Understanding Network Connectivity and Email

Connection types

- Growth of Mobile Communications
  - https://www.youtube.com/watch?v=W61pPk6Gszo
- Cellular
  - On the go connectivity
- Wi-Fi
  - Connectivity in certain fixed locations
- Bluetooth
  - Piconet, My-Fi – personal device connectivity

Cellular Network Standards

- 3G – Third Generation (1998)
  - Major standard that dominated the market for years
  - GSM – Global System for Mobile Communications
    - Rival in USA was called Code Division Multiple Access (CDMA)
    - Initially CDMA was faster
    - Unique to US
    - CDMA not compatible with GSM

Cellular Network Standards

- 4G – Fourth Generation (2008)
  - Uses IP not traditional phone circuits
  - Designed for mobile broadband access
  - Faster than 3G
    - Download 10-20Mbps (300Mbps theoretical max)
    - Upload 3-10Mbps (75Mbps theoretical max)
  - Rural optimal cell size about 5km

Cellular Network Standards

- 5G – Fourth Generation (2016)
  - Speeds of 1 Gbps (20 Gbps theoretical max)
  - Three 5G classifications
    - Enhanced Mobile Broadband (eMBB)
      - Cell phone and mobile communication
      - 600 MHz to 6 GHz Range
    - Ultra-Reliable Low Latency Communications (URLLC)
      - For autonomous vehicles and industrial applications
      - 24 GHz to 86 GHz
      - Easily blocked by obstructions so half mile distance
    - Massive Machine Type Communication (mMTC)
      - Supports IoT (Internet of Things)

Cellular Data Connections

- Devices can share their data connections to allow other devices to have connectivity.

- Security is important so make sure password is secure.

- Be aware of your plans data limit!

- Need to know how to do on iPhone and Android devices
  - Android setup
    - https://www.youtube.com/watch?v=lU84XZUFAWw
  - iPhone setup
    - https://www.youtube.com/watch?v=LRxbbq1w5e8
  - Both use WPA2 encryption

Tethering

- When you have connected a device to a hotspot
- Used to be for when cable connected, but now any sharing

Airplane Mode

- Name as no signals allowed on planes
  - Some airlines do provide wi-fi now
- A quick way to stop all external connections
- Android
  - Enable/Disable in notifications area at top of screen
  - Use settings
- iPhone
  - From Settings
  - Control Centre

Cellular Updates

- Mobile phones have 3 Operating Systems!
  - Small specialised to handle specific devices function
    - Few hundred KB in size
    - RTOS – Real Time Operating System
      - Lightweight
      - Fast
      - Real-Time (minimize lag in data transfers)
  - First - Baseband OS
    - Manages Wireless Communications
    - Baseband Updates / radio firmware / radio firmware update
  - Second – Subscriber Identity Module (sim)
    - Manages the transfer between phone and SIM chip (Carrier Specific)
    - Stores user account information
    - Phone ID
    - Security Data

Radio Firmware

- Normally updated with OS
- Remote RTOS update not available on Apple
- Android WARNING!
  - Be sure you know the source
  - Know why the update is needed
  - Allow the update to complete
- PRI Update
  - Product Release Instruction
  - Settings for config items for the network the device is on
- PRL Update
  - Preferred Roaming List
  - A list of preferences for cellular tower connections

Baseband RTOS
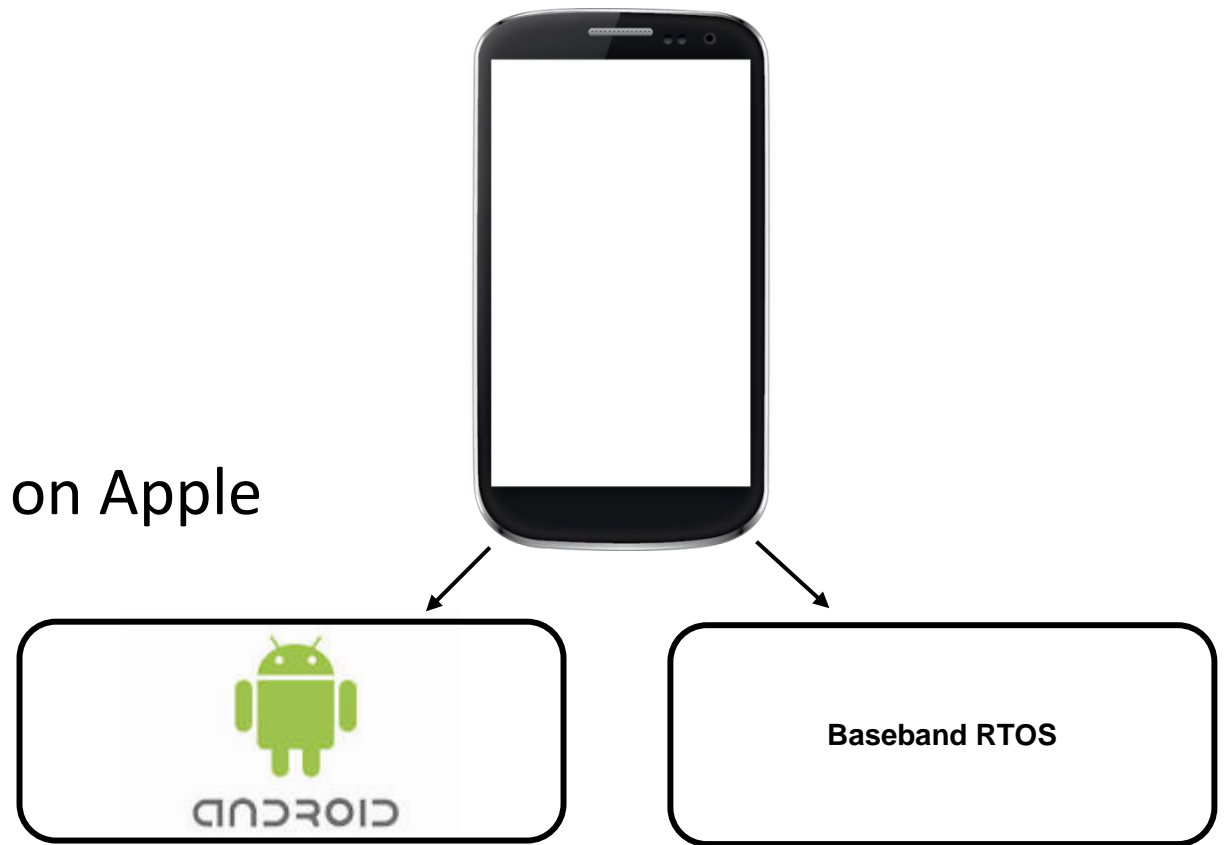
IMEI and MEID Numbers

- International Mobile Equipment Identity
  - 15 Digit serial number
  - Stored in the EIR database.
  - Used to invalidate stolen phones
  - Uniquely identifies the mobile device.
  - *#06#
- MEID
  - Mobile Equipment Identifier
  - Identical to first 14 digits of IMEI

IMSI Numbers

- International Mobile Subscriber Identity
  - Stored on the device's SIM card.
  - Uniquely identifies the subscriber
  - Has 3 elements
    - 3 digits are Mobile Country Code (MMC)
      - 234 for the UK
    - Two or three digit Mobile Network Code (MNC)
    - Mobile Station Identifier Number (MSIN)
- Try *#*#4636#*#*

Other Acronyms

- Integrated Circuit Card Identifier (ICCID)
  - 19 or 20 digit id for each individual SIM card

- Secure Element Identifier (SEID)
  - Long Hexadecimal code the uniquely identifies the phone

- iPhone
  - Settings -> General -> About

- Android
  - Settings -> System -> About

Wi-Fi Connection
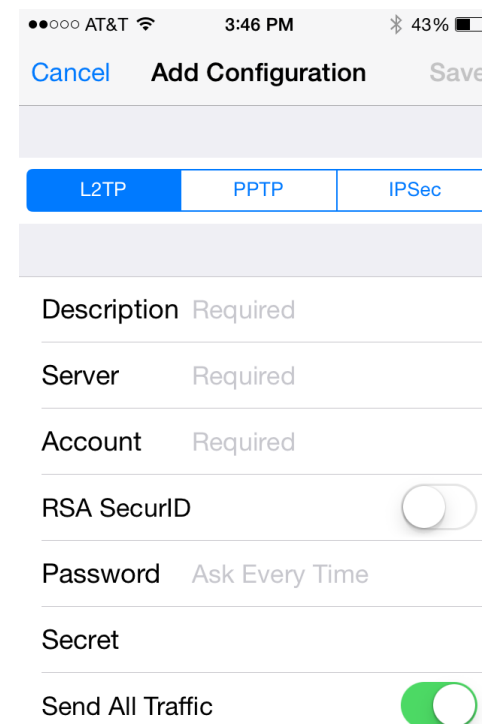

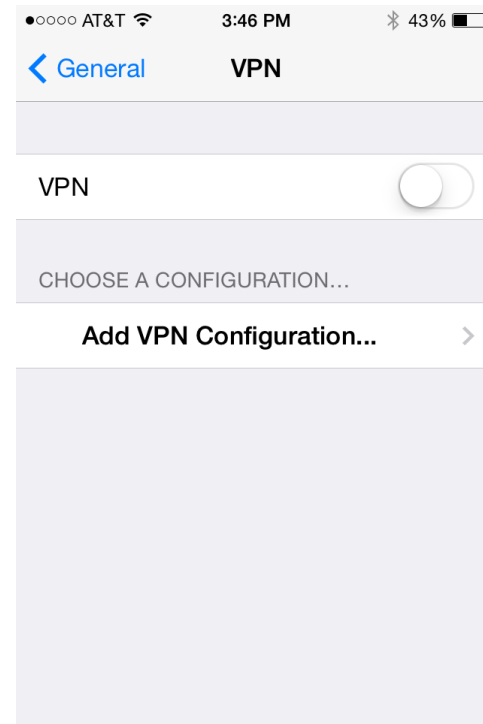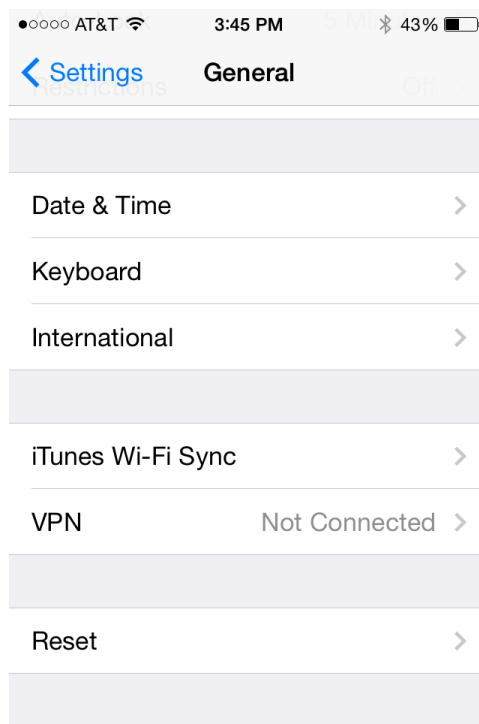**iPhone network configuration**

Android network configuration

Disable Cellular Data

- iPhone
  - Settings -> Turn off/on switch called Cellular Data

- Android
  - Settings -> Wireless Networks -> Data Usage
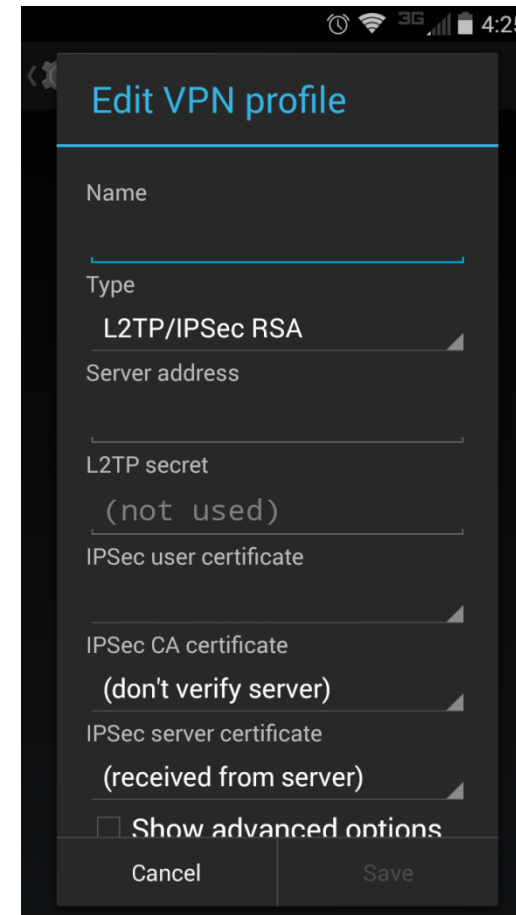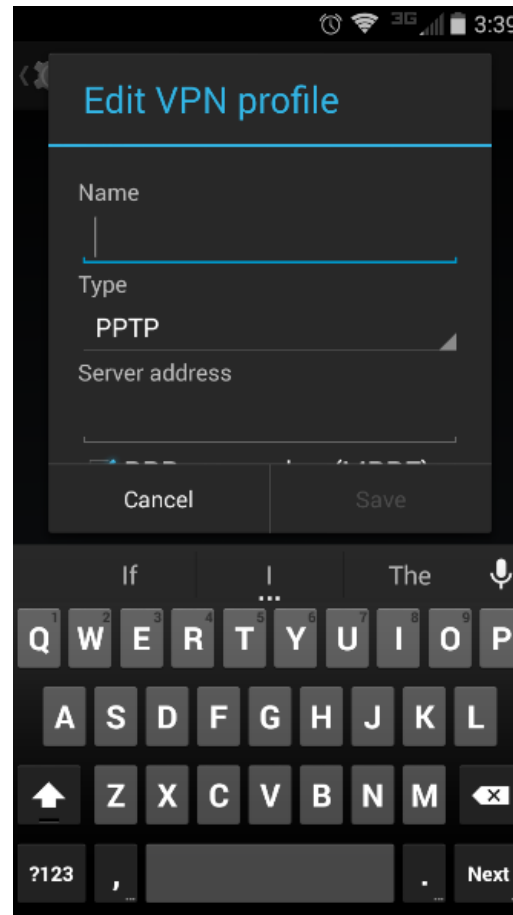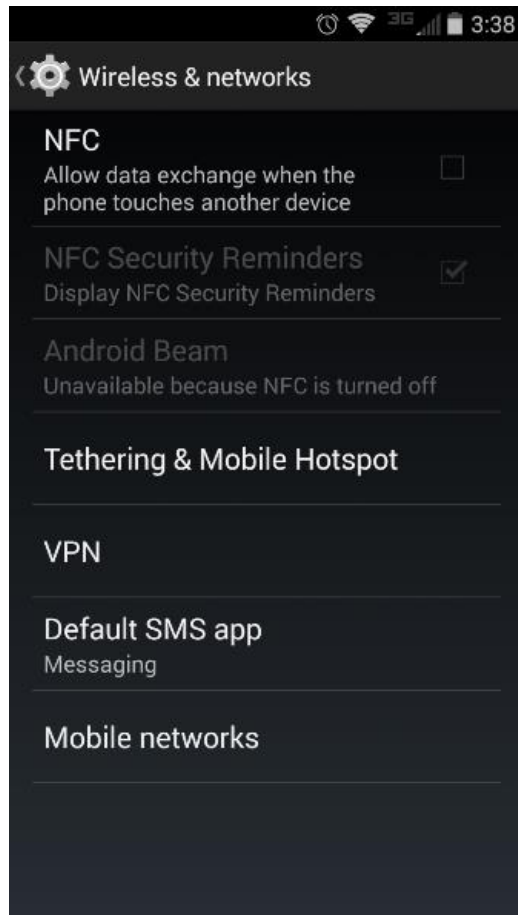   - Turn on/off Mobile Data switch

VPN Settings

- Secured Network Connection over an unsecure network
  - Allows connection to corporate office as if in the office

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Bluetooth

- Process is called Pairing

  - Operates as SSO (Single Sign ON)

    - Once paired, it will reconnect within range

- CompTIA A+ Bluetooth pairing steps
  - Enable Bluetooth (allow device discoverability)
  - Enable pairing
  - Find the device for pairing
  - Enter the appropriate PIN code
  - Test the connection

Global Positioning Systems

- Satellite based navigation systems
- Provides location (Lat, Long, height) and time
- Military system free for commercial use: navigation, farming, oil& gas,
- Satellites: GPS (US), GLONASS (Rus), Galileo (EU)
    - https://en.wikipedia.org/wiki/Satellite_navigation#Comparison_of_systems
- Group of satellites called a constellation
    - Approx 12550 miles above the earth
- Typically 22-35 satellites in a maintained constellation
    - GPS and GLONASS use 24 Satellites

Global Positioning Systems

- Uses trilateralation (incorrectly called triangulation) and accurate clocks.
  - 3 satellites for position
  - 4 required to give height
  - 10-15m accuracy
- Military has access to higher accuracy on GPS
- Users pay more for higher accuracy on Galileo
- GPS receivers – a range of shapes and sizes – either in built or stand alone
- https://www.youtube.com/watch?v=FU_pY2sTwTA

GNSS - Global Navigation Satellite Systems

- About 12,550 miles above earth
  - Geostationary satellites 22,236 miles above earth
- https://en.wikipedia.org/wiki/Satellite_navigation#Comparison_of_systems
- SPS – Standard Positioning System
  - 100m accuracy horizontal
  - 156m accuracy vertical
  - Uses Coarse Acquisition (C/A) code
- PPS – Precise Positioning Service
  - 22m accuracy horizontal
  - 27.7m accuracy vertical
  - Uses Precise (P) code

Satellite 1 Location
Satellite 2 Location
Known Receiver Location
Satellite 3 Location
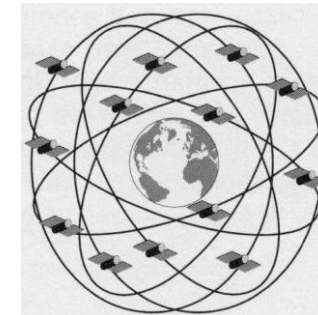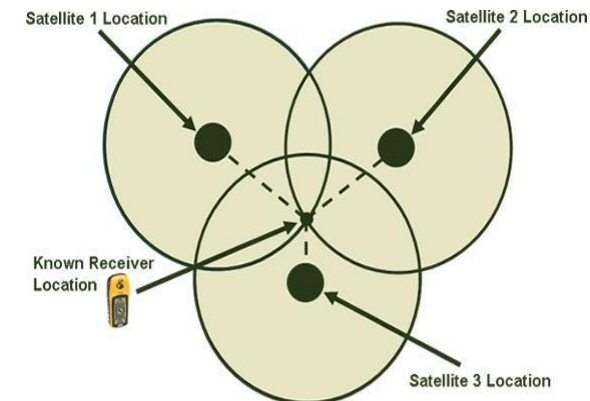
GPS Devices

- Can be embedded on small devices
- Popular brands
  - Garmin
  - Tom Tom
  - Magellan
- Most modern GPS receivers accurate to 10 to 15 meters
- Commonly called Location Services on mobiles

Mobile Device Management (MDM) and Mobile Application Management (MAM)

- MDM
  - Software on a server
  - Allows mobile devices to be enrolled on corporate network for security management
  - Allows remote tracking, lock, unlock, encrypt, and device wipe.
- MAM
  - Software on the device
  - Access for remote network administrators
  - Permit or deny specify software packages
  - Corporate App Store

Two Factor Authentication

- Improve security

- Additional information from the user required

- Additional Information Changes regularly

- Can set up for Windows Login
  - https://support.microsoft.com/en-us/account-billing/how-to-use-two-step-verification-with-your-microsoft-account-c7910146-672f-01e9-50a0-93b4585e7eb4

Configuring Email Accounts

- So many different providers
  - iCloud
  - Exchange
  - Google
  - Yahoo
  - AOL
  - Outlook.com

- https://www.youtube.com/watch?v=zTjLS1rShNU

TCP/IP Mail Protocols - SMTP

- Simple Mail Transfer Protocol (SMTP)
  - The standard protocol for sending emails across the Internet.
  - SMTP protocol works on two ports:
    - Port 25 - this is the default SMTP non-encrypted port
    - Port 465 - this is the port used if you want to send messages using SMTP securely

- IMAP and POP3 are the two most commonly used Internet mail protocols for retrieving emails. Both protocols are supported by all modern email clients and web servers.

TCP/IP Mail Protocols - POP

- Post Office Protocol (POP)
- Standard mail protocol to receive emails from a remote server to a local email client.
- Downloads email messages from server to your local computer for reading offline.
  - messages removed from the email server.
- Not for accessing your accounts from multiple locations.
  - Reduces the space your email account uses on the server.

- By default, the POP3 protocol works on two ports:
  - Port 110 - default POP3 non-encrypted port
  - Port 995 – connect for using POP3 securely

TCP/IP Mail Protocols - IMAP

- The Internet Message Access Protocol (IMAP)
- Accesses email on a remote server from a local client.

- Allows simultaneous access by multiple clients.
  - More suitable for mail access from different locations
  - Allows messages to be managed by multiple users.

- By default, the IMAP protocol works on two ports:
  - Port 143 - default IMAP non-encrypted port
  - Port 993 – connection for using IMAP securely

Securing Emails

- SMTP, POP, IMAP all insecure

- SSL – Secure Socket Layer
- TLS – Transport Layer Security

- SMTP with SSL – Port 465
- SMTP with TLS – Port 587
- IMAP with SSL/TLS – Port 993
- POP with SSL/TLS – Port 995

Data Synchronisation

- Contacts
- Programs
- Email
- Pictures
- Music
- Videos
- Calendar
- Bookmarks
- Documents
- Location data
- Social media data
- eBooks
- Passwords

Data Synchronisation

- EAS
  - Exchange ActiveSync
  - Connect to Exchange server
  - Access email, calendars, and contacts
- Cloud services
  - iCloud
  - OneDrive
  - Google Drive
- Subscription services
  - Dropbox
  - iTunes
- Online storage services
- Microsoft 365
  - Allows Desktop and Laptop to be identical
  - Start -> Settings -> Accounts -> Sync Your Settings
  - Must be enabled on both computers

Data Synchronisation

- You will need a specific system account.

- You will need an email account.

- If using Exchange, control may be given to the Admin.

- Organizations may have specific requirements.

- Certain devices might require additional software.

- Certain devices might require using specific network protocols to enable synchronization.

- The device may need to authenticate a service, not just vice versa

Need to know

- How to connect a mobile device to a network
- Understand how to pair a Bluetooth device
- Know basic protocols for email
- Know about S/MIME
- Know basic commercial email providers
- Understand PRI, PRL, baseband OS
- Know difference between IMEI and IMSI
- Know the three synchronisation methods (Cloud, Desktop, & Car)
- Know what data gets synchronised
- Know the connection types for synchronisation (Wi-Fi & USB)