Masking and Shifting

* A picture containing graphical user interface

  Description automatically generatedThe Boolean operators in pictorial form for hardware circuits are:
* The Boolean operators can be used in many ways in a computer. They can be used to initialise a register to zero, they can swap two register values around with no intermediate required, and they can perform shifting and masking.

Graphical user interface, text, application

Description automatically generated

Initialising a register to zero in assembler code.

Graphical user interface, text, application

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Swapping two registers with no intermediate.

* In IPv4 each IP address splits into a network address (left hand bits) and a host part (remaining right hand bits). However, when routing packets over the internet, the routers are only concerned with the network address.
* In the early internet there were classes for certain bit ranges, but now it’s CIDR (Classless Inter-Domain Routing) where we need to define where the split occurs in the 32 bits, and that’s where network masks come in.
* Generally, you’re presented with an IP address as well as a integer value preceded by a slash (the number must be less than 32) this value is the netmask. To find the network address you need to:
* Step 1: Convert the dotted decimal IP address into a 32-bit binary form.
* Step 2: Convery the netmask value to 32-bit binary form.
* Step 3: Apply the AND function
* Step 4: Convert the resulting AND binary back into dotted decimal.
* Step 5: See how many bits were remaining to see how many possible host values there are.
* For example, 143.117.69.72 /23

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First 23 bits kept the same because of the netmask.

Result = 143.117.68.0

This remaining section is the host part. We are able to work out how many host values there could be from this by seeing how many bits are remaining, and in this case it’s 9. Therefore there’s (210 -2) hosts available. Therefore, in this example there are 1022 possible host values. The reason we take away 2 is because in accordance with the IEEE we can’t use all 0s or all 1s for a host address.

* We can also, in order to reduce the number of hosts, borrow bits from the host section of the IP address by subtracting some bits, and then adding them to the network section of the IP address, therefore extending it. This is called SUBNETTING.
* For example, if we had an original netmask of /18, and then we borrow 5 bits from the host part of the IP address, the host section is reduced from 14 bits to 9 bits, and the netmask is increased from /18 to /23. These extra 5 bits can be assigned values, allowing for 30 different possible combinations (26 – 2) it would be 32 different values, but once again we can’t use all 0s or all 1s.

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