Routing and Netmasks

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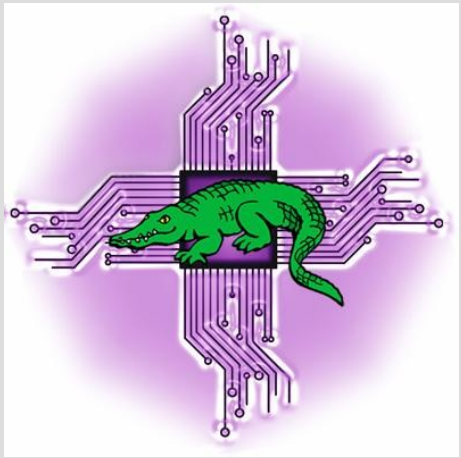

Routing and Netmasks

Routers connect networks and route packets from one network to another.

They break up broadcast domains *and* collision domains; they do not forward broadcasts by default.

They filter information based on Layer 3 OSI (i.e., on IP address)

Routing and Netmasks

An IP address consists of 32 bits of information, dividing in four octet bits which can be depicted as dotted decimal or binary

The Network Address identifies the network. The host portion identifies to node. They also have a subnet mask which reflects use of the network address (255 = all bits on, 0 all bits off).

IVT uses a Class A addressing system for its local area network. This *could* provide 16,777,214 hosts. But will someone think of the poor switches?!

Routing and Netmasks

Subnets allow for the creation of multiple networks from a single network.

This can reduce traffic (less broadcast domains, less congestion), simplify management and isolate problems and facilitate WAN management.

The basic principle is that bits are taken from the host portion of the address for extra subnets.
More subnets means (overall) less hosts.

Routing and Netmasks

Subnets must be planned!

1) Determine the number of required network I.Ds (one per subnet, one for each WAN connection)

2) Determine the number of hosts I.Ds (one per TCP/IP host, one for each router interface)

3) Create the following: One subnet mask for the entire network; A unique subnet ID for each physical segment; A range of host I.Ds for each subnet.

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Classless Inter-Domain Routing (CIDR) or Variable Length Subnet Masks (VSLMs)

Classful default netmasks are 255.0.0.0 (Class A), 255.255.0.0 (Class B), 255.255.255.0 (Class C). Classless uses VLSMs often shown in slash notation (e.g., /8, /16, /32). Class no longer is tied to mask. e.g., a B address can have a subnet mask of /32 (e.g., 172.16.0.0, subnet mask 255.255.255.0).

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Subnetting: A Binary Example (part 1)

A class C address has 8 host bits available for subnetting.
Let's take two.

Binary	Decimal	Shorthand
1000 0000	128	/25 (not normal)
1100 0000	192	/26
1110 0000	224	/27
1111 0000	240	/28
1111 1000	248	/29
1111 1100	252	/30
1111 1110	254	/31 (not valid except for PPP links)

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Subnetting: A Binary Example (part 2)

Borrow two bits from the host (netmask 255.255.255.192).

The two subnets are 01 000000 (64) and 10 000000 (128). The first valid host on Subnet 64 is 65 (01 000001), the last valid host is 126 (01 111110), the broadcast addrss is 127 (01 111111). For Subnet 128, the values are 129, 190 and 191 respectively.

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Subnetting: The Quick Method (Part 1)

Yes, you can subnet in your head!

Q1: How many subnets does the subnet mask produce?
A1: 2^x-2, where x is the number of masked bits (e.g., 2^2-2 = 2).
Q2: How many hosts per subnet?
A2: 2^y-2, where y is the number of unmasked bits (e.g., 2^6-2=62 hosts per subnet)
Q3: What are the valid subnets?
A3: 256-subnet mask = block size. (e.g., 256-192 = 64. Subnets are 64 and 128)
Q4: What's the broadcast address for each subnet?
A4: The address with all host bits turned on, the only immediately preceeding the next subnet.
Q5: What are the valid hosts?
A5: The numbers between the subnets, not including the all 0s and all 1s

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Subnetting: The Quick Method (Part 2)

On which subnet does the node 192.168.10.33 with subnet mask 255.255.255.254 reside?

The block size is 256-224 = 32. So it falls in the 192.168.10.32 block, and has a broadcast address of 192.168.10.63. The valid host range for nodes on this subnet is x.33 to x.62

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Subnetting: The Quick Method (Part 3)

It's all good if you know your two times table!

(e.g., 172.16.0.0 with subnet mask 255.255.255.128/25).

This one *looks* wrong. Indeed, it's one of the hardest. But... it produces 510 subnets with 126 hosts each. Which means it's useful.

172.16.0.0 is the network address. 255.255.255.128 is the netmask.
Subnets? 2^9-2 = 510. Hosts? 2^7-2=126.
Valid subnets? 256-255=1, 2, 3 ... in the *third* octet (remember it's class B).
In the *fourth* octet it's 256-128=128. So effectively you get two subnets for each fourth octet value, hence 510 subnets.

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Subnetting: The Quick Method (Part 3)

The following table is the subnet, first host, last host and broadcast of the first four subnets and the last subnet.

Subnet	0.128	1.0	1.128	2.0	2.128	...	255.0
First Host	0.129	1.1	1.129	2.1	2.129	...	255.1
Last Host	0.254	1.126	1.254	2.126	2.254	...	255.126
Broadcast	0.255	1.127	1.255	2.127	2.255	...	255.127

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Supernetting.

A strategy for the insane or desparate. Uses CIDR to increase the number of hosts and reduce the number of networks.

More broadcast traffic, less manageable. But it does reduce the size of the routing table and, if things are that bad, it gives you some extra hosts.

Routing and Netmasks

Acknowledgements.

Various CCNA books by Todd Lammle. Buy his stuff. It's good.