Why Packets Matter

Capturing Packets and Solving WLAN Issues
(Why, How, Where, When)

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IT Professional Wi-Fi Trek 2015
#wifitrek

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Synopsis

Packet analysis shouldn't be a last resort. It should be an integral part of any WLAN analysis procedure.

Why?

Why a Packet Analyzer?

- 802.11 is the language of Wi-Fi
- 802.11 is a complex protocol – strong foundation but many, many layers
- Unlike wired networks, an inefficient physical layer (Layer 1) leads to protocol issues that require packet analysis
- Interpreting 802.11 packets captures requires experience and a good understanding of the 802.11 protocol

But Don’t Just Take It From Me …

- *What’s in Your Wi-Fi Tool Box?*
  - Spectrum Analyzer
  - Protocol Analyzer (packet analyzer or sniffer)
  - Site Survey

http://www.informationweek.com/interop/whats-in-your-wi-fi-tool-box/d/d-id/1113592

George Stefanick

- In Wi-Fi since early 2000s
- Numerous certifications
- Wireless Architect for a large healthcare system managing 25,000+ Wi-Fi Clients
- Consultant
- Cisco VIP 2012, 2013, 2014
- Aruba MVP 2014
- Blog www.my80211.com

What Can You Address with a Protocol Analyzer?

- Wi-Fi is not authenticating ….
- Wi-Fi is slow ….
- Wi-Fi is dropping connections ….
- Wi-Fi doesn’t work
- Wi-Fi is unreliable ….

Critical Elements of a Protocol Analyzer

- High fidelity, high-speed packet capture
- Multi-channel analysis
- Long-term packet storage
- Visualization
- Analysis modules
- High-quality decodes

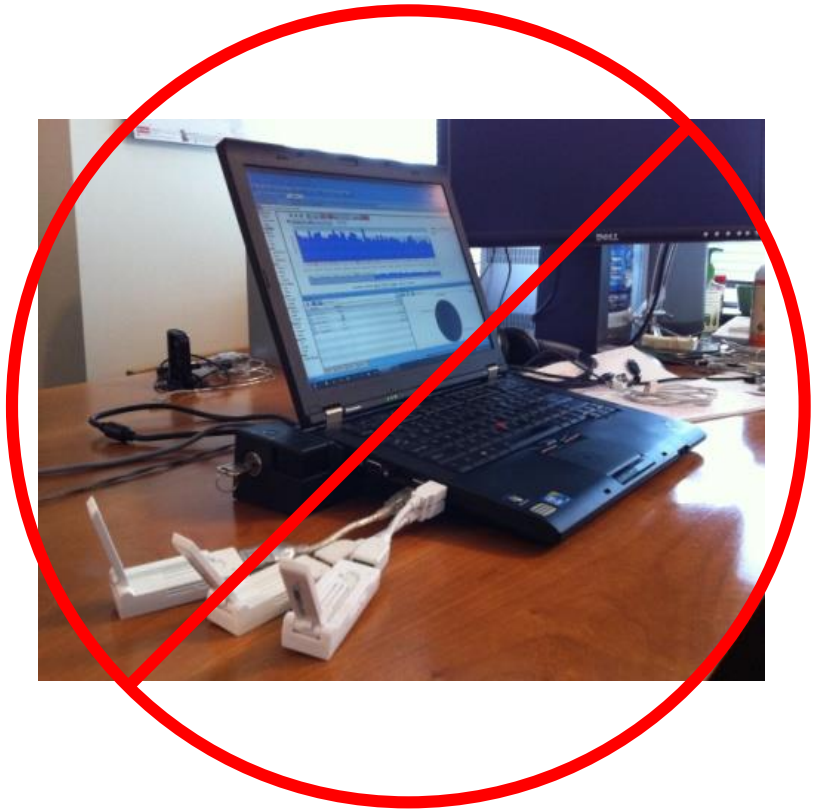
How? Where?

Packet Capture Requires a Point-of-Presence

But Don’t Confuse Portable with Point-of-Presence

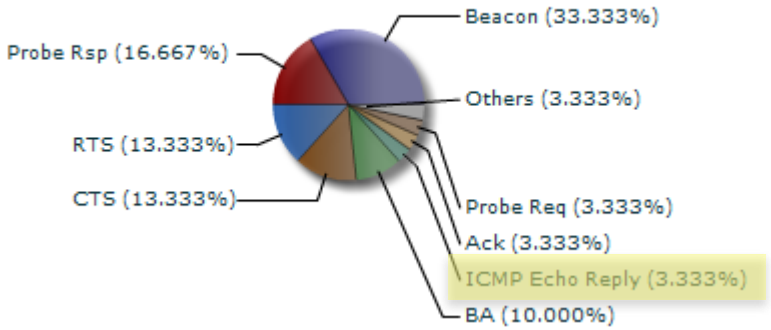
Portable,

but not the only way, and maybe not the best way, to be “present”

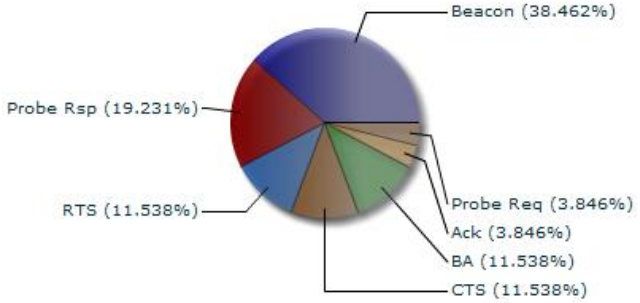


802.11ac vs. Portable Packet Capture

1,733Mbps vs. 866Mbps



vs.



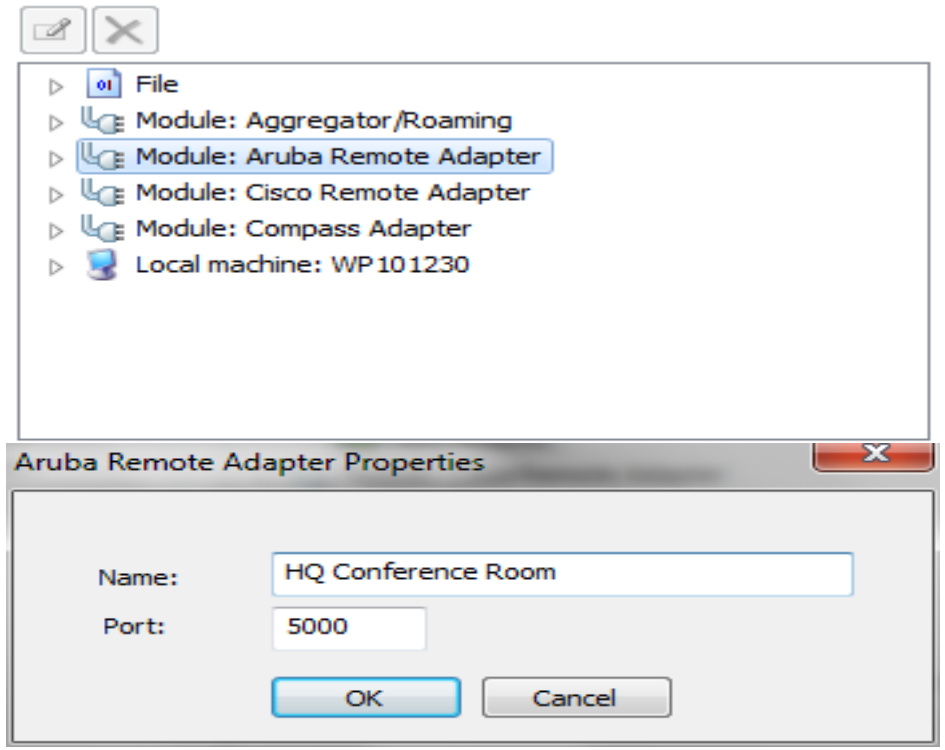
What happened to my ping data?

Remote Point-of-Presence

- As wireless approaches wired speeds, it's time to start relying on the wire
- Distributed analysis using deployed assets – typically APs – is the only effective solution as wireless capabilities and speeds grow
- The choices:
  - Custom Remote Adapters
  - Remote PCAP
  - Remote sensors

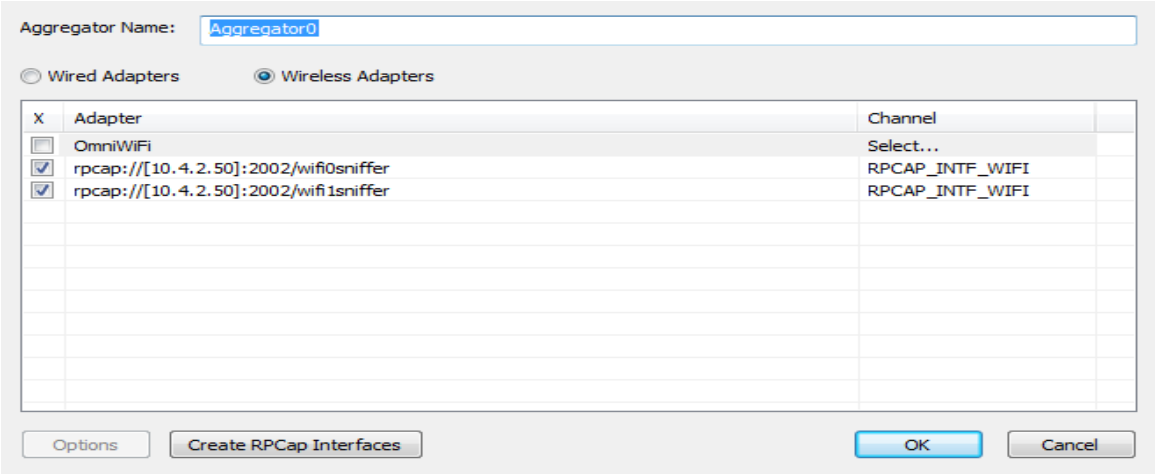
Custom Remote Adapters

- Specific to Savvius and OmniPeek
- Allow an AP to be put into promiscuous mode and act like a direct-connected sniffing device
- APs are “reconfigured” via the AP controller software
- Depending on the manufacturer and the model, APs may or may not be able to continue sending traffic



Remote Pcap

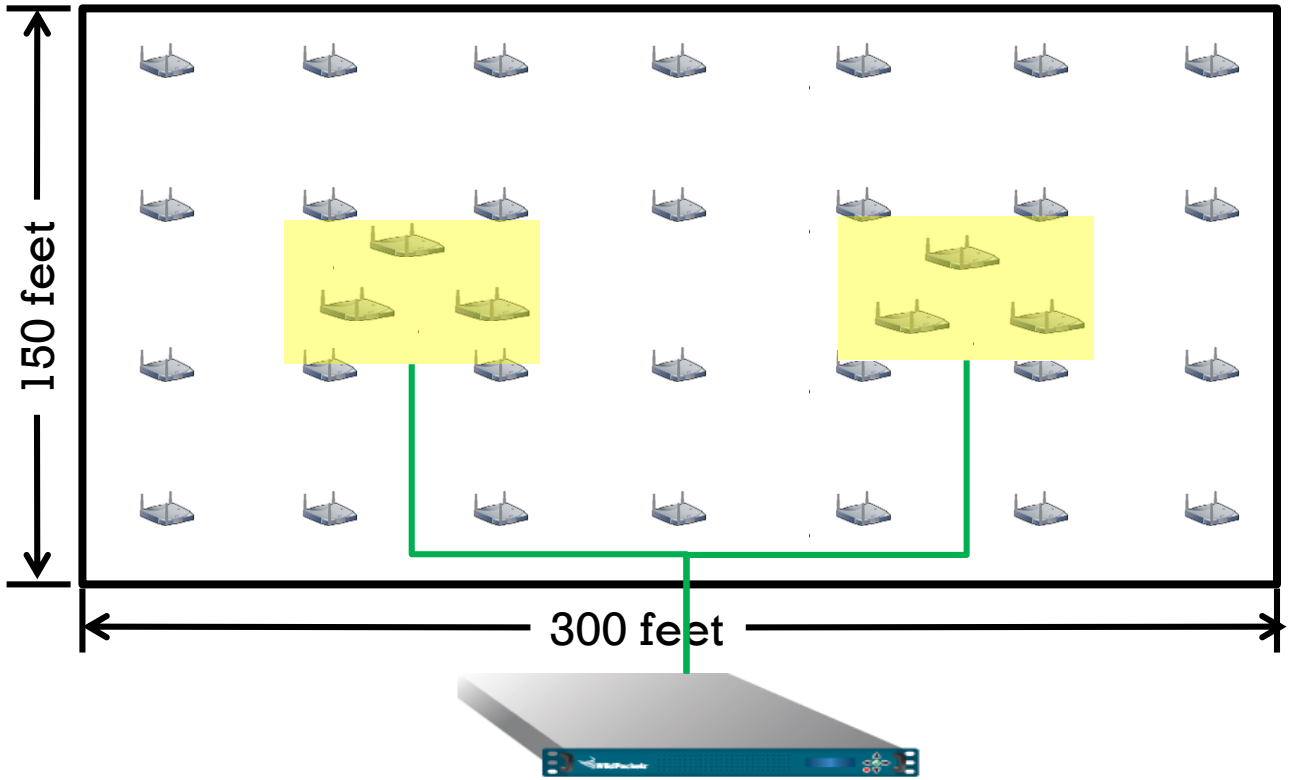
- A WinPcap feature that allows interaction with a remote machine to capture packets
- Simply start a capture on the analyzer and point it to the available RPCAP interfaces
- Typically not a “marketed feature”
- Devices we have worked with include:
  - Aerohive: Model HiveAP 120
  - Ruckus: ZoneFlex 7363 (requires ZoneDirector Controller)



Example
Mission-Critical Financial Trading

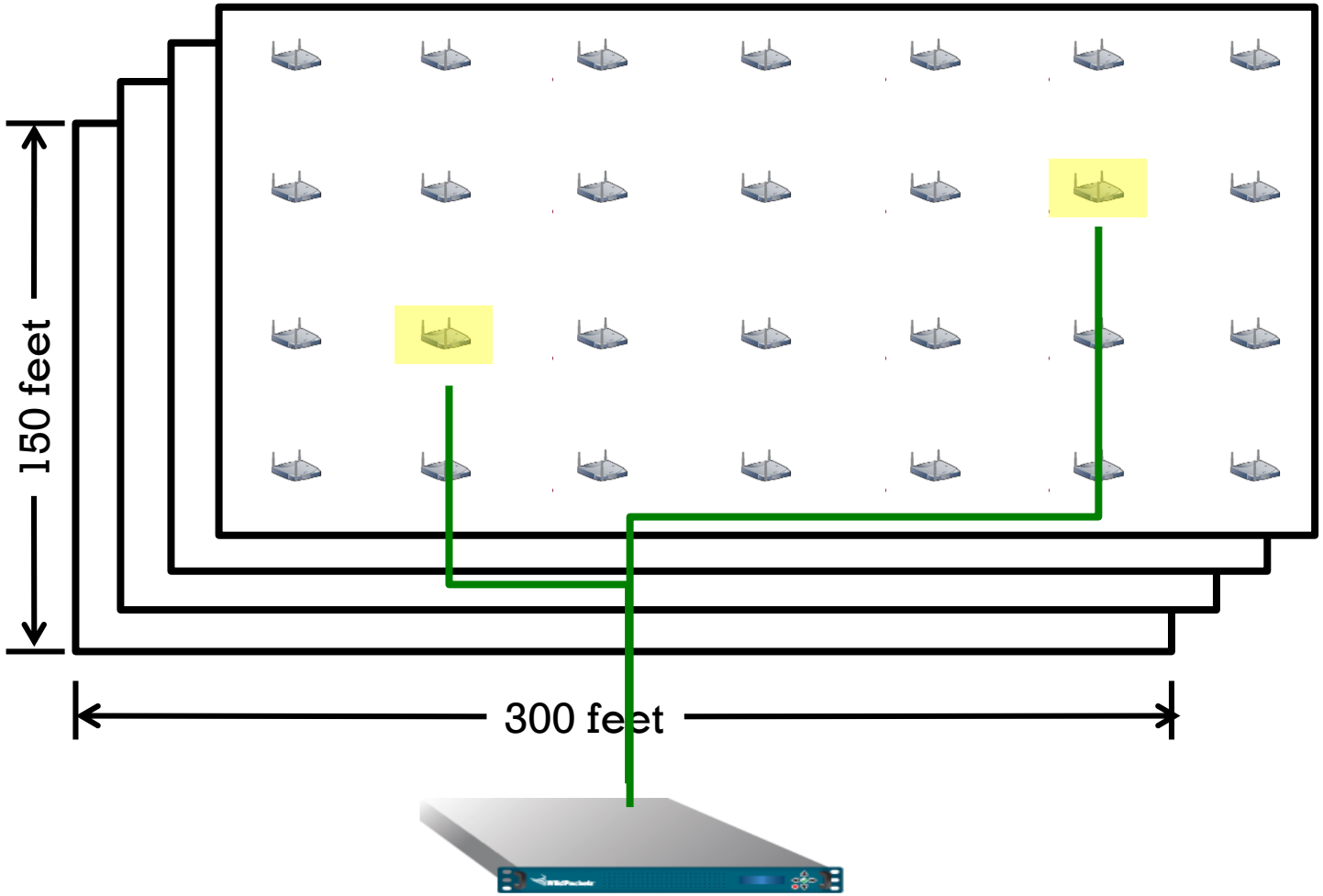
- All users on Wi-Fi; BYOD
- 100’s of simultaneous users
- 100’s of trades per second
- Deliver, verify that each individual gets the same QOS to guarantee fair trading
- Single appliance solution
- 24x7 forensics data capture with additional real-time captures to handle spot problems

High Density/Small Physical Footprint Deployment



- Dense deployment – 28 APs per trading floor
- Sensor APs – 2 groups of 3
- ***Provides dedicated, 24x7 monitoring***

Highly Distributed, Multi-Campus Deployment



- Dense deployment ~ 28 APs per building floor
- 100's of building floors
- ***Reactive capture and analysis***

When?

Solving Problems with Packets

- **Verifying device capabilities**
  - Network capabilities – look at beacons
  - Client capabilities – look at probe requests
- **Verifying device configuration**
  - QoS enabled/disabled
  - Beacon intervals too long/short
  - CTS frames that look like duration attacks (10,000µs duration field)
- **Troubleshooting connection/authentication issues**
- **Identifying sources of poor VoFi quality**
- **Identifying network bottlenecks**
  - Chatty clients
  - Probe requests
  - Inefficient network utilization
  - Wireless is slow
- **Analyzing roaming issues**
  - Sticky clients
  - Roaming latency

When?
Examples

Verifying Device Capabilities
Network Capabilities - Beacons

```
Packet Info
    Packet Number:        7
    Flags:                0x00000000
    Status:               0x00000000
    Packet Length:        231
    Timestamp:            04:08:49.065573700 10/16/2013
    Data Rate:            12  6.0 Mbps
    Channel:              161  5805MHz  802.11a
    Signal Level:         100%
    Signal dBm:           -38
    Noise Level:          0%
    Noise dBm:            -5
[0-23]    802.11 MAC Header Version=0 Type=%00 Subtype=%1000 Frame
802.11 Management - Beacon
    Beacon Timestamp:     62290534458  Microseconds [24-31]
    Beacon Interval:      100  Time Units (102 Milliseconds, and 400
    Capability Info:      %0000000000000001 [34-35]
    SSID      ID=0 Len=14 SSID=Wild Bright AC [36-51]
    Rates:    ID=1 Len=8 Rate=6.0 Rate=9.0 Rate=12.0 Rate=18.0 Rate=
    TIM:      ID=5 Len=4 DTIM Count=0 DTIM Period=1 Bitmap Control=%
    QBSS:     ID=11 Len=5 Station Count=1 Channel Utilization=1 Avai
    HT Cap:   ID=45 Len=26 HT Capability Info=%0000100011101111 A-MP
    HT Info:  ID=61 Len=22 Primary Channel=161 HT Operation Element
    Extended CapabilitiesID=127Len=8 Extended Capabilities=%00000000
    VHT Capabilities elementID=191Len=12 VHT Capabilities Info=%0000
    VHT Operation elementID=192Len=5 VHT Operation Information=Chann
    VHT Transmit Power EnvelopeID=195Len=4 Transmit Power Informatio
    WPS       ID=221 Len=24 OUI=00-50-F2 OUI Type=4 Version=0x10 Wi-
    Vendor SpecificID=221Len=9 OUI=00-10-18 Value=(6 bytes) [190-200
    WMM       ID=221 Len=24 OUI=00-50-F2 OUI Type=2 OUI SubType=1 Ve
FCS - Frame Check Sequence
    FCS:                  0x469A80BA  Calculated
```

```
HT Capability Info:   %0000100011101111 [77-78]
                      0....... ........ L-SIG TXOP Protection Support: Not Supported
                      .0...... ........ AP does Not allow use of 40MHz Transmissions In Neighboring BSSs
                      ..0..... ........ Reserved
                      ...0.... ........ BSS does Not Allow Use of DSSS/CCK Rates @40MHz
                      ....1... ........ Maximal A-MSDU size: 7935 bytes
                      .....0.. ........ Does Not Support HT-Delayed BlockAck Operation
                      ......00 ........ No Rx STBC Support
                      ........ 1....... Transmitter does Support Tx STBC
                      ........ .1...... Short GI for 40 MHz: Supported
                      ........ ..1..... Short GI for 20 MHz: Supported
                      ........ ...0.... Can Not receive PPDUs with HT-Greenfield format
                      ........ ....11.. SM Power Save Disabled
                      ........ ......1. Both 20MHz and 40MHz Operation is Supported
                      ........ .......1 LDPC coding capability: Supported
A-MPDU Parameters:    %00010111 [79]
                      xxx..... Reserved
                      ...101.. Minimum MPDU Start Spacing: 4 usec
                      ......11 Maximum Rx A-MPDU Size: 65,535 Bytes

VHT Supported MCS Set
Rx MCS Map:           %1111111111101010 [143-144]
                      ........ ......10 Supported MCS index for 1 SS: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
                      ........ ....10.. Supported MCS index for 2 SS: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
                      ........ ..10.... Supported MCS index for 3 SS: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
                      ........ 11...... Supported MCS index for 4 SS: Not provided
                      ......11 ........ Supported MCS index for 5 SS: Not provided
                      ....11.. ........ Supported MCS index for 6 SS: Not provided
                      ..11.... ........ Supported MCS index for 7 SS: Not provided
                      11...... ........ Supported MCS index for 8 SS: Not provided
```

Verifying Device Capabilities
Client Capabilities – Probe Requests

```
802.11 Management - Probe Response
    Probe Timestamp:      62294733406  Microseconds [24-31]
    Beacon Interval:      100  Time Units (102 Milliseconds, and 400 Microseconds) [32-33]
    Capabilit Info:       %0000000000000001 [34-35]
                            0....... ........ Immediate Block Ack Not Allowed
                            .0...... ........ Delayed Block Ack Not Allowed
                            ..0..... ........ DSSS-OFDM is Not Allowed
                            ...0.... ........ No Radio Measurement
                            ....0... ........ APSD is not supported
                            .....0.. ........ G Mode Short Slot Time [20 microseconds]
                            ......0. ........ QoS is Not Supported
                            .......0 ........ Spectrum Mgmt Disabled
                            ........ 0....... Channel Agility Not Used
                            ........ .0...... PBCC Not Allowed
                            ........ ..0..... Short Preamble Not Allowed
                            ........ ...0.... Privacy Disabled
                            ........ ....0... CF Poll Not Requested
                            ........ .....0.. CF Not Pollable
                            ........ ......0. Not an IBSS Type Network
                            ........ .......1 ESS Type Network
```

```
SSID
    Element ID:           0  SSID [36]
    Length:               14 [37]
    SSID:                 Wild Bright AC [38-51]
Supported Rates
    Element ID:           1  Supported Rates [52]
    Length:               8 [53]
    Supported Rate:       6.0  Mbps  (BSS Basic Rate) [54]
    Supported Rate:       9.0  Mbps  (Not BSS Basic Rate) [55]
    Supported Rate:       12.0  Mbps  (BSS Basic Rate) [56]
    Supported Rate:       18.0  Mbps  (Not BSS Basic Rate) [57]
    Supported Rate:       24.0  Mbps  (BSS Basic Rate) [58]
    Supported Rate:       36.0  Mbps  (Not BSS Basic Rate) [59]
    Supported Rate:       48.0  Mbps  (Not BSS Basic Rate) [60]
    Supported Rate:       54.0  Mbps  (Not BSS Basic Rate) [61]
```

Verifying Device Configuration
QoS

```
802.11 MAC Header
    Version:        0 [0 Mask 0x03]
    Type:           %10  Data [0 Mask 0x0C]
    Subtype:        %1000  QoS Data [0 Mask 0xF0]
```

Verifying Device Configuration
Beacon Intervals

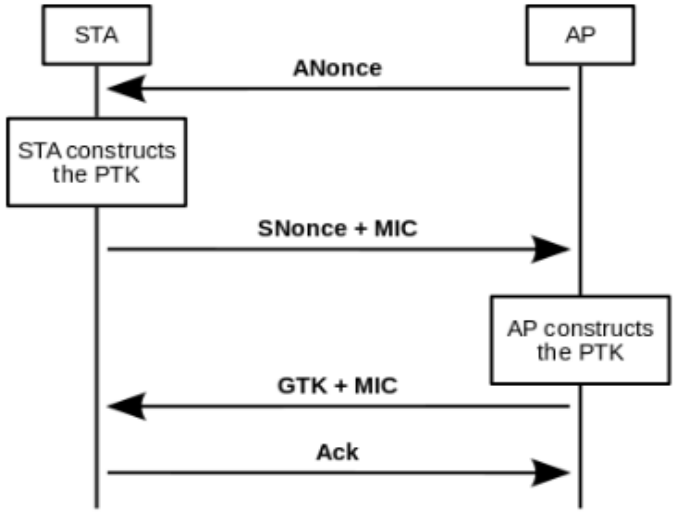
```
802.11 Management - Beacon
    Beacon Timestamp:      62295040058  Microseconds [24-31]
    Beacon Interval:       100  Time Units (102 Milliseconds, and 400 Microseconds) [32-33]
    Capability Info:       %0000000000000001 [34-35]
                              0....... ........ Immediate Block Ack Not Allowed
                              .0...... ........ Delayed Block Ack Not Allowed
                              ..0..... ........ DSSS-OFDM is Not Allowed
                              ...0.... ........ No Radio Measurement
                              ....0... ........ APSD is not supported
                              .....0.. ........ G Mode Short Slot Time [20 microseconds]
                              ......0. ........ QoS is Not Supported
```

Verifying Device Configuration
CTS Excessive Duration

```
Packet Info
    Packet Number:      10
    Flags:              0x00000001
    Status:             0x00000000
    Packet Length:      14
    Timestamp:          23:07:55.313722100 11/19/2012
    Data Rate:          12  6.0 Mbps
    Channel:            149  5745MHz  802.11a
    Signal Level:       36%
    Signal dBm:         -59
    Noise Level:        60%
    Noise dBm:          -68
    Expert:
802.11 MAC Header
    Version:            0 [0 Mask 0x03]
    Type:               %01  Control [0 Mask 0x0C]
    Subtype:            %1100  Clear To Send (CTS) [0 Mask 0xF0]
    Frame Control Flags: %00010000 [1]
        0... .... Non-strict order
        .0.. .... Non-Protected Frame
        ..0. .... No More Data
        ...1 .... Power Management - power save mode
        .... 0... This is not a Re-Transmission
        .... .0.. Last or Unfragmented Frame
        .... ..0. Not an Exit from the Distribution System
        .... ...0 Not to the Distribution System
    Duration:           18800  Microseconds [2-3]
    Receiver:           68:EF:BD:B3:8C:49  Geo Cisco Phone [4-9]
FCS - Frame Check Sequence
    FCS:                0xA200C8BD  Calculated
```

Troubleshooting Connection/Authentication Issues

Authentication – EAPOL Key Exchange



- The AP sends a nOnce key to the STA
- The STA sends its own nOnce key to the AP with a Key MIC
- The AP sends the key data with another MIC
- The STA sends a confirmation to the AP

3	Symbol AP	Client Computer	Symbol AP	EAPOL-Key
4	Client Computer	Symbol AP	Symbol AP	EAPOL-Key
5	Symbol AP	Client Computer	Symbol AP	EAPOL-Key
6	Client Computer	Symbol AP	Symbol AP	EAPOL-Key

```
EAPOL - Key
    Type:                 254  WPA key descriptor [36]
    Key Information:      %0000000010001001 [37-38]
    Key Length:           32  TKIP [39-40]
    Replay Counter:       8027 [41-48]
    Key nOnce:            0x18E53C7DC10DFE66E444D27212FDB8827845340A1E3FF101A6D8DE6E391
    EAPOL-Key IV:         0x00000000000000000000000000000000 [81-96]
    Key RSC:              0x0000000000000000 [97-104]
    Key ID:               0x0000000000000000 [105-112]
    Key MIC:              0x00000000000000000000000000000000 [113-128]
    Key Data Length:      0 [129-130]
EAPOL - Key
    Type:                 254  WPA key descriptor [36]
    Key Information:      %0000000100001001 [37-38]
    Key Length:           32  TKIP [39-40]
    Replay Counter:       8027 [41-48]
    Key nOnce:            0x5FCFCF061936365CB8F2E4DFBE30CFEC13FAFA17E8D52A2DD2F7086464D
    EAPOL-Key IV:         0x00000000000000000000000000000000 [81-96]
    Key RSC:              0x0000000000000000 [97-104]
    Key ID:               0x0000000000000000 [105-112]
    Key MIC:              0x9026181E57DF809B9BFD11B6B013718C [113-128]
EAPOL - Key
    Type:                 254  WPA key descriptor [36]
    Key Information:      %0000001110100001 [37-38]
    Key Length:           32  TKIP [39-40]
    Replay Counter:       8029 [41-48]
    Key nOnce:            0x18E53C7DC10DFE66E444D27212FDB8827845340A1E3FF101A6D8DE6E391
    EAPOL-Key IV:         0x18E53C7DC10DFE66E444D27212FDB882 [81-96]
    Key RSC:              0x1A00000000000000 [97-104]
    Key ID:               0x0000000000000000 [105-112]
    Key MIC:              0xEC203AB8313F8E10C0424C4CBF20F98C [113-128]
    Key Data Length:      32 [129-130]
    Key Data:             0x278EA9526DFCA2A4BEBB141BB737D0D6EB472416410AD1AEF59CAB5724B
EAPOL - Key
    Type:                 254  WPA key descriptor [36]
    Key Information:      %0000001100000001 [37-38]
        000. .... .... .... Reserved
        ...0 .... .... .... Key Data is Not Encrypted
        .... 0... .... .... Handshake Not Requested
        .... .0.. .... .... No Error
        .... ..1. .... .... Initial Key Exchange Complete
        .... ...1 .... .... MIC Included in Frame
        .... .... 0... .... ACK Not Set
        .... .... .0.. .... Install Flag: Ignored
        .... .... ..00 .... Key Id 0
        .... .... .... 0... Group STA Key
        .... .... .... .001 Key Descriptor Vers: HMAC-MD5 is the
    Key Length:           32  TKIP [39-40]
```

Identifying Sources of Poor VoFi Quality

- RTP packets (G.711)
- Overall VoIP analysis
- Jitter, packet loss, latency

Protocol	Percentage	Bytes	Packets
G.711	95.544%	1,386,826	5,827
RTCP	0.107%	1,560	12
SIP	0.437%	6,341	9

Call Number	SSRC	Name	End Cause	Codec	Media Type
1	3942986A	G.711 10.10.1.232:safetynetp<--10....	BYE	G.711 µ-law	Voice
1	000018BE	G.711 10.10.1.232:safetynetp-->10....	BYE	G.711 µ-law	Voice

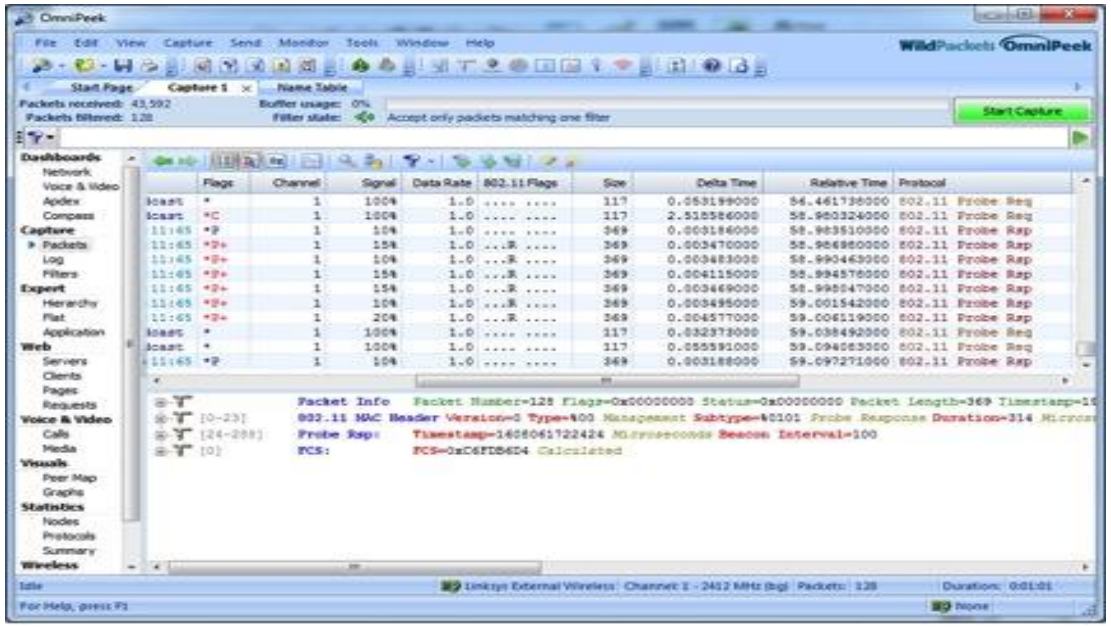
Details | Event Summary | Event Log

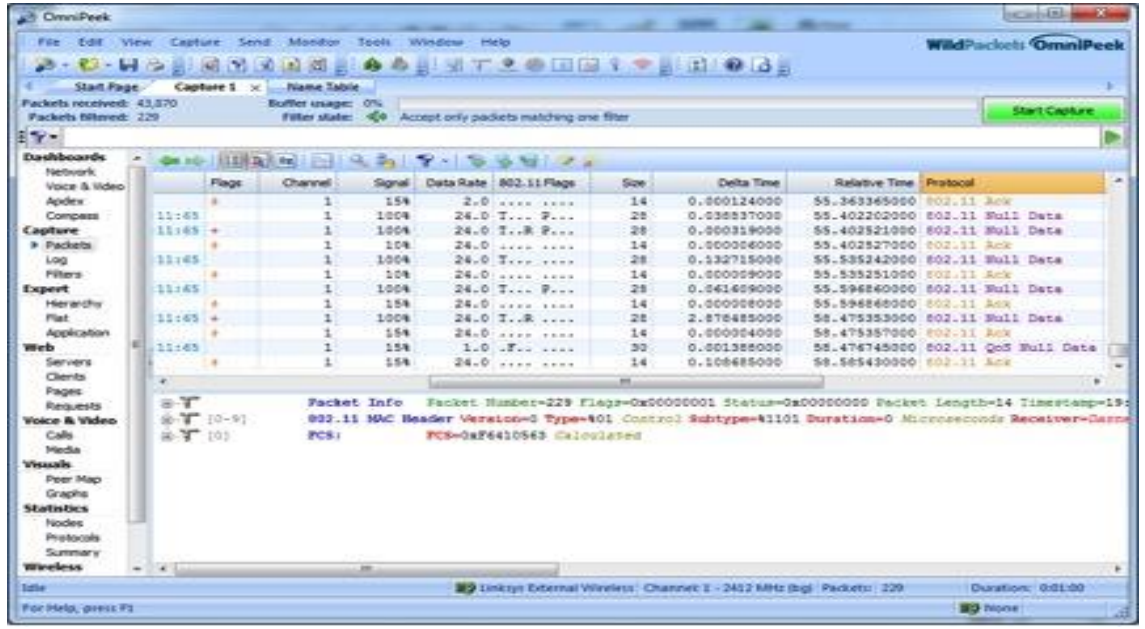
Name	Value	Name	Value
Call Number	1	Name	G.711 10.10.1.232:safetynetp<--10.10.1.200:12242
Flow Index	2	From	"3CXPhone"<sip:200@10.10.1.200:5060>;tag=f34f1106
SSRC	3942986A	To	<sip:2745495@10.10.1.200:5060>
Flow ID	2	Call ID	OGZlZDk5MTAzNjg4MzdjYzhhZGFmZjA3NTY0Y2UwMmE.
Caller Address	10.10.1.232	End Cause	BYE
Caller Port	40000 safetynetp	Signaling	SIP
Callee Address	10.10.1.200	Protocol	G.711
Callee Port	12242	Codec	G.711 µ-law
Gatekeeper Address		Bit Rate	64000
Gatekeeper Port		Media Type	Voice
Source Addr	10.10.1.200	Setup Time	0.002783
Source Port	12242	PDD	3.185682
Dest Addr	10.10.1.232	Start	10/13/2009 12:42:56
Dest Port	40000 safetynetp	Finish	10/13/2009 12:43:52
Media Packets	3054	Duration	55.496566
Media Frames	122160	One-Way Delay	0.147000
		Packet Loss %	3.564
R Factor Listening	64	Jitter	0.000553
R Factor Conversational	61	MOS-LQ	3.16
R Factor G.107	61	MOS-CQ	3.01
R Factor Nominal	93	MOS-PQ	3.40
VS-AQ		MOS-Nom	4.19
VS-MQ		MOS-A	
VS-PQ		MOS-AV	
VS-TQ		MOS-V	

Identifying Network Bottlenecks

- Chatty/probing clients, i.e. phones
- Inefficient network utilization
- Wireless is slow

Chatty Clients





Device On – Unassociated

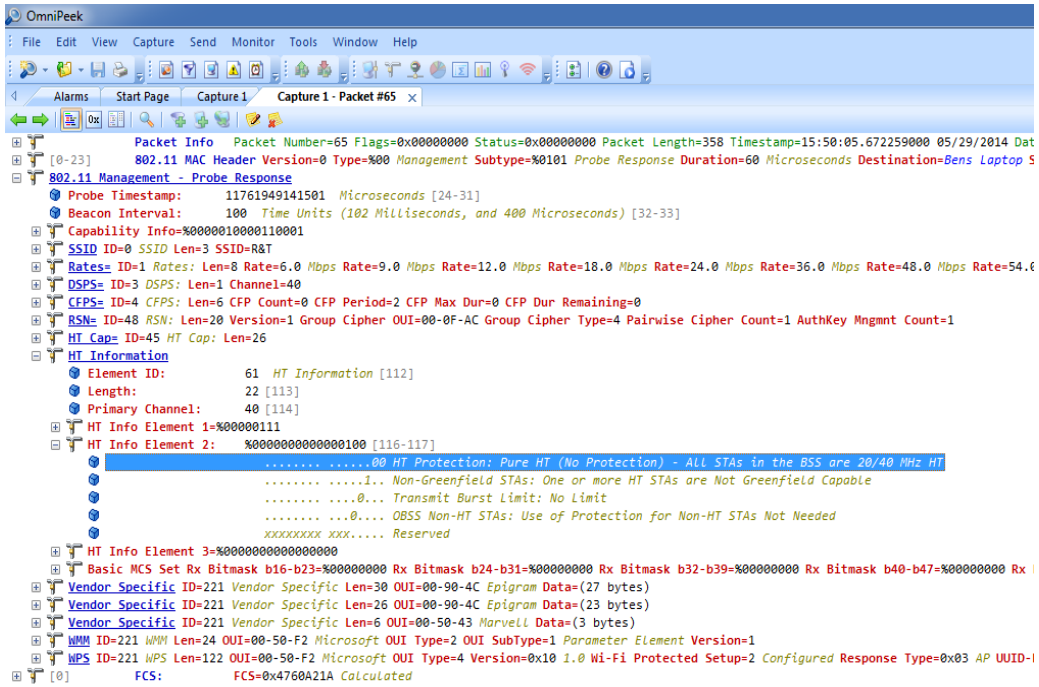
- Larger frames, low data rate, fewer packets
- ~250µsec/frame

Associated

- Smaller frames, higher data rate, more packets
- ~1µsec/frame

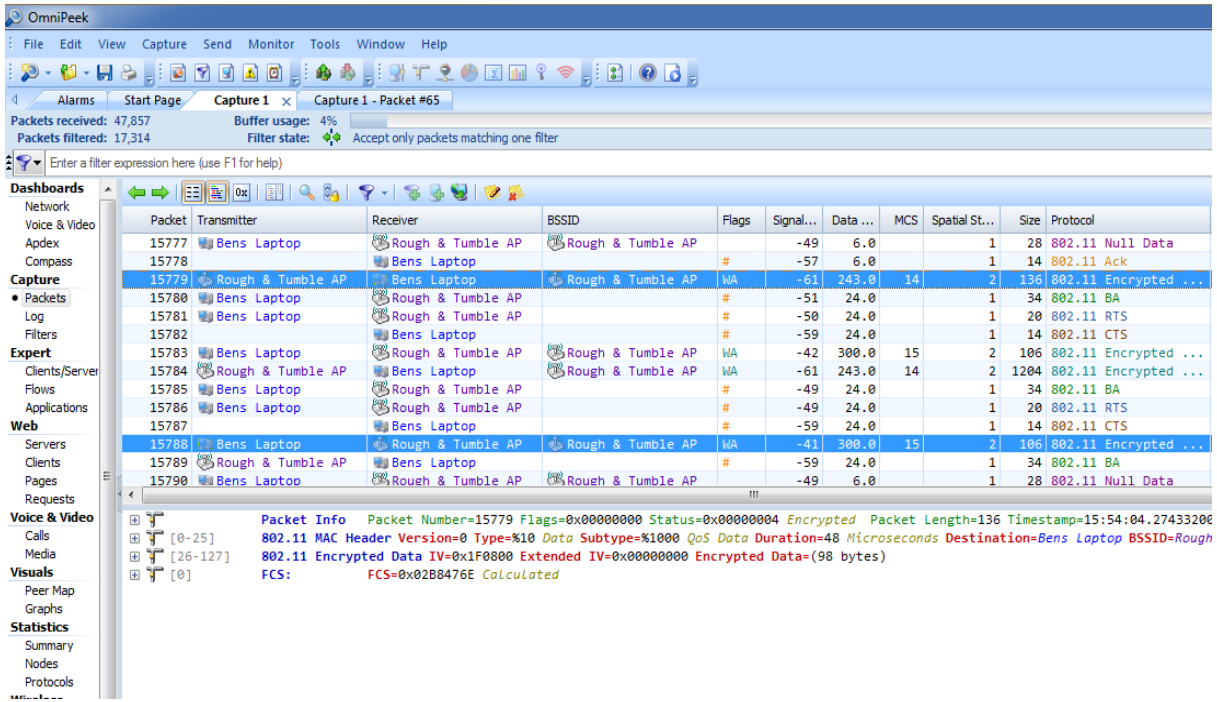
http://www.sniffwifi.com/2012/04/phones-on-wlan.html

Inefficient Network Utilization



Probe response

- Pure HT mode
- No protection should be used (no RTS/CTS)



Data transmission

- Some HT clients still using protection
- Unnecessary mgmt packets @ 24Mbps diminish WLAN efficiency

http://www.sniffwifi.com/2014/05/why-are-you-slowing-down-my-wifi-apple.html

Wireless Is Slow - Retransmissions

Pa...	Source	Destination	BSSID	Flags	Size Bar
1949	10.8.0.175	10.4.58.73	ProximWire:4F:1B:06	+	802.11 Data IP TCP
1950	10.8.0.175	10.4.58.73	ProximWire:4F:1B:06	+	802.11 Data IP TCP
1951	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06		802.11 Data IP TCP HTTP
1952	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06	+	802.11 Data IP TCP HTTP
1953	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06	+	802.11 Data IP TCP HTTP
1954	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06		802.11 Data IP TCP HTTP
1955	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06		802.11 Data IP TCP HTTP
1956	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06	+	802.11 Data IP TCP HTTP
1957	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06		802.11 Data IP TCP HTTP
1958	10.8.0.175	10.4.58.73	ProximWire:4F:1B:06		802.11 Data IP TCP
1959	10.8.0.175	10.4.58.73	ProximWire:4F:1B:06	C+	802.11 Data IP TCP
1960	10.8.0.175	10.4.58.73	ProximWire:4F:1B:06	+	802.11 Data IP TCP
1961	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06		802.11 Data IP TCP HTTP
1962	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06	+	802.11 Data IP TCP HTTP
1963	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06	+	802.11 Data IP TCP HTTP
1964	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06		802.11 Data IP TCP HTTP
1965	10.8.0.175	10.4.58.73	ProximWire:4F:1B:06	+	802.11 Data IP TCP
1966	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06		802.11 Data IP TCP HTTP
1967	10.4.58.73	10.8.0.175	ProximWire:4F:1B:06		802.11 Data IP TCP HTTP

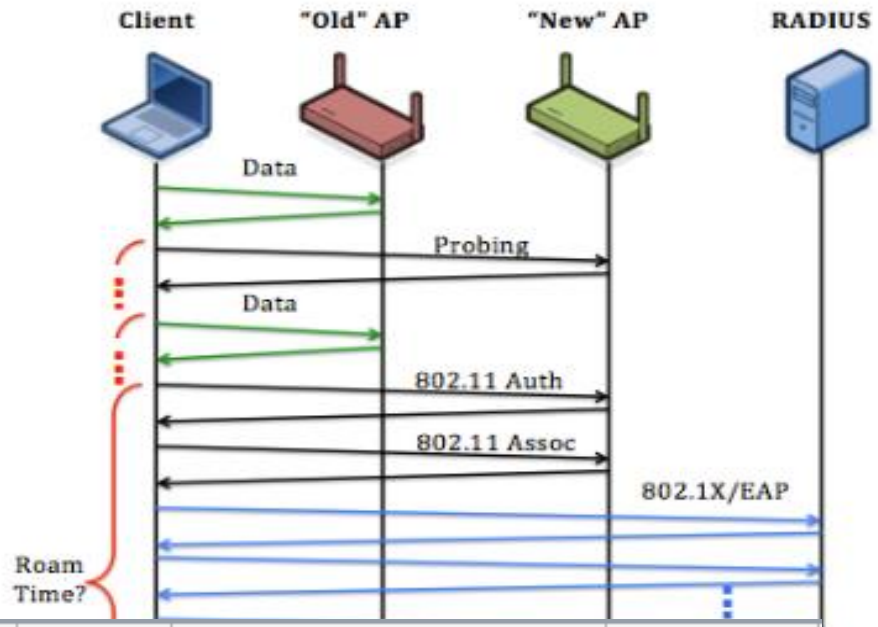
```
Frame Control Flags:  %00001010 [1]
    0... .... Non-strict order
    .0.. .... Non-Protected Frame
    ..0. .... No More Data
    ...0 .... Power Management - active mode
    .... 1... This is a Re-Transmission
    .... .0.. Last or Unfragmented Frame
    .... ..1. Exit from the Distribution System
    .... ...0 Not to the Distribution System
```

Packet	Relative Time	IP ID	Expert
1	0.000000	3295	
2	0.091011	18563	
3	0.091014	3300	
4	0.091017	3301	
5	0.185298	18571	
6	0.188321	18572	
7	0.189393	3305	
8	0.274432	18573	
9	0.408863	3306	
10	5.421561	3314	
12	7.832377	3316	TCP Slow First Retransmission (2.410816 seconds ...
13	8.094537	19690	
14	8.095559	3317	TCP Retransmission (2.673998 seconds from pack...
15	8.201252	19696	
16	8.207219	19697	

Packet	Relative Time	IP ID	Expert
11	0.408702	3306	
12	5.419631	3314	
13	5.420315	3314	
14	5.421547	3314	
16	7.830755	3316	TCP Retransmission (2.409208 seconds from pack...
17	7.831347	3316	
18	7.832359	3316	
19	8.094958	19690	
20	8.095627	3317	TCP Retransmission (2.674080 seconds from pack...
21	8.201915	19696	
22	8.207849	19697	
23	8.208364	19697	
24	8.209149	19697	
25	8.210565	19697	
26	8.213458	19697	

Analyzing Roaming Issues

- Sticky clients
  - Clients make poor roaming decisions
  - Look for: signal strength and lower-than-expected data rates
- Roaming latency
  - Criteria for determining latency depends on your perspective



Pa...	Source	Destination	BSSID	Flags	Channel	Signal	Data Rate	Size Bar	Relative Time
1	66.248.222.36	10.250.1.122	Cisco:3C:FA:A6		11	58%	54.0	IP UDP	0.000000
2	66.248.222.36	10.250.1.122	Cisco:3C:FA:A6		1	60%	54.0	IP UDP	0.370909

Name	MAC	IP	Time	Latency (sec)	Source AP	Destination AP	Source Channel	Destination Cha...
Intel:4B:23:93	00:1C:BF:4B:23:93	66.248.222.36	11:22:26.997 2/11/2008	10.615	Cisco:FC:07:E6	Cisco:3C:FA:A6	11 - 2462 MHz (...	11 - 2462 MHz (...
Intel:4B:23:93	00:1C:BF:4B:23:93	66.248.222.36	11:24:01.409 2/11/2008	0.370	Cisco:3C:FA:A6	Cisco:3C:FA:A6	11 - 2462 MHz (...	1 - 2412 MHz (bg)
Intel:4B:23:93	00:1C:BF:4B:23:93	66.248.222.36	11:24:01.780 2/11/2008	2.567	Cisco:3C:FA:A6	Cisco:3C:FA:A6	1 - 2412 MHz (bg)	11 - 2462 MHz (...
HonHaiPrec:45:8D:02	00:16:CE:45:8D:02	72.246.103.48	11:37:53.441 2/11/2008	9.002	Cisco:CE:BE:A6	Cisco:CE:BE:A6	1 - 2412 MHz (bg)	6 - 2437 MHz (bg)
HonHaiPrec:45:8D:02	00:16:CE:45:8D:02	216.252.124.207	11:38:02.443 2/11/2008	0:06:28.908	Cisco:CE:BE:A6	Cisco:CE:BE:A6	6 - 2437 MHz (bg)	1 - 2412 MHz (bg)

Summary

- Packet analysis is an essential part of any wireless engineer's toolkit
- In many cases packets are the *ONLY* way to determine the root cause of an issue
- Packet analysis doesn't always involve just looking at the packets themselves
- Don't assume portable, in-person analysis is your only choice

Thank You!

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IT Professional Wi-Fi Trek 2015
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