Ethernet Unleashed!

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What We'll Cover

- 802.11 Overview
  - Why its needed
  - How it's used
  - Where it's used

- Why You Should Care
  - Market segment size and growth
  - Key trends

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"Investments at the desktop are idle, because people are spending less time at their desks."

-- Gartner Group

- ~25% of corporate PCs are now laptops
- Mobile voice is already common; mobile data isn't
  - Yet >90% of all comm. traffic is data
- 80% of F2000 buying or evaluating WLANs

-- Gartner Group

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Environment: Computing Trends

- "6 Web World"[1] Emerging
  - PCs, TVs/consoles, PDAs, phones, eCom & embedded
- Driven by "Anytime, Anywhere" connectivity
  - Each user acct. avail. on many devices (PDA, laptop,...)
  - Wired ⟺ wireless roaming
  - LAN ⟺ WAN roaming
  - Voice & data converging on IP networks
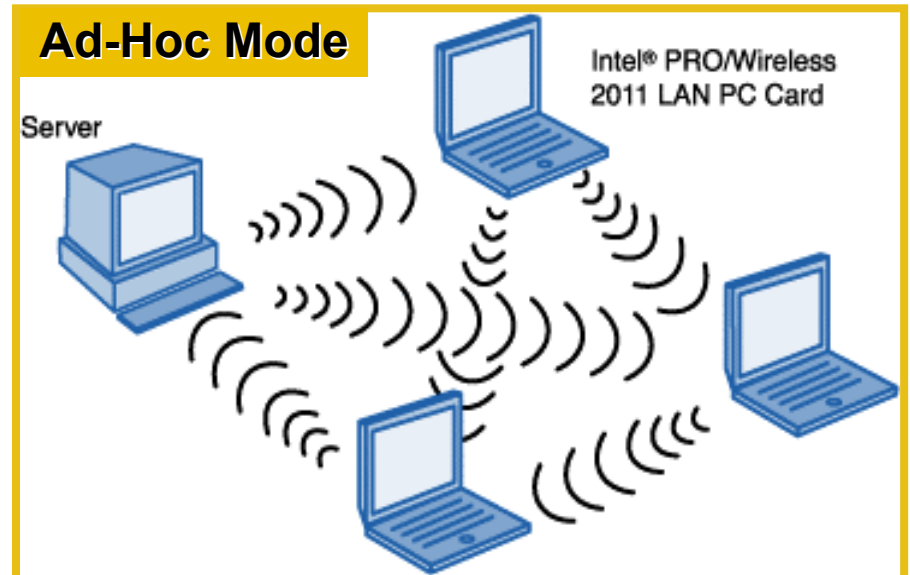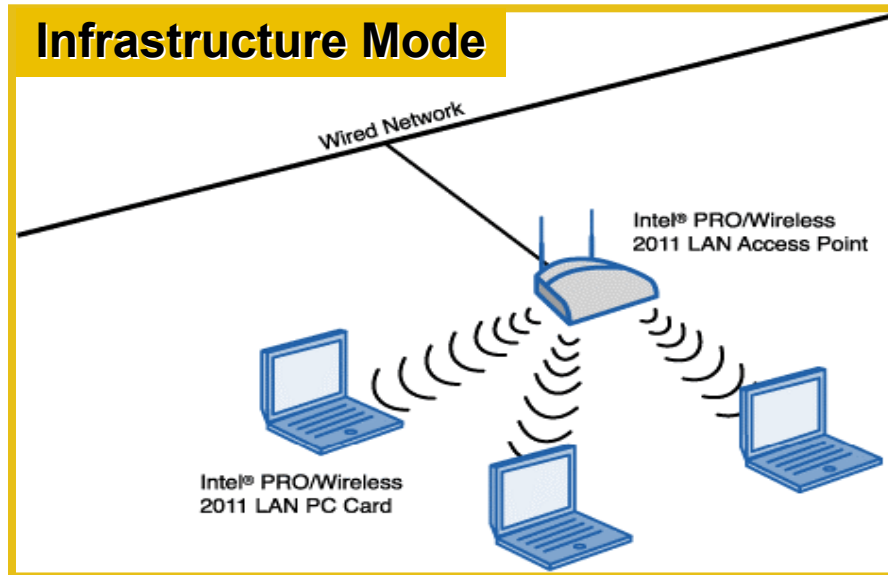- New gizmos + 802.11 = "Cauldron of innovation"[2]

1 Bill Joy   2 Jeff Farber

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What is a Wireless LAN?

- **A wireless extension of a wired LAN**
  - To support mobile connectivity
  - To reach hard to wire locations

- **"Instant infrastructure" for small biz & branch offices**
- **An instant peer-to-peer network**

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802.11 At-A-Glance

- Bandwidth
  - 11 Mbps $\rightarrow$ 54 Mbps
- Security
  - WEP or IPsec today
  - 802.11i tomorrow
- Mobility
  - Inherent with all APs on the same subnet
  - MobileIPv4 needed to roam across subnets
- Manageability
  - With standard apps via SMNP

"If any one technology has emerged the past few years that will be explosive in its impact, it's 802.11."

-- Bill Gates

Why Now (and Not Before)?

Before	**Now**
• Standards	• Standards
– No industry alignment	– 802.11b, Wi-Fi™
• Cost	• Cost
– $1,000	– $150
• Performance	• Performance
– 1-2 Mbps	– 11 Mbps $\rightarrow$ 22 Mbps
• Mkt. Validation	• Mkt. Validation
– Mostly unknown vendors	– Virtually all LAN vendors
– Mostly vertical usage	– Showcase enterprise accts.

Intel's 802.11 Vision & Goals

Internet

Internet

Internet

Internet

Internet

Hilton
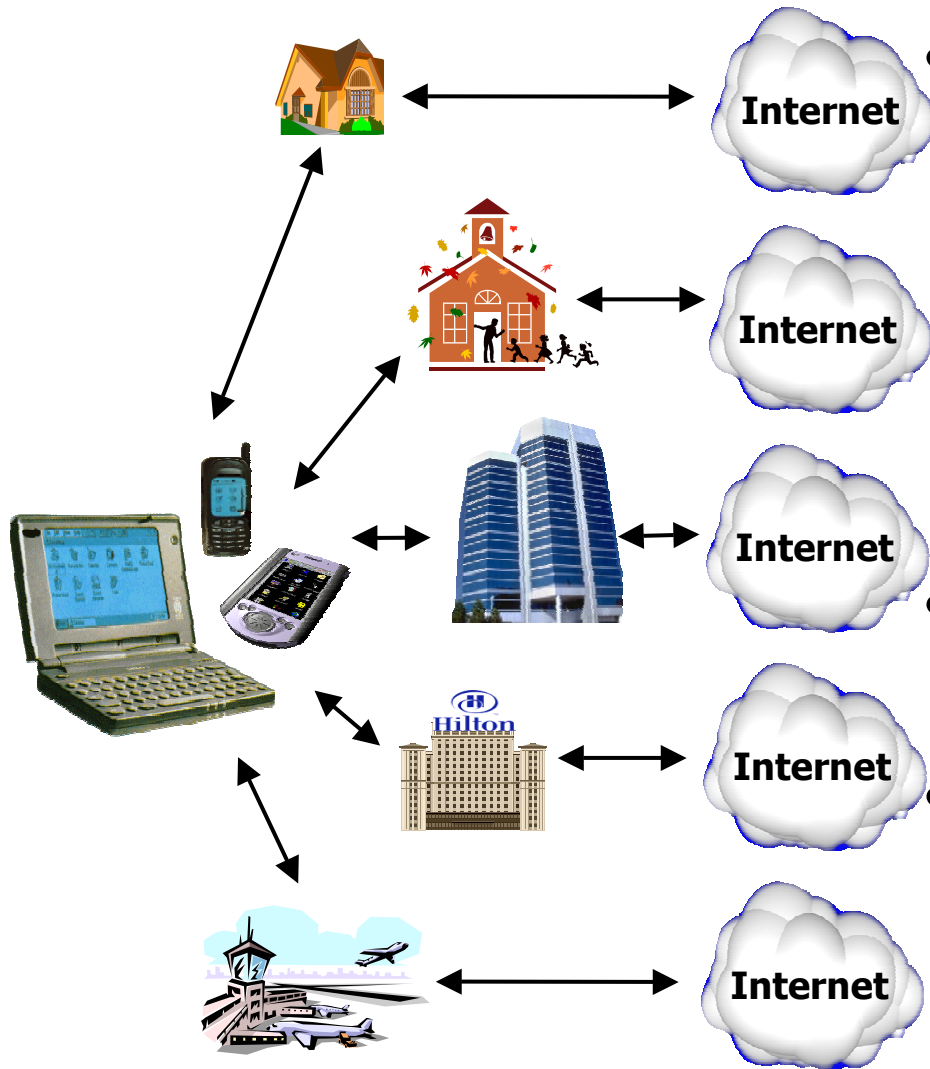
- Vision:
  - Easy, trusted connectivity anytime, anywhere
    - <u>Easy</u> = auto-discovery & auto-config.
    - <u>Trusted</u> = private, protected session
    - <u>Anytime, anywhere</u> = True roaming across nets (wired-wireless, LAN-WAN)
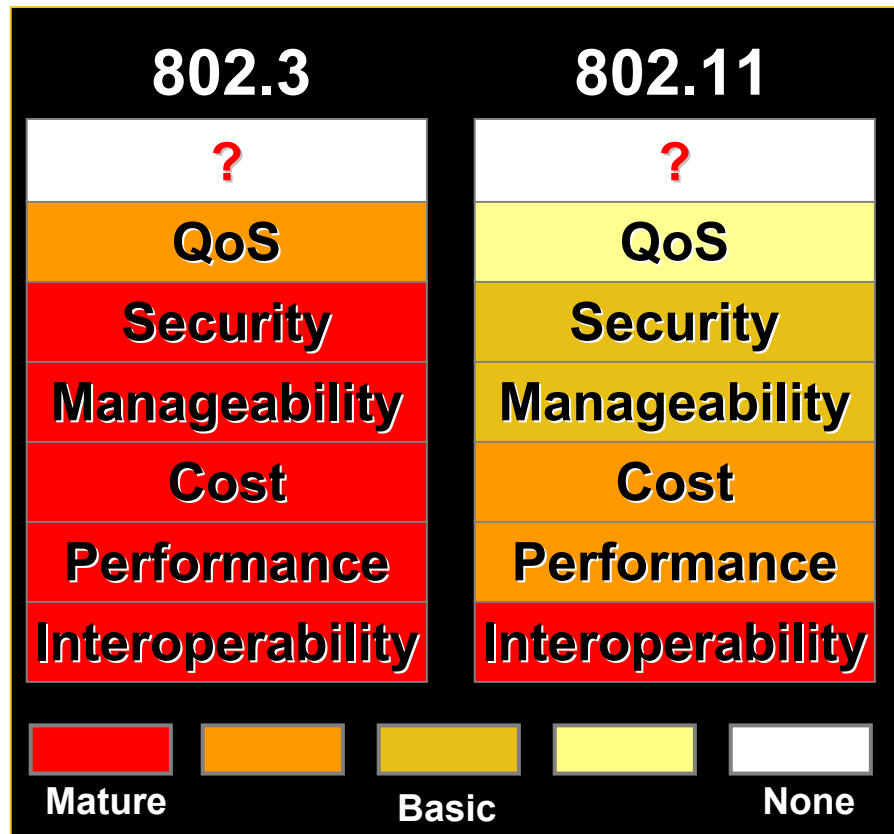
- Commitment:
  - Hundreds of $M across Intel

- Goals:
  - Grow the market to ubiquity
  - Deliver the best products to serve that market

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How We're Achieving Our Vision

802.3	802.11
?	**?**
QoS	**QoS**
Security	**Security**
Manageability	**Manageability**
Cost	**Cost**
Performance	**Performance**
Interoperability	**Interoperability**

Mature — Basic — None

- Driving necessary enhancements
  - IEEE TGi Security & Microsoft's SSN
  - IEEE TGe QoS & Microsoft's WME
  - IEEE 802.11 WNG (WLAN Next Gen.)
  - Wireless 1394 Working Group
  - Home Net. Config. Spec. & UPnP Gateway Spec.
  - IEEE TGh TPC & DFS for EU
  - IETF MobileIP & IPv6
  - ITU SG 16
  - Wx3GIO & 3GIO Mobile Comms
  - Ultra-low power initiative
  - Wake-on-Wireless (LAN)
  - WECA Board of Directors
  - 5GHz Ind. Advisory Group Founder
- Shaping the ecosystem
  - Lobbying 802.11a approval in EU
  - Stimulating ubiquitous hotspots
  - Enabling true roaming

Environment: Adoption Trends

BUSINESS ADOPTION

SMB, IT
Seeds → Pilots → Deployment

HOME ADOPTION

BB Bundles, OEM Bundles

TASTE IT
at WORK

BUY IT
for HOME

TARGET AUDIENCE
- Mobile professionals
- Road warriors
- Tech zealots

DEMAND IT
on the ROAD

INTER-CITY ROAMING

Planes, Trains, Hotels

INTRA-CITY ROAMING

Home, Office, Around Town

Marriott. SPIRIT TO SERVE 75 Years

AAdvantage

Chevron

bp

STARBUCKS COFFEE

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Enterprise Usage

Vertical (App.-Driven)	Horizontal (Infra.-Driven)
Customer Service	**"LANs-In-A-Box"**
Hertz	Prudential
Mobile Data Capture	**Extending Corp. LANs**
NYSE	Microsoft
Real-time Info. Access	**Public 'Net Access**
Allscripts Healthcare Solutions	Starbucks Coffee
	Ad-hoc Networks
	Cambridge Technology Partners

- Large Campuses
  - Wireless overlay to wired infrastructure to provide continuous, real-time connectivity
- Branch Offices
  - Alternative to wired net
- Telecommuters
  - Bringing broadband to home offices with no new wires
  - Getting more hours from execs.
- Public "Hotspots"
  - Broadband access at airports, hotels, coffee shops, …
- Ad-hoc Networks
  - Consulting, sales, training

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In Summary
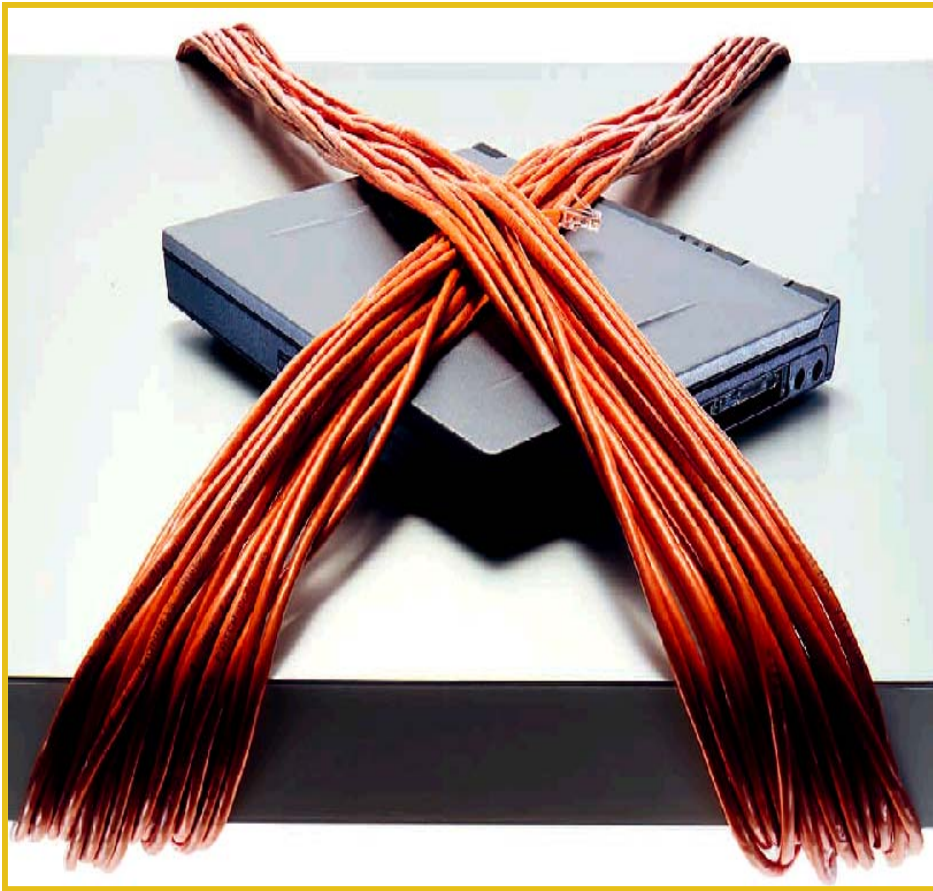
- 802.11 is ready for prime-time today
  - Wireless overlays to wired infrastructure
  - Branch office "LANs-in-a-Box"
  - Telecommuters
  - Public hotspots
  - Ad-hoc sharing
- It's getting even better
  - Enhanced security
  - Enhanced QoS

802.11: because mobility is a terrible thing to waste!

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The Intelligent Way to Connect™

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Backup

802.11's Evolution

Task Group	Purpose	Frequency	Data Transfer Rate
A (802.11a)	*High speed wireless in 5 GHz band*	*5 GHz*	*Up to 54 Mbps*
B (802.11b)	*High speed wireless in 2.4 GHz band*	*2.4 GHz*	*Up to 11 Mbps*
D (802.11d)	International Roaming	2.4 & 5 GHz	N/A
E (802.11e)	Increase QoS & higher security for 802.11	2.4 & 5 GHz	N/A
F (802.11f)	Develop standards for inter- access point protocol	2.4 & 5 GHz	N/A

802.11's Evolution Continued

Task Group	Purpose	Frequency	Data Transfer Rate
G (802.11g)	Higher speed extension of 802.11b	2.4 GHz	22 Mbps
H (802.11h)	Enhance 802.11a spectrum & power management for Europe	5 GHz	Up to 54 Mbps
I (802.11i)	Enhance WLAN encryption & authentication security	2.4 & 5 GHz	N/A
802.1x (section under 802.11i)	LAN security standard for wired & wireless networks	2.4 & 5 GHz	N/A

802.11g vs. Dual-band

Dual-band APs Ship	802.11a FCS in UK & Netherlands	Dual-band Clients Ship	802.11g Ratification Expected	802.11g Wi-Fi Cert. Expected

Q4 '01	Q1 '02	Q2 '02	Q3 '02	Q4 '02	Q1 '03	Q2 '03	2H '03 - 2004
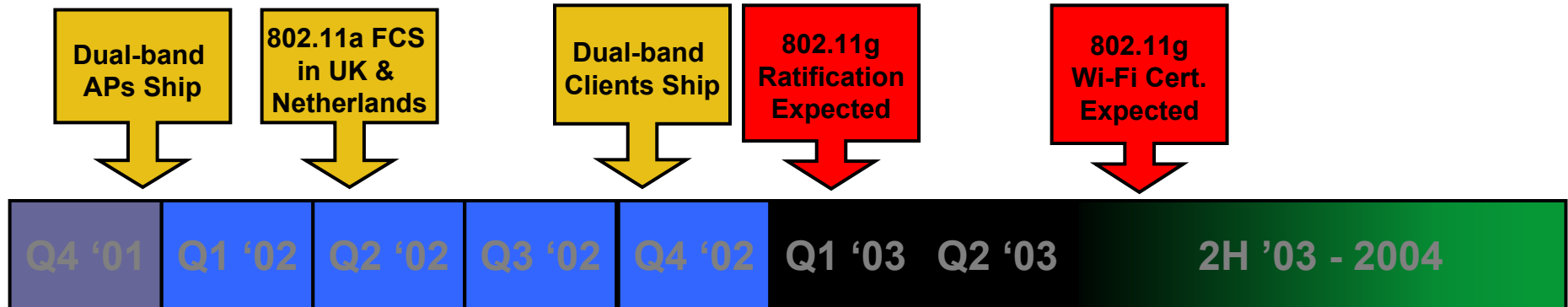
- 802.11ab available Q4'02; 802.11g not ratified 'til '03
  - 896 technical comments/objections filed last week
- 802.11g-only is not a good migration path from 802.11b
  - Requires the same infrastructure upgrade as 802.11a, but doesn't have 802.11a's other benefits: clean spectrum; 8+ channels
  - Not WHQL certifiable with Longhorn
  - Inter-channel interference with OFDM and CCK on adjacent channels
    - Requires either a HW change to create a new signal – *Not a FW upgrade*
    - Or, reducing Tx power to only 10mW -- ↓ *effective range to 50% of .11a*
  - 802.11g APs required to tell 802.11g NICs they can't transmit while 802.11b NICs are transmitting (RTS/CTS) -- ↓ *thruput to 34% of .11a*
  - 802.11g's channels & thruput can't support the XPC vision

802.11a & 802.11b Compared

- There are 3 main differences between 802.11a & 802.11b:

  - Speed (data throughput) – 802.11a is **the wireless networking technology fast enough to take care of business**

  - Network Capacity – **combined bandwidth**

  - Level of Interference – **Clean radio spectrum**
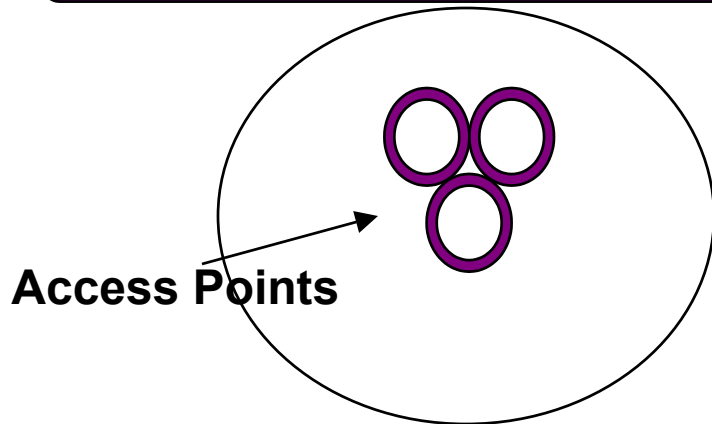
802.11a & 802.11b Compared

- 802.11a Higher Throughput
  - **802.11a (54 Mbps) is up to 5x faster than 802.11b (11Mbps)**
  - **Speeds fast enough to create stand-alone wireless networks**
  - **Higher throughput available for more users per access point**
  - **Supports Higher Performance Applications**

"More bits per buck"

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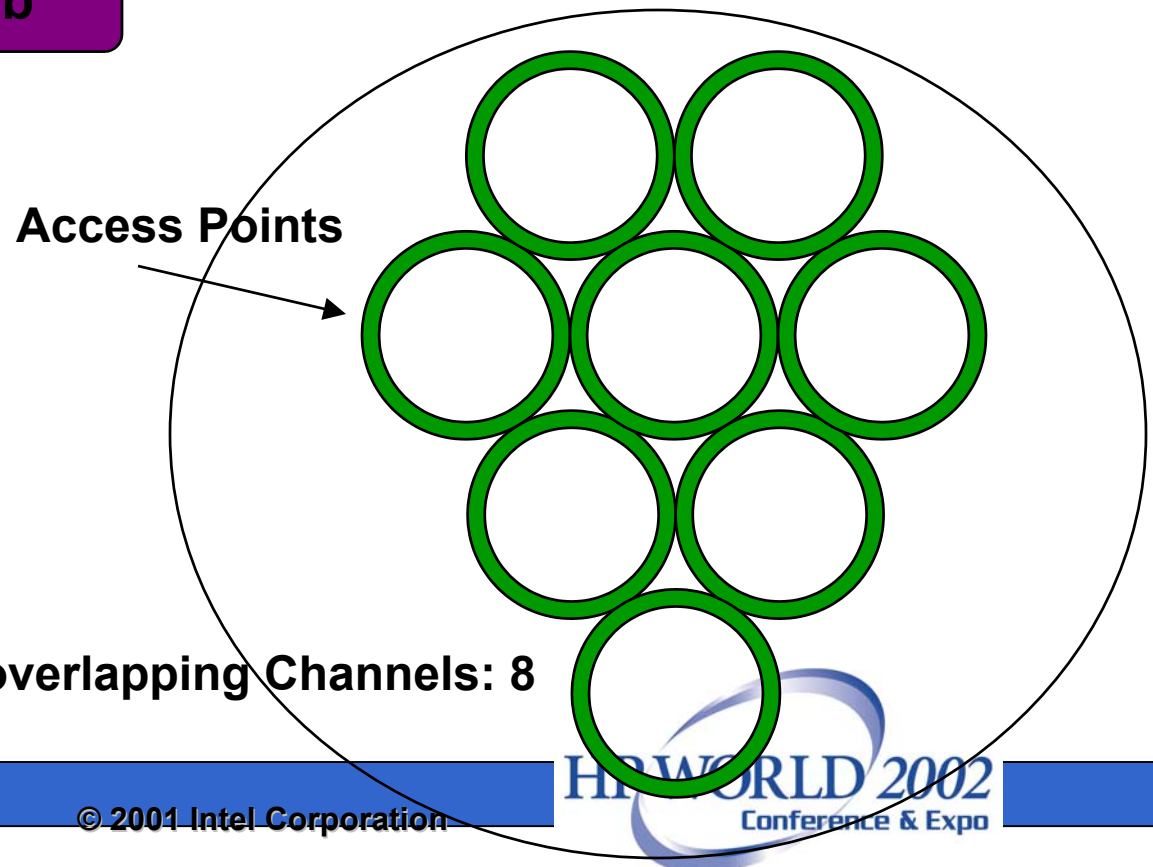Conference & Expo

802.11a & 802.11b Compared

- *802.11a Higher Network Capacity* - **8 Channels - allows more dense deployment of APs effectively increasing overall bandwidth**

Your network with 802.11a

Your network with 802.11b

Access Points

Access Points

Non-overlapping Channels: 3

Non-overlapping Channels: 8

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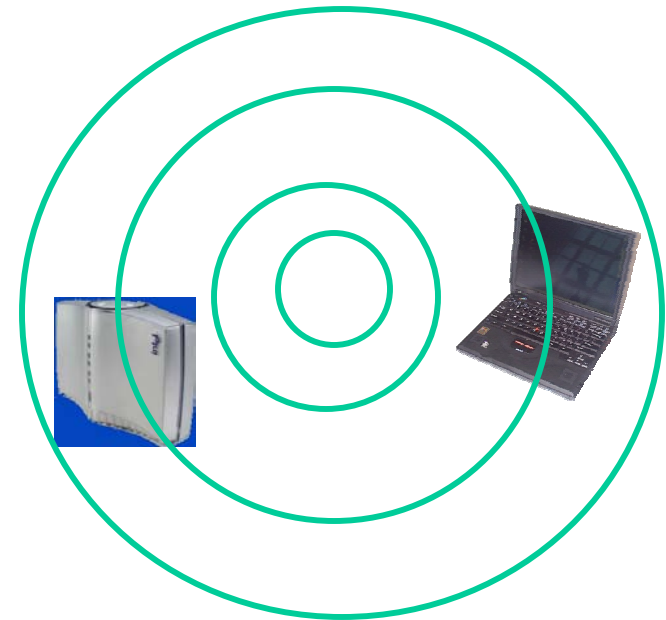
802.11a & 802.11b Compared

- Cleaner Spectrum = More Reliable Performance
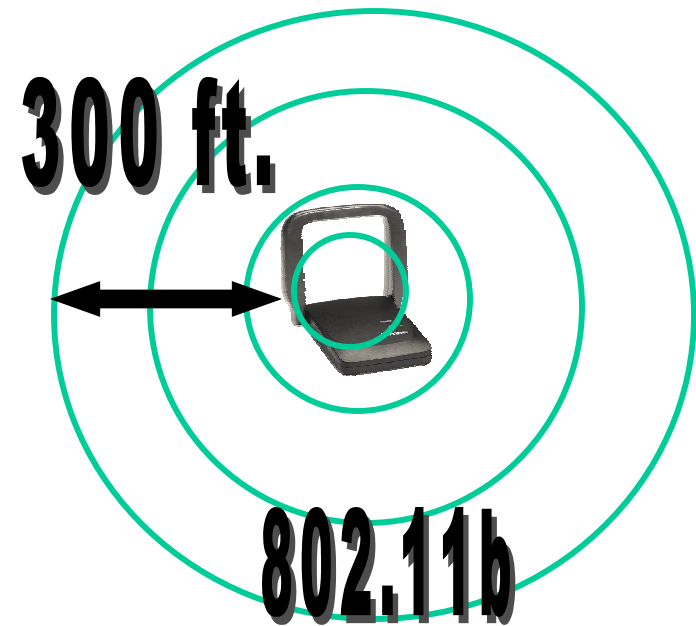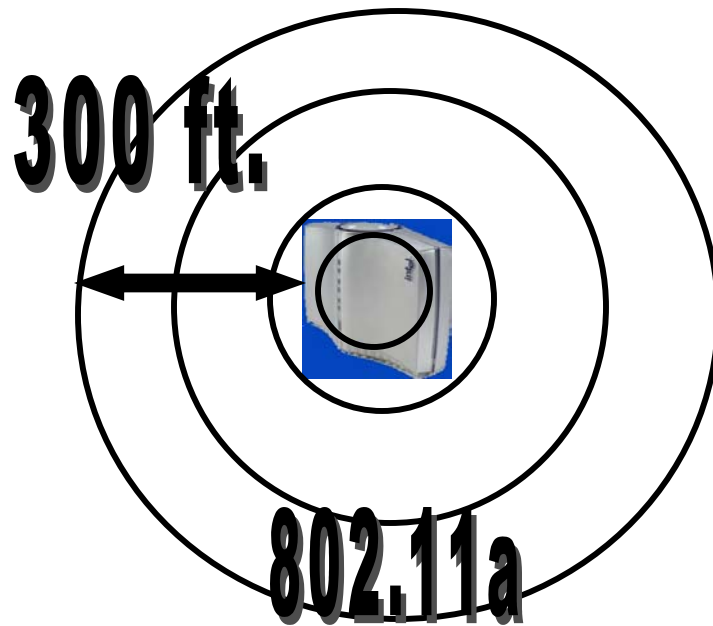 - 5 GHz is a "Clean Spectrum" - no interference issues with things like cordless phones, Bluetooth, microwaves, …

2.4 GHz WLAN Network

5 GHz WLAN Network

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802.11a Range

- Competitors have falsely alleged that 802.11a product range is shorter than that of 802.11b

- 802.11a offers range (indoors) that is comparable with 802.11b products

300 ft.

802.11a

300 ft.

802.11b

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802.11a Range

- 802.11a offers higher data rates than 802.11b at any given range

300 ft. @ 6 Mbps

300 ft. @ 1 Mbps

802.11a

802.11b

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