IEEE 802.11n

Osama I. Al-Dosary
Consulting Systems Engineer
dosary@cisco.com

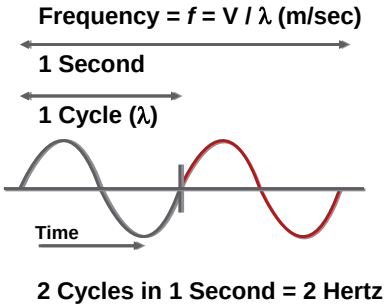
Agenda

- Dot 11n Tech Overview
- Draft 2.0
- Power over Ethernet Considerations
- Summary

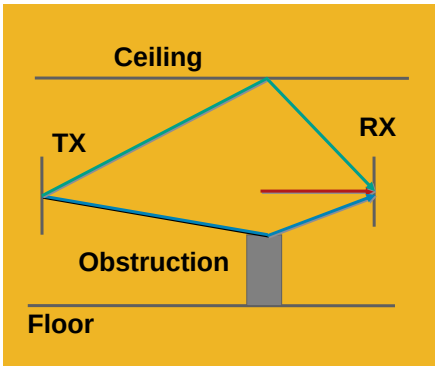
dot11n Technology Overview

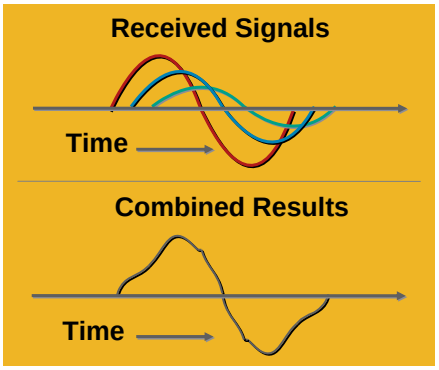
Radio Waves

- Waves are measured by frequency of movement
- Radio devices operate in bands or a designated frequency range
- 5GHz wavelength ~ 6 cm
- 2.4GHz wavelength ~ 12 cm

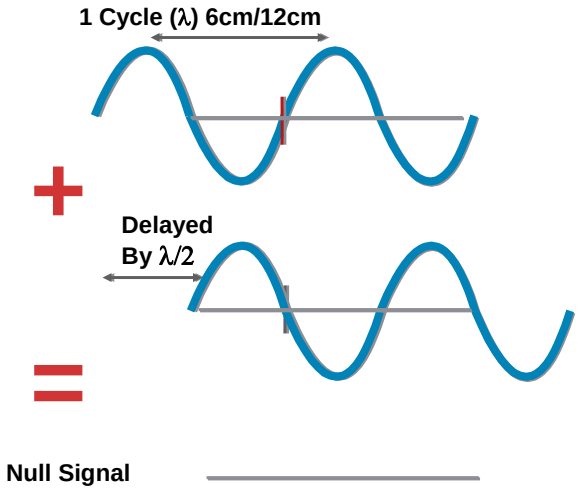


Multipath





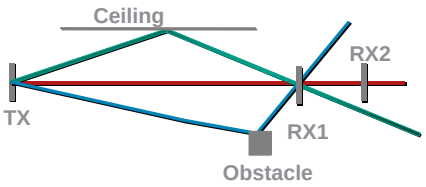
Null Signals



Diversity

- In a multipath environment, signals null points are located throughout the area
- Moving the antenna slightly will allow you to move out of a null point and receive the signal correctly

Dual Antennas Typically Mean if One Antenna Is in a Null, the Other One Will Not be, therefore Providing Better Performance in Multi-path Environments



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802.11n Highlights

- Better overall end-user experience for high bandwidth data, voice and video applications
  - 5x higher throughput
  - More reliable and predictable coverage
- Backwards compatibility with 802.11a/b/g clients
  - Clients will co-exist for a long time

Primary 802.11n Components		
Multiple Input Multiple Output (MIMO) Maximal Ratio Combining (MRC) Beam forming Spatial multiplexing	**40 MHz Channels** Two adjacent 20 MHz channels are combined to create a single 40 MHz channel	**Improved MAC Efficiency** Packet aggregation: multiple packets aggregated in a single transmission Block Ack

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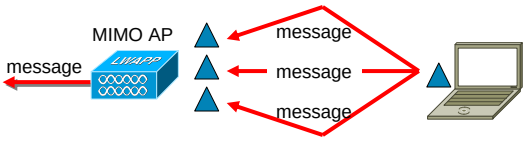
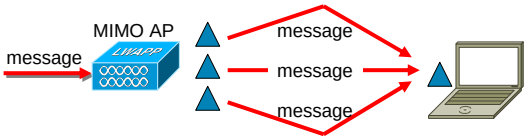
MIMO Overview

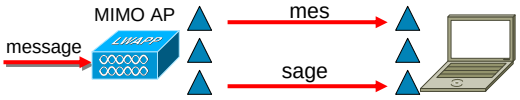
Maximal Ratio Combining
- Performed by receiver
- Combines multiple received signals
- Increases receive sensitivity
- Works with non-MIMO and MIMO clients



Transmit beam forming
- Performed by transmitter
- Ensures signal received in phase
- Increases receive sensitivity
- Works with non-MIMO and MIMO clients



Spatial Multiplexing
- Transmitter and receiver participate
- Multiple antennas txmt concurrently on same channel
- Increases bandwidth
- Requires MIMO client



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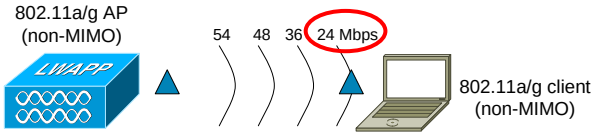
MIMO Increases PHY Data Rates for all clients

☒ Maximal Ratio Combining (MRC)
☒ Beam forming
☒ Spatial Multiplexing



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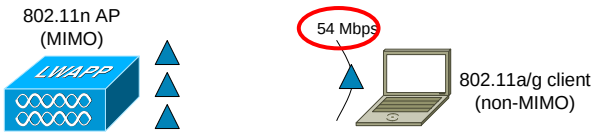

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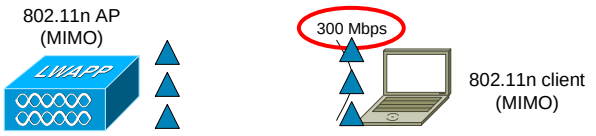

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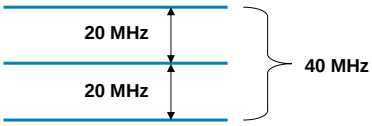
40-MHz Channels and Packet Aggregation

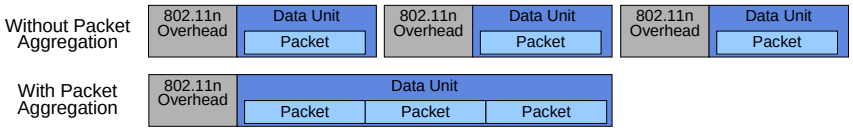
40-MHz Channels:
802.11n supports both 20- and 40-MHz wide channels
Wider channels means more BW per AP
(not per physical location)

Auto Analogy:
Twice the traffic lanes, twice the cars



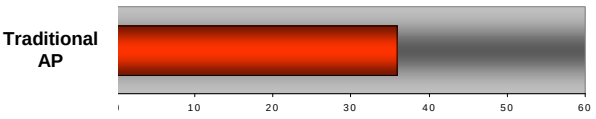
Packet Aggregation:
Combine multiple data units into one frame
Saves on 802.11n and MAC overhead

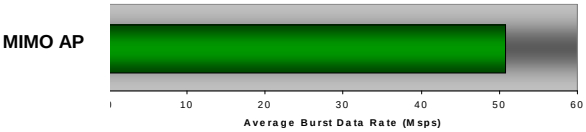
Auto Analogy:
Car pooling is more efficient than driving by yourself



More consistent, reliable coverage

- Higher mean throughput, more reliable connections for each client
  - Consistent throughput and coverage
  - Better reliability, better user experience
  - Fewer help desk calls

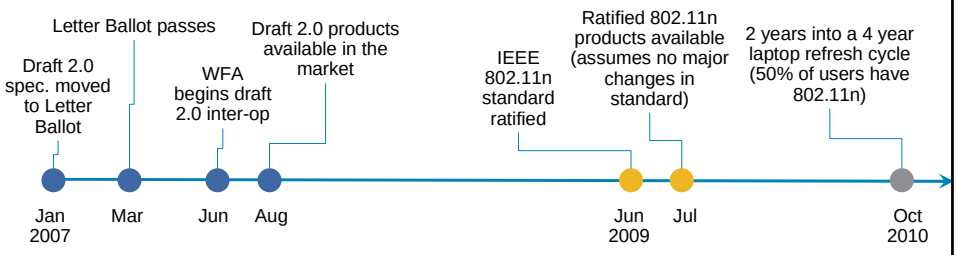




Draft 2.0

802.11n Standard Update

- **IEEE 802.11n standard is still under development**
  - Changes to the standard are still being made (base features are mostly stable, optional features are in flux)
  - Architectural and Security reviews are still underway
  - Letter Ballot passed in Mar ’07 (Draft 2.0)
  - WFA certification of 802.11n Draft 2.0 products mid-2007
  - Official ratification date has been **pushed back to June 09!**



Introducing the Aironet AP1250

- The industry's first enterprise 802.11n upgradeable access point
  - Support for draft 802.11n version 2.0 including Multiple Input, Multiple Output (MIMO) technologies
- Modular platform
  - Field upgradeable radio modules provides investment protection
  - Provides a path to support future technologies
    - Spectrum analysis
    - Enhanced location services
- Designed to support higher speed WLAN technologies
  - Faster CPU to handle higher data throughput
  - Increased memory for expanded feature set
  - 10/100/1000 Ethernet port for high capacity uplink
  - Larger power supply to handle greater power requirements
- Available in both Unified (LWAPP) and Autonomous versions

Rugged Modular Platform

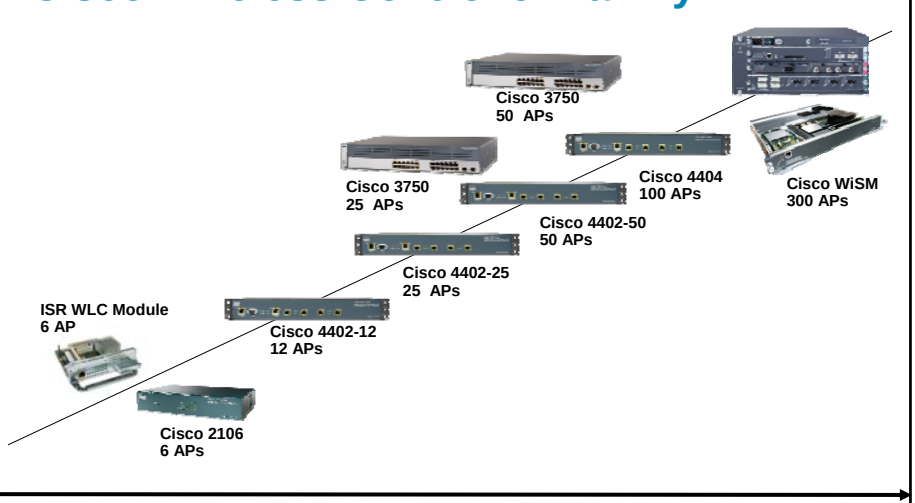
- Rugged design
  - Metal enclosure
  - Extended operating temperature range (–20 to +55°C)
  - External antenna connectors
  - Plenum rating
  - Flexible mounting options

New Antennas for AP1250

- Dipoles
  - New dipole without hinge (gray)
    - 2.4 GHz 2.2 dBi (AIR-ANT2422DG-R)
    - 5 GHz 3.5 dBi (AIR-ANT5135DG-R)
  - Also supports existing dipoles with hinge (black & white)
- Omnidirectional
  - Single enclosure with 3 antenna elements
    - 2.4 GHz 3dBi (AIR-ANT2430V-R)
    - 5 GHz 4 dBi (AIR-ANT5140V-R)

- Blue dot indicates 5 GHz

Cisco Wireless Controller Family



Power Over Ethernet Considerations

Enhanced PoE (ePoE)

- Delivers higher power than 802.3af (Class 3, 15.4W) but lower than 20 Watts per port
  - –This is not 802.3at/POE+
  - – High power mode is negotiated via CDP between the switch and the powered device
  - – Supported on Catalyst E-series switches and Catalyst 6500 line cards
- Operation when AP1250 is plugged into a Cisco switch
  - –AP1250 boots up as a class 3 device with radios disabled
  - –Switch and AP auto-negotiate a higher power level using CDP
  - –If the switch cannot provide the required power then radios remain off
- When powered with a non-Cisco standard PoE switch source AP1250 will operate under 15.4W.

AP1250 Dual Radio Powering Options

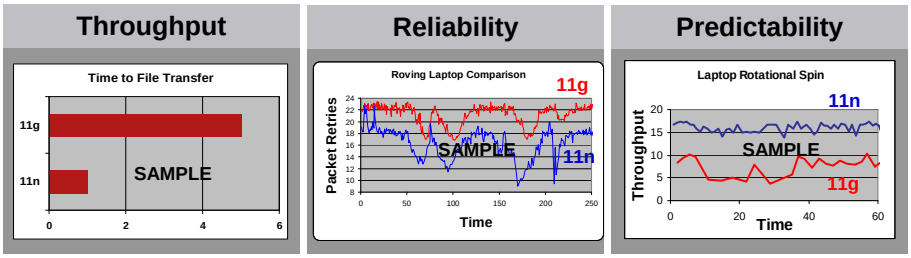
Power Mode	802.3af	Cisco Enhanced PoE
Max Power at PSE	15.4 W	16.8-20 W
# of radios supported	1 or 2	2
MIMO Mode (Tx x Rx)	1 radio: 2x3 2 radios: 1x3[1]	2x3
Dual radio Limitations[1]	No MCS 8-15 data rates in 2.4 & 5GHz (maximum PHY data-rate 157.5 Mbps/radio)	1:1 replacement of legacy APs[2] ensures maximum performance and functionality. (Max PHY data-rate 300 Mbps per radio)
Catalyst Switch Support	Any 802.3af switch	3560E, 3750-E 4500E: X4648-E, X4648+E 6500: X6148 / X6148A / X6548

A Power Injector and Power Supply are also available as powering options

Summary

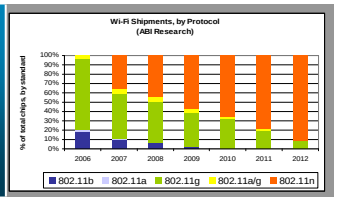
Cisco Next Generation Wireless

- Cisco Next Generation 802.11n
  - 2x increase in reliability
  - 5x increase in throughput
- 300 Mbps per radio
- Backwards compatible with existing 802.11abg clients
- Operates in 2.4GHz and 5GHz
- MIMO improves wireless network reliability and predictability



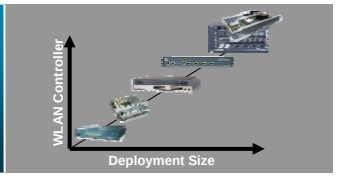
Cisco Architectural Advantage

- Expect a gradual migration to 802.11n
  - Architectural flexibility
  - Backwards compatibility with ABG
  - Tested interoperability with Intel



- Next-generation Aironet 1250 access point
  - Wi-Fi Certified 802.11n draft 2.0 standard
  - Future RF technologies
  - 10/100/1000 Ethernet

- Unified Wireless Network – 11n Ready
  - Flexible architecture – n+1 scalability (scale as you grow)
  - No redesign required



More info @

cisco.com/go/wireless

Cisco Enhanced PoE - Recommended

	Supported Switches	Software Release	Notes
Cat3K	3750E: WS-C3750E-24PD-S WS-C3750E-24PD-E WS-C3750E-48PD-S WS-C3750E-48PD-E WS-C3750E-48PD-SF WS-C3750E-48PD-EF 3560E: WS-C3560E-24PD-S WS-C3560E-24PD-E WS-C3560E-48PD-S WS-C3560E-48PD-E WS-C3560E-48PD-SF WS-C3560E-48PD-EF	12.2(44)SE	▪Supports 2 radio 11n mode ▪Switch power supply must be correctly sized for PoE load
Cat4K	4500E Linecards: WS-X4648-RJ45V-E WS-X4648-RJ45V+E	12.2(44)SG	▪Supports 2 radio 11n mode ▪No limitations on the number of AP1250s that can be used with a card or chassis ▪Chassis power supply must be correctly sized for PoE load
Cat6K	Linecards: WS-X6148A-GE-45AF WS-X6148-GE-45AF WS-X6548-GE-45AF PoE daughter cards: WS-F6K-48-AF= WS-F6K-GE48-AF=	12.2(33)SX	▪Supports 2 radio 11n mode ▪Recommend 1:1 replacement of 802.11a/b/g to 802.11n ▪No limitations on the number of AP1250s that can be used with a card or chassis ▪Chassis power supply must be correctly sized for PoE load