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## Open Transport: TCP/IP Control Panel Simplified (7/96)

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TOPIC -----

This article provides a simplified explanation of the elements of the Open Transport TCP/IP control panel settings.

DISCUSSION -----

Question: What does the TCP/IP control panel let me do?

Answer: The Transmission Control Program/Internet Protocol (TCP/IP) control panel lets your Macintosh speak the protocol or "language" of the Internet. The Mac OS uses AppleTalk, the protocol of Apple Macintosh computers and LaserWriter printers. But the Internet uses the TCP/IP protocol suite, which is the "language" of UNIX systems.

Question: What is an IP address?

Answer: Each machine or "host" connected to the Internet must have a unique IP address in order to communicate with other hosts. It is like a telephone number. An IP address is a 32-bit number, usually expressed in dotted decimals, for example: 128.1.1.24

Question: What is the significance of the dotted decimals in an IP address?

Answer: Similar to the way a telephone number is divided into area code, exchange, and individual phone number, an IP address is also subdivided into octets (each "octet" is 8 bits, 8 bits X 4 octets = 32 bits) that designate network, subnetwork, and node. The network is like the area code; it describes a certain piece of the Internet where your Macintosh is connected. A subnetwork is similar to an exchange; it further breaks down the network into smaller chunks, and each subnetwork can have its own range of nodes, like the individual phone numbers on that exchange. Note that not all networks use subnetworking to further divide their network.

Question: What is the subnet mask?

Answer: This mask is what is used to indicate which bits of your 32-bit IP address designate the "network", and which bits designate the "node".

Remember that the dotted decimal format is just an easy way of expressing the 32-bit address. If you were to write out the example address, 128.1.1.24, in binary numbers, it would look like this:

```
10000000.00000001.00000001.00011000
```

The subnet mask is also a 32-bit number; when superimposed over the IP address, every bit that matched a "1" would be part of the "network", and every bit that matched a "0" would be part of the node. For example, a subnet mask of 255.255.0.0 would look like this:

```
11111111.11111111.00000000.00000000
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This would indicate that the first two octets of the IP address (128.1) indicated the network. The last two octets (1.24) are the node on the network 128.1.0.0.

There are three main classes of IP addresses and each class has a default subnet mask. The class is determined by the first few bits of the 32-bit IP address, as indicated below. For example, because the first bit of a class A address must be 0, when expressed in decimal numbers, the first octet will be 127 (01111111) or lower, because 128 in binary numbers starts with a "1": 10000000.

Begin\_Table

Class	Identified by 1st Octet	Default Subnet Mask
A	First bit = 0 (0-127)	255.0.0.0
B	First two bits =10 (128-191)	255.255.0.0
C	First three bits = 110 (192-223)	255.255.255.0

End\_Table

Each organization can use the bits for their nodes to define subnets at their routers. For example, a class A address has the first 8 bits defining the network. An organization might decide to take the two middle octets – 16 bits – to define subnets, and then the final 8 bits would define a node on the subnet on the network.

This information is used by routers to determine how to route the IP packets to the network you are attached to.

Question: What are the different ways I can connect to the Internet?

Answer: If you are connected to a LAN that has access to the Internet, you simply use that LAN connection for your Internet communications. If you are on an Ethernet or Token Ring LAN, you can select either Ethernet or Token Ring, respectively, in the connect via field of the TCP/IP control panel. These types of networks support different protocols, so you can direct AppleTalk and TCP/IP, as well as other protocols such as IPX, over these networks at the same time.

If you are on a LocalTalk LAN, or connecting via Apple Remote Access, then you are limited to using AppleTalk protocols. However, TCP/IP packets can be

encapsulated in AppleTalk packets for transmission over these connections. This is referred to as "MacIP". To use MacIP, you need a MacIP server, which sits on both an AppleTalk and a TCP/IP network, and acts as a middleman between you and the Internet. You send your AppleTalk encapsulated IP packet to the MacIP server using AppleTalk protocols; it strips off the AppleTalk encapsulation, and places the IP packet out on the Internet. When packets are destined to you from the Internet, it does the reverse.

If you are not on a LAN that has connections to the Internet, then you can gain access through Internet Service Providers (ISPs). SLIP (Serial Line IP) or PPP (Point-to-Point Protocol) connections give you access to the Internet, using your modem and phone lines.

Question: Where do I get an IP address and a subnet mask?

Answer: This information must come from the person who is in charge of the network you are physically connecting to. If you are connected to a LAN that has a connection to the Internet, talk to your network administrator. If you are using a SLIP or PPP connection, talk to your Internet Service Provider (ISP).

The network administrator or ISP will also tell you the manner in which you can obtain your IP address (whether you are assigned one that you have to enter manually, or whether you get one from a server), in addition to the other information you need to configure TCP/IP.

Question: What are BOOTP, RARP, and DHCP?

Answer: These terms stand for Bootstrap Protocol, Reverse Address Resolution Protocol, and Dynamic Host Configuration Protocol. These protocols let a computer obtain its IP address (and sometimes other information, such as subnet mask) from a server. In the simplest terms, when a machine needs an IP address (on a Macintosh, this might be when you first attempt to launch an application that uses TCP/IP protocols), it asks the server for an IP address. Depending on the type of server, you are either assigned an address that has been set aside especially for your machine, or you are given one from a pool of available addresses.

These protocols are used to make administration of large networks easier.

Question: What is a domain name and a domain name server?

Answer: Because it is difficult for humans to remember a series of somewhat meaningless numbers, we assign names to them. Apple Computer's domain is apple.com; it also has lots of subdomains, such as corp.apple.com, and austin.apple.com. The subdomains simply define smaller areas within the apple domain. A machine called max on the subdomain info.apple.com would have a fully qualified domain name of max.info.apple.com, and its IP address might be 204.16.92.4. A domain name server in each domain is in charge of keeping a table of the machines in its network and their IP addresses. If you want to talk to max you can address it with either its IP Address or with its name. If you use its name, you need to resolve the name by asking a domain name server for that

machine's IP address. This is all done behind the scenes.

Question: How does domain name resolution work?

Answer: Your network administrator or ISP should give you the IP addresses of one or more domain name servers. You list these in the field called Name server addr: in the TCP/IP control panel.

Here is an example which shows how a name is resolved. Assume that Sue's TCP/IP control panel is configured with a domain name of drc.corp.apple.com. Her admin domain is apple.com. Also in her search domain names, she has entered info.apple.com.

She has listed three different IP addresses in the Name server addr field.

When Sue attempts to connect to a machine using its domain name, max.austin.apple.com., her Macintosh computer contacts the first domain name server in the list to see if it can resolve the name (if it can give her the machine's actual IP address). If it cannot do so, the other name servers are tried, in the order Sue has listed them.

Note that max.info.apple.com. is a "fully-qualified" domain name; the period at the end indicates this. Using simply max is possible, but because max is not fully qualified (and this is clear because it does not contain a single "."), a domain name must be appended to it before a domain name server can resolve it.

First, Sue's own domain is tried: max.drc.corp.apple.com. If a search on this name fails, other attempts to resolve the name are made by dropping off one subdomain at a time, until she reaches her admin domain. For example, the searches are conducted on the following names, in the order given:

max.drc.corp.apple.com  
max.corp.apple.com  
max.apple.com

If the name is not found, it attempts to resolve the name using the domain name in the Search domain names field, in this case:

max.info.apple.com

Question: What is the host file?

Answer: A host file is a text file that resides at the root level of your System Folder, and contains a table of domain names and IP addresses. This table can also be used for domain name resolution, but domain name servers are more commonly used, because they are easier to manage and maintain. If your network administrator gives you a host file to use, simply place it within your System Folder.

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