

# Wi-Fi that just works

It's a journey - not a destination

# Why Listen

- Keith R. Parsons
- 12 years dedicate to Wi-Fi
- CWNE #3, and 55 other Certifications
- Wireless LAN Professionals, Inc.

# How do NICs work?

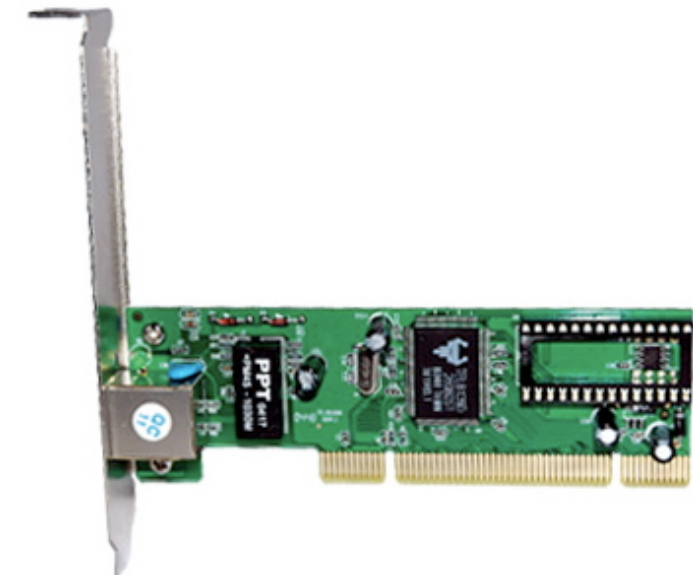
- Convert electromagnetic energy into bits (ones and zeros)



- Using Modulation Schemes

# Wired NIC

- Convert electrical energy via modulation scheme into bits
- Preamble, Header, Frame Body, FCS
- Check Destination MAC Address
- Check for CRC Error
- Forward to OS Protocol Stack



# Wireless NIC

- Antenna - blocks all RF but 2.4GHz
- Modulation Filter - blocks all but 802.11
- Preamble, Header, Frame Body, FCS
- Adds Radio Tap Header - RSSI, Channel
- Check Destination MAC Address
- Check CRC Frame



# Wired vs Wireless

CSMA/CD	CSMA/CA
Simple MAC Layer	Complex MAC Layer
XbaseX Cable	802.11 a,b,g,n, ac
No Encryption	Encryption
Predictable Performance	Load Effects Performance
Secure	Difficult to Secure

# Network Device Review

- Repeater - regenerate signal
- Hub - multi-port repeater
- Bridge - MAC based forwarding
- Switch - multi-port bridge
- Router - regenerate new frame with new MAC header - Layer 3

# What is an Access Point?

- Repeater ?
- Hub ?
- Bridge ?
- Switch ?
- Router ?

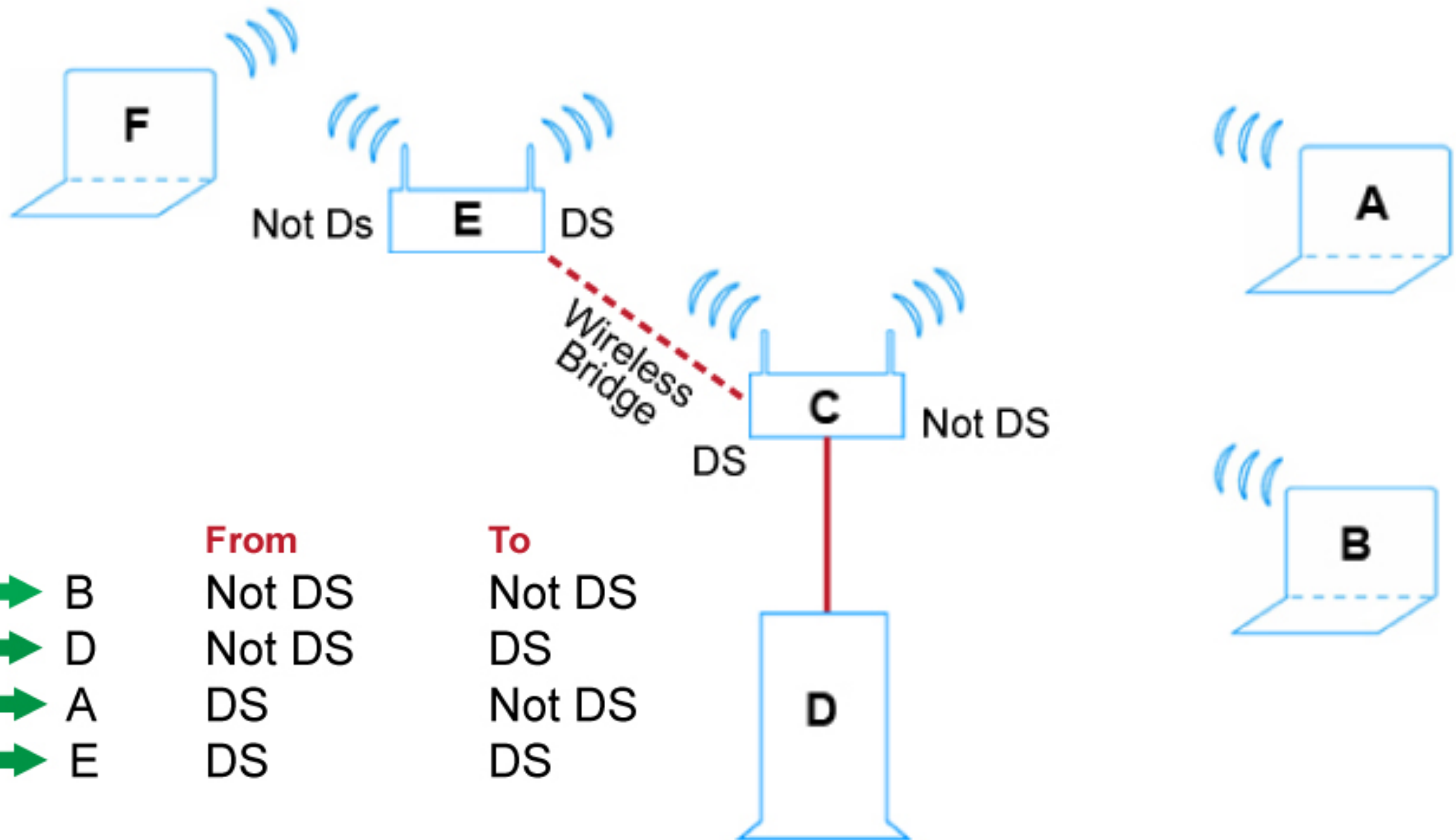




# Deep Dive into 802.11

- 802.11 designers were way smart
- Used every single bit to maximize throughput
- Some things are counter-intuitive

# Frame Header DS Bits



# Design Requirements

RSSI Primary (Coverage)

Beacon Interval, DTIM Interval

RSSI Secondary (Overlap)

End to End QoS

Frequency Allocations

WMM Access Categories

Co-Channel Interference

Codec Choices

Device to Radio Ratios

Distributed Forwarding

Special High Density Areas

Transport Delays

Jitter, Latency, Packet Loss,  
MOS Scores

Protection Modes

# Designing for 1:1

- Shorthand version
- Two 5GHz AP's available in 90% of target areas at stronger than -68dBm
- Allows for High Density and High Throughput
- Requires 2.4GHz radios to throttle back

# Wi-Fi Security

Associating

Beacon/Probe (Request/Response)

Authentication (Request/Response)

Association (Request/Response)

Authentication

Minimum of 4-Way Handshake

Personal (PSK)

Enterprise (802.1X EAP)

Encryption

TKIP or AES

Upper Layers

DHCP, DNS, Default Gateway, VLAN Assignment

# 802.11 Association

- Associating (Link Light)
- Beacon/Probe (Request/Response)
- Authentication (Request/Response)
- Associating (Request/Response)

# Authentication

- Authentication
  - Open
  - PSK - Personal
  - Enterprise - RADIUS/802.1X

# Encryption

- None
- TKIP
- CCMP-AES



# Upper Layers

- VLAN Assignment
- DHCP (Request/Response)
- Subnet Mask
- Default Gateway
- DNS
- Captive Portal ?

# Am I Connected?

- Association
- Authentication
- Encryption
- Upper Layers

# BYOD Demonstration

- Come Along For The Ride

# Wi-Fi Stress Test

- Trying to 'Break' Access Points
- What we learned

# Where to go...

- CWNP Program
- [WLANProfessionals.com/Resources](http://WLANProfessionals.com/Resources)
- Twitter - @keithrparsons
- Get Involved - Ask Questions!