Chapter 5 - WiFi

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Finally! After almost a full day we get to WiFi!

Complex systems are almost always divided into layers

Isolate the user of a layer from the complexity of lower layers

Simplify communication to the layer above it

TCP/IP Network Stack is such a hierarchical system… each layer has a clear IN and OUT

Each layer has a data unit that it uses to embed the information

Layer 1: Physical: 802.11: Bits: sends and receives streams of bits

Doesn’t know what it is sending – just a stream of 1’s and 0’s

Layer 2: Datalink: 802.11 MAC: Frames: a unit of data to transmit – a collection of bytes… the datalink layer dispears at the ROUTER… it is a LAN ONLY thing.

Layer 3: Network: IP: Packets: Frame data plus source and destination IP address

Bytes can arrive in any order and are not guaranteed

Layer 4: Transport: TCP or UDP:

TCP (reliable, ordered, and error checked stream of bytes)

UDB (not guaranteed order or to be delivered)

Layer 5: Application: HTTP, MQTT, etc.: Data

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WiFi Basics

Station and Access Point

To connect, need to know SSID and Encryption type

WICED takes care of the rest (band, channel)

Encryption: Mostly WPA2 in use with 1 of 2 password schemes

PSK (pre shared key)

Enterprise

MAC address is a unique 48-bit number

Datalink layer addresses each frame with a source and destination MAC address

ARP – Address Resolution Protocol

Each device has an ARP table (MAC to IP map)

Each device listens to ARP requests and if it hears its IP address responds with its MAC

If you ARP for an address not on your LAN, the router responds with its MAC

This is what allows the hierarchical routing to happen

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DCT – device configuration table

Table in flash with WiFi information (SSID, password, etc.)

This is the “magic” magic wiced\_network\_up

Programmed into flash but can be read/written by the app on the fly

Need to add string to the make file

Start with template

3 modes:

1. Client AP (station)
2. Soft AP (access point)
3. Config AP (access point only for configuration

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How to find available values (right click)

Hierarchical nature of the DCT structure – talk through hierarchy

Point out paragraphs on how to read/write

Needs to be done in sections

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wiced\_network\_up is the magic of WICED studio – just make one call and you are connected.. this is what deals with all of the bad things that can happen out there. You would think that it is all well documented in IEEE specs and stuff.. but the bottom line is that there is a crapload of tribal knowledge built into WICED. If there is one command that represents what we are doing… this is IT!

Interface is STA, AP, P2P or Ethernet

Config is how you get IP address, netmask, etc. Can be static or DHCP

IP\_Settings is a structure it settings if you use static, otherwise NULL

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WICED\_RESULT\_T

returned by many functions

just a giant enumeration

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Introducers – how you get your IoT to connect to WiFi

1. Use Bluetooth to configure WiFi settings
2. Use a USB or serial connection
3. Have the IoT device act as an AP until it is configured, then it becomes a STA
4. Pre-program

We will mostly use method 4 for simplicity

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Exercises – 60 minutes