

GCSE Computer Science

CPD Session for Leeds West Academy

Leeds West Academy

LEADING IN LEARNING



Networking

- types of networks:
 - LAN (Local Area Network)
 - WAN (Wide Area Network)
- factors that affect the performance of networks
- the different roles of computers in a client-server and a peer-to-peer network
- the hardware needed to connect stand-alone computers into a Local Area Network:
 - wireless access points
 - routers/switches
 - NIC (Network Interface Controller/Card)
 - transmission media
- the internet as a worldwide collection of computer networks:
 - DNS (Domain Name Server)
 - hosting
 - the cloud
- the concept of virtual networks.

Networking

- star and mesh network topologies
- Wifi:
 - frequency and channels
 - encryption
- ethernet
- the uses of IP addressing, MAC addressing, and protocols including:
 - TCP/IP (Transmission Control Protocol/Internet Protocol)
 - HTTP (Hyper Text Transfer Protocol)
 - HTTPS (Hyper Text Transfer Protocol Secure)
 - FTP (File Transfer Protocol)
 - POP (Post Office Protocol)
 - IMAP (Internet Message Access Protocol)
 - SMTP (Simple Mail Transfer Protocol)
- the concept of layers
- packet switching.

Networking

- forms of attack
- threats posed to networks:
 - malware
 - phishing
 - people as the 'weak point' in secure systems (social engineering)
 - brute force attacks
 - denial of service attacks
 - data interception and theft
 - the concept of SQL injection
 - poor network policy
- identifying and preventing vulnerabilities:
 - penetration testing
 - network forensics
 - network policies
 - anti-malware software
 - firewalls
 - user access levels
 - passwords
 - encryption.

LAN vs WAN

Local Area Network

On one site - Uses own cabling / wifi

Wide Area Network

Across at least 2 separate sites

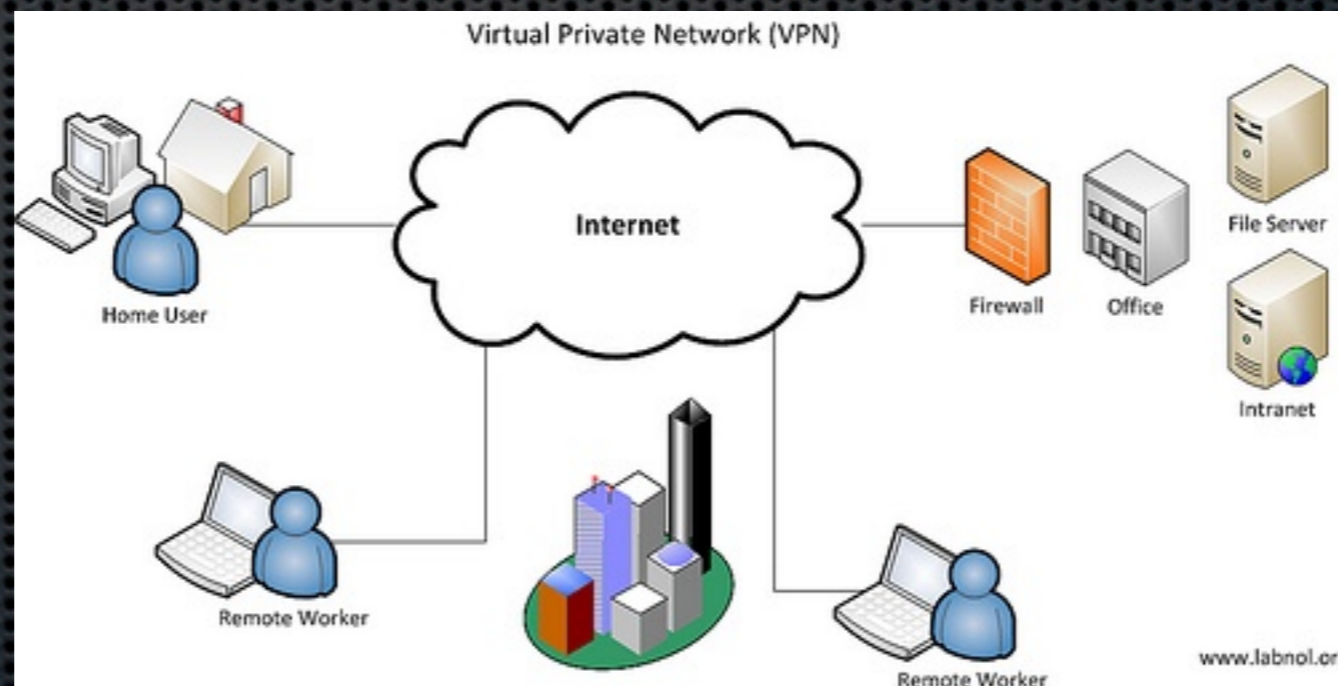
Uses existing phone lines / telecoms network

Virtual Networks

A network made up (at least partly) of virtual links

Virtual Private Network (VPN)

Uses a WAN but looks like a LAN



<https://www.flickr.com/photos/amit-agarwal/4228688555>

Virtual Networks

A network made up (at least partly) of virtual links

Virtual LAN (VLAN)

Taking one large LAN and segmenting it into several smaller logical LANs (e.g. science block, maths block)

Packet Switching

Performance Factors

Bandwidth (maximum rate of data transfer)

Distance (signal attenuation)

Traffic (frequency of traffic collisions)

Client-Server vs Peer-Peer

Client-Server

A server has what you need (e.g. a web page / video)

Clients request the resource and the server sends it

If there are many clients, the server can be overwhelmed and wait times can be unacceptable

Client-Server vs Peer-Peer

Peer-Peer

Three computers all have the same video

Users who want the video can download individual chunks from any of the three original computers

While a user is downloading chunk 7 from user 1, they can be sharing chunk 6 with users 12 and 15

All devices on the network are equal (peers)

Client-Server vs Peer-Peer

Peer-Peer

The most well known example is bit torrent / file sharing

Other uses include the original BBC iPlayer

Copyright implications are a concern - much file sharing (though not all) is centered around pirating of film, tv, music & computer games

Hardware

Transmission Media

Ethernet (RJ45/Cat5/Cat6)

Optical fibre

NIC (Network Interface Controller)

One per network channel (e.g. ethernet, wifi, fibre)

Hardware

Router / Switch

Wired device to route signals across the network

Sometimes combined with a wireless access point

Wireless Access Point

Provides wifi access (emphasise wifi \neq mobile data)

Layers

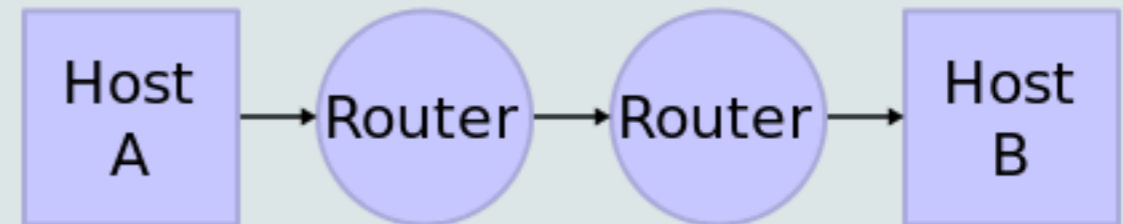
Light touch!

Think addressing:

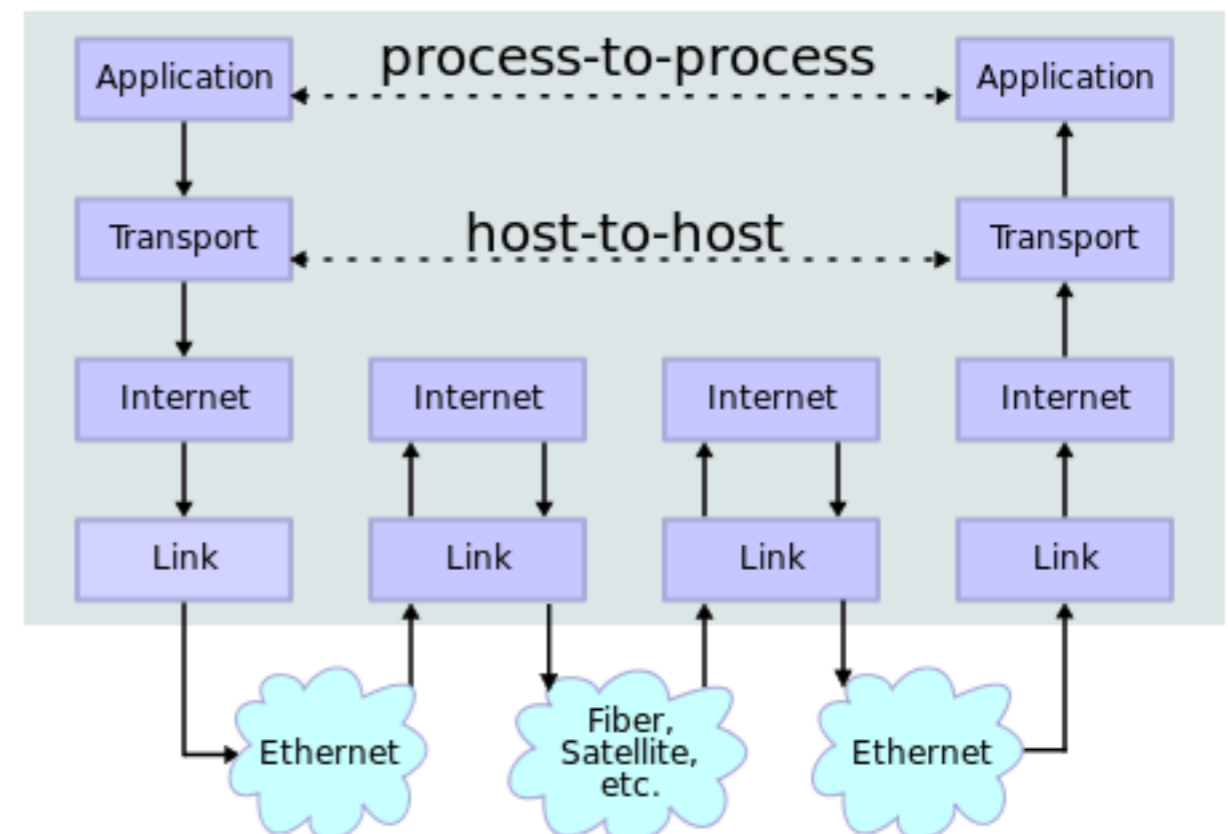
A letter to another school

A letter to a department

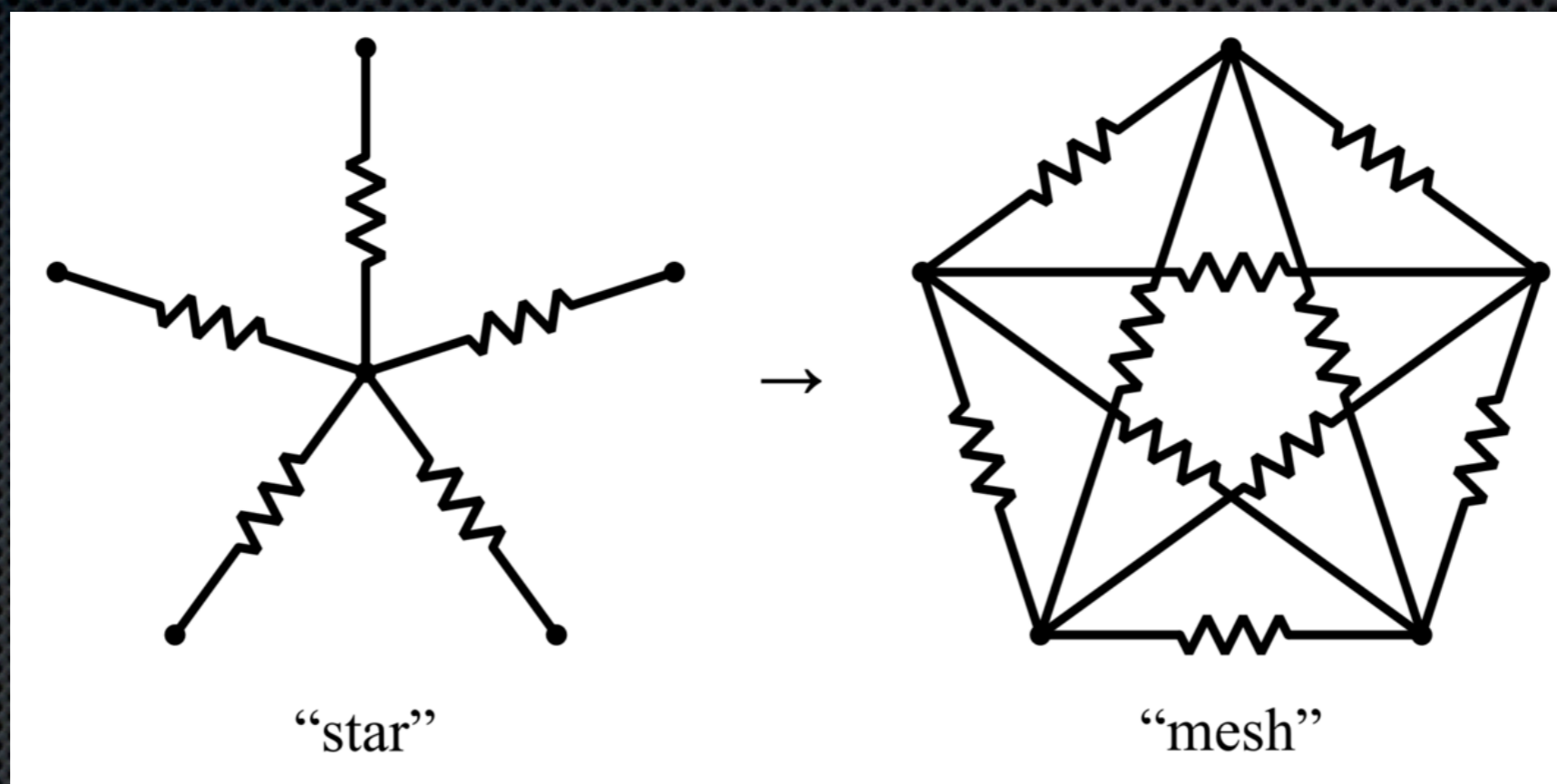
Network Topology



Data Flow



Topologies



Wikimedia

Topologies

Star

One central point (router/switch)

Useful for small/medium LANs

Mesh

Greater redundancy in case of failure

More routes available if traffic is heavy

Addressing

IP Address

Temporary, software-based address to identify your computer within a network

IPv4: 192.168.0.1 (4 numbers from 0 to 255, ~4.3b)

MAC Address

Permanent, hardware-based address to uniquely identify your NIC. 12 hex digits e.g. 12:34:56:78:9A:BC

More about wifi

A lot like FM radio stations

Broadcast/receive on a specific frequency

Typically 14 channels (2.4GHz - 802.11b / 802.11g)

~38 channels (2.4GHz + 5GHz - 802.11n)

Wifi encryption

Signal is broadcast indiscriminately

Typical methods are WEP (poor) or WPA/2 (good)

Need to enter a passphrase in order to connect

Often public wifi spots are unencrypted!!

The Internet

The Internet ≠ The World Wide Web

Global mesh network

Uses the TCP/IP protocol

Includes:

web pages (HTTP / HTTPS)

email (POP / SMTP / IMAP)

file transfer (FTP / SCP)

command line access (SSH / Telnet)

The Internet

Hosting

Providing access to online data (typically a website)

You CAN host yourself, although some ISPs forbid this

Typically you buy (rent) hosting off-site

Cloud

Online access to computer systems. Commonly used for file storage but can be used for remote computer processing tasks. Examples include iCloud, Google Drive, Cloud9, Office365

DNS

Domain Name Service

A method of matching user friendly address with usable IP addresses

e.g. leedswestacademy.org.uk = 88.208.252.131

No secret algorithm - just a giant lookup table

DNS

Method

User types a URL into a web browser (for example)

Request goes to DNS server

DNS server returns the IP address

Web browser sends request to the IP address

Data comes back from the server

What's left?

Network security

See ishouldbemarking.wordpress.com