

Clarifying a Few Network Items

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The ARP Protocol

- IP machines use the ARP protocol to determine the layer 2 or MAC addresses of machines they want to communicate with. ARP requests are broadcast to all machines on the local IP Segment.
- Suppose A has an IP Address of 12.13.14.4 and it wants to communicate with an IP address of 12.13.14.7. The ARP broadcast says something like “I am Machine A with IP address 12.13.14.4. If you have the IP address 12.13.14.7, please reply back with your Layer 2 address.
- Since the ARP request was a layer 2 broadcast, all the machines on the local IP segment will process the packet, but only the one machine with address 12.13.14.7 will reply. Machine A then sends the IP packet to the Layer 2 address.
- ARP is trusting and provides no facility for checking authentication. Thus a hacker could easily spoof an ARP reply.

IP Adjacency Test and Subnet Masks

- An IP machine first needs to know what network a target host it wants to communicate with is on. This is where the subnet mask is used.
- Subnet masks are typically 255.0.0.0, 255.255.0.0, and 255.255.255.0. Many others are possible, but we will only discuss these three subnet masks.
- Subnet masking uses bitwise “binary anding” to determine the host and target networks. The rules for binary anding are 1 and 1 = 1 and any other combination is 0. The decimal number 255 in binary is 1111 1111.
- Binary anding with 1111 1111 gives you exactly what you started with. But binary anding with 0000 0000 always yields 0000 0000.

The Adjacency Test

- Suppose machine A has the address 12.13.14.4, machine B has the address 12.13.14.7, and Machine C has the address 12.13.15.9. Suppose A is using the 255.255.255.0 subnet mask.
- A determines its IP subnet by binary anding its address with 255.255.255.0, which yields 12.13.14.0. When A “binary ands” machine B’s address with its own subnet mask, A gets 12.13.14.0 for B’s network. So A determines that B is on its network, and will ARP to find B’s MAC address and then send the packet to that MAC address.
- If A was trying to communicate with machine C, whose address is 12.13.15.9, it would decide that C is not on its network. It would normally then ARP for its default gateway’s MAC address. The default gateway would reply with its MAC address and Machine A would then send the packet to that MAC address.
- So the rules for IP packet transmission are:
 - First, calculate the address of your network and the target network using subnet masking.
 - If the target machine’s network is the same as your network, ARP to find the target machine’s MAC address and send the IP packet to that MAC address.
 - If the target machine’s network is not the same as yours, the ARP for the default router’s MAC address and then send the packet to its MAC address.

IP Private and Public Addresses

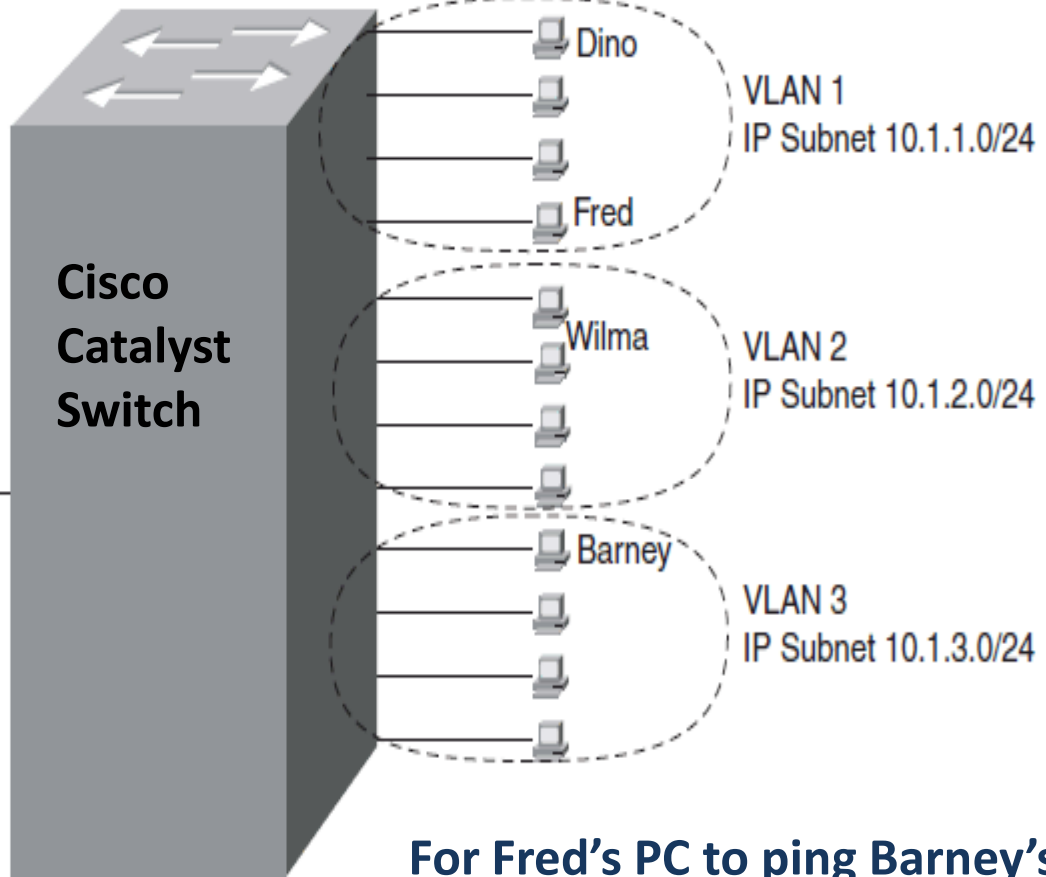
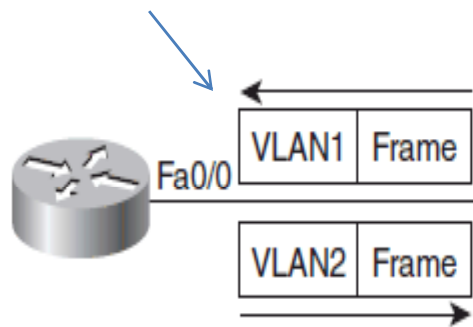
- There are three ranges of private IP addresses. These addresses do not route out onto the internet. If you use these in your private address, you must use address translation
 - 10 range - all addresses in 10.x.y.z
 - 172 range – all addresses in 172.16.x.y to 172.31.x.y
 - 192 range – all addresses in 192.168.0.x to 192.168.255.255

VLANs and IP subnets

Notice that the 3 VLANs are each in a separate IP subnet.

VLAN Framing -

notice the extra VLAN header.



For Fred's PC to ping Barney's PC, Fred's packets go to the router and then back to the switch.