FAQs

What are the main differences between the 802.11 networking standards?

802.11 Networking Standards Comparison:

	802.11a	802.11b	802.11g	802.11n	802.11ac
Throughput (Max)	54 Mbps	11 Mbps	54 MBps	300 Mbps	866.7 Mbps
Modulation	OFDM	DSSS	DSSS, OFDM	OFDM	OFDM
Release	1999	1999	2003	2009	2012
Frequecy (GHz)	5 GHz	2.4 GHz	2.4 GHz	2.4/5 GHz	5 GHz
Bandwidth (MHz)	20 MHz	20 MHz	20 MHz	20/40 MHz	20/40/80/160 MHz
MIMO Streams	1	1	1	4	8

What are the benefits in conducting a Wireless Site Survey?

Wireless surveys are undertaken to aid in the planning and deployment of a new network and to assess an existing network. The benefits in conducting a site survey are to determine any dead spot

holes, interference, overall signal coverage, RF behaviour and RF coverage areas to determine the appropriate placement and position of wireless access points. A step by step video tutorial can be seen at: **https://community.ja.net/groups/wtas-wireless-technology-advisory-service/article/passive-site-survey** [1]

What are the different types of antennas that can be used in a WLAN?

The role of the antenna can have a significant impact on the speed of your wireless connection. The speed of your connection will be dependent on the strength of your signal which impacts on the data you can receive and transmit. There are two types of antennas used for WLANs:

- **Omni-Directional** – Radiates signals equally in all directions. Often used in majority of access points to propagate signal around a 360 degrees central node.

- **Directional –** Radiates signal in one direction only with a higher gain in an oval shaped pattern. Directional antennas are often used outdoors to extend wireless coverage to a designated area. Further information about deploying wireless externally can be found here: https://community.ja.net/library/advisory-services/deploying-external-wi-fi-campus-based-network [2]

What are the differences between Active, Passive and Predictive wireless site survey?

Active site surveys are often used to troubleshoot the performance of WiFi networks upon post deployment. During an active site survey, the site survey application device's wireless adapter is associated to an access point or SSID. In active mode you are also able to measure live throughput rates, packet loss, round trip time and signal levels.

Passive site surveys are often used in pre development stages to identify suitable locations to install wireless access points. During a passive site survey the site survey application is not associated to any access point or SSID but passively gathers all RF data from active access points including any neighbouring access points. Once complete the passive survey will give a good overview of the overall RF environment including signal strength and signal to noise ratios.

A predictive or virtual site survey produces a simulation of the RF environment using the survey application’s modelling tools. Floor plans of the site are imported into the survey application and the user must capture accurate details of the buildings construction (walls, floor, windows, large objects, construction materials etc), which is then entered into the floor plan. Virtual access points are then placed onto the floor plan to give estimate expected coverage within its marked locations.

What is 802.11ac Channel Bonding?

As 802.11ac operates in the 5 GHz spectrum, there are more non-overlapping channels available in

comparison to 2.4 GHz band, resulting in increased design flexibility. 802.11ac makes use of larger channels at 80 MHz and eventually 160 MHz channels by using channel bonding techniques which bundles 20 MHz together to form an increased wireless pipe within its spectrum. 80 Mhz will allow for five non over-lapping channels in the US and EU/EU. 160 Mhz will allow for one non-overlapping channel in the US and two non-overlapping channels in the UK/EU.

How can I deal with WiFi interference?

Any device that can emit an electro-magnetic signal - cordless phones, bluetooth devices, microwave ovens and even pre-existing WiFi networks operating within the same channel - can cause RF interference. This can cause packet loss or even loss of service. Various approaches can be taken to address interference issues, including reducing the AP's transmission power. This is useful when there are several APs installed close to each other as it avoids signal overlap and makes better use of the limited number of channels. An advantage is that it reduces the number of clients associating to an AP, which can improve performance. This, however, can result in reduced signal strength which in turn can lead to coverage holes and lower data rate.

Spectrum Analysis tools such, as AirMagnet Spectrum XT is ideal for troubleshooting real time WLAN deployments. Cisco Clean Air wireless access points have a combined spectrum analysis chipset, which is able to identify and report sources of interference. This allows you to monitor air quality through your wireless controller or import into Cisco Spectrum Expert for live analysis. Also, clean air APs are self-healing meaning that if there is any interference within a Wi-Fi channel, the APs can change channels automatically to another that is unaffected.

What are the Client Authentications in WLAN?

- **Open** – No authentication methods are used, therefore results in users not needing to verify devices to join the WLAN.
- **Pre-shared key encryption** – Pre-shared keys is a shared secret, which is manually distributed among a set of clients. PSK is used as Wi-Fi encryption such as WEP and WPA where the access points and clients all share they same key.
- **Cisco Lightweight EAP (LEAP)** – LEAP is a proprietary method of authentication by Cisco that uses 802.1X authentication types for WLANS.
- **EAP-FAST** – Proprietary to Cisco as a replacement for LEAP.
- **EAP-TLS** – Transport Layer Security (TLS). Uses PKI to secure communicate to authentication server.

- **Protected EAP (PEAP)** – Jointly developed by Cisco, Microsoft and RSA Security which encapsulates EAP via TLS tunnel for client based authentication.

What are the WLAN Encryption Types?

- **WEP (Wired Equivalent Privacy) –** Now deprecated since the ratification in 2004 of WPA2.

- **WiFi Protected Access (WPA) –** WPA with implemented TKIP protocol which can also operate on WEP capable hardware.

- **IEEE 802.11i (WPA2)** – Standard to replace WPA. Introduces CCMP AES based encryption mode for stronger security. There are two versions of WPA2: WPA2-Personal and WPA2-Enterprise.

Can I use 5GHz UNII-2 channels in the UK, or will this interfere with RADAR?

Yes, you can use the UNII-2 (5470 – 5725 MHz) extended channel range in the UK, provided the Wi-Fi equipment is certified for use in the ETSI region. ETSI Certified equipment will implement Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS), which prevent interference with RADAR equipment.

What does 3 spatial streams mean? Does a 3x3 antenna provide 3 spatial streams?

Multiple In Multipe Out (MIMO) antenna arrays make spatial streams possible, but 3x3 array doesn't necessarily mean 3 spatial streams. In 802.11n products the antenna array is usually written in the form TxR, indicating the number of transmit and receive antennas the device has. 3x3 indicates that the device has 3 antennas for transmission and 3 antennas for receiving. This can lead to confusion with spatial streams.

Spatial Division Multiplexing (SDM) is technology used in 802.11n and is made possible by MIMO to achieve greater throughput. SDM allows transmission (and reception) of multiple, simultaneous data streams on the same channel, using multiple antennas. Each spatial stream requires its own transmit and receive antenna. However a 3x3 antenna array does not equal 3 spatial streams, as the number of spatial streams is determined by the radio chipset. In 802.11n, using 20 MHz wide channels, 2 spatial streams will provide a maximum data rate of 144 Mb/s (MCS 15). Using 40 MHz wide channels, 2 spatial streams will provide a maximum data rate of 300 Mb/s (MCS 15).

What is STBC?

STBC is space-time block coding. STBC is an optional feature of 802.11n, implemented in some chipsets, which is often confused with spatial streams. STBC is an encoding performed by some chipsets which improves the signal-to-noise ratio. This encoding is unrelated to SDM.

What is 5th Generation WiFi?

5th Generation WiFi is a term sometimes applied to IEEE 802.11ac. 802.11ac is a wireless standard which operates in the 5GHz spectrum and provides speeds of up to 6.93Gbps. This is achieved using up to 8x8 antennas with 8 spatial streams. However, most clients will have 2 or 3 spatial stream chipsets and will see data rates of up to 1.73Gbps and 2.34Gbps respectively.

802.11ac equipment will be backwards compatible with (4th Generation) 802.11n technology.

Why do I only get 270 Mbps and not 300 Mbps when I connect using 802.11n (5GHz)?

The difference in PHY rate, in this instance, is due to the guard interval negotiated between the client and the access point. The standard guard interval for WiFi is 800ns, however 802.11n offers the option of a 400ns guard interval. Using a 400ns guard interval will increase the PHY rate from 270 to 300 Mbps. If your connection rate is only 270 Mbps your client hasn't successfully negotiated a short guard interval.

Should I enable 40Mhz wide channels for 802.11n (2.4GHz)?

Generally, 40MHz wide channels should not be used in the 2.4GHz spectrum. This is due to a lack of non-overlapping channels. Using 40MHz wide channels in the 2.4GHz spectrum leads inevitably to channel interference, as one access point will use 82% of the available spectrum.

Can I use 802.11n in the 2.4GHz space?

Utilising 802.11n in the 2.4GHz is not really recommended as in order to use it properly you use the 40MHz side-by-side channels and there aren't any that don't overlap in the 2.4GHz space. It is better to only use the 40MHz mode in the 5GHz as there are lots of channels available; if you do wish to utilise 2.4GHz 802.11n, keep it to the 20MHz mode. This gives clients slightly better coverage/signal strength (not throughput).

Can 802.11a technology be used outdoors?

Yes, Band B, 5.470-5.725Gz can be used to support a network for mobile devices (licence not required) and Band C, 5.725-5.850GHz can be used for inter-building links provided an inexpensive licence is obtained from Ofcom, 5.8GHz Fixed Wireless Access Licence [3]. Band A, 5.150-5.350GHz must NOT be used outside of buildings.

An excellent short paper on the 5GHz bands and legal usage in the UK can be found on this

external link:

- Pointers on using the 5GHz WiFi bands [4]

Can Cisco 'fat' WAPs be used with multiple broadcast SSIDs and dynamic VLANs?

This question concerns 'thick' access points - which are in fact 'smart'/'autonomous'/'distributed' standalone devices. Whilst a lot of organisations deploying large numbers of access points choose to deploy 'lightweight' 'thin' access points, there are a number that prefer to deploy autonomous 'thin' devices - particularly those in the early stages of WLAN deployment and where the size of the WLAN does not justify the cost of distributed technology. Until recently there was a widely-known issue with Cisco fat APs and multiple BSSIDs and dynamic VLAN allocation. This has now been addressed in the latest release of Cisco IOS 12.3.8-JEA. [5]

Links
[1] https://community.ja.net/groups/wtas-wireless-technology-advisory-service/article/passive-site-survey
[2] https://community.ja.net/library/advisory-services/deploying-external-wi-fi-campus-based-network
[3] http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/rlans/5.8_fwa_index/
[4] http://www.solwise.co.uk/downloads/files/intheuk5ghz.pdf
[5] http://www.ja.net/services/authentication-and-authorisation/janet-roaming/technology.html#cisco_fat_waps_BSSID_VLANs