



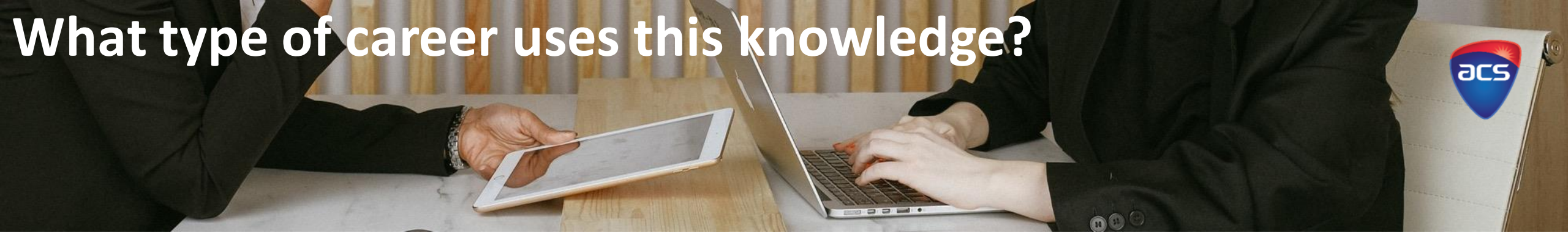
# Data Networks

---

## **LEVELS 7-8**

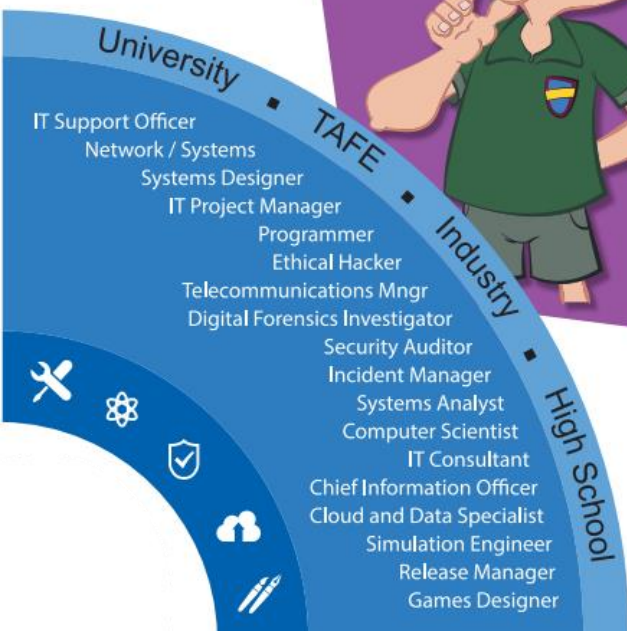
Investigate how data is transmitted and secured in wired, wireless and mobile networks, and how the specifications affect performance (ACTDIK023)

# What type of career uses this knowledge?



## Technology Services

Provide specialist  
IT advice & services  
to clients



## Technology Services

- *Technical | Specialities*

Use your deep technical skills to securely manage and interpret clients' data.

- Cloud Computing

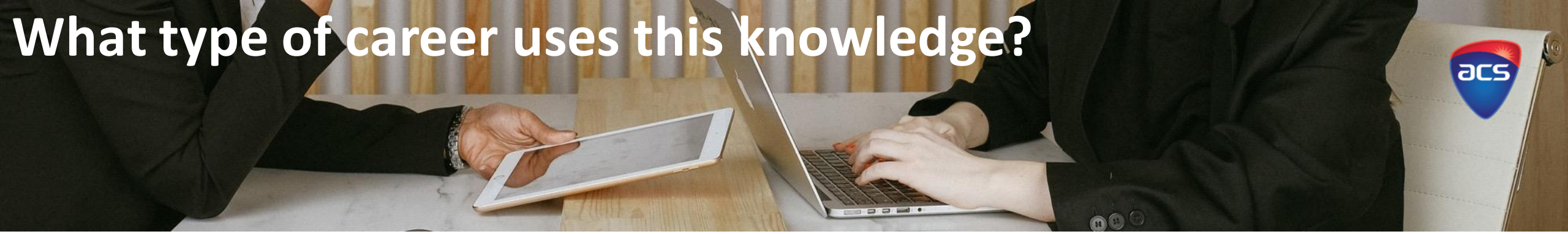
As more companies adopt cloud systems into their organisation, there are many cloud computing roles which include, Cloud Architect, Software Engineer, Services Developer, Consultant etc.

## Networking Specialist

- Develop, document and execute integration of products and/or systems so that all components function as they should.



# What type of career uses this knowledge?



Cloud Computing

Networking Specialist

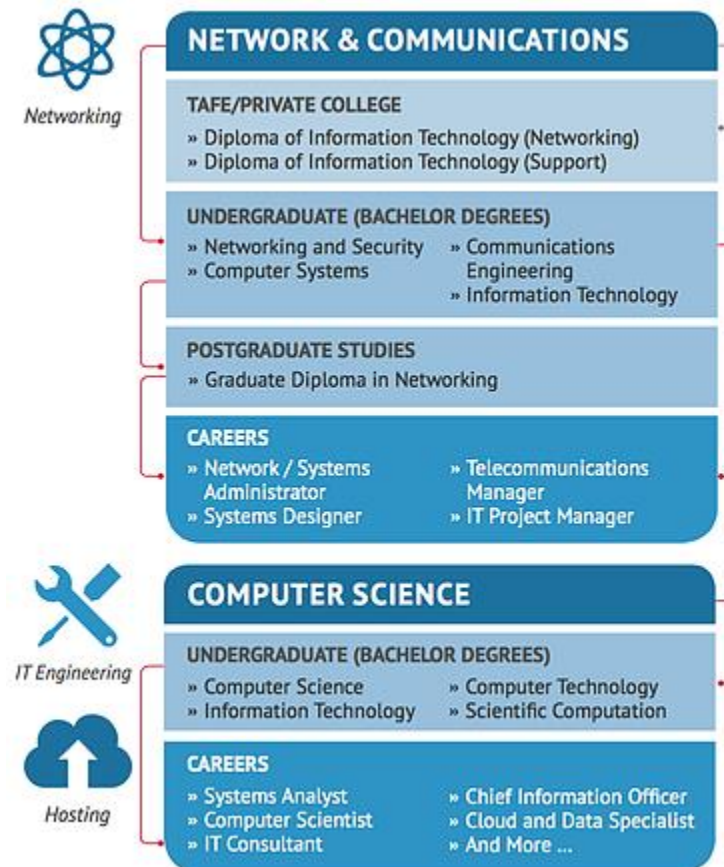
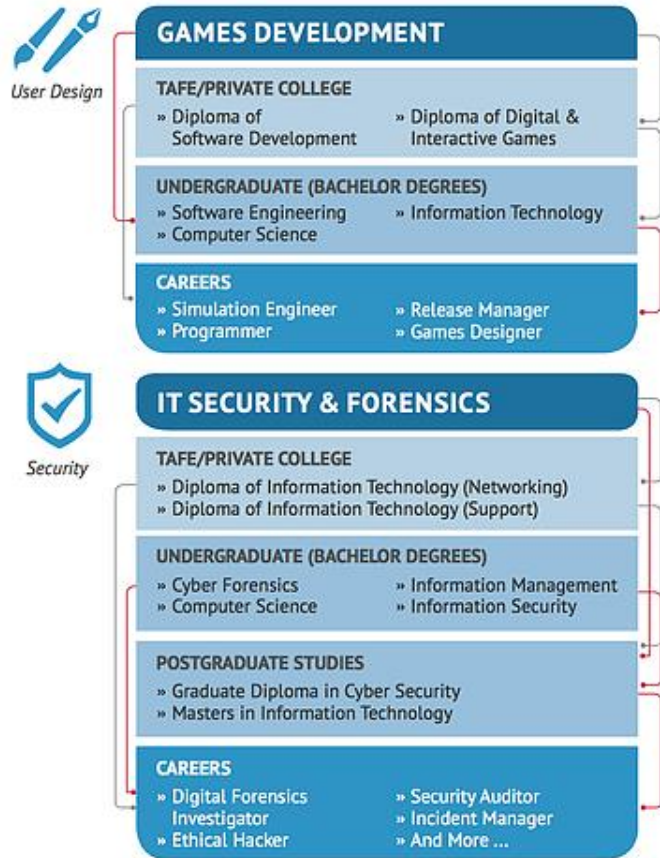


Source: <https://youtu.be/NKLuNQsgKXc>



Source: <https://youtu.be/ehqMA3Dq0ml>

# What type of career uses this knowledge?







# The Jobs of the Future ICT Career Wheel for students



**= Dream Job**

The secret ingredient for landing your dream job is 'work experience'. When study is combined and integrated with an industry placement (such as an internship), more possibilities open up.



# Definitions



<b>Bandwidth</b>	The amount of data that can be transferred on a network in a time period
<b>Client</b>	Software or hardware that accesses a service made available by a server
<b>Encryption</b>	Encoding data that can be only be accessed by authorised users by decryption
<b>Ethernet cable</b>	A networking cable to connect hardware in networks
<b>Handshake</b>	Establishes rules for communication when a device tries to communicate with another device
<b>Hubs</b>	A device used to connect multiple network-enabled devices, not commonly used is a modern LAN
<b>Internet</b>	Global network, consisting of interconnected networks and devices using communication protocols to share data
<b>ISP</b>	Internet Service Provider – the company that you pay in return for access to the internet
<b>LAN</b>	Local area network. The small wired network set up in an office or house
<b>Modem</b>	Modulates data into a signal that is sent and received over a phone line, and turned back into digital data
<b>Router</b>	Connects networks and directs network traffic (data) between them
<b>Server</b>	Software or hardware that provides functionality for clients
<b>SIM card</b>	(Subscriber identity module) smart card that stores data for cellular telephone subscribers
<b>Switch (Bridge)</b>	Manages the sharing of multiple computers or networks on the same data connection – many to one
<b>WLAN</b>	Wireless LAN where hardware is connected wirelessly

# Networks

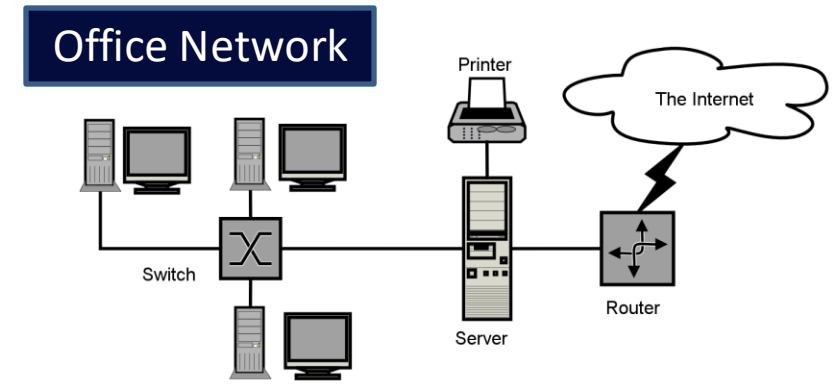
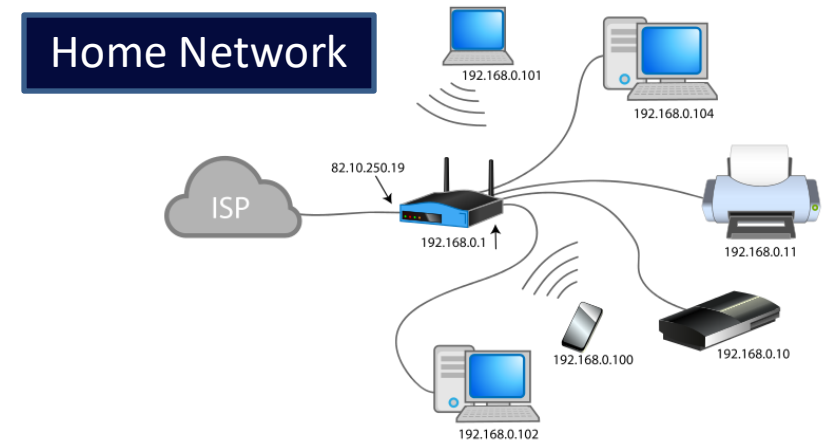


A network consists of two or more computers connected by a cable or wireless connection to exchange data. A computer network can be made up of computers, print devices, network devices, and computer software. Once the network is set up it can transmit data, voice, and video communications over Ethernet cables, wire, fiber-optic media, radio waves, infrared waves, and microwaves. Computer networks affect our lives in lots of different ways.

Every day they help us to:

- exchange e-mail
- visit websites
- download software
- participate in electronic commerce
- work in “The Cloud”

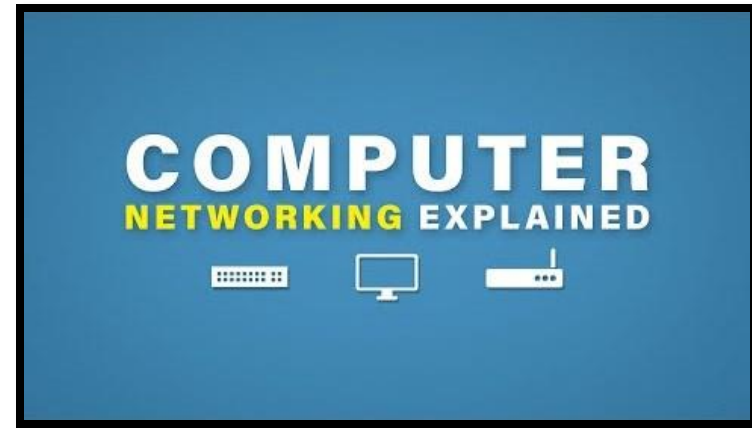
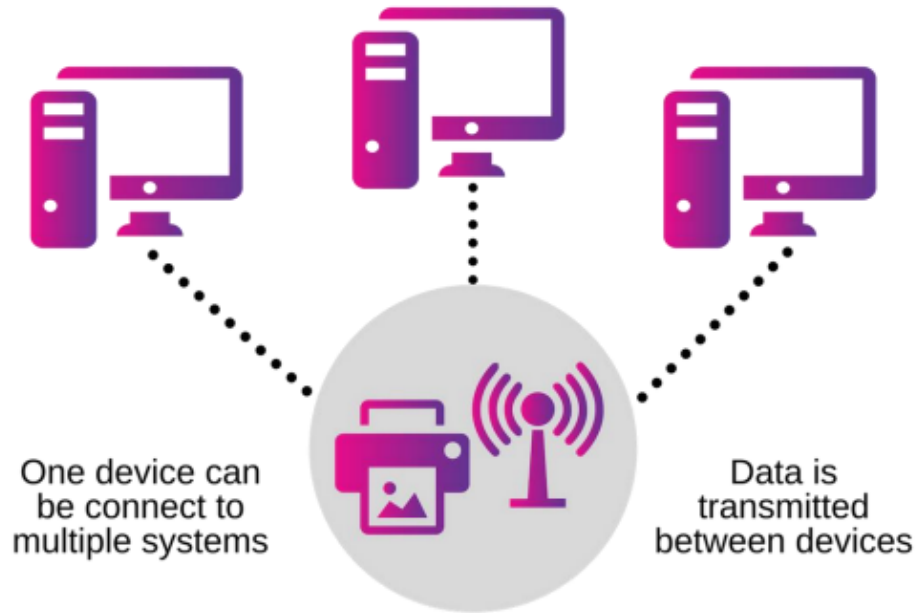
They are even used for urgent tasks like providing information on road conditions during storms, and immediately transporting vital documents. One of the most important advantages of a computer network is the ability to share information and peripheral hardware, like documents, email, data, pictures, files, printers and software / applications.





# NETWORKS

When digital systems are linked together they form networks.



Source: <https://youtu.be/tSodBEAjz9Y>

Digital systems can be connected by:





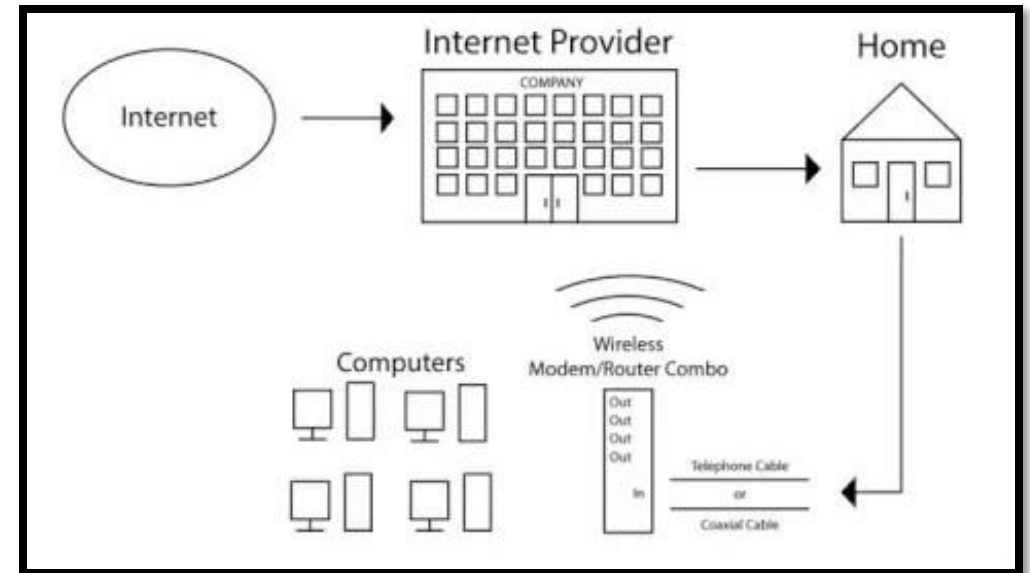
# The Modem and Router Explained



## Modem (short for modulator-demodulator)

A modem device lets you connect to the Internet through Ethernet cables, data connections and telephone lines. Modems control signals on telephone lines so that digital data is encoded and transmitted, then demodulated and decoded at the other end, however, modern technologies no longer require this process to take place due to the new data transfer modalities like cable and satellite.

When you connect a modem to a router instead of directly into your computer, all devices on the network will be able to access the Internet through connection to the router. Modems can have wifi connection functionality, as well as several ports for you to connect peripherals like printers and gaming consoles, or desktop computers. These connection options are the purpose of the router.



Source: <https://youtu.be/KBvGAAPDY3g>

# The Modem and Router Explained



## Router

The router is situated between your modem and your LAN. It lets you connect several devices to the Internet through a single Internet connection. The router enables all your LAN devices to communicate with one another. The router also provides protection for your devices instead of them being directly exposed to the Internet.

The Internet thinks that all traffic coming from your house is coming from a single device. The router can direct the correct traffic to the correct device on your network.

Most homes have a modem with a built-in router.

IP (Internet Protocol) Address is the unique address of your network device, helping connect your computer to other devices on your network and the internet. An IP Address is made up of numbers or characters.

An example of an IP address would be 507.547.13.612



# Wired, wireless and mobile networks



Digital systems can be connected, enabling users to access one device (printer) from multiple digital systems (desktop computers or mobile devices). These devices will form a network. Connected devices share information and data can be transmitted between the devices.

Connections to form a network include:

## Wired

Fastest data transfer speeds, no mobility. Best for offices that need fast and secure data transmission over a local area

## Wireless

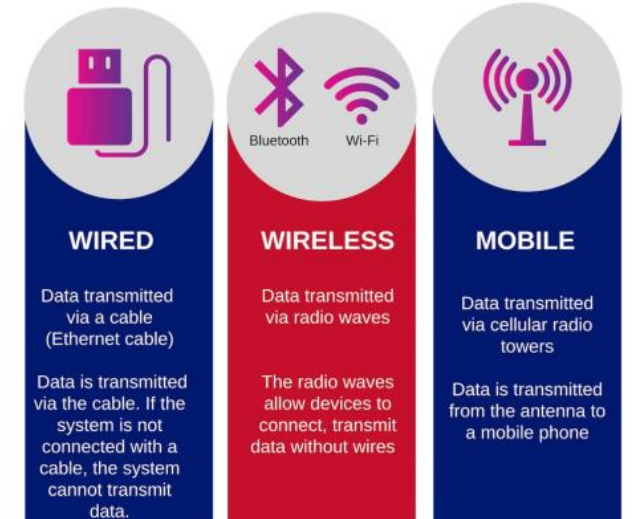
Speed limited by distance from the router, great mobility. Great for local areas like schools where students and teachers have laptops. The speed is still good, and many workplaces use a secure wireless network combined with some wired infrastructure. Security is important as hackers can easily access unsecured wireless networks

## Mobile

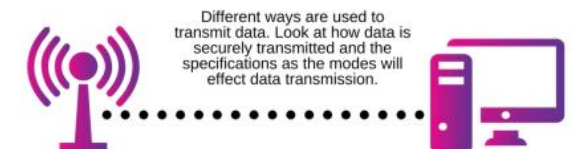
High cost of data access, great mobility, speed is comparable to wireless. Used over large areas and distances where wifi is not available. Data is usually provided as part of a plan with a phone company

## DATA

Networks transmit data



These modes will influence the speed to transmit data.

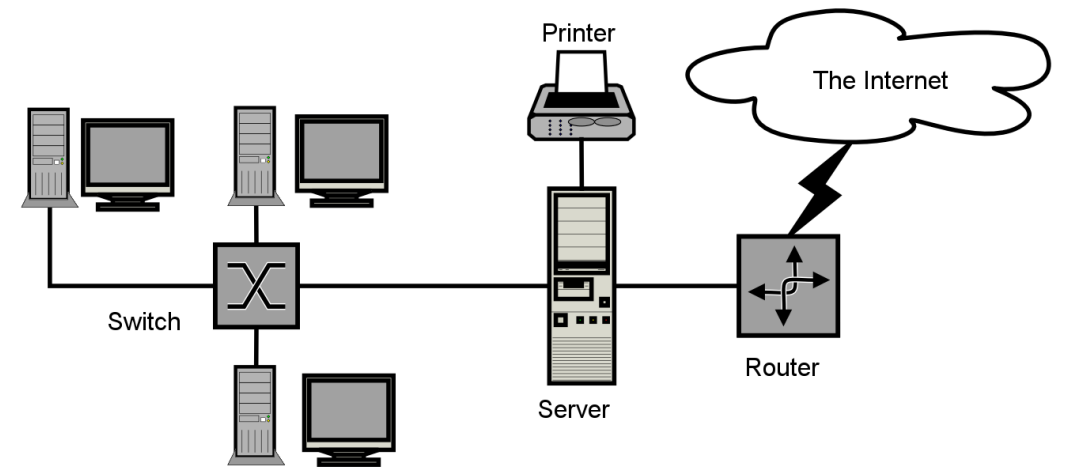


# Wired Network



## Wired (Ethernet Cables)

- Wired networks connect devices and peripherals with cables
- These high-speed Ethernet cables can move data very quickly
- Great for speed as the connection is one to one, not one to many and the signal does not lose strength over distance
- Strong security as remote hackers cannot access the network
- A wired network will stay in the same small area, like an office
- It is not convenient for people who need to move around
- Lots of cables can mean lots of messy workstations
- If the workspace has multiple workstations, there is a need for more hardware like switches and routers that can direct the data to the correct destination
- For example, if there are 10 workstations and one printer, the cables from the ten printers will go into a switch, and one cable will go from the switch to the printer



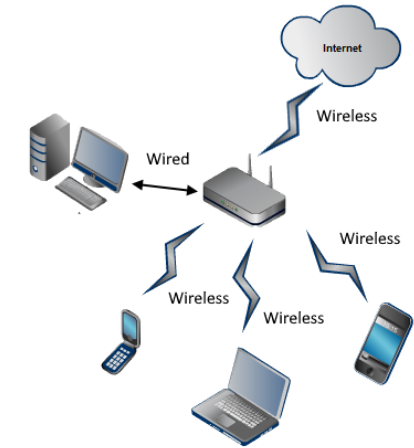


# Wireless Networks



## Wireless (WiFi – Wireless Fidelity)

- No wires attached to the device, connected via radio signal
- Wireless access allows for flexible use with mobile devices inside a space (work, home)
- Data flow is not as fast as a Wired network connection
- Devices access the wireless network and log in with a username and password
- Wireless router sends and receives data to and from wireless clients and the internet
- There are two WiFi frequencies (some routers support both, some support one)
  - 2.4Ghz – oldest type of band, low speed, high distance,
  - 5Ghz – fast speed, low distance, more data can be carried, harder to move through walls
- The router sends and receives the WiFi (radio) signals which lose strength over distance



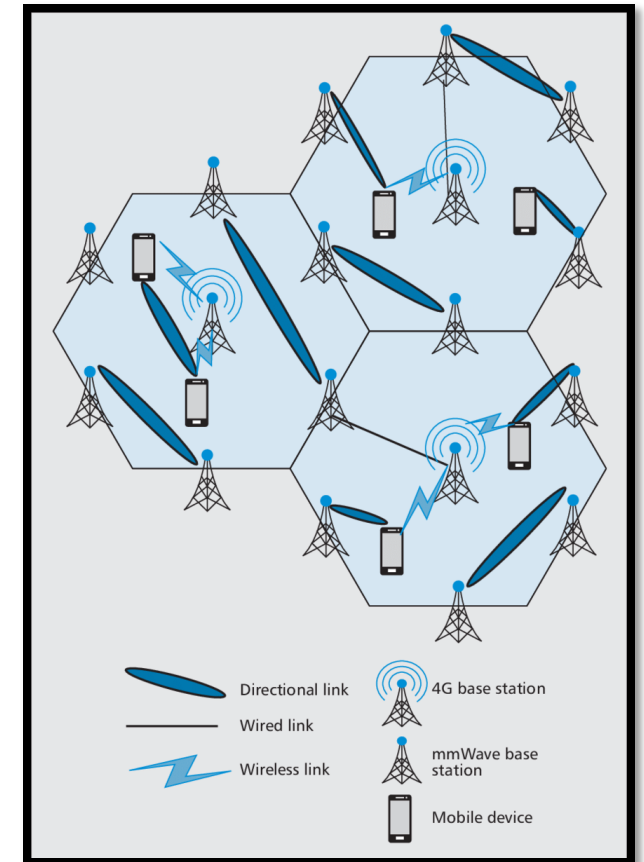
Source: <https://youtu.be/xmabFJUKMdg>

# Mobile Networks



## Mobile Networks (Cellular)

- A radio network used outside of local areas, mostly with sim cards
- The device will have a sim card that has a data plan bought through a telecommunications company like Telstra
- The device will wirelessly connect with a base station transceiver (mobile phone tower) that is located inside a hexagonal area called a cell
- The tower is connected to a digital exchange to send the signal to the other participant in the call or internet interaction





# Mobile Networks



## Mobile Networks (Cellular)

- The cells overlap, so as you move, your device connects with the next tower in the cell next to the previous tower, and you won't lose your connection
- The cells connect to one another and to telephone switches or exchanges
- Mobile networks have evolved through a series of generations
- Each new generation (1G, 2G, 3G, 4G) provided faster, more stable connections
- The latest technology is the 5G network, which has faster speeds, greater bandwidth and reduced interference with other nearby wireless devices



Source: <https://youtu.be/kxLcwIMYmr0>

# Communications Protocols for Transmitting Data



Computer networks and telecommunications cannot function without communication protocols. These are official descriptions of the formats and rules for digital messages. Communication protocols are necessary to send and receive messages in or between computing systems like networks.

Communications protocols provide:

- Authentication
- Error detection
- Error correction
- Signaling

Communications protocols are applied to hardware and software. There are many communications protocols used in all aspects of digital systems and networking for digital communications.



Source: <https://youtu.be/zn1jk-7ZuqI>



Source: <https://youtu.be/4sE4jFVo21A>



# Communications Protocols for Transmitting Data



## Well known protocols include:

- File Transfer Protocol (FTP) – standard network protocol used when transferring files between a client and a server on a network, often needing a username and password for a handshake
- Transmission Control Protocol/Internet Protocol (TCP/IP) - TCP performs the handshake between network devices on the Internet to establish a socket, which is open during the exchange of data
- Hypertext Transfer Protocol (HTTP) – used to control data transfer over the internet, using a web browser
- Hypertext Transfer Protocol Secure (HTTPS) - encrypts internet communication and offers a secure connection

## HTTPS @ Website

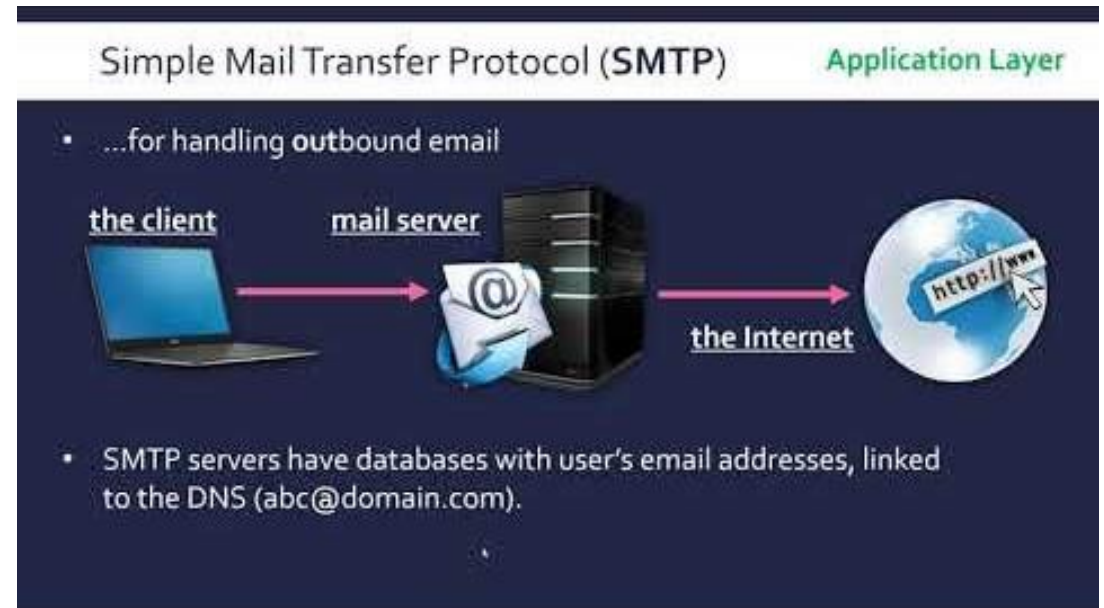


# Communications Protocols for Transmitting Data



## Email Protocols

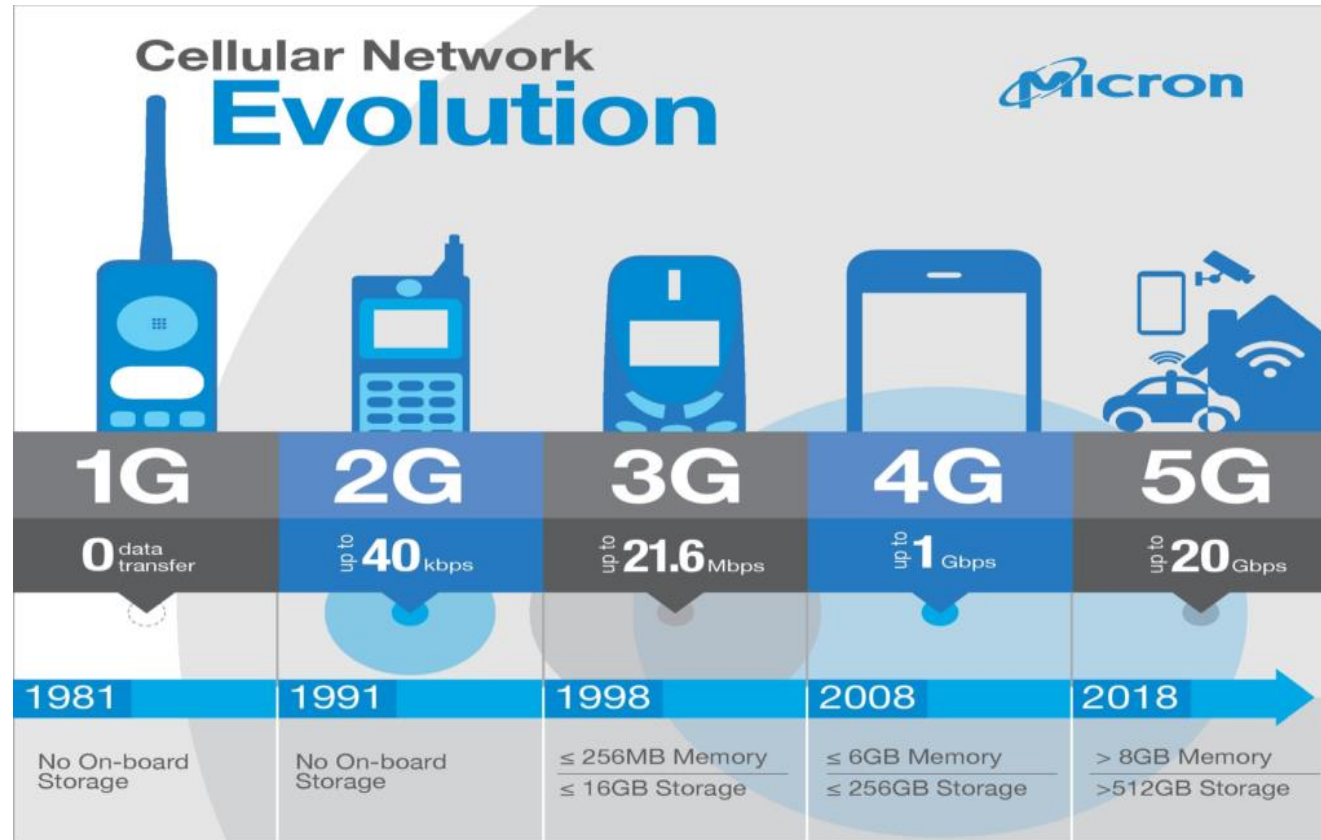
- Post Office Protocol (POP3) - downloads file onto local computer
- Internet Message Access Protocol (IMAP) – emails are stored on the mail server, so you can access emails from multiple locations
- Simple Mail Transfer Protocol (SMTP) - sends emails via internet, setting the communication rules for the server



Source: <https://youtu.be/rWHbwyPCB5I>



# Wired, wireless and mobile networks



# Acknowledgements



## About ACS

ACS is the professional association for Australia's technology sector. More than 48,000 ACS members work in business, education, government and the community. ACS exists to create the environment and provide the opportunities for members and partners to succeed.

ACS strives for technology professionals to be recognised as drivers of innovation in our society, relevant across all sectors, and to promote the formulation of effective policies on technology and related matters. Visit [www.acs.org.au](http://www.acs.org.au) for more information.

## About the ICT GISP

The Information and Communications Technology Gateway to Industry Schools program encourages partnerships between industry, government, schools and their communities to build Queensland's future information technology workforce. The program provides an important opportunity to address the significant shortfall of young, emerging ICT talent in Queensland. Access more information and ICT teaching resources below:

ICT GISP Website - <https://qldictgisp.acs.org.au/home.html>

ICT Educators Community of Practice - <https://www.acs.org.au/ict-educators.html>

The Big Day In ICT Careers - <https://www.thebigdayin.com.au/>

ICT Careers Wheel - <https://qldictgisp.acs.org.au/career-pathways.html>

**The Department of Employment, Small Business and Training funds this Gateway to Industry Schools Program initiative**





# Acknowledgements

The ACS ICT Educators resources are licensed under a Creative Commons Attribution 4.0 International License.

Schools and educators can join the ICT Educators' Community of Practice and can, without charge:

- Use — Use for own purposes.
- Share — Copy and redistribute the material in any medium or format.
- Adapt — Remix, transform, and build upon the material for any purpose, even commercially.

When sharing, or adapting, you must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

All users are invited and welcome to collaborate with ACS and other users to create and maintain the resources, and participation will be acknowledged.

More information about creative commons can via the creative commons' website:

<https://creativecommons.org/>