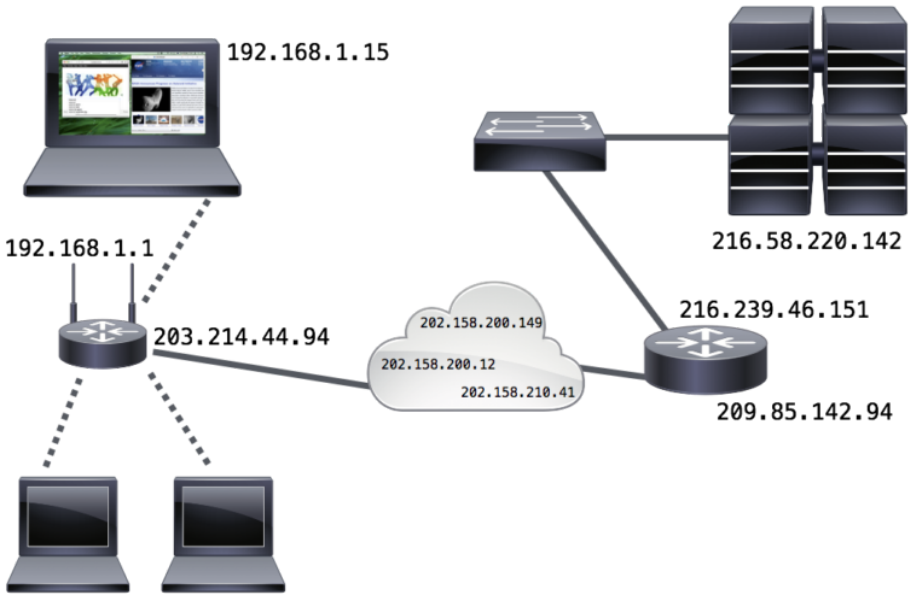
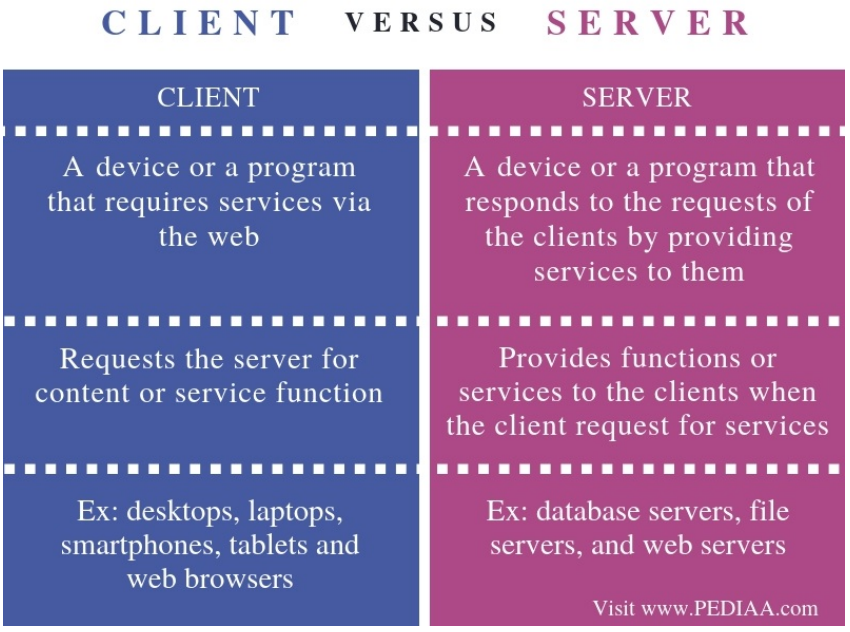
FIT1047 PASS WEEK 8

Internet Model
Application Architecture
HTTP and SMTP Application Layer



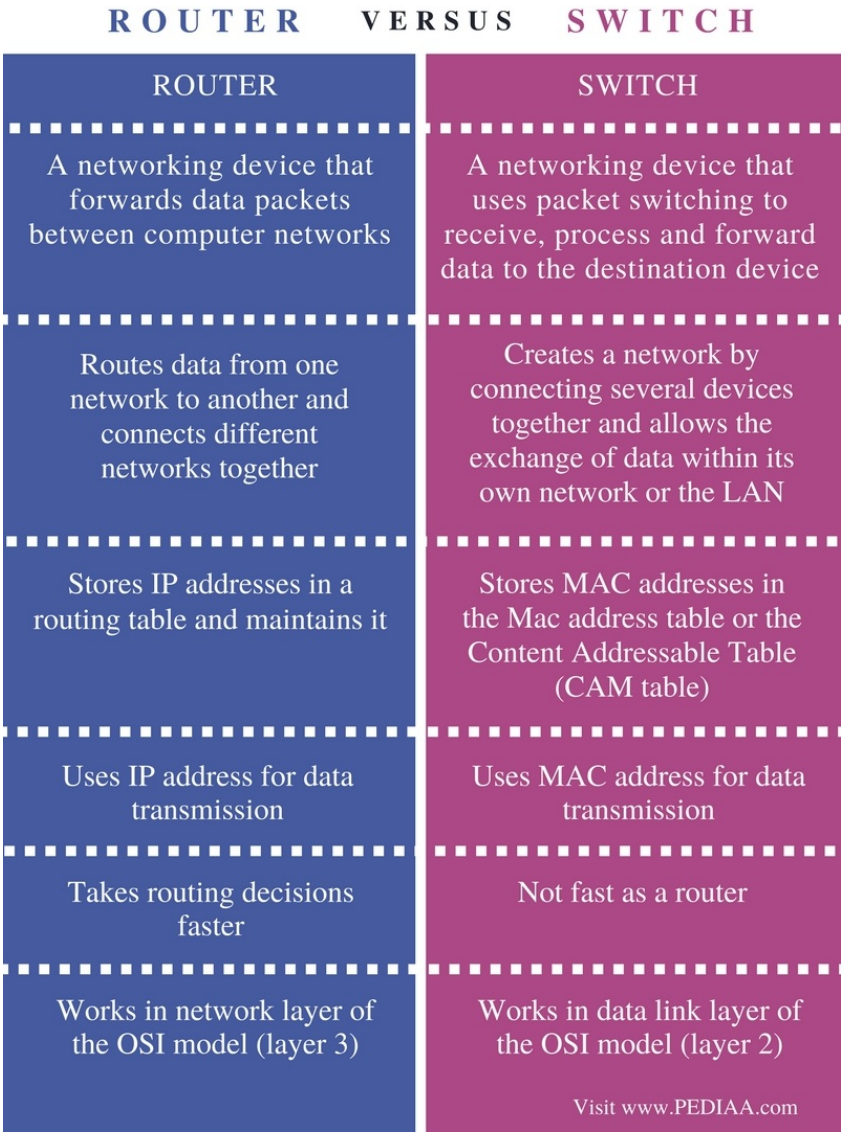
What is the difference between a client and a server?

Client	Server
device (e.g. a computer or a smart phone) that enables users to *access* the network	device (usually a dedicated computer) that *provides services* to clients



What is the difference between a switch and a router?

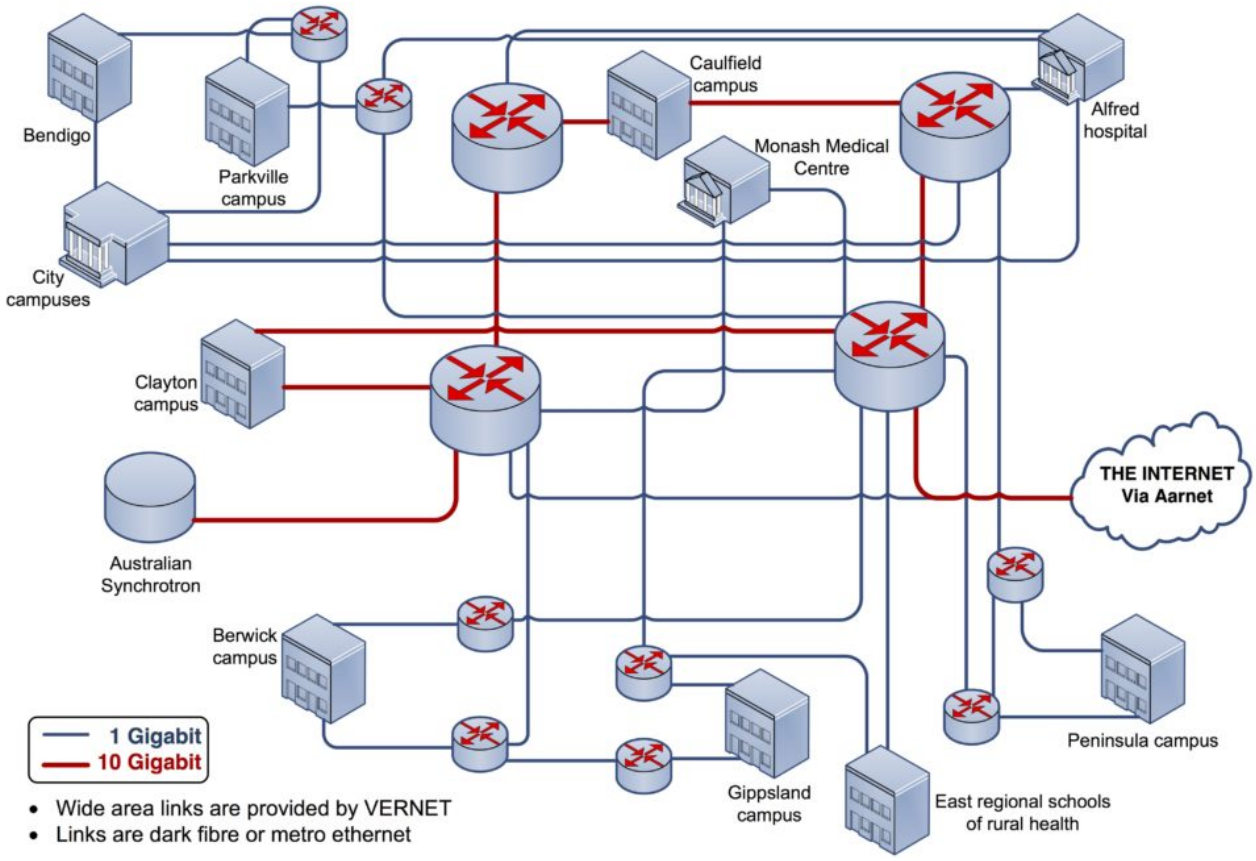
Switch	Router
connects multiple devices to form a LAN. Devices in the same LAN can communicate with each other.	connects different networks to allow devices of different networks to communicate with each other.

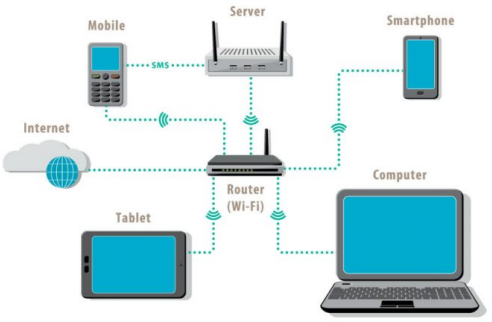


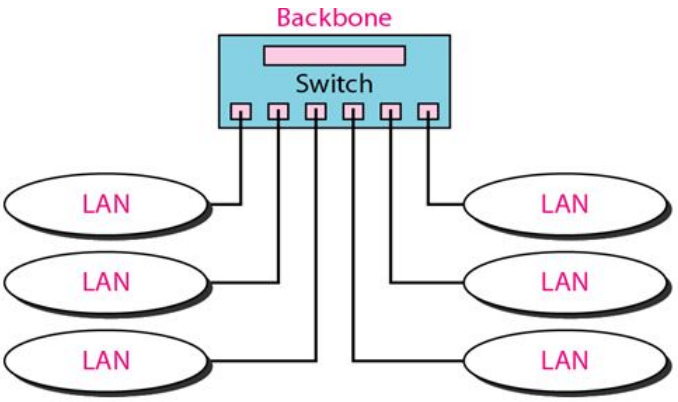
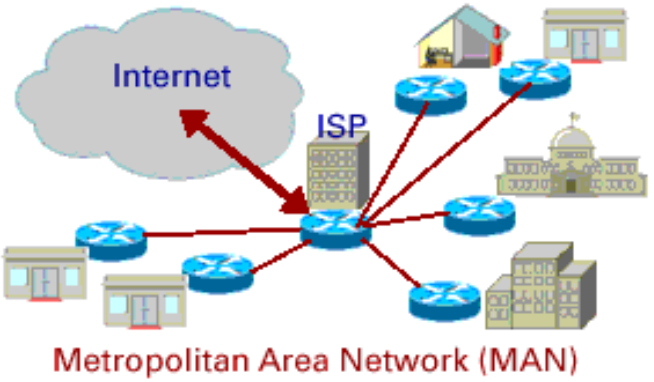
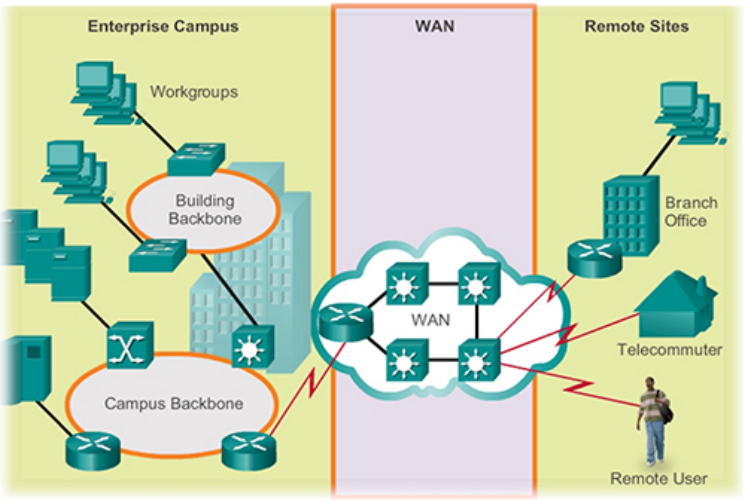
Addresses

- each device in a network needs a unique address to identify it as the receiver of a particular message
- IP address sends message from 1 network to another
- MAC address used within same LAN

Types of Network



Local area network (LAN)	 • Groups of clients and/or servers sharing local circuit • Directly connected to each other using switches and cables or radio waves • All devices in a LAN can communicate directly with each other • Example: wireless network at home

Backbone network (BN)	 • Connect multiple LANs using router • Provide high speed to handle network traffic between LANs (typically 10 Gbps) • Example: BN connect different floors of building/ different building on campus
Metropolitan area network (MAN)	 • Several kilometers • Connect LANs and BNs across different locations. • *Leased* by telecommunication companies
Wide area network (WAN)	

	• Similar to MAN except larger distance • Connection between different countries

What is latency?

- Latency describes how long it takes for one bit of data to travel from a sender to a receiver

What are the factors affecting latency of a network?

- Signal speed
- devices message passing through

Network application architectures

- Client communicates with server to provide users an *application*
- Each application has a different task to fulfill

How to describe the different tasks provided by applications?

Presentation logic	• Defines how an application is **presented** • Example: User interface
Application logic/ Business logic	• Defines how an application **behaves** • Example: Implements what should happen when the user clicks a button or receives a new message or types a word
Data access logic	• Defines how the application **manages** its data • Example: Retrieving a piece of information when the user performs a search
Data storage	• Defines how the application **stores** its data • Example: In the form of files on a disk

Application architecture defines how to split the work between **client** and **server**.

	Client-based	**Client-server**	**Thin-client**	**Server-based**
Presentation	C	C	C	S
Application/ business	C	C	S	S
Data access	C	S	S	S
Data storage	S	S	S	S
Feature	Time consuming	Balanced workload	Only one server needs updating	Prone to server outage due to massive data, expensive upgrade
Example	File server	Typical email systems	“digital assistants” - Microsoft Cortana or Apple’s Siri	“Dumb terminal”

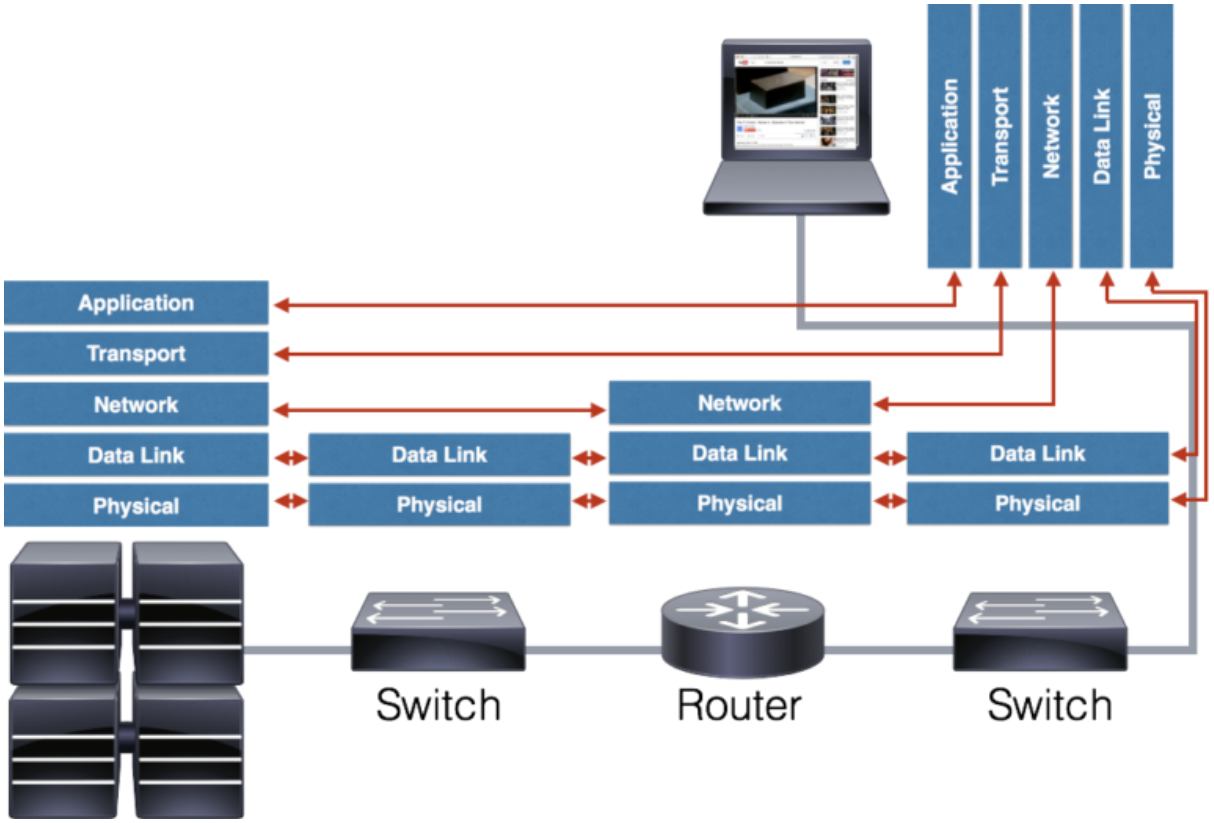
Special architecture

Multi-tier	• More than 1 server needed • Dedicated servers for application logic, data access and storage
Peer-to-peer	• No servers used at all • Directly connect multiple clients with each other • Example: distributed file sharing

Layers and Protocols

The Internet Model

- Describes a packet switching network



Layer		
1	Hardware/ Physical	• Concerned with the actual hardware, such as cables, plugs and sockets, antennas • Specifies the *signals* that are transmitted over cables or radio waves
2	Data link	• Defines the interface between hardware and software • Specifies how devices within one local area network exchange packets

3	Network	• Responsible for *routing* - deciding which path a packet takes through the network •
4	Transport	• Establishes a logical connection between an application sending a message and the receiving application • Breaks up a large message into individual packets and reassembles them at the receiving side • Ensure that messages are received correctly, re-sending packets if they were received with errors
5	Application	• Actual application software that a user interacts with

- A **switch** only needs to implement the **hardware** and **data link** layers, because it is only responsible for communication inside a local network. It ignores the higher level layers.
- A **router** requires an implementation of the **network** layer in order to perform its function, but it can ignore the transport and application layer.

Message Encapsulation

- Protocol - formal language that defines how two applications talk to each other
- Encapsulation - method of designing modular communication protocols in which logically separate functions in the network are abstracted from their underlying structures by inclusion or information hiding within higher level objects

Layer	Protocol Data Unit (PDU)
Application	Message
Transport	Segment
Network	Packet
Data Link	Frame
Physical	Bit

Application Layer

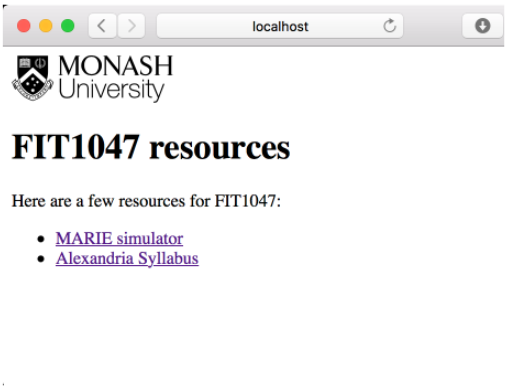
Uniform Resource Locator (URL)

- address of a *document* on the world wide web
- textual address that uniquely identifies where to find a particular document on the Internet, and how to retrieve it
- Scheme - describes which protocol must be used to retrieve the document
- Host - identifies the server
- Path - identifies a particular document on the server

HTML documents

- web page represented by a document written in the *Hypertext Markup Language* (HTML)

```
<html>
  <body>
  <img
src="http://www.monash.edu/__data/assets/git_bridge/0006/509343
/deploy/mysource_files/monash-logo-mono.svg">
    <h1>FIT1047 resources</h1>
    <p>Here are a few resources for FIT1047:</p>
    <ul>
      <li><a href="https://mariejs.xyz">MARIE simulator</a>
</li>
      <li><a
href="https://www.alexandriarepository.org/syllabus/introductio
n-to-computer-systems-networks-and-security/">Alexandria
Syllabus</a></li>
    </ul>
  </body>
</html>
```



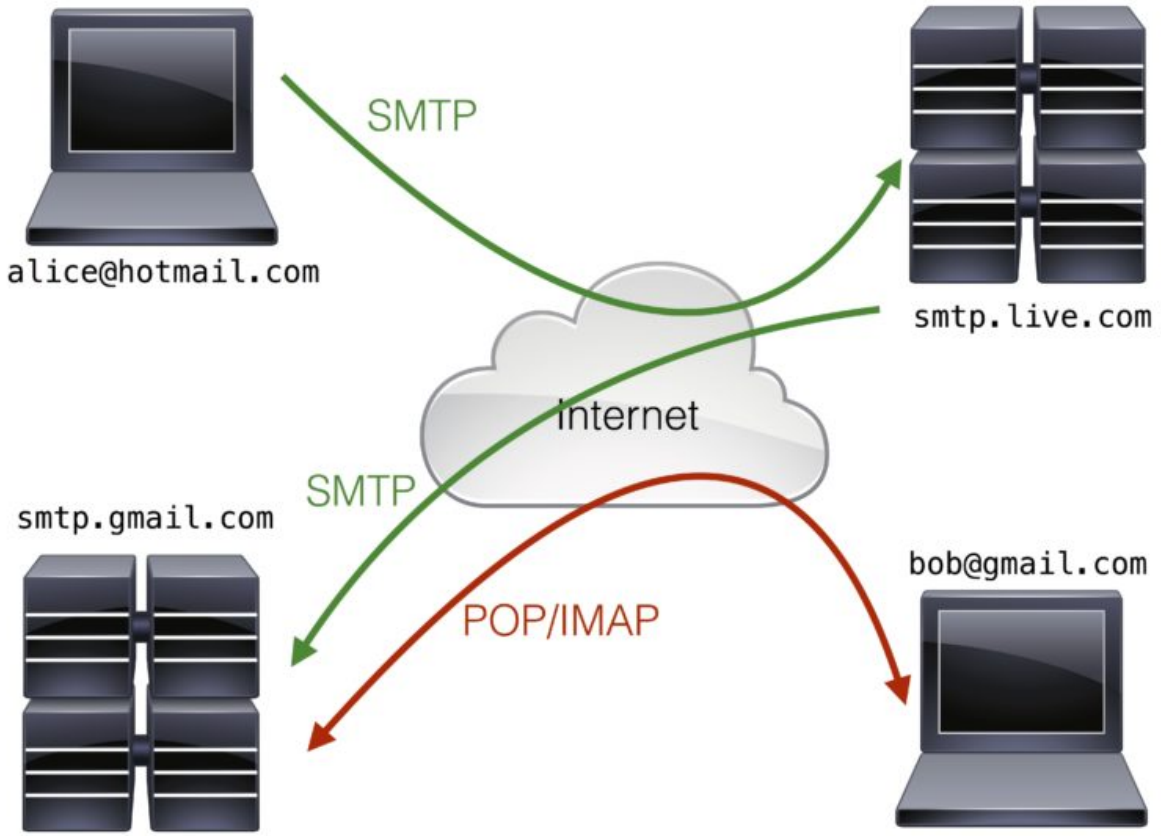
Hypertext Transfer Protocol (HTTP)

- HTTP defines how a web browser requests a document from a web server, and how the web server responds.
- Operates in *request-response cycle*
- HTTP is *stateless* - every request sent independently & server cannot recognise users.
    - **Session identifier** - unique ID that a Web site's server assigns a specific user for the duration of that user's visit (session)
    - **Cookies** - small piece of data that is returned as part of the HTTP response header, web browser stores the cookie, and every time it

makes a request to that web server, it will send the cookie back to the server

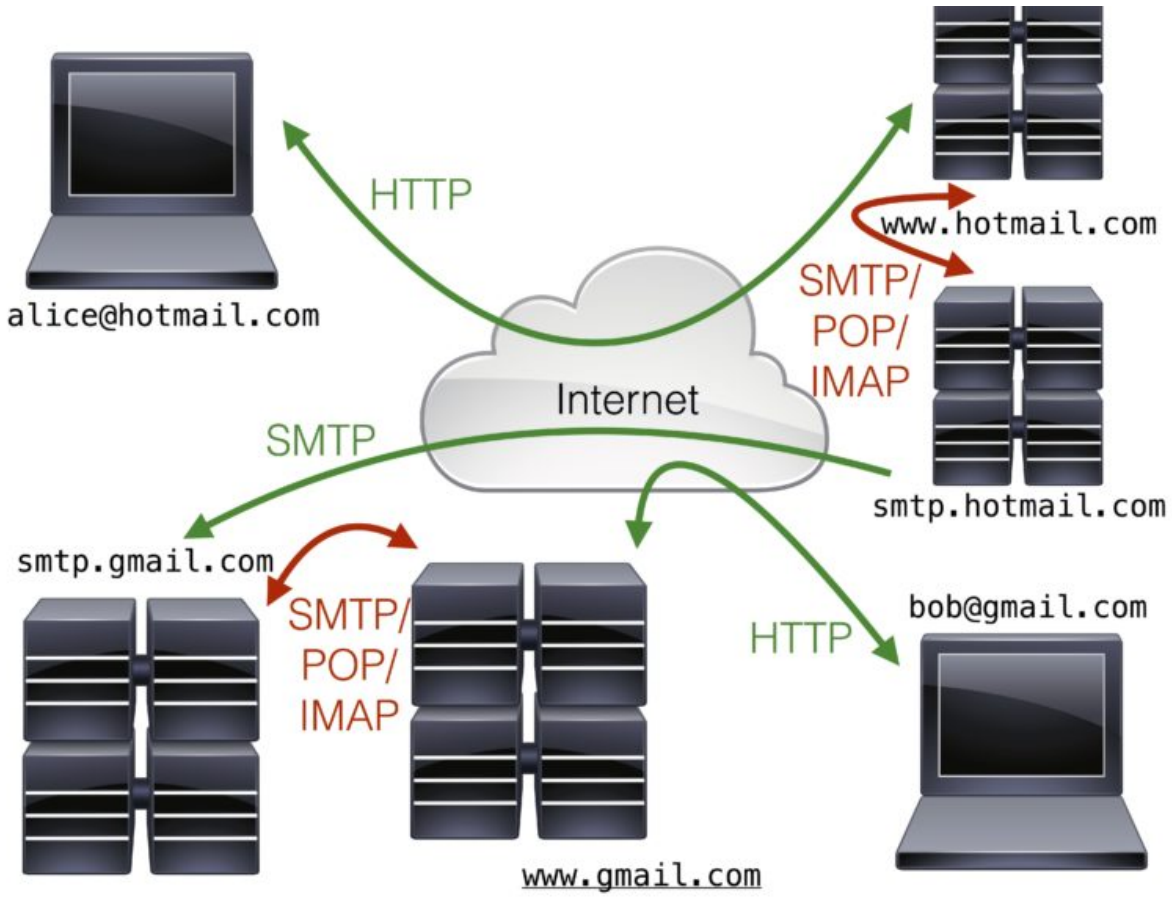
Electronic Mail

Two-tier



What is the difference between POP and IMAP?
The difference between POP and IMAP is mainly that POP downloads messages onto the client, and usually deletes them from the server in the process. With IMAP, messages remain on the server, and multiple clients can access the same email account at the same time, marking messages as read or unread, and synchronising the state of the "inbox" across all devices.

Three-tier



Past year questions

Name the layers of the TCP/IP architecture (also called the Internet Model), and briefly explain the function of layer 2.

- Application, Transport, Network, Data Link, Physical
- Layer 2 is the Data Link layer: This layer is the interface to the hardware; it encodes digital data into signals to be sent over the physical medium and it controls access to the physical medium.

Briefly explain how a switch works.

A switch connects different devices in a Local Area Network. When it receives a packet, it looks into its forwarding table to find out to which port the device with the destination MAC address is connected to. If the destination is not in the forwarding table, it sends the message to all ports. When a packet comes in e.g. from MAC address A on port 3, it adds that information to the forwarding table.

Briefly explain how a router works.
A router provides the connection between different IP networks. When a packet comes in, it looks up the destination IP address in its routing table. It then sends the packet either directly to the destination (if the destination is directly connected to the router), or to another router. Routing tables can be configured statically or using dynamic routing protocols.

Name the acronym of the application layer protocol used for accessing the World Wide Web.
HTTP

What is the difference between Two-tier mail and three-tier mail?

- Two-tier
    - Client-server architecture
    - Client implements application logic, talks to server using SMTP, POP/IMAP
- Three-tier
    - Thin-client architecture (accesses web application)
    - Server handles application logic
    - Client accesses server using HTTP