THE INTERNET

Internet: global network of networks. Started life as ARPANET in the late 1960s.

WWW a resource available on the Internet made up of millions of websites and webpages.

URL

Uniform Resource Allocator (URL): a method for identifying the location of resources on the internet

http :// www.bbc.co.uk / index.html

- *http:* protocol being used (could be https or ftp)
- *www.bbc.co.uk:* fully qualified domain name (FQDN)
  - *www:* server being accessed (mail.bbc or ftp.bbc also exists)
  - *bbc.co.uk:* domain name. Domains are unique (uniqueness assured by issuing authority ICANN)
    - *bbc:* name of organisation
    - *co:* type of organisation
    - *uk:* location where the website is registered
- *index.html:* filename (and path) to locate the specific file needed

IP Addresses

Internet Protocol (IP) Address: unique number that identifies devices on a network. Originally 4 bytes. Every domain is mapped to an IP address, this translation is made by a domain name server (DNS)

Private or non-routable addresses: used on private networks in order to route data around the network, it is not directly connected to the Internet but hidden behind a router or firewall (10.x.y.z, 192.168.y.z, 172.16.y.z - 176.31.y.z).

IPv6: since IPv4 2^{32} addresses are running out, IP v6 has been created using 128 bits in 8 blocks of 16 bits (expressed in hexadecimal separated by colons :).

Port numbers

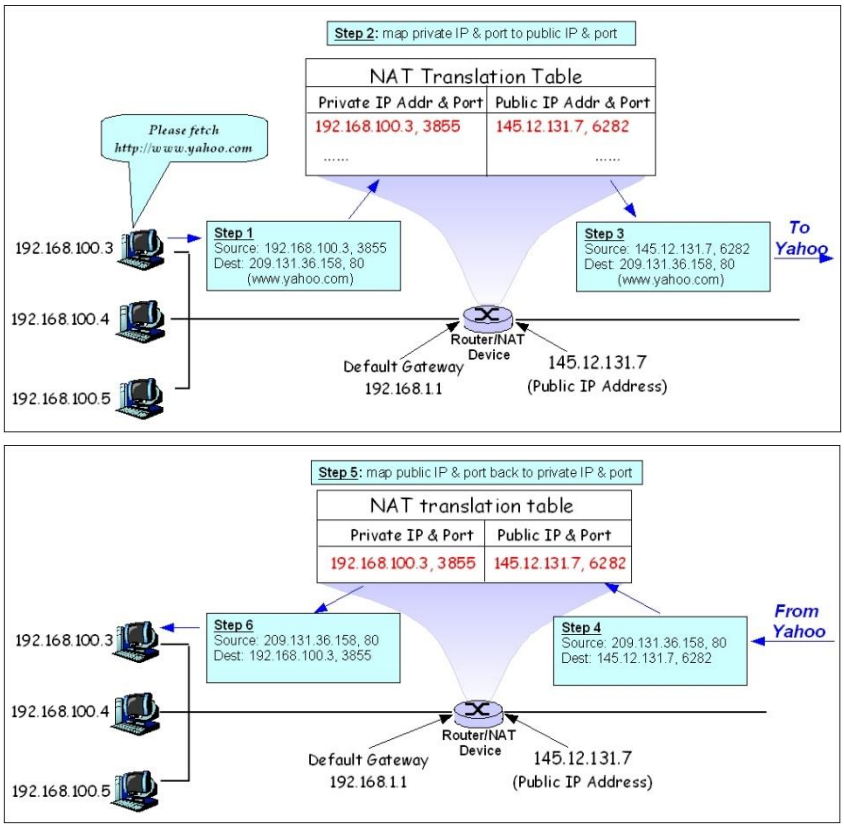
Port: 16 bits number used to identify a particular process or application on a network. 250 well-known ports. Assigned by the TCP (Transmission Control Protocol)

Port number	*Internet Service*
21	FTP: File Transfer Protocol
22	SSH: Secure Shell Protocol
23	Telnet:
25	SMTP: Simple Mail Transfer P used when email is delivered from an email client to an email server or when email is delivered from one email server to another
53	DNS: Domain Name Server
80	HTTP
110	POP3: Post Office Protocol, allows an email client to download an email from an email server.
143	IMAP: Internet Message Access Protocol similar to POP3, but with many more features.

Network Address Translation

NAT translation table stores internal and external IP addresses, source port and translation port.

Where the translation table does not contain a match to a port number in a packet received from a computer on the Internet, the packet is dropped for security reasons.



Port forwarding

If a LAN Server with a non-routable IP address needs to provide services to clients on the Internet, the router on the Server's LAN must be programmed to accept requests against it's Public IP Address provided a specified Port No is used. This request will be forwarded to a specific node on the LAN (like a pre-programmed entry in the NAT Translation table) – this is called Port Forwarding.

Socket: an endpoint of a communication flow across a computer network. Sockets are made in software and consists of an IP Address and a Port No (e.g. 209.131.36.158:80 → IP:port). Entries in any NAT Translation table are sockets.

Subnet masking

Subnet masking: a method of dividing a network into multiple smaller networks

Gateway: node on a network that acts as a connection point to another network with different protocols.

Networks are often sub-divided for geographical, numerical (max 255 each) or speed reasons. A NIC can understand if the node it wants to sent the packet to is in the same subnet (so just send the packet) or a different one (so send it to the gateway) by

1. ANDing own address with Subnet Mask to extract Network Id
2. ANDing destination address with Subnet Mask to extract Network Id
3. Comparing the resultant Network Ids

Dynamic Host Configuration Protocol (DHCP): a set of rules for allocating locally unique IP addresses automatically to devices as they connect to a network (e.g. leasing an IP Address with an agreed expiry date saves time at connection and frees up IP addresses if not regularly used).

Internet registries

ICANN – International Corporation for Assigned Names and Numbers – allocate and administer domain names and IP addresses through the department IANA which controls 5 Regional Internet Registry (RIR).

Routing: process of directing packets of data between networks. Routers are organised hierarchically with national, regional and local routers and the packets usually follow a path similar to a source → LCA → sink on a tree.

Packet switching: message to send over the Internet is broken in to packets. Each packet routed across network independently. Each packet has:

- Header
  - Source Address MAC Address & IP Address
  - Destination Address MAC Address & IP Address
  - TCP adds a Packet Id to enable end host to put packets in order
  - Protocol which protocol is being used
- Body
  - Payload the Data
- Footer
  - Checksum mathematically derived number based on the data to determine if the packet has been received intact.