COURSE SAMPLES: WIRELESS LANS

Wireless LAN Modes and Names

Mode	Service Set Name	Description
Ad hoc	Independent Basic Service Set (IBSS)	Allows two devices to communicate directly. No AP is needed.
Infrastructure (one AP)	Basic Service Set (BSS)	A single wireless LAN created with an AP and all devices that associate with that AP.
Infrastructure (more than one AP)	Extended Service Set (ESS)	Multiple APs create one wireless LAN, allowing roaming and a larger coverage area.

1 Wireless LANs

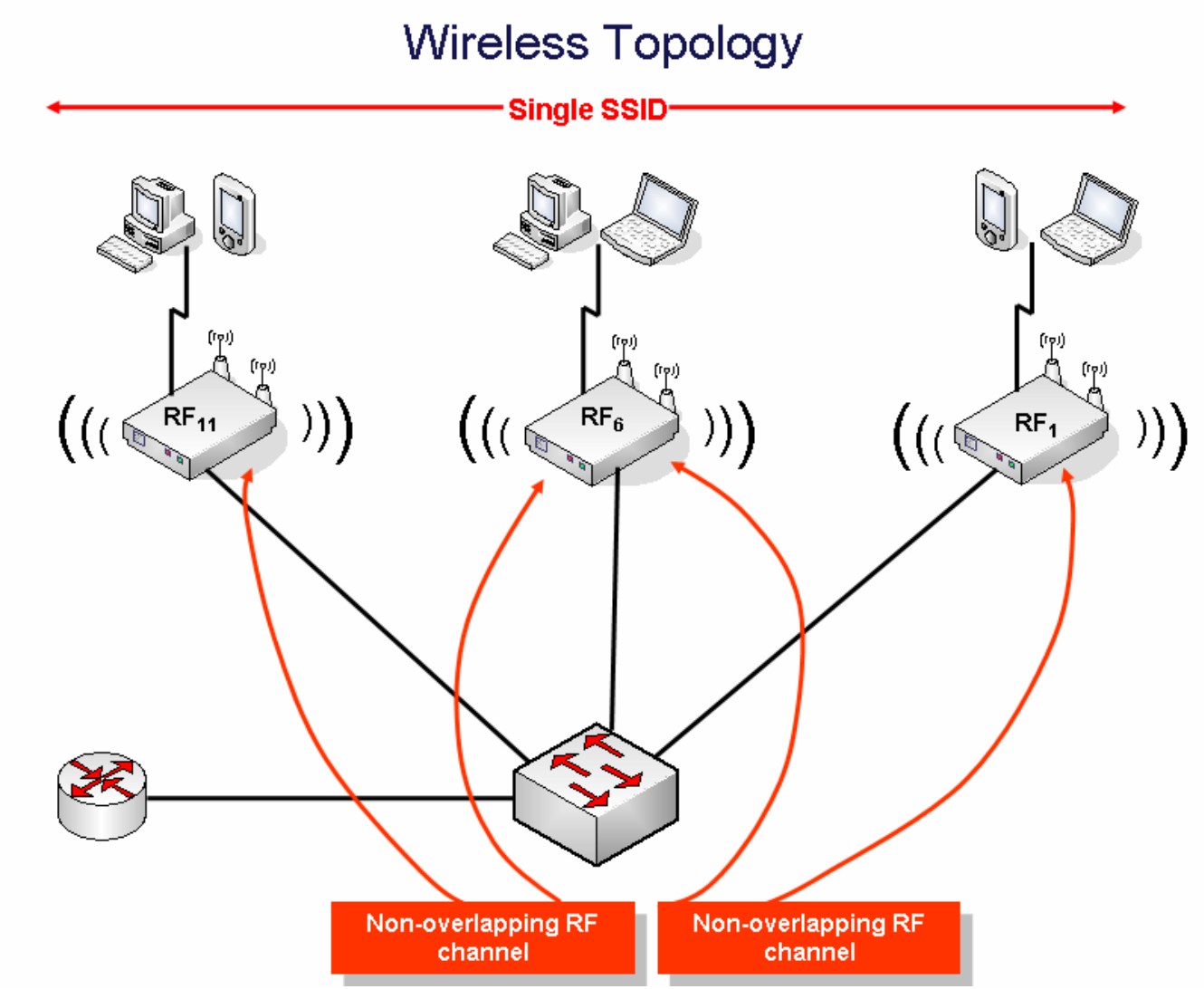
1.1 Wireless LAN Modes

Wireless LAN clients can operate in one of several modes:

- Ad hoc mode allows clients to send traffic directly between them, without the use of a central Access Point (AP). It can be useful for small numbers of clients communicating for a relatively short time. This mode is also known as Independent Basic Service Set (IBSS)
- Infrastructure mode uses the services of an Access Point (AP), and clients associate with the AP across the wireless medium. Although not necessary, the AP commonly connects using Ethernet to the switched and routed infrastructure, and to the wider global Internet.

Infrastructure mode has two service sets available.

- The Basic Service Set (BSS) consists of a single AP providing a wireless LAN
- The Extended Service Set (ESS) consists of several APs joined together (typically using wired infrastructure between ATs) to provide greater coverage within a single wireless LAN. Because all of the APs are part of the same LAN, hosts can maintain their IP address as they move between APs. Adjacent APs should use non-overlapping channels in this case to avoid interference between APs.



1.2 Example Wireless LAN ESS Deployment

The example opposite shows a simple ESS deployment using a single SSID and different non-overlapping RF channels.

WLAN Standards

Feature	802.11a	802.11b	802.11g
Year ratified	1999	1999	2003
Maximum speed using DSSS	-	11Mbps	11Mbps
Maximum speed using OFDM	54 Mbps	-	54 Mbps
Frequency band	5 GHz	2.4GHz	2.4GHz
Channels (non-overlapped)*	23 (12)	11 (3)	11 (3)
Speeds required by standard (Mbps)	6, 12, 24	1, 2, 5.5, 11	6, 12, 24

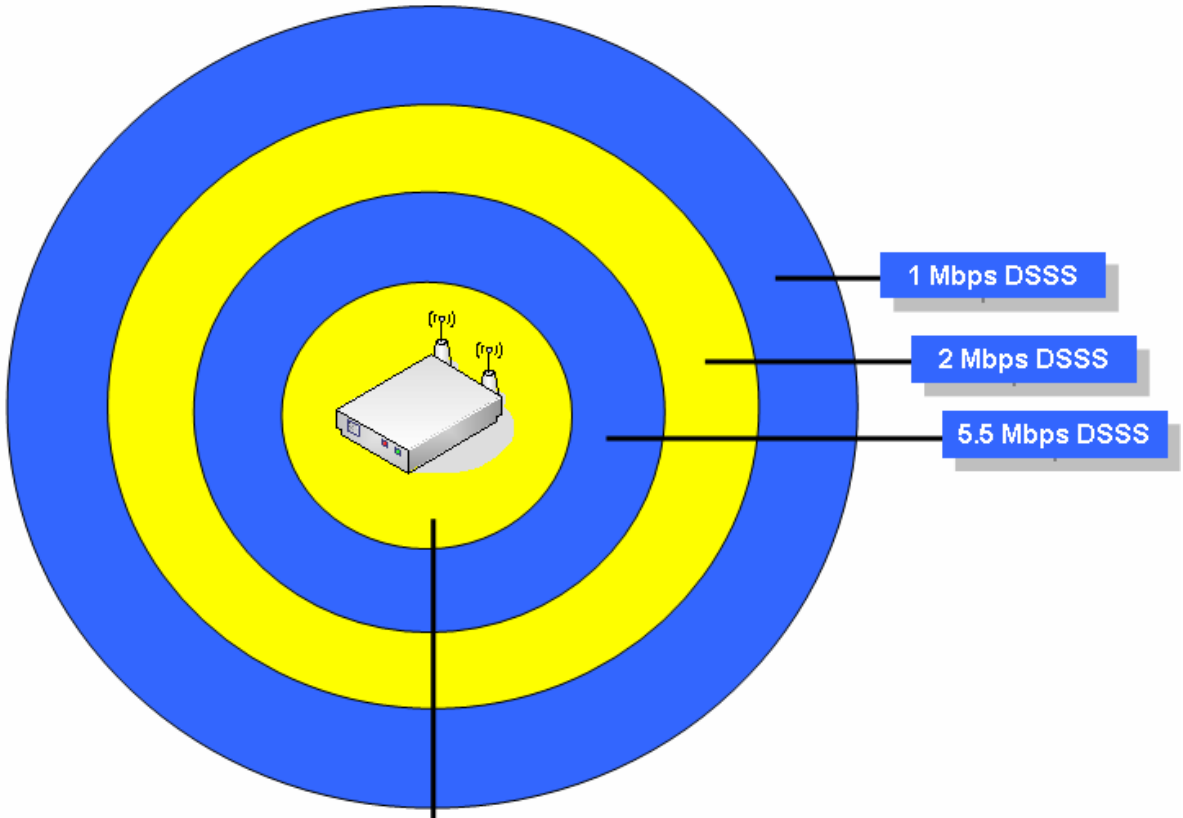
1.3 Standards for Wireless LANs

The wireless LAN standards are formally produced by the IEEE. The 802.11 series of wireless LAN standards (the ones we are concerned with in this course) use unlicensed radio spectrum, whereas most use of the radio spectrum requires a specific licence to use. The key 802.11x standards are listed in the table opposite, together with the maximum bit rates supported, the radio spectrum used, the modulation scheme used, etc.

- IEEE 802.11b uses Direct Sequence Spread Spectrum modulation (DSSS) and operates at rates up to 11 Mbit/s. It has 14 channels available, of which 1, 6 and 11 are non-overlapping.[1]
- IEEE 802.11a uses Orthogonal Frequency Division Multiplexing (OFDM), can operate up to 54 Mbit/s, and has a large number of non-overlapping channels
- IEEE 802.11g uses DSSS for backwards compatibility with IEEE 802.11b at bit rates up to 11 Mbit/s; it uses OFDM for rates up to 54 Mbit/s. As for IEEE 802.11b, it provides 3 non-overlapping channels, channels 1, 6, 11

[1] The use of non-overlapping bands is important when ESS mode with multiple APs is being used; this allows adjacent APs to avoid interference with each other by using the non-overlapping channels.

Wireless LAN Speed and Distance Trade-offs



1.4 Deployment Approach

1.4.1 Coverage, Data Rates and Capacity of Wireless LANs

Various factors affect the coverage and speed achieved by a wireless LAN.

- The maximum transmit power is limited by the national regulatory bodies such as the FCC in the USA and Ofcom in the UK.
- The effective power can be selectively increased by using a directional antenna to boost the signal in one sector, for example
- As stated previously, materials near the AP or client can affect propagation, and lead to blind spots in coverage

Wireless LANs use an estimate of the Signal to Noise Ratio (SNR) achieved between the AP and a client to adjust the data rate of a specific link:

- Lower SNR leads to lower data rates
- Higher SNR leads to higher data rates

Steps in Deployment of Wireless LAN's

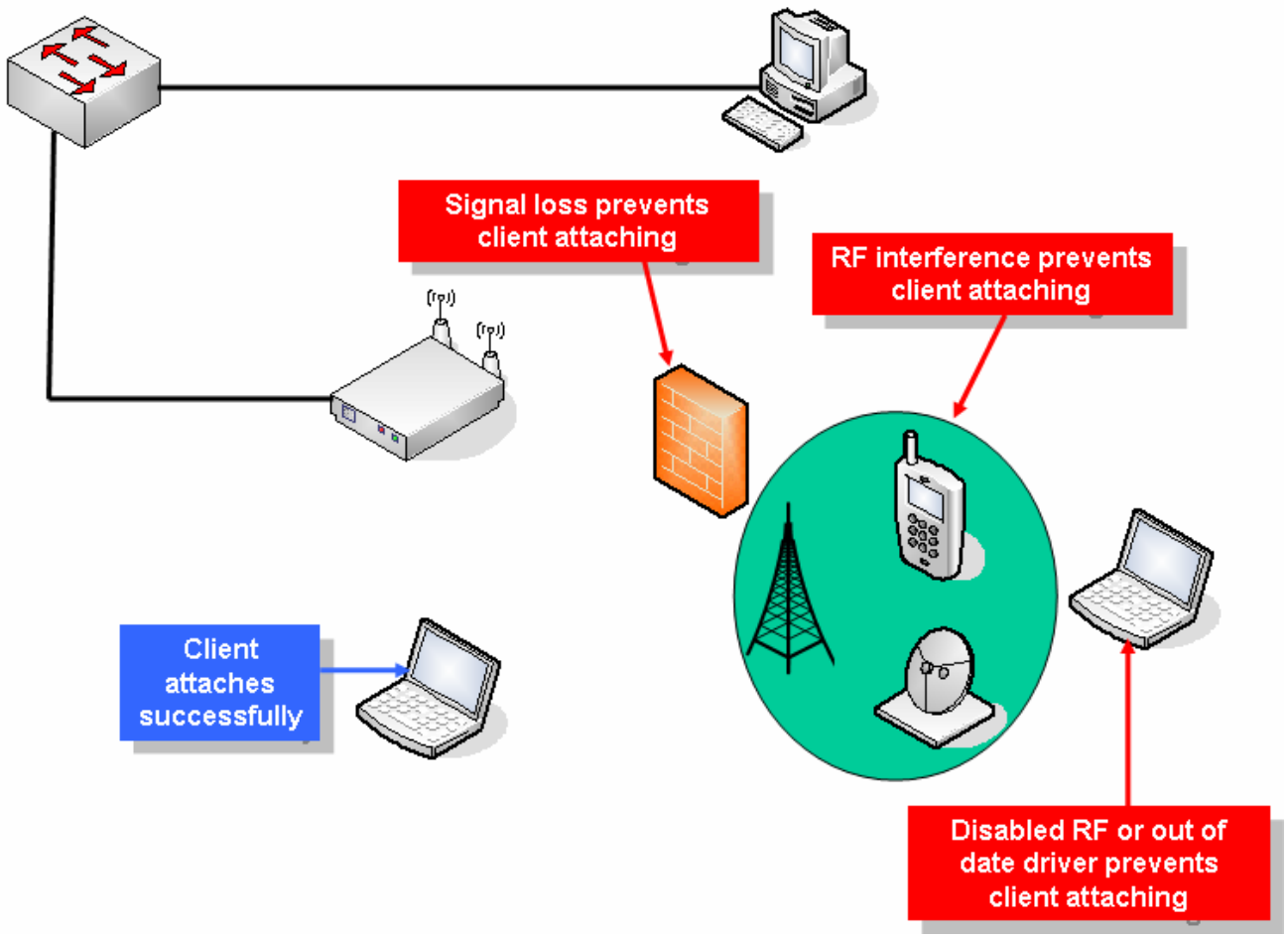
- Audit supporting services such as DHCP, VLAN, Ethernet switching.
- Install initial AP, check wired side operation.
- Configure basic Wireless LAN including SSID, Channel, Mode without security.
- Configure Wireless LAN test client and confirm end-to-end connectivity.
- Configure security settings on AP and test client and verify operation.
- Add additional clients and complete any final installation steps.

1.4.2 Steps in Deployment of Wireless LANs

The following steps are generally recommended for installing and commissioning a wireless LAN installation. The approach starts by making a simple deployment, then building upon a basic network to add features and coverage once the basic network is known to be working.

- Before any deployment of Wireless LAN infrastructure, carry out an audit to ensure that supporting services for the wireless LAN are in place, including DHCP service, VLAN connectivity, and wired infrastructure to the Internet (if required)
- Install the initial AP, and ensure it operates correctly on the wired side of the device, including allocation of its IP address (for management), default gateway and mask. It should be possible to ping and traceroute to and from the APs IP address to other parts of the network and/or the Internet at this point
- Configure the basic wireless LAN elements of the AP, including the Service Set Identifier (SSID), the channel to use, and the wireless LAN mode (802.11a/b/g/mixed). No security should be enabled at this point, otherwise basic connectivity problems may be hidden.
- Configure a test client to attach to the wireless LAN, and verify that the client has full connectivity to the VLAN and the Internet
- Configure the desired security settings on the AP and wireless client, and verify operation again
- Add additional clients as required to complete the installation

WLAN Service Area and Data Rates



1.4.3 Trouble-shooting Wireless LAN Installations

Assuming the basic checks of wired infrastructure have been passed, and problems persist with the wireless side of a wireless LAN, the following points are worth considering.

1.4.4 Interference and Signal Loss

Wireless LANs can suffer from interference from other devices operating on the same unregulated frequency, or at frequency multiples or sub-multiples of it.

- Microwave ovens, wireless telephone handsets, and other RF devices in this band can affect performance of the AP or clients that are located close to it. Try operating the AP on a different channel, if it is suspected that another AP or other RF device might be causing interference
- Large metal objects can affect the propagation and attenuation of wireless LAN signals, for example steel beams in buildings, metal doors on fridges, etc. The physical deployment of APs and clients should be reviewed, particularly if coverage is partial, and satisfactory from some locations

1.4.5 Client Issues

Most clients have a means to disable the Wireless LAN radio, either in hardware or software or both.

- If problems exist with a particular client, check the wireless LAN is enabled.[2]
- Check that current versions of drivers are installed, and that clients and APs are tested for compatibility

[2] Note that the radio setting is separate from the NIC setting; it may show as active, but not connected, because the radio is disabled