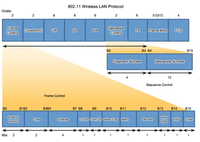
Lecture 9c - Wireless Networks

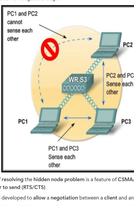
Type: Lecture
Materials: Empty
Reviewed: ☑

1. Wireless Communications

- 802.11 Wireless Frame



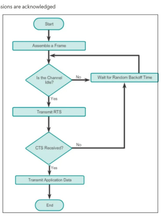
- The Hidden Node Problem
  - PC1, PC2 and PC3 sense **WR3**
  - PC1 and PC2 cannot sense each other
  - **PC1**
    - does **not detect PC2** activity on the channel
    - sends data while **PC2 is transmitting**
    - A collision occurs
  - **PC3** is sensed by **both PC1 and PC2**, so there are **no collisions involving** PC3
  ⇒ **Collision Detection** is not good enough.



  - The means of **resolving** the **hidden node problem** is a feature of **CSMA/CA** called **request to send/clear to send (RTS/CTS)**
  - **RTS/CTS** was developed to **allow** a **negotiation** between a **client** and an **access point**
  - When **RTS/CTS** is **enabled** in a network, **access points** allocate the medium via **CTS** to the **requesting station** for as long as is **required** to **complete the transmission**
  - When the **transmission** is **complete**, **other stations** can **request** the channel via **RTS**

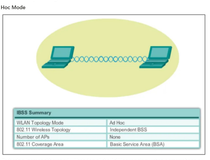
2. CSMA/CA

- All transmissions are acknowledged



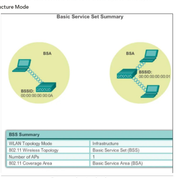
3. 802.11 Topologies

- Ad Hoc Mode

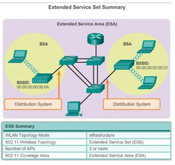


IBSS Summary	
WLAN Topology Mode	Ad Hoc
802.11 Wireless Topology	Independent BSS
Number of APs	None
802.11 Coverage Area	Basic Service Area (BSA)

  - **Tethering (personal hotspot)** - Variation of the Ad Hoc topology when a smartphone or tablet with cellular data access is enabled to create a personal hotspot.
- Infrastructure Mode



BSS Summary	
WLAN Topology Mode	Infrastructure
802.11 Wireless Topology	Basic Service Set (BSS)
Number of APs	1 or more
802.11 Coverage Area	Basic Service Area (BSA)

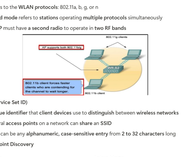


ESS Summary	
WLAN Topology Mode	Infrastructure
802.11 Wireless Topology	Extended Service Set (ESS)
Number of APs	2 or more
802.11 Coverage Area	Extended Service Area (ESA)

- Infrastructure Mode – ESS
  - **Extended Service Sets**
    - When a **single BSS** provides **insufficient RF (Radio Frequency) coverage**, one or more can be joined into an **extended service set (ESS)**
    - In an ESS, **one BSS** is **differentiated** from another by the **BSS identifier (BSSID)**, which is the **MAC address** of the access point
    - The **coverage** area is the **extended service area (ESA)**
  - **Common Distribution System**
    - Allows **multiple access points** in an ESS to appear to be a **single BSS**
    - An ESS generally includes a **common SSID** to allow a user to roam **from AP to AP**
    - An ESS should have **10 to 15 %** overlap between cells in an **extended service area**

4. Association Parameters - Infrastructure Mode

- Channel Usage
  - The solution to **802.11b interference** is to use **non-overlapping** channels **1, 6, and 11**
  ⇒ Make sure **adjacent APs** do **not** use **overlapping** frequency.



  - **Channels 12-13** not available in all countries.
  - **More (25) non-overlapping (20MHz)** channels available in the **5GHz band.**

- Network Mode
  - Refers to the **WLAN protocols** 802.11a, b, g, or n
  - **Mixed mode** refers to **stations** operating **multiple protocols** simultaneously
  - An **AP** must have **a second radio** to operate in **two RF bands**

- SSID (Service Set ID)
  - **Unique identifier** that client **devices** use to **distinguish** between **wireless networks**
  - Several **access points** on a network can **share** an **SSID**
  - **SSID** can be any **alphanumeric, case-sensitive entry** from **2 to 32 characters** long
- Access Point Discovery

Passive Mode

- **AP advertises** its SSID via **broadcast beacon frames**
- Contains the **SSID**, supported **standards**, and **security settings**
- Allows **wireless clients** to learn about **networks servicing** the local area

Active Mode

- **Wireless clients must know** the name of the **SSID**
- Wireless client initiates the **process** by **broadcasting** a probe **request frame** on **multiple channels**
- May be **required** if an AP or wireless router is configured to **not broadcast** beacon frames
- Does **NOT** constitute **network security**

5. AP Association

- Beacon Frames
  - Frames used by the **WLAN network (the AP)** to **advertise** its **presence**

- Three-Stage Association Process

- **Step 1 – Probing**
  - Clients can either **search** for a specific network or **attempt to discover** available WLANs
- **Step 2 – Authentication**
  - *OPEN* means **no password**, always **authenticated**
  - *Shared Key* involves **pre-shared knowledge**
- **Step 3 – Association**
  - Finalize security and bitrate options
  - **Establish** data link
  - AP maps **association identifier (AID)** to the **WLAN client**, equivalent to a **port on a switch**