networking devices, that functions as a single large network."
source: http://docwiki.cisco.com/wiki/Internetworking_Basics#What_Is_an_Internetwork.3F

In short, the Internet is an internetwork that extends across the entire planet.

It is composed of smaller internetworks, which in turn are composed of local area networks.

Although other protocols are also used to some extent, the predominant protocol for communication over the Internet is the Internet Protocol, or simply IP.

We know that IP addresses can be assigned dynamically (DHCP) or statically, but how are they provisioned?

In other words, who decides what the static IP address should be or what group of IP addresses may be handed out by a particular DHCP server? And how are these decisions made?

A critical characteristic in the provisioning process is the type of IP address.

IP addresses may be either public or private. Public addresses are also known as global or unique addresses.

If you connect a bunch of computers together into a LAN, you can give each computer any IP address you like.

Each computer will simply use the ARP protocol to communicate with the other computers on the LAN.

An IP address that can be used only on a particular LAN is known as a private address.

Accordingly, different LANs can freely use the same private IP addresses.

In fact, ISPs that connect home users to the Internet routinely use private IP addresses.

For example, Comcast provisions the IP address 10.0.0.2 for the first computer to connect through the cable modem.

That means that thousands of home computers have the same IP address of 10.0.0.2!

By contrast, a public IP address is globally unique; it may be used for hosts that connect with other hosts that are not on the same LAN.

Provisioning of public IP addresses begins with IANA, the Internet Assigned Numbers Authority.

Currently, the role of IANA has been assigned to ICANN, the Internet Corporation for Assigned Names and Numbers.

ICANN assigns ranges of addresses to Regional Internet Registries, who, in turn, assign subranges to Local Internet Registries.

Ultimately, the registries assign ranges of IP addresses to network providers.

The network providers are responsible for deploying the hardware and software that connect hosts and route IP packets.

In return for their investment, network providers lease IP addresses to customers.

The current scheme for provisioning is known as Classless Inter-Domain Routing, or CIDR.

In CIDR, an IP address is divided into two parts: a network prefix and a host identifier.

A range of addresses is defined as a set of IP addresses that have the same network prefix. The set is known as a subnet.

Hosts within a range differ only by their host identifier.

We will use IP version 4 (IPv4) addresses in our examples but CIDR applies as well to IP version 6 (IPv6).

Note that IPv4 addresses consist of four bytes, each expressed as a decimal number, that are separated with periods. The four bytes, however, comprise a set of 32 bits, which are used by the CIDR notation.

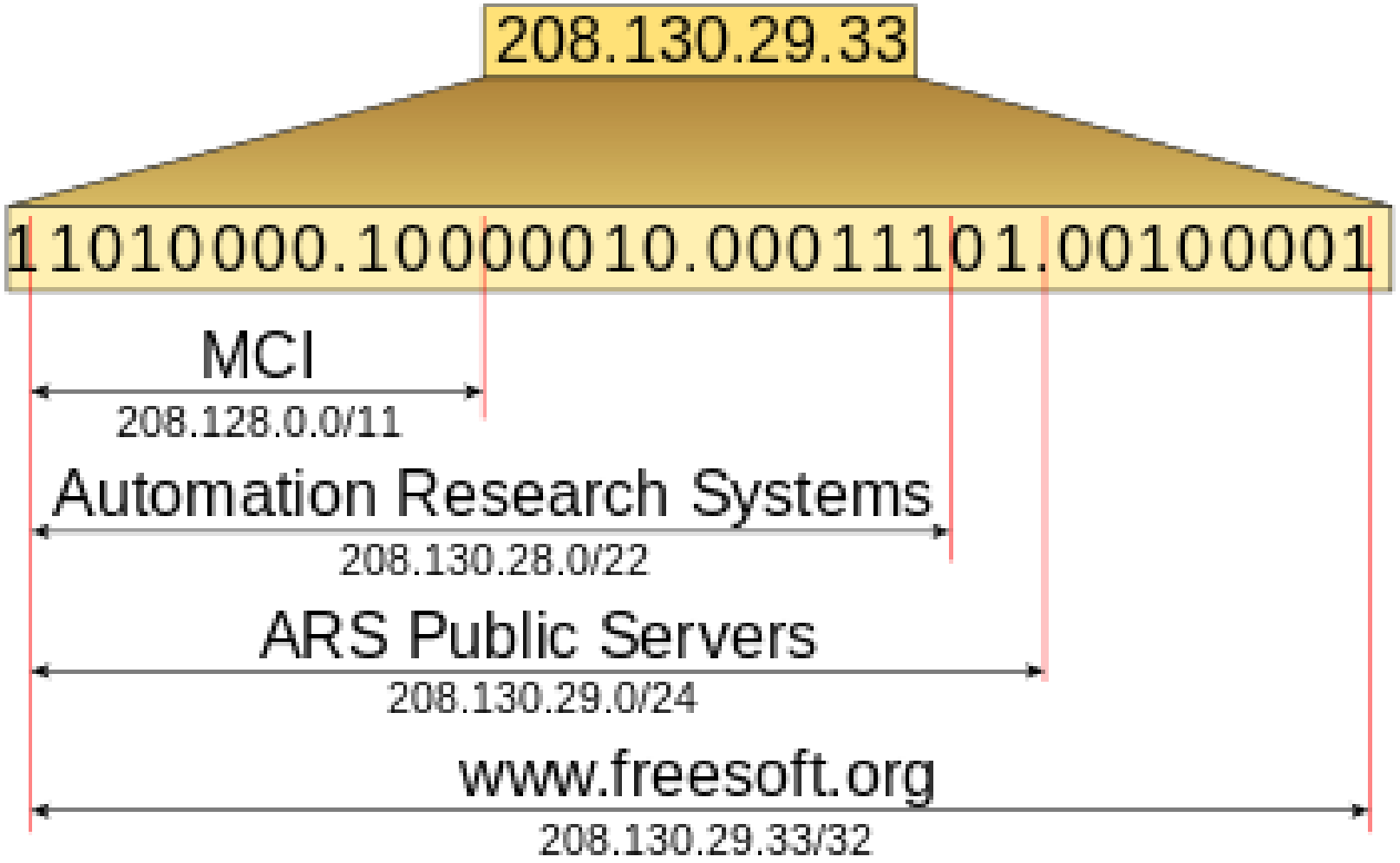
In CIDR notation, 192.168.1.0/24 represents a range of addresses that begin with the network prefix 192.168.1 (the first 24 bits).

In contrast, 192.168.1.0/8 represents a range of addresses that begin with the network prefix 192 (the first 8 bits).

Returning to the first example, 192.168.1.0/24, because there are only 8 bits left for the host identifier (32 bits in the address minus the 24 bits in the prefix), the range contains only 256 IP addresses. Specifically, the first address in the range is 192.168.1.0, the second is 192.168.1.1, the third is 192.168.1.2, etc.

In the second example, 192.168.1.0/8, the prefix is only 8 bits long; therefore, 24 bits are left for composing host identifiers. Because 2^24 is approximately 16 million, the range contains approximately 16 million IP addresses.

Complete provisioning example:



For more information, see “Classless Inter-Domain Routing” on Wikipedia.