



Cisco Unified Wireless Network



Agenda

- A Mobile Revolution
- Unification Trends
- WLAN Technology Overview
 - LWAPP
- Cisco Unified Wireless Network
 - Mobility Services
 - Benefits
 - Product Portfolio
- Cisco Advantage

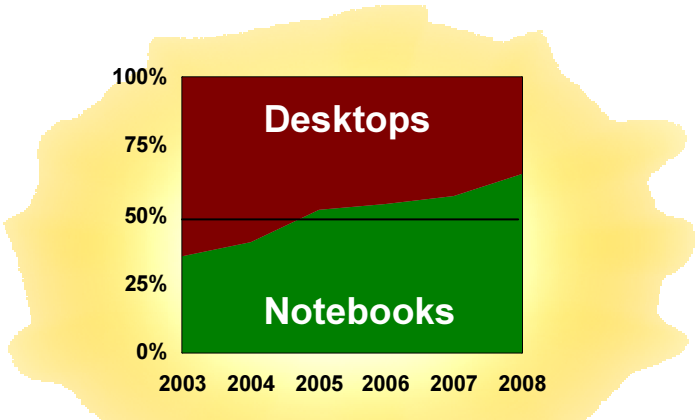
A Mobile Revolution



Mobilizing the Experience

From Internet to Mobility Age

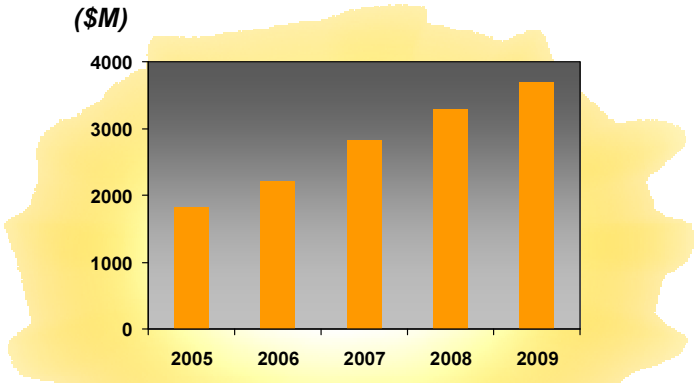
Beyond the tipping point...



More notebooks sold than desktops



95% of notebooks Wi-Fi enabled



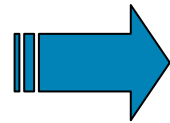
WLAN Market nears \$4bn by 2009

Mobility is Changing....

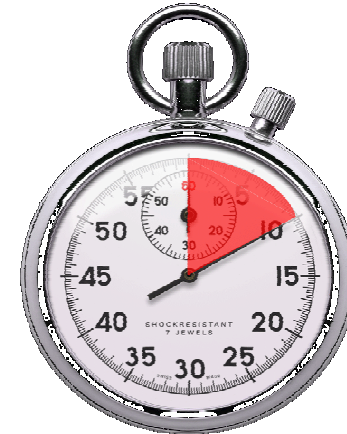
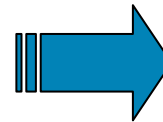
The Way We Do Business



1950s-1990s
Letters and inter-office
memos



1990s-2002
Voice Mail and Email provide
“Same Day” response



Today
Real-time interaction –
Instant Messaging, two-way
text paging, Blackberry, etc

*Today's Climate Requires Anywhere, Anytime
Connectivity*

Network Unification



Unified Service Delivery

Unification: History Repeated

2005+

- Common platform for intelligent services
- Greatest efficiencies and lowest TCO
- Extensive application support common across entire network



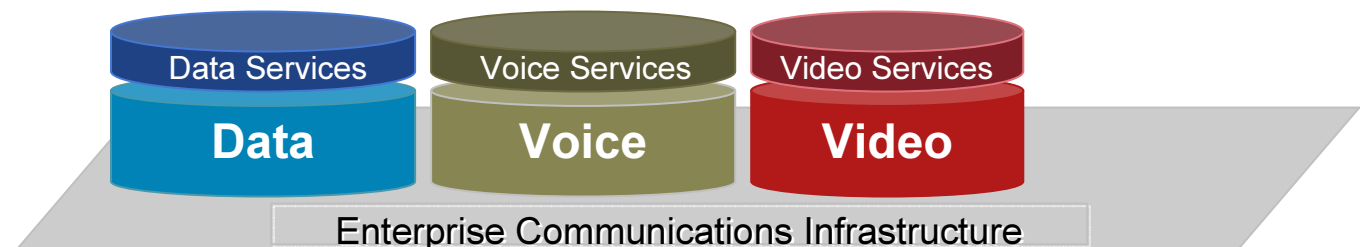
2000s – 2005s

- Converged IP network lowers TCO
- Some application efficiencies, not optimized
- Overlay wireless remains a support and management burden

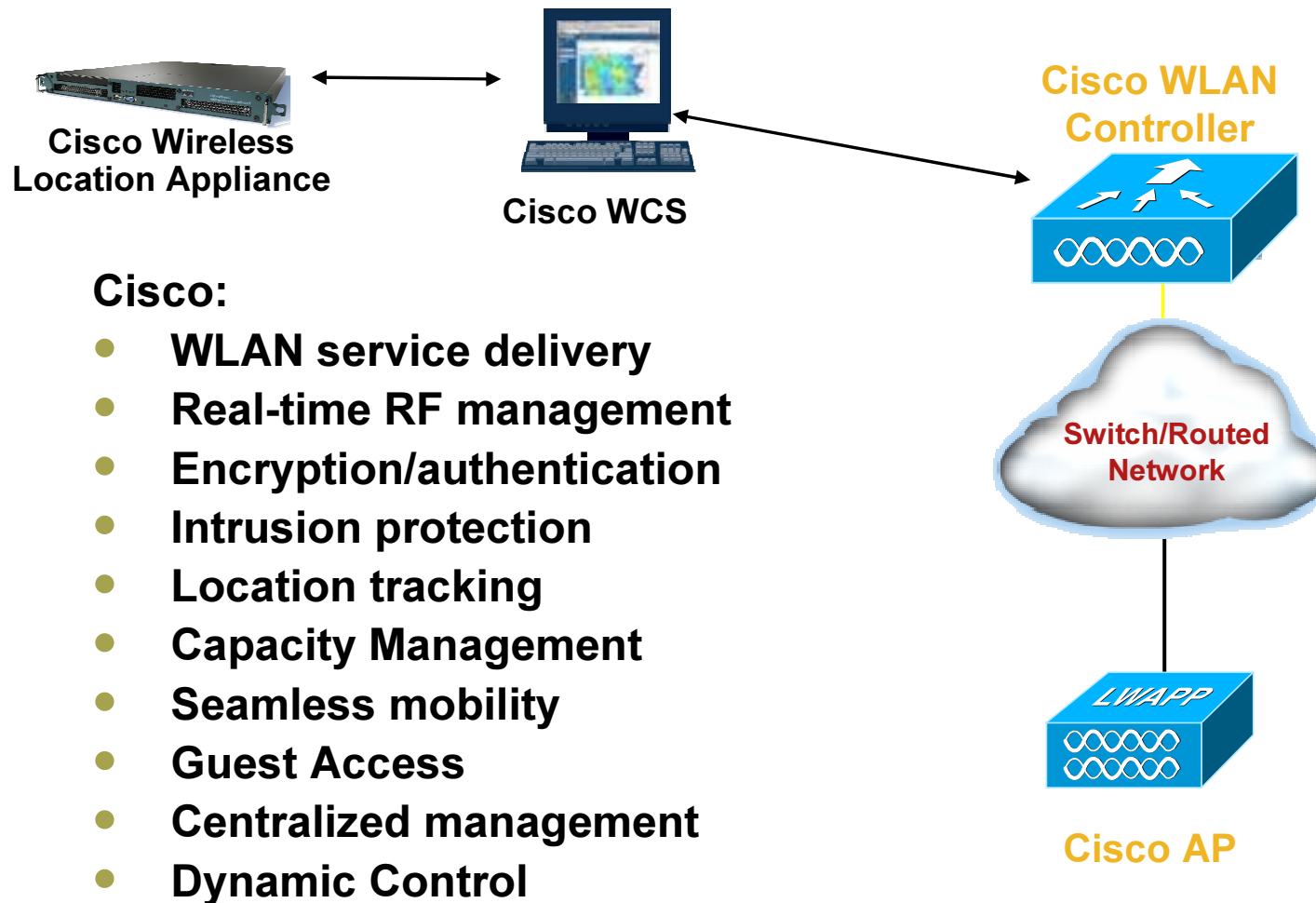


1980s – 2000s

- Separate communications networks
- No common services
- High support costs and limited efficiency
- Siloed applications



A Unified WLAN System

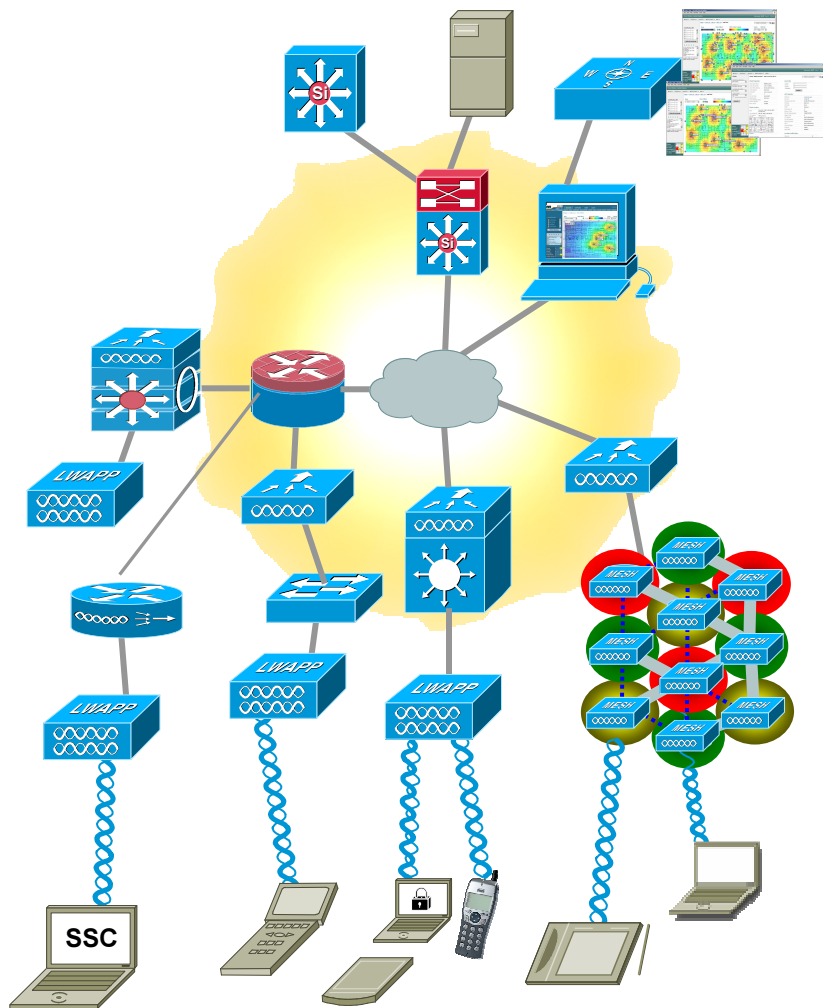


Cisco:

- **WLAN service delivery**
- **Real-time RF management**
- **Encryption/authentication**
- **Intrusion protection**
- **Location tracking**
- **Capacity Management**
- **Seamless mobility**
- **Guest Access**
- **Centralized management**
- **Dynamic Control**

Cisco Unified Wireless Network

End-to-End, Unified – Only Cisco



Wireless LAN Mobility Services

Unified cellular and Wi-Fi VoIP. Advanced threat detection, identity networking, location-based security, asset tracking and guest access.

World-Class Network Management

Same level of security, scalability, reliability, ease of deployment, and management for wireless LANs as wired LANs.

Network Unification

Integration into all major switching and routing platforms. Secure innovative WLAN controllers.

Access Points

Ubiquitous network access in all environments. Enhanced productivity. Proven platform with large install base and leading market share. Plug and Play.

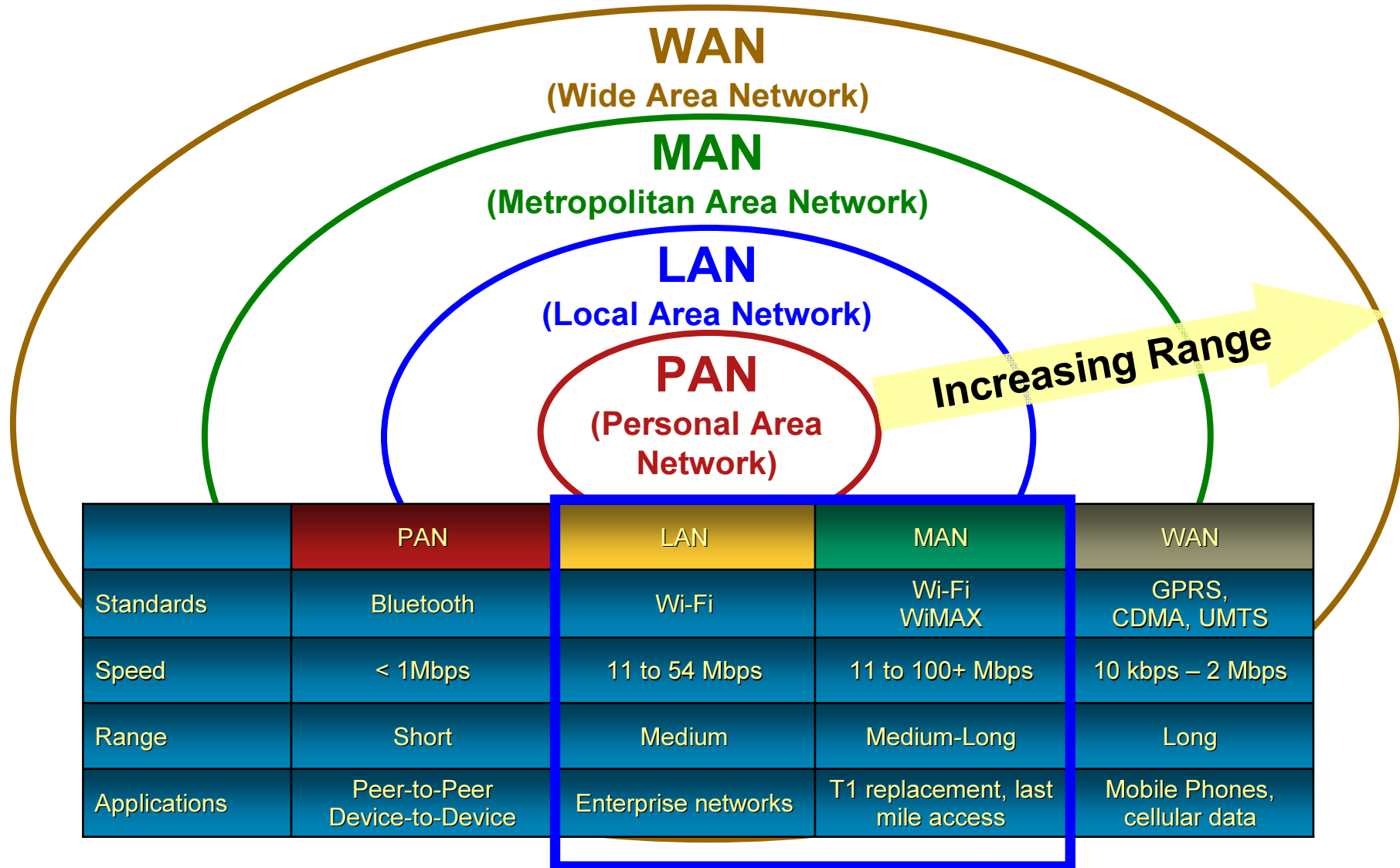
Client Devices

95% of Wi-Fi silicon is Cisco Compatible Certified. Cisco SSC delivers uniform security and services for wired and wireless connections

WLAN Technology Overview

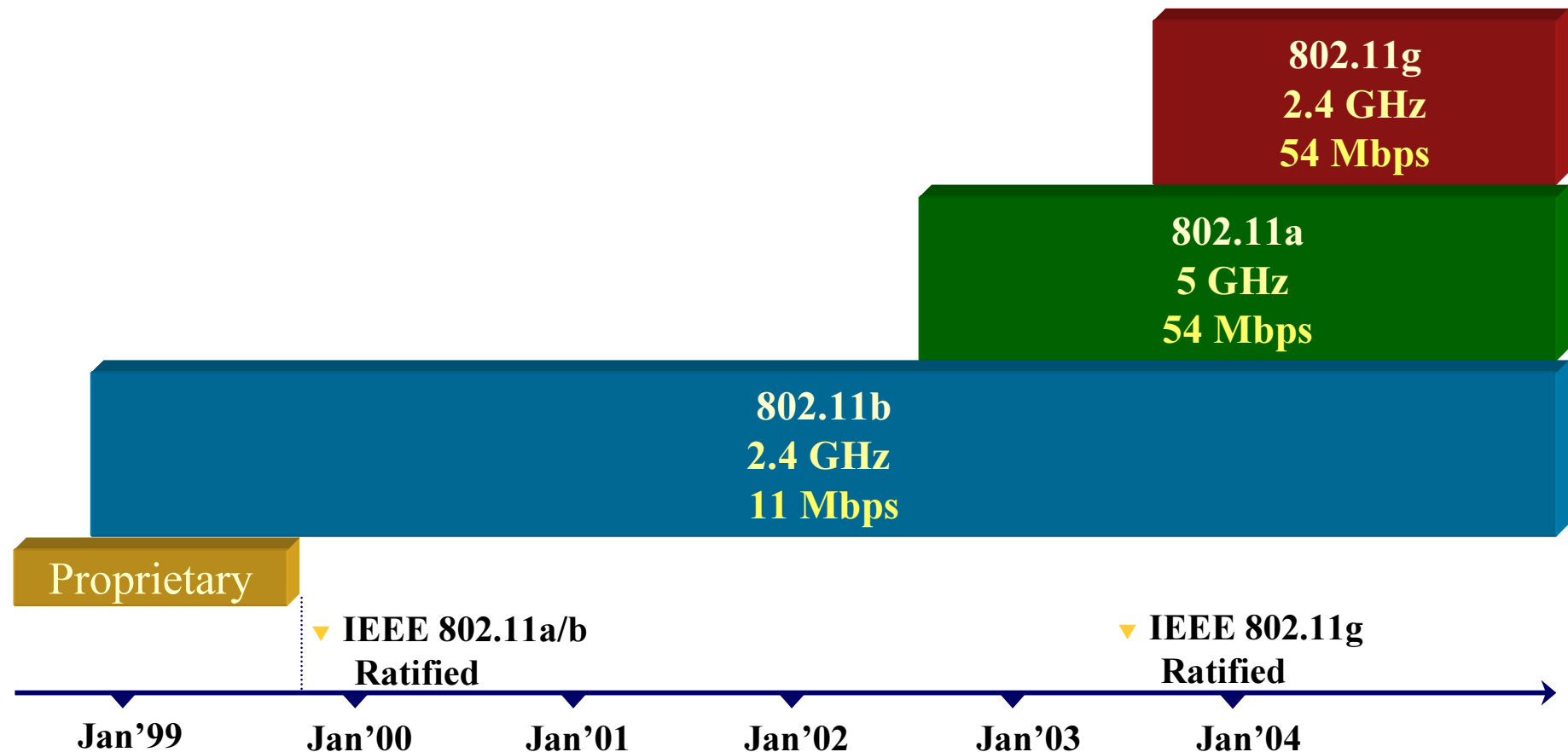


Wireless Technologies





WLAN Speeds & Frequencies



802.11a/b/g Comparison

Range

Data Rates	802.11g	802.11a
54 Mbps	32 m	26 m
48 Mbps	55 m	46 m
36 Mbps	79 m	64 m
24 Mbps	87 m	70 m
18 Mbps	100 m	79 m
12 Mbps	108 m	85 m
11 Mbps	111 m	
9 Mbps	116 m	94 m
6 Mbps	125 m	100 m
5.5 Mbps	130 m	
2 Mbps	136 m	
1 Mbps	140 m	

Typical indoor ranges measured using an AP1242AG with 2.2-dBi dipole antenna for 2.4 GHz, and 3.5-dBi omnidirectional antenna for 5 GHz.

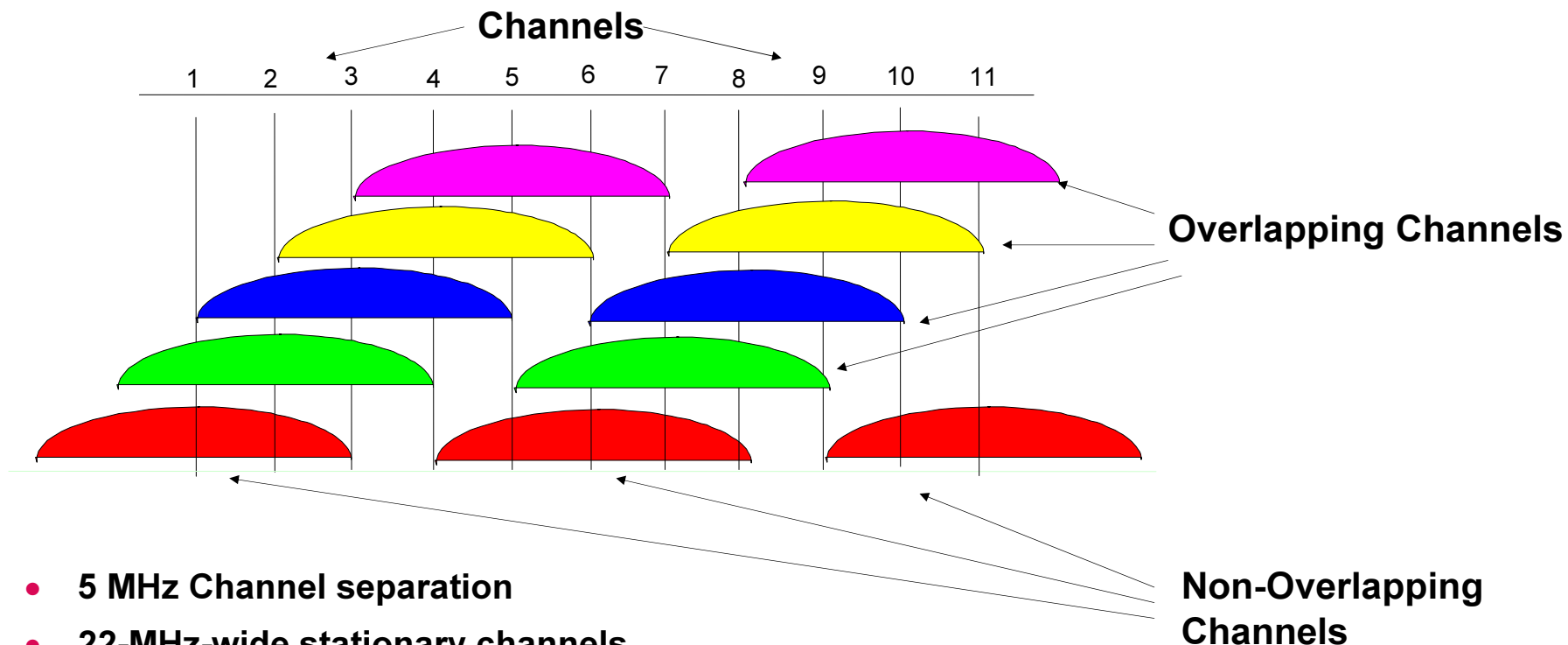
802.11a/b/g Comparison

Throughput and Network Capacity

	Frequency	Data Rate (Mbps)	Throughput (Mbps)	Non-overlapping Channels	Network Capacity (Mbps)
802.11b	2.4 GHz	11	6	3	18
802.11g (with .11b clients in cell)	2.4 GHz	54	14	3	42
802.11g (No .11b clients in cell)	2.4 GHz	54	22	3	66
802.11a (today)	5 GHz	54	25	12	300
802.11a (With add'l ETSI channels)	5 GHz	54	25	23	575

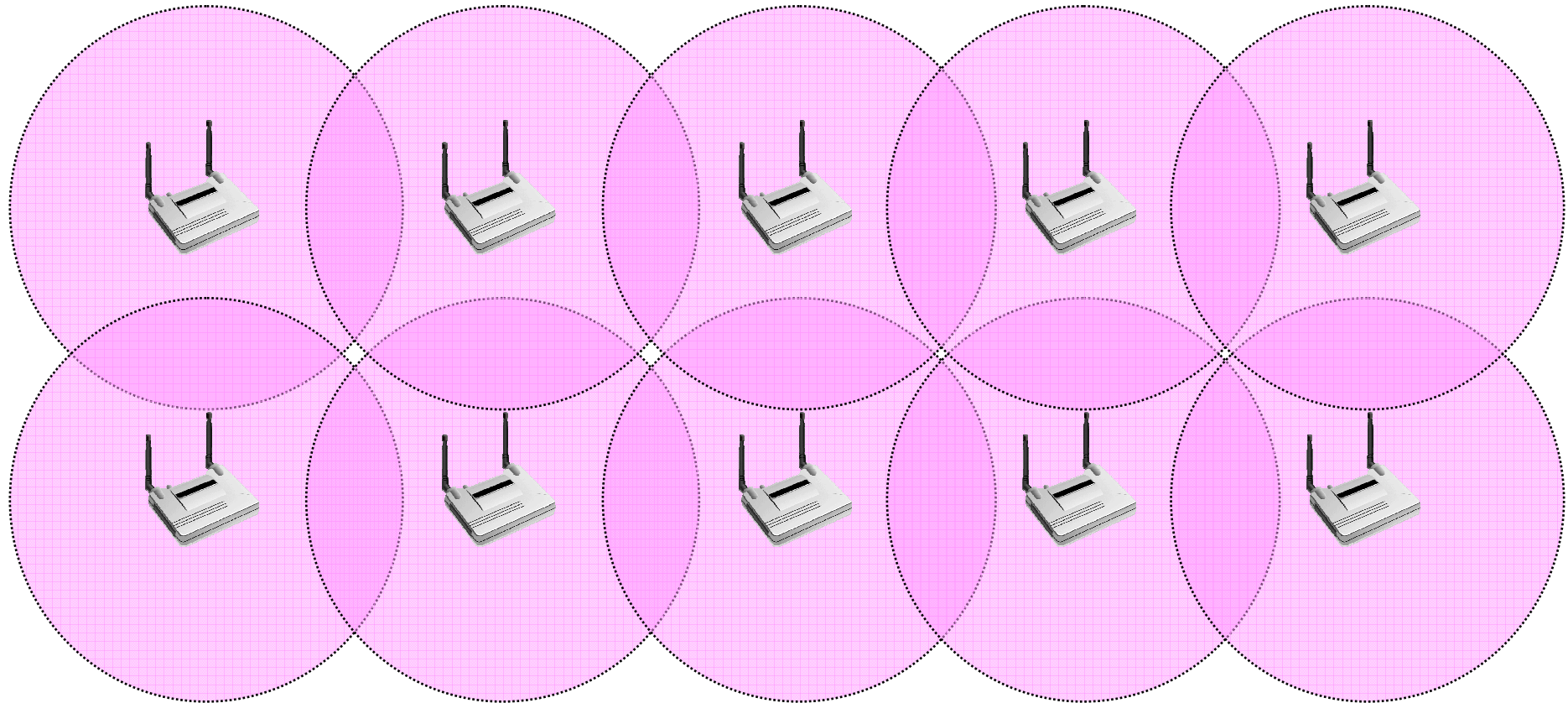
802.11g throughput is reduced in “mixed cells” with both .11b & .11g clients due to backward compatibility constraints; however, with the recently implemented “CTS-to-Self” default on the AP, mixed cell throughput has been improved.

IEEE 802.11b/g Channel Allocations

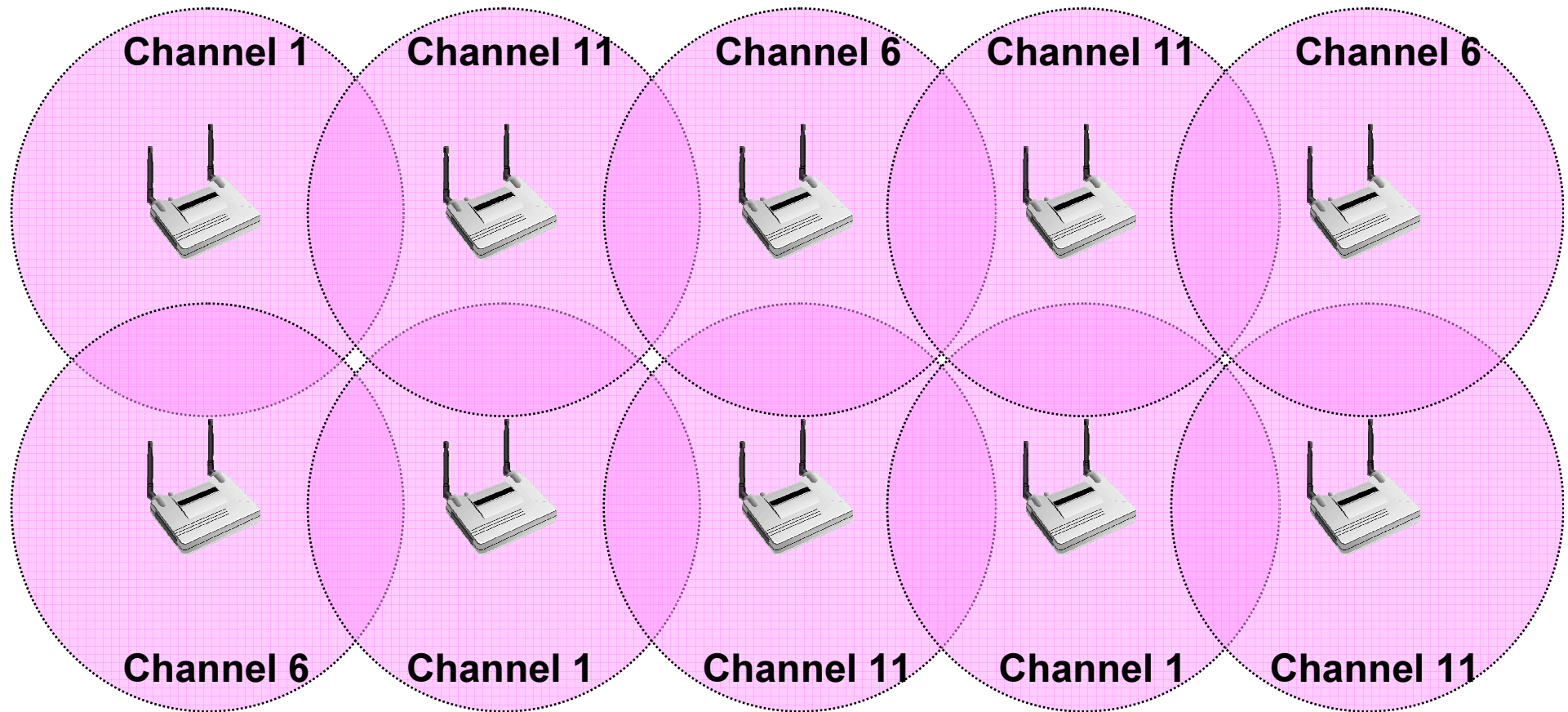


- 5 MHz Channel separation
- 22-MHz-wide stationary channels
- 3 nonoverlapping channels (1, 6, and 11)
- 3 APs can occupy same area - set at different frequencies

RF Coverage

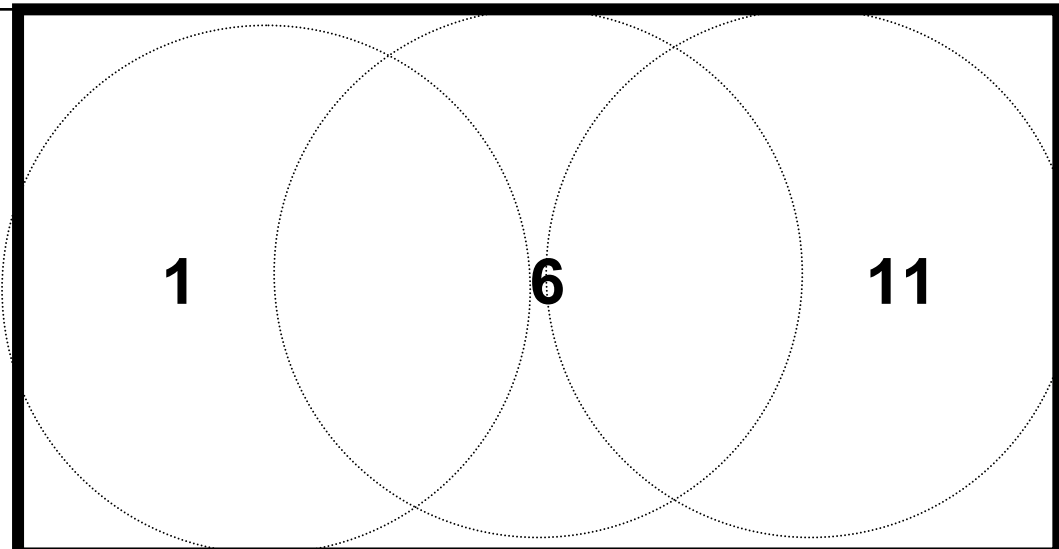


Channel Mapping

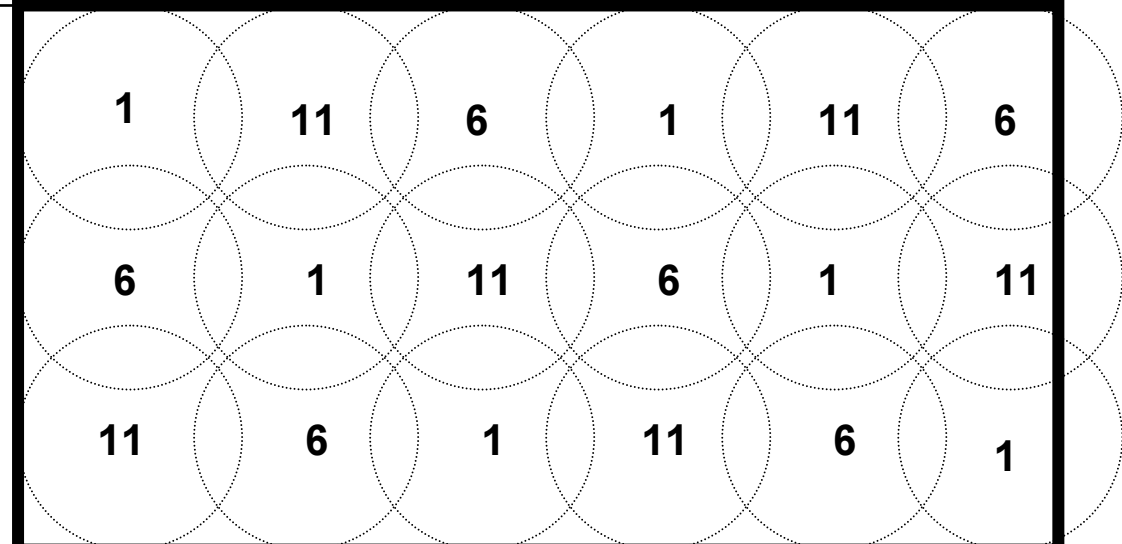


In-Building Design Considerations

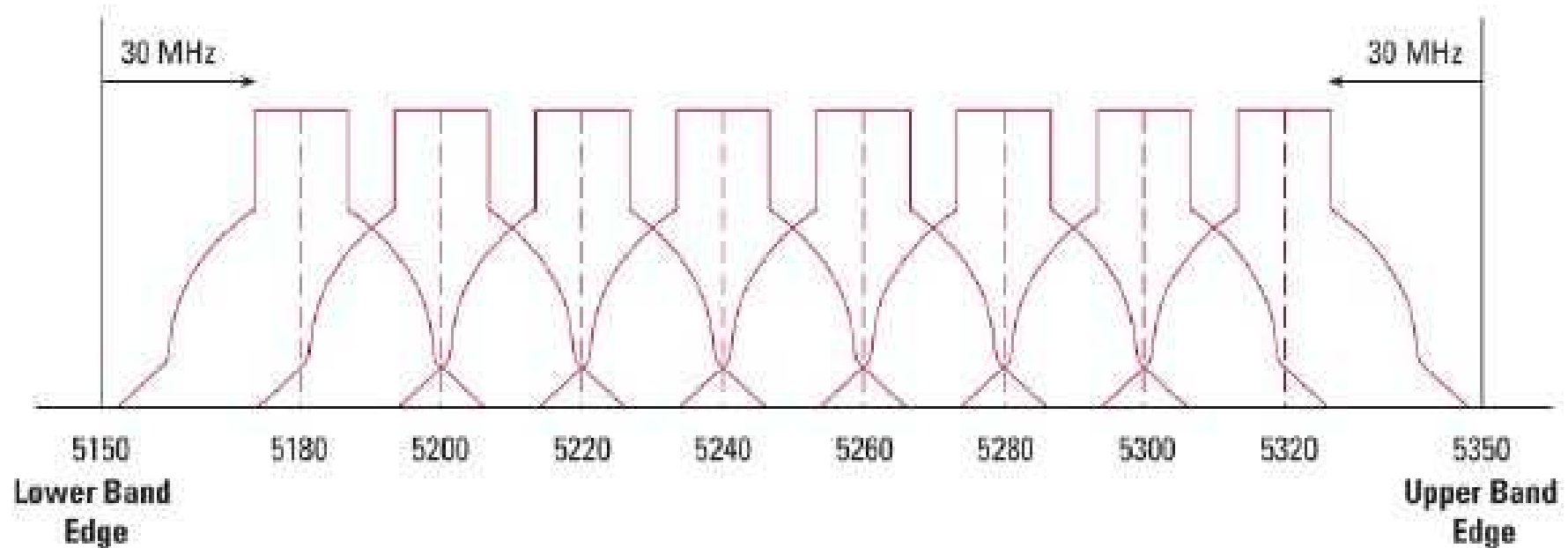
- 200 Users on the Floor
- Full Antenna Power: 30mW
- 3 Access Points
- 67 Users per AP of shared bandwidth



- 200 Users on the Floor
- Reduce Antenna power to 5mW
- 18 Access Points
- 11 Users per AP of shared bandwidth



IEEE 802.11a Channel Allocations



- 20 MHz Channel separation
- 60-MHz-wide stationary channels
- 12 nonoverlapping channels: 8 indoor, 4 outdoor
- 8 APs can occupy same area - set at different frequencies

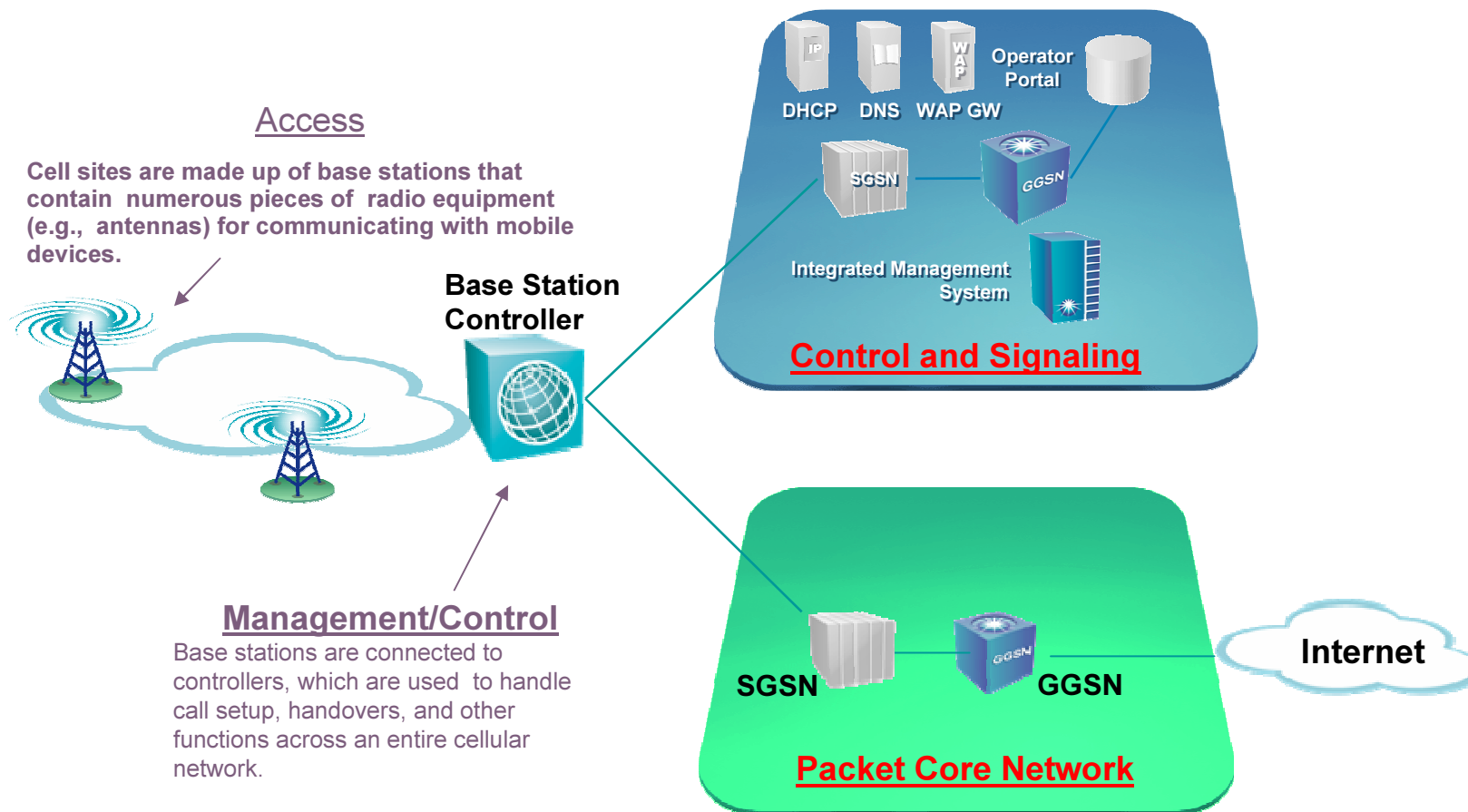
LWAPP

(Light Weight Access Point Protocol)



Lessons From Cellular Networks...

Access, Control, and Traffic Forwarding must be separated from one another to build scalable, reliable wireless networks



Management/Control

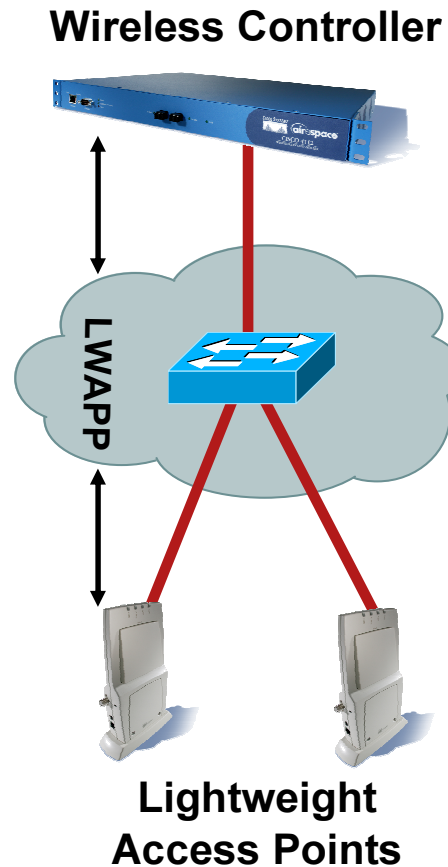
Base stations are connected to controllers, which are used to handle call setup, handovers, and other functions across an entire cellular network.

Centralized Controller and Lightweight AP Architecture

- Security policies
- QoS policies
- RF management
- Mobility management

Division of Labor
Split MAC

- Remote RF interface
- MAC layer encryption



Controller MAC Functions

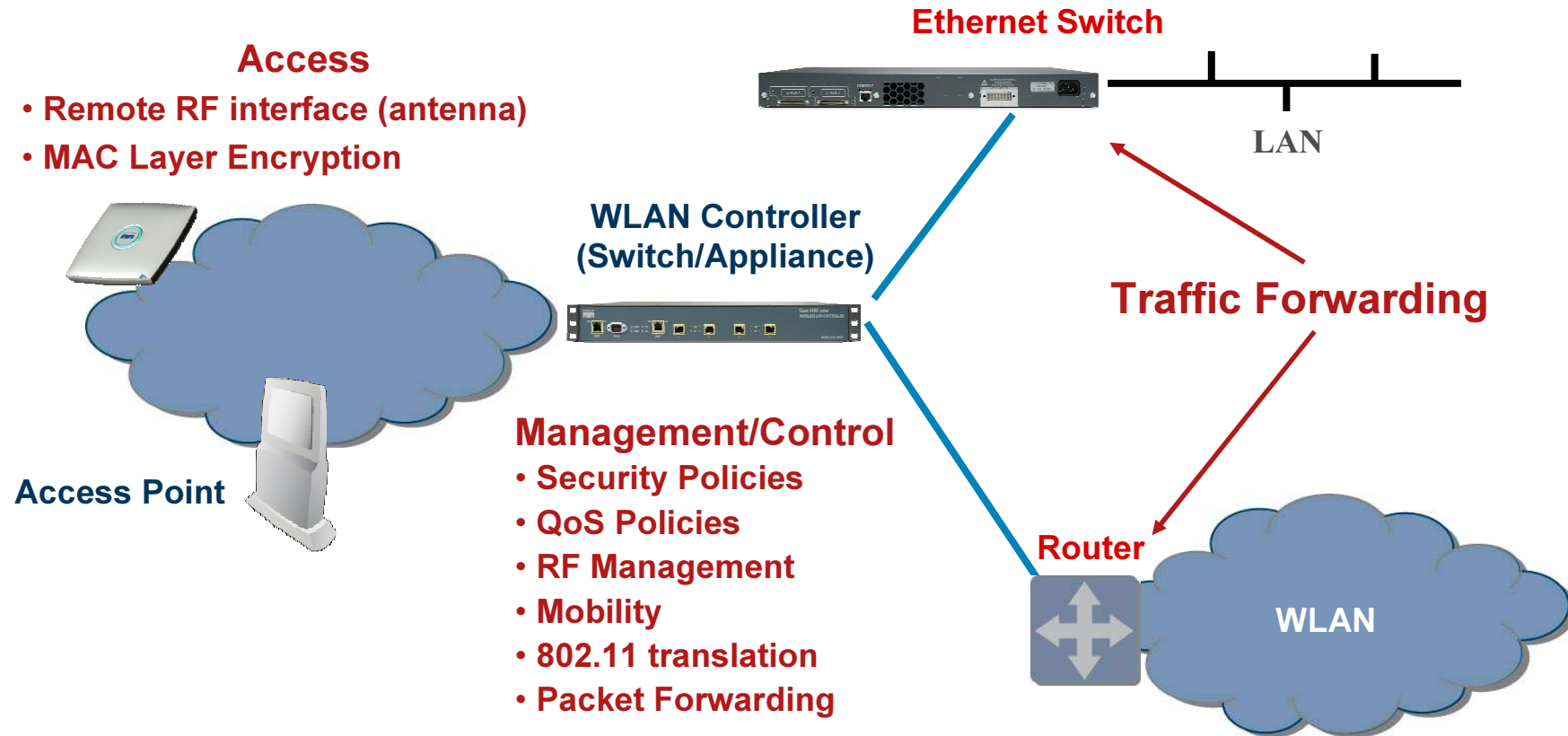
- 802.11 MAC mgmt: (Re)association requests and action frames
- 802.11 Data: Encapsulate and sent to AP
- 802.11e resource reservation: Control protocol carried to AP in 802.11 mgmt frames—signaling done in the controller
- 802.11i authentication and key exchange

AP MAC Functions

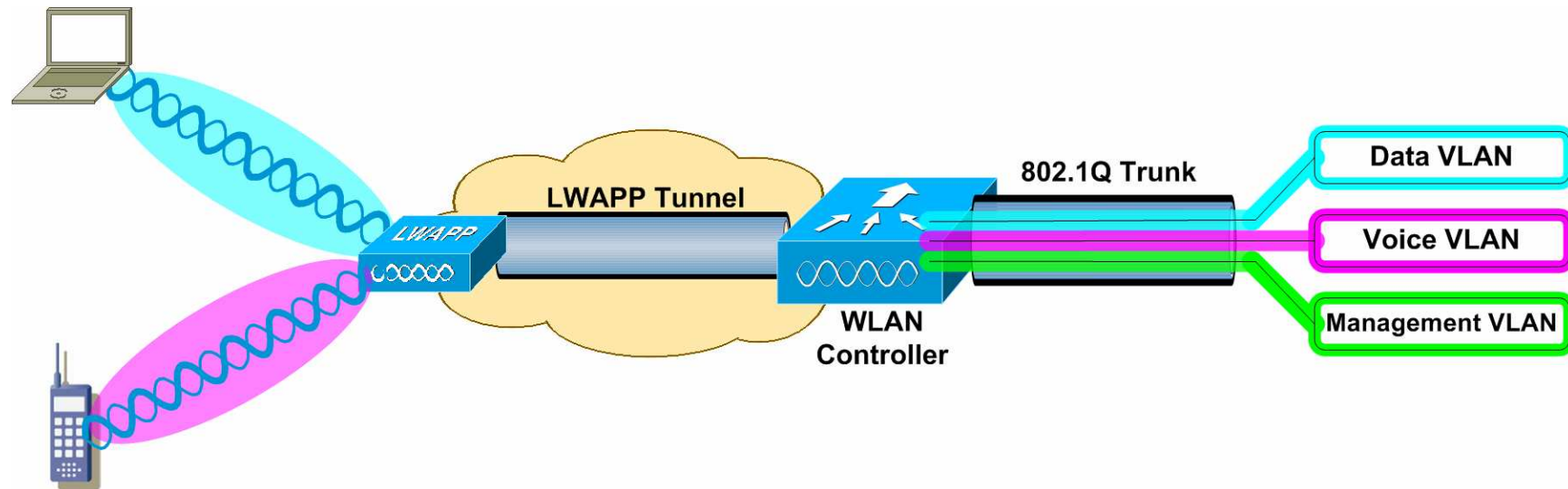
- 802.11: Beacons, probe response, auth (if open)
- 802.11 control: Packet ack and retransmission (latency)
- 802.11e: Frame queuing and pkt prioritization (access to RF)
- 802.11i: Encryption in AP

The Split Mac Architecture

Patented “Split MAC” Architecture for Optimal Performance and Function



Understanding WLAN Controllers—The WLAN Controller as a Network Device



- **WLAN Controller**

- For wireless end-user devices, the controller is a 802.1Q bridge that takes traffic of the air and puts it on a VLAN

- From the perspective of the AP, the controller is an LWAPP Tunnel end-point with an IP address

- From the perspective of the network, it's a Layer-2 device connected via one or more 802.1Q trunk interfaces

- **The AP connects to an access port—no concept of VLANs at the AP**

Cisco Unified Wireless Network



Mobilizing the Experience

Wireless LAN Mobility Services

Security



- Automatic, 24 x 7 security and compliance monitoring for breaches via wireless medium
- Network access control based on user location

Guest



- Guest networks for customers, partners and auditors
- Vendor replenishment networks
- Public access networks

Voice



- Real-time mobile voice communications
- Improved collaboration via mobile unified communications
- Faster customer service response

Location



- Asset management
- Location-based content distribution
- Streamlined workflow using historical location data

Pervasive Wireless Network

The Mobility Services Business Case

• **38% of companies have more than 20 guests per month that require network access¹**

(11% have more than 200 guests per month)¹



• **42% of companies indicated that IT spends more than 4% of its time looking for assets¹**

(8% spend more than 15% of their time)¹



• **55% of companies indicated that over 10% of their cellular bill is from calls originating on campus¹**

(15% have 50%+ of calls start on campus)¹

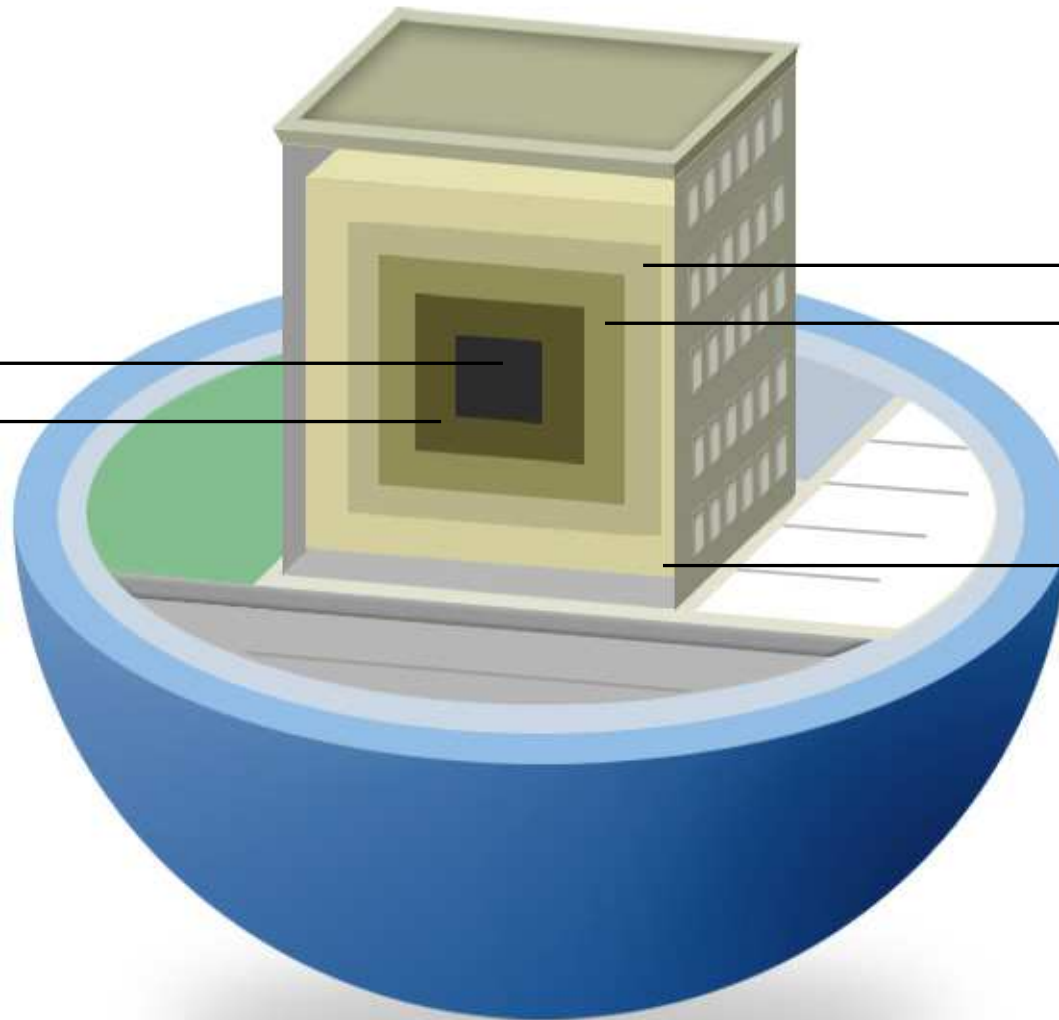


Source: From a commissioned study conducted by Forrester Consulting on behalf of Intel:
¹ WLAN Adoption Study, July 2006

Wireless Security Is Fully Covered

Physical
User and Device
Tracking;
Location Based
Security

RF
Coverage Area
and Interference
Avoidance



Data
802.11i; VPN;
Attack Signatures

User/Device
X.509; 802.1X
(RADIUS);
Web-Auth; IDS

Application
Network Access
Control; Firewall

Wireless Security Is Fully Covered

Physical
User and Device
Tracking;
Location Based
Security

RF
Coverage Area
and Interference
Avoidance



Data
802.11i; VPN;
Attack Signatures

User/Device
X.509; 802.1X
(RADIUS);
Web-Auth; IDS

Application
Network Access
Control; Firewall

Wireless Security: Authentication and Encryption

- **Encryption:**

- WEP**

- TKIP**

- CCMP-AES**

- **Authentication:**

- EAP-TLS**

- EAP-FAST**

- LEAP**

- PEAP-MSCHAP**

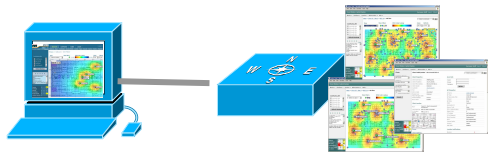
- PEAP-GTC**

- EAP-MD5**

- EAP-TTLS**

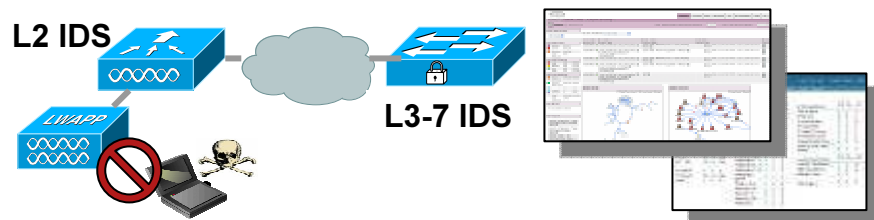
Cisco Unified Wireless Security Solution

End-to-End, Unified – Only Cisco



Fine-grained Mapping and Authentication

Location services enable precise mapping of clients and threats, allowing fine-grained authentication and quick removal.



Wired IDS Integration

Unified wired and wireless IDS ensures malicious wireless clients are disconnected from the network.



Cisco NAC Appliance

Wireless Endpoint Compliance

Cisco NAC prevents wireless endpoints from introducing viruses, spyware, malware, etc.



Wireless IDS/IPS

Comprehensive wireless threat identification and over-the-air prevention.



Offsite Endpoint Protection

Cisco Secure Agent detects and prevents offsite wireless threats such as ad hoc networks.

Guest Access Business Challenges

- Guests need access to network resources
 - 35% of companies have more than 20 visitors that require network access per month*
 - E-mail, price lists, presentations, demos, etc...
- Setting up wired access estimated @ 1 person-hour
 - IP address assignment
 - Guest device configuration
 - VLAN/switch port configuration

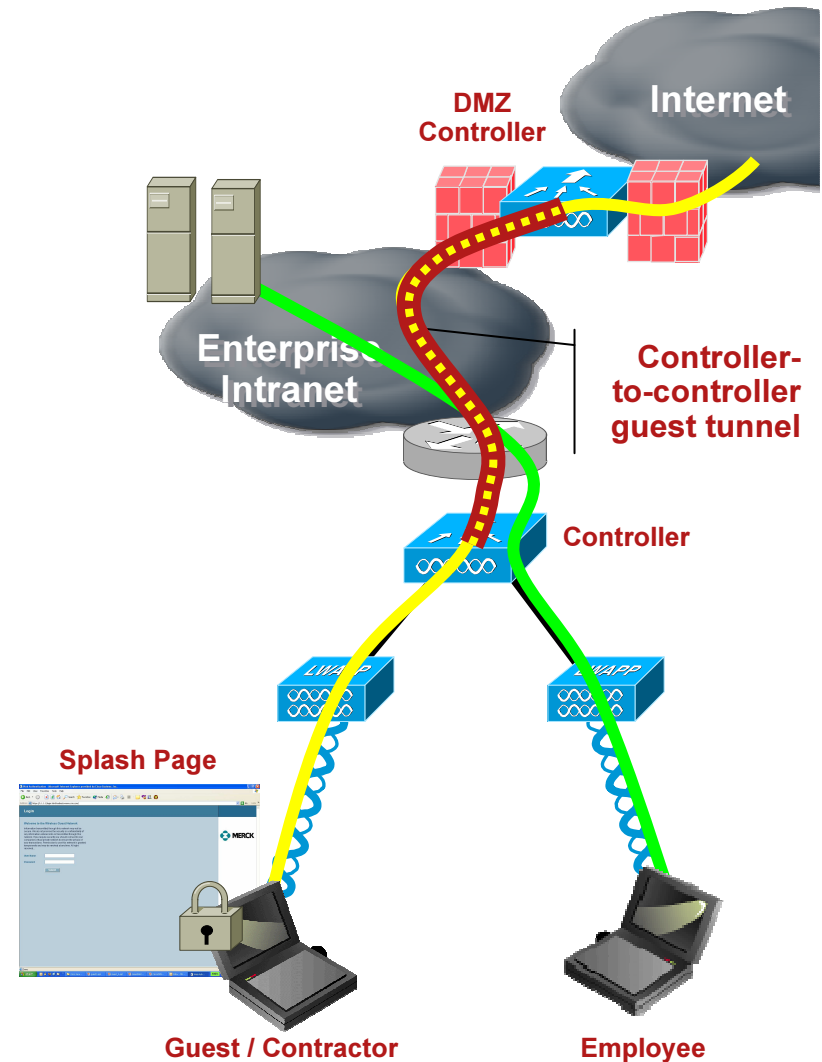


- Public Internet Access not feasible with wired only
 - Example: visitors to a store or outlet – must be wireless

* Source: Intel Wireless LAN Adoption Study; Forrester Research

Guest Services – Path Isolation

- Additional level of security
 - Guest traffic never mixes with enterprise traffic
- Controller-to-controller tunnel directs all guest traffic outside the firewall
- Guest controller applies policies to guests
- Internal corporate controller manages employee traffic
- Guest and Employee traffic is never on the same path



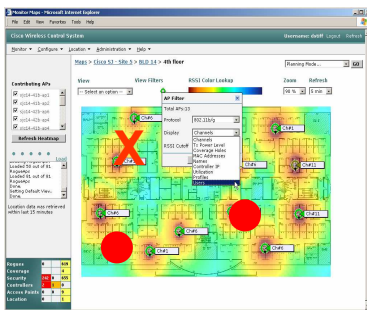
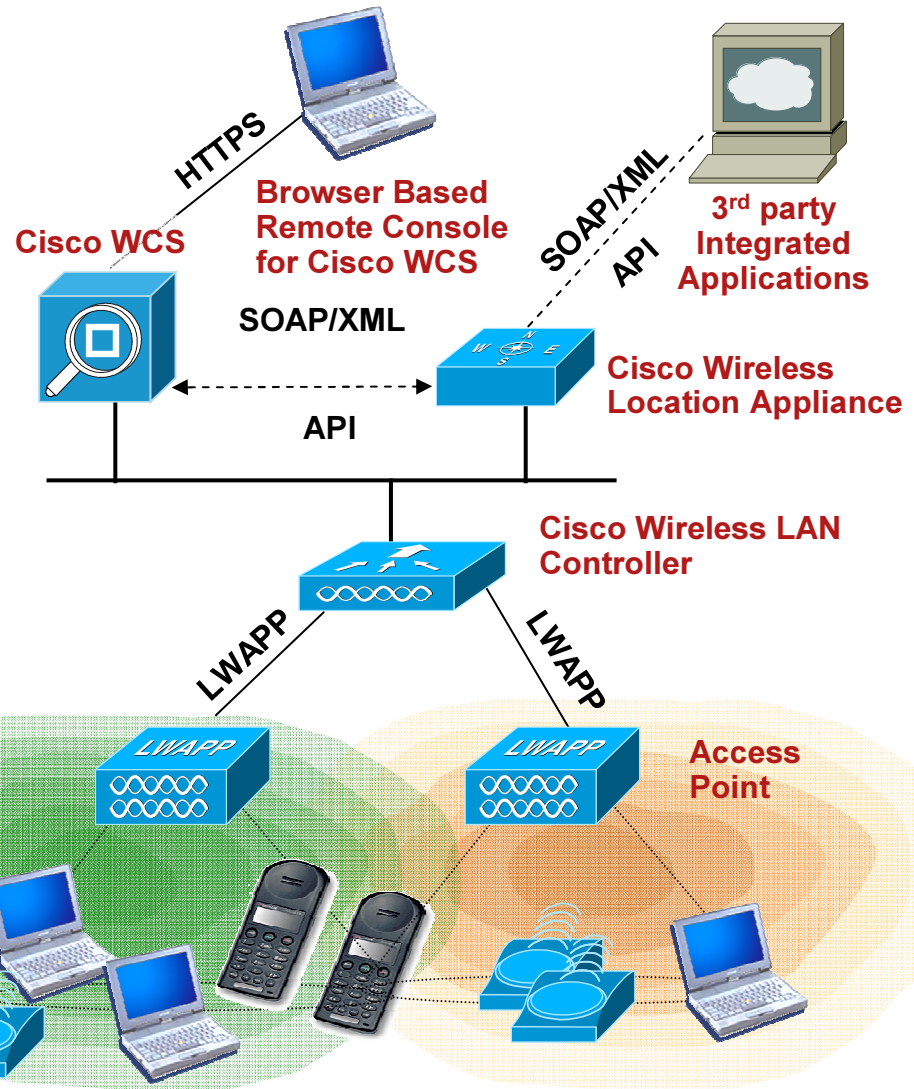
Cisco Unified Wireless Network Voice Services Solution

- Seamless mobile voice communications across the enterprise
- Only end-to-end unified wireline and wireless voice solution
- Rich selection of enterprise-class and industry specific voice clients
- Increased call capacity, higher network availability and improved performance



Cisco Unified Wireless Network Location Services

- 1st integrated location solution
- Advanced RF Fingerprinting for high accuracy location resolution within a few meters
- Rich location information available to 3rd party applications
 - E911, asset tracking, workflow automation, content distribution and retrieval
- Quick location of rogue access points and other wireless threats



Benefits of Unification



Optimizing Wireless Performance

Simple, Secure Client Connectivity

It All Starts with the Client

- **Over 90% of Wi-Fi silicon is Cisco Compatible**
- **Tested interoperability for business-class reliability**

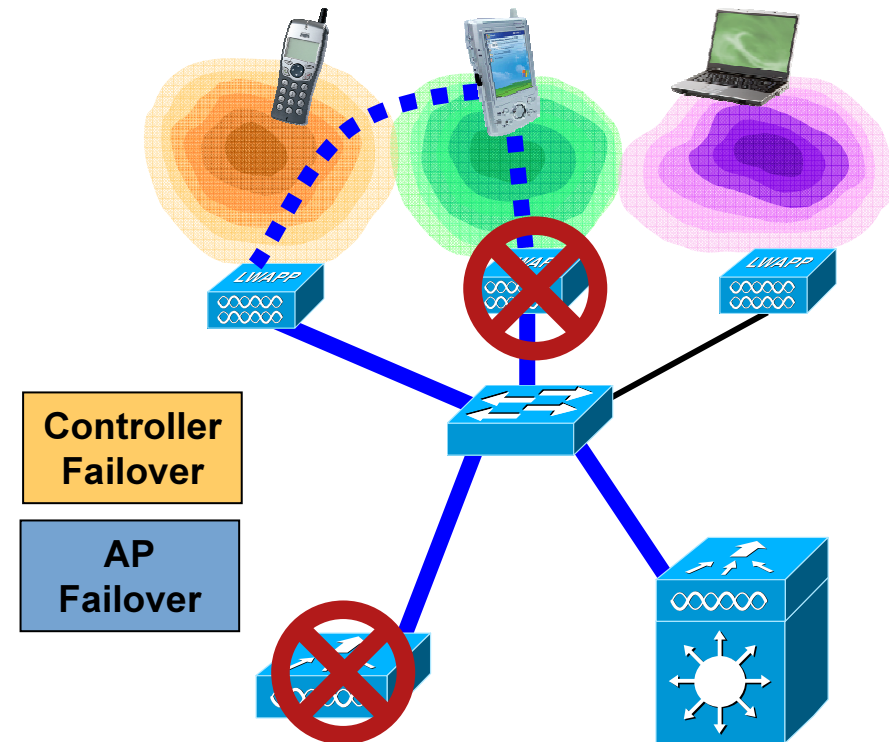


Benefits

- Simplified deployment of mobility services
- Tested compatibility with Cisco Infrastructure
- Accelerates new features while supporting standards
- End-to-end security

Business-Class Reliability for Mission Critical Mobility

- **Maximized system availability**
 - Controller redundancy
 - Access point failover
- **System level management automates failover to guarantee availability**



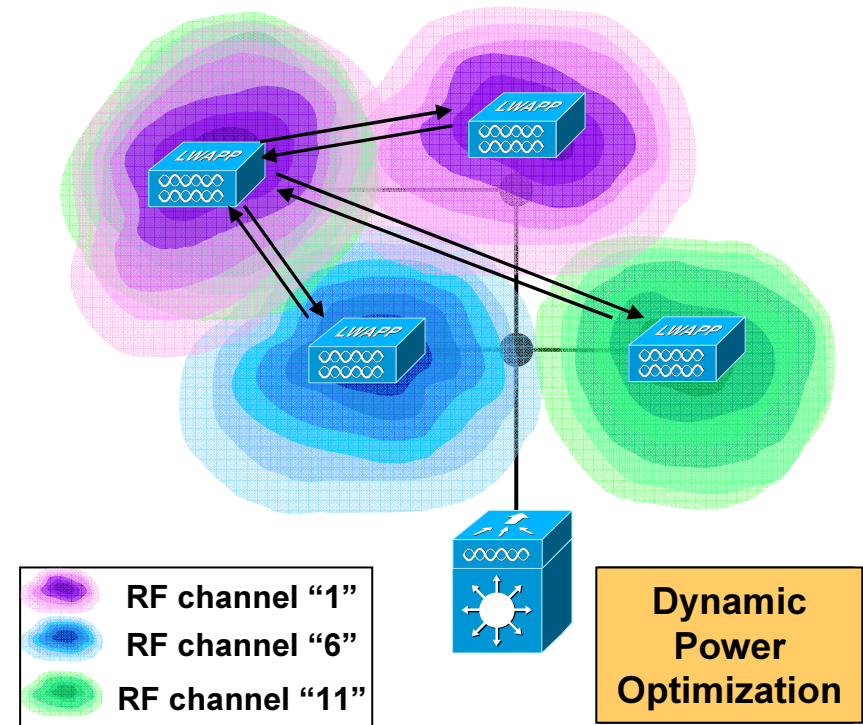
Benefits

- No single point of failure
- Automated network failover decreases support and downtime costs
- Wireless network reliability on par with wired

Radio Resource Management

Real-Time RF Management

- The RF domain is an ever changing environment
 - Users are mobile
 - Interference prone
- The controller has a system level view of the RF domain and adjusts individual access points to optimize coverage and network availability



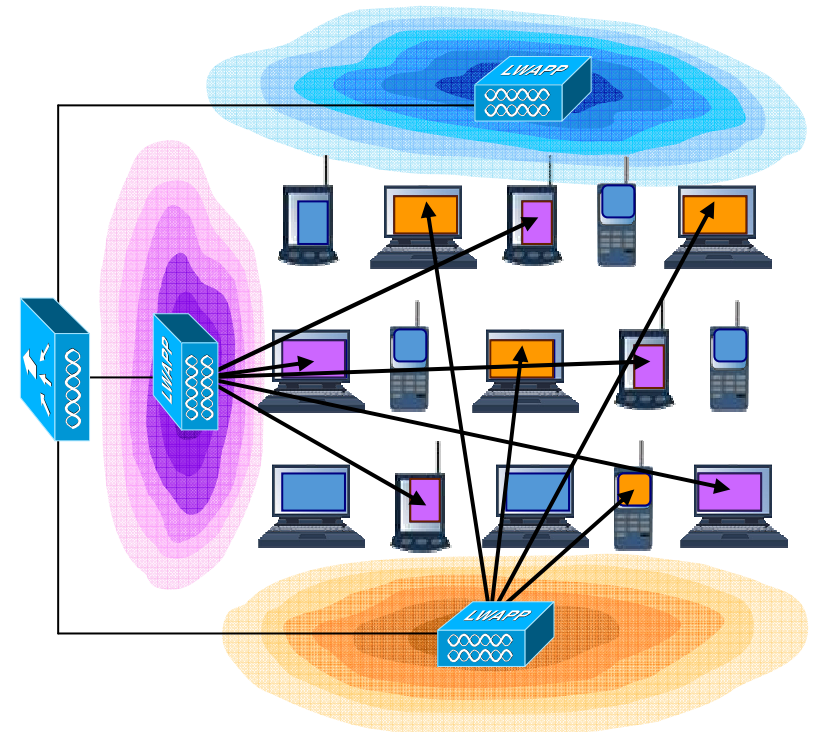
Benefits

- An optimized RF environment allows for superior application performance and higher network availability
- Complete RF management without specialized RF skills
- No RF recalibration required – decreased support costs

Radio Resource Management

Enterprise-Class Network Performance

- **Dynamic client load balancing**
- **Solving performance & capacity problems in high density areas**
e.g. conference rooms, cafeteria...
- **Clients and infrastructure determine optimal load balancing**



Benefits

- **Preserves application and network performance**
- **Guarantees bandwidth and lower latency for network sensitive applications (e.g. voice over IP)**
- **Decreased support costs; increased user satisfaction**

Cisco Unified Wireless Network



Product Portfolio

Cisco Compatible Extensions

The Standard for Client Advancement

Over 90% of client devices Cisco Compatible



Client Devices

Features

- Assured compatibility with 400+ devices
- Standards-based
- Enhanced security, mobility, and performance
- Supports Mobility Services i.e.. Location, voice

Benefits

- Accelerates innovation
- Supports diverse enterprise applications
- Ensures multi-vendor interoperability
- Enables simplified deployment of mobile WLAN clients

<http://www.cisco.com/go/ciscocompatible/wireless>

Single Client for Uniform Security and Services

- **Key Features:**

- **802.1X authentication for wired and wireless devices**

- **Windows XP/2000 support**

- **EAP:**

- **EAP-FAST, EAP-MD5, PEAP-MSCHAP, PEAP-GTC, EAP-TLS, EAP-TTLS, Cisco LEAP**

- **Encryption:**

- **WEP, Dynamic WEP, TKIP, AES**

- **Standards:**

- **WPA and WPA2**



Cisco Secure Services Client

Features

- Unified wired and wireless client
- Support for industry standards
- Endpoint integrity
- Single sign-on capable
- Enabling of group policies
- Administrative control

Benefits

- Reduces client software
- Simple, secure device connectivity
- Minimizes chances of network compromise from infected devices
- Reduces complexity
- Restricts unauthorized network access
- Centralized provisioning

Proven Platform for Mobile Access

Indoor Access Points



1130AG



1000



1121BG

Indoor Rugged Access Points



1240AG



1230AG

Outdoor Access Points/Bridges



1500



1400



1300

Access Points

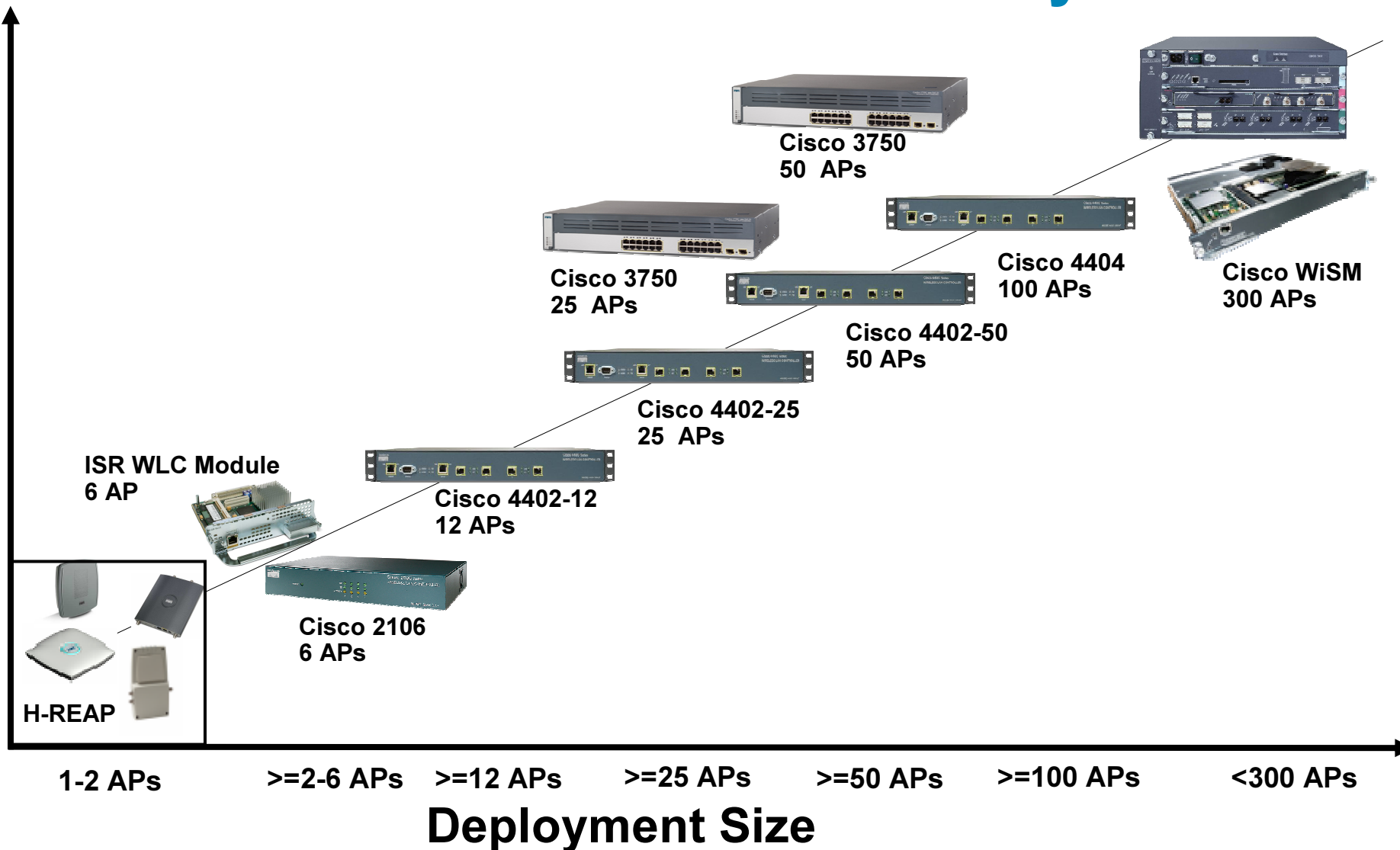
Features

- Industry's best range and throughput
- Enterprise class security
- Many configuration options
- Simultaneous air monitoring and traffic delivery
- Wide area networking for outdoor areas

Benefits

- Zero touch management
- No dedicated air monitors
- Supports all deployment scenarios (indoor and outdoor)
- From secure coverage to advanced services

Cisco Wireless Controller Family



Cisco Wireless Control System (WCS)



World-Class Network Management

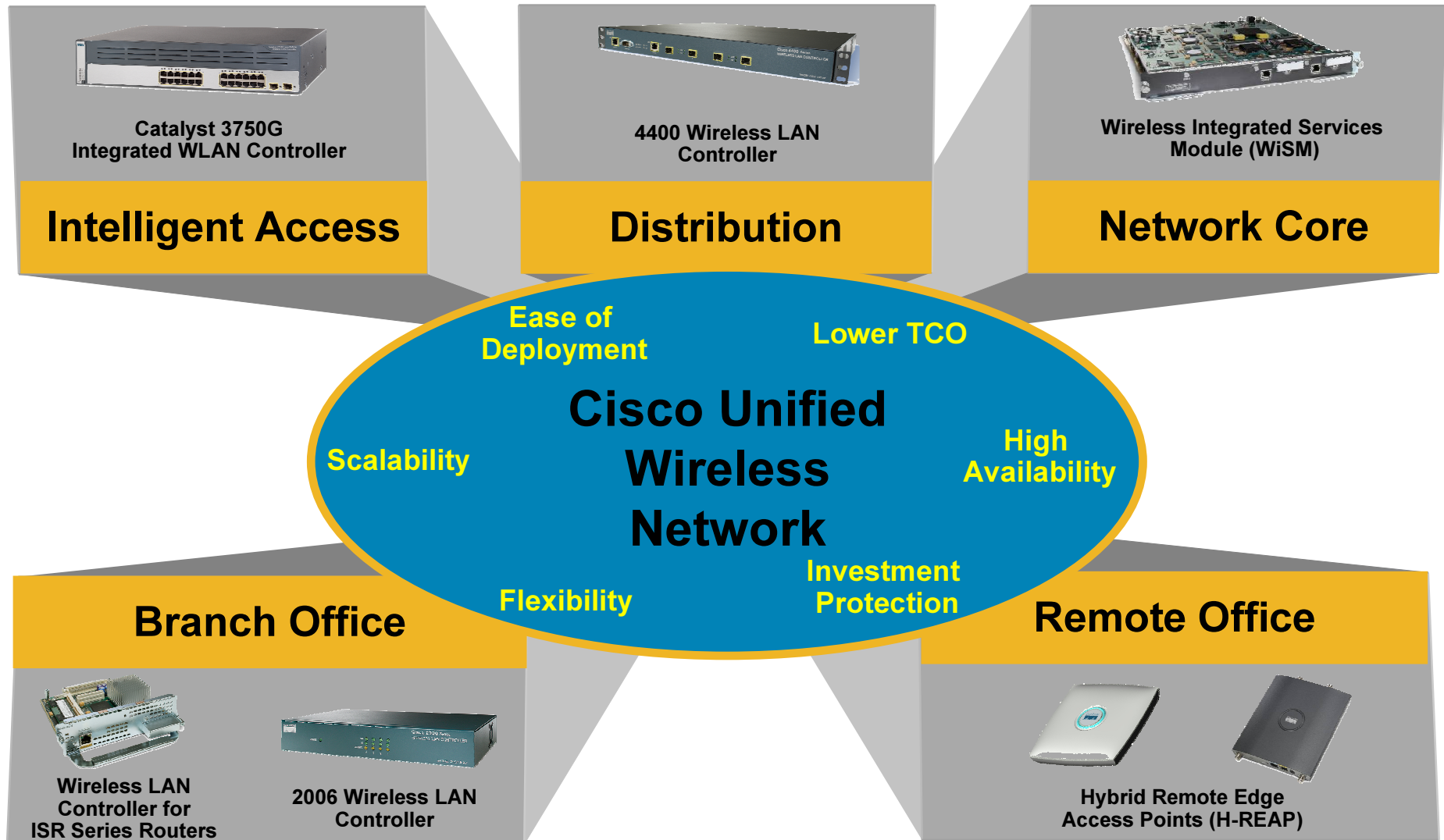
Features

- Client troubleshooting (via CCX)
- Planning, configuration, monitoring, location, IDS/IPS, and troubleshooting
- Hierarchical maps
- Intuitive GUI and templates
- Policy based networking (QoS, security, RRM, etc.)

Benefits

- Lower OPEX and CAPEX
- Better visibility and control of the air space
- Consolidate functionality into a single management system
- Determines location and voice readiness

Delivering Network Unification



Voice over WLAN

Requires end-to-end intelligence



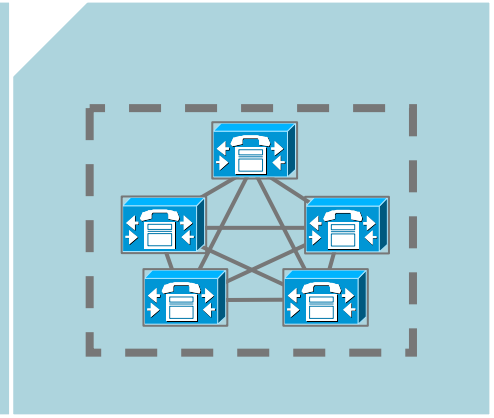
VoWLAN Clients



Voice Ready WLAN Infrastructure



Unified Wired/Wireless LAN Infrastructure



Cisco CallManager & Mobility Applications

Today

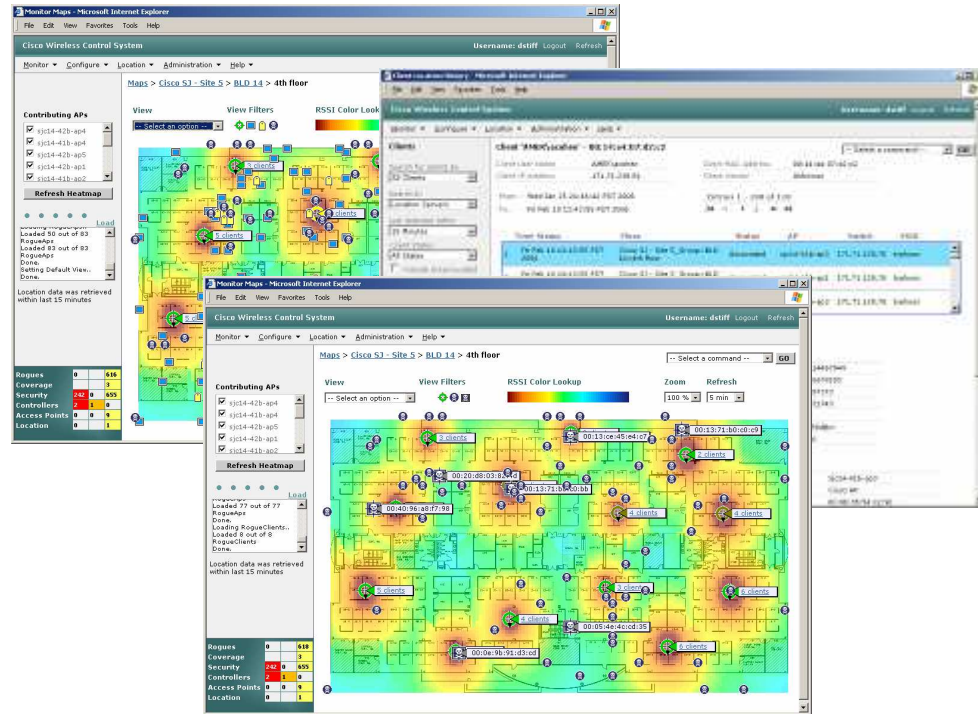
- Comprehensive on campus solution
- Dedicated clients, soft phones
- CCX enables QoS, Fast Secure Roaming
- IEEE 802.11b easy to use wireless IP phone
- Pixel display provides intuitive access to features and applications

Future!

- Mobility on / off campus
- Dual 802.11 and cellular phone
- Partners: Nokia, RIM
- Additional voice clients

Location Tracking Services

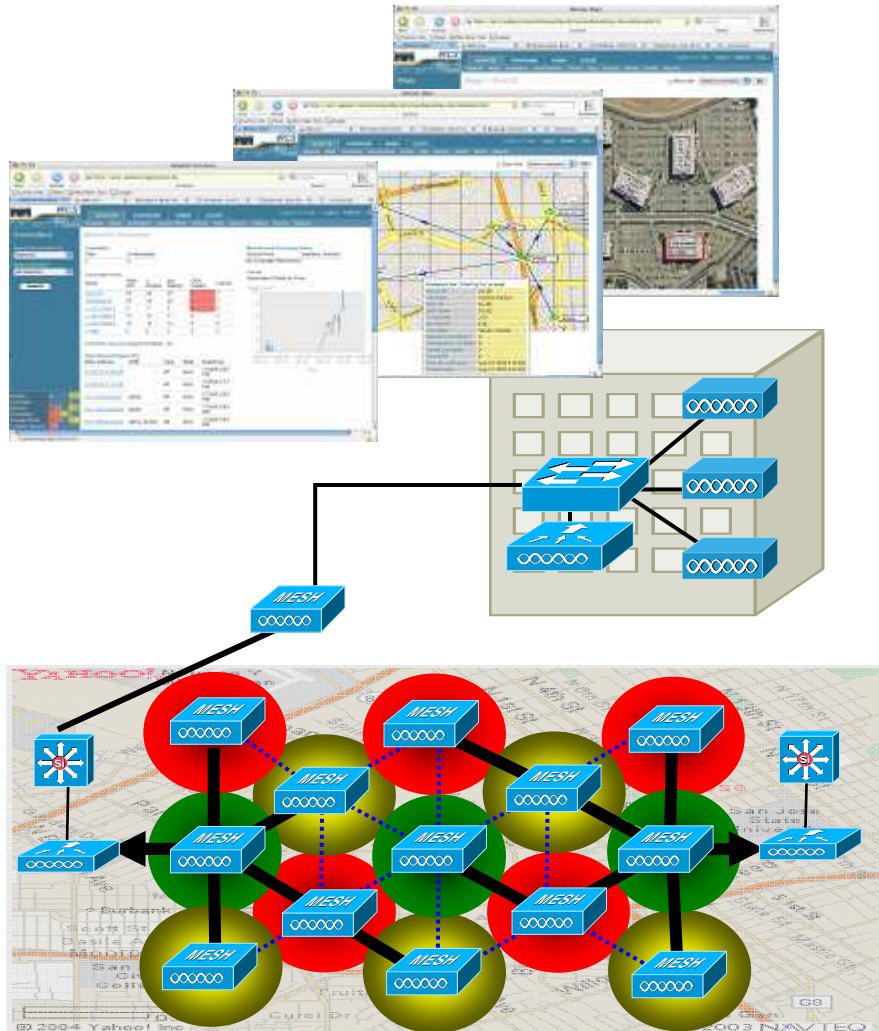
- 1st integrated location solution
- Real-time location services
 - Asset tracking
 - Rogue AP and device location
 - E911 services
- Advanced RF fingerprinting for greater accuracy
- Simultaneous real-time tracking 10,000+ devices
- API Third Party Applications
- RF capacity management
- Intuitive management GUI



Cisco 2700 Series Wireless Location Appliance



First Unified Indoor and Outdoor Wireless Solution



- Cisco Wireless Mesh Solution
- Single management platform eases deployment and ongoing maintenance
- Self-Configuring, Self-Healing
 - Zero-Touch Configuration
 - Cisco's new Adaptive Wireless Path (AWP) Protocol
- Engineered with Ease of Deployment and Management as Top-of-Mind
- Robust Embedded Security
- Seamless Mobility
- Deployment
 - Point-to-Point Bridging
 - Point-to-Multipoint Bridging
 - Outdoor Wi-Fi Extension
 - Wireless Mesh Networking

Cisco on Cisco

A case study on ubiquitous deployments

- Cisco end to end solution

- 3100+ Access Points
- 60,000 wireless clients
 - 2,000 wireless VoIP phones
 - 10,000 wireless PDAs



- Ubiquitous coverage

- 380+ Sites in 85+ Countries

- Mobility Services

- Voice over WLAN
- Guest Services
- RF IDS / Rogue AP detection



Proof Points

- 43% use the WLAN as their PRIMARY network
- 30% say WLAN is critical to job
- 50% say WLAN is highly useful to job

User Experience

- 70% rate WLAN service as good or excellent
- 28% want more coverage
- 25% want more bandwidth

*Source: Internal Cisco IT Survey
7000 Employees surveyed
March, 2006*

Cisco Advantage



Proven Solutions

Shaping the Industry

- Wi-Fi Alliance founding member



- Initial author of 802.11 and LWAPP (and subsequent resources on the subject)



- Chair of numerous IEEE Committees (802.11i, 802.11r, 802.11m)

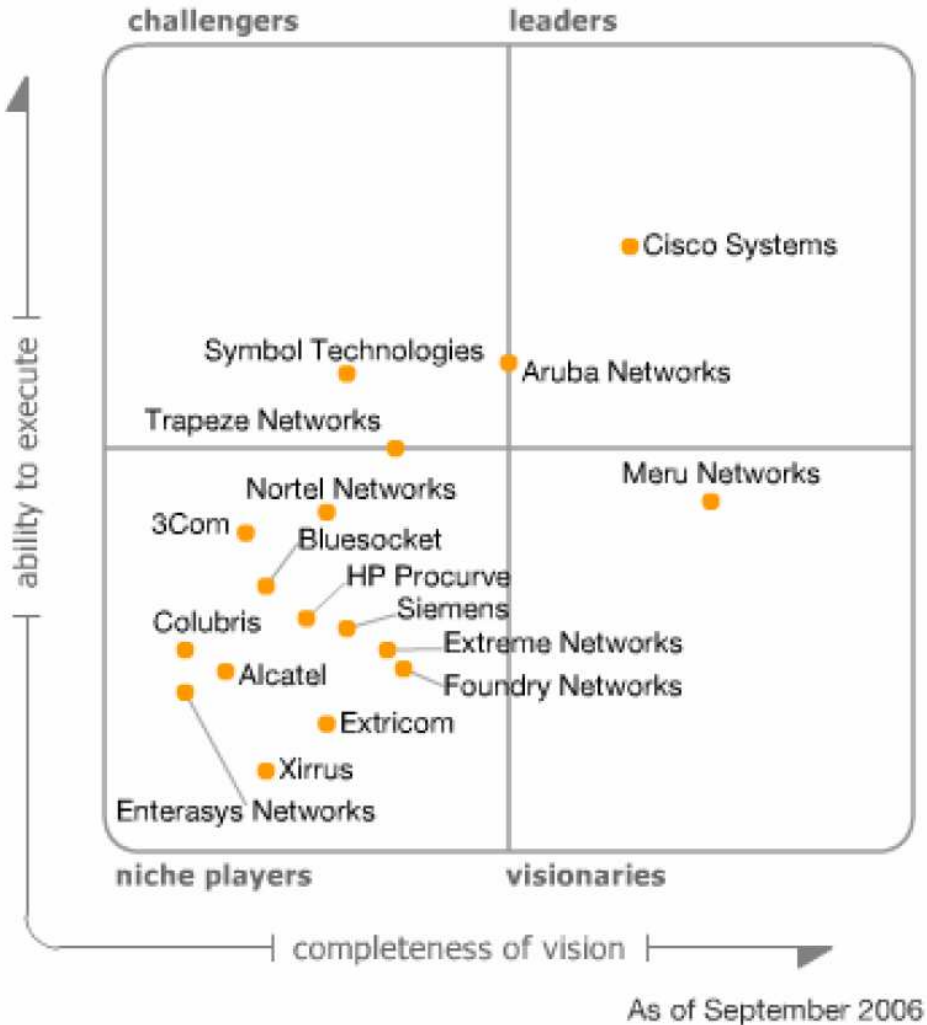


Proven Customer Track Record

- Close to 4 Million Cisco APs deployed worldwide
- 128,000+ Cisco WLAN customers worldwide
- 95% of Fortune 500 companies use Cisco products
- Largest Cisco deployment with dual-band APs at 1,200 Home Depot stores
- Cisco ranked Top 10 Most Powerful Networking Company by Network World
- Cisco # 1 for Innovations In IT by InformationWeek 500

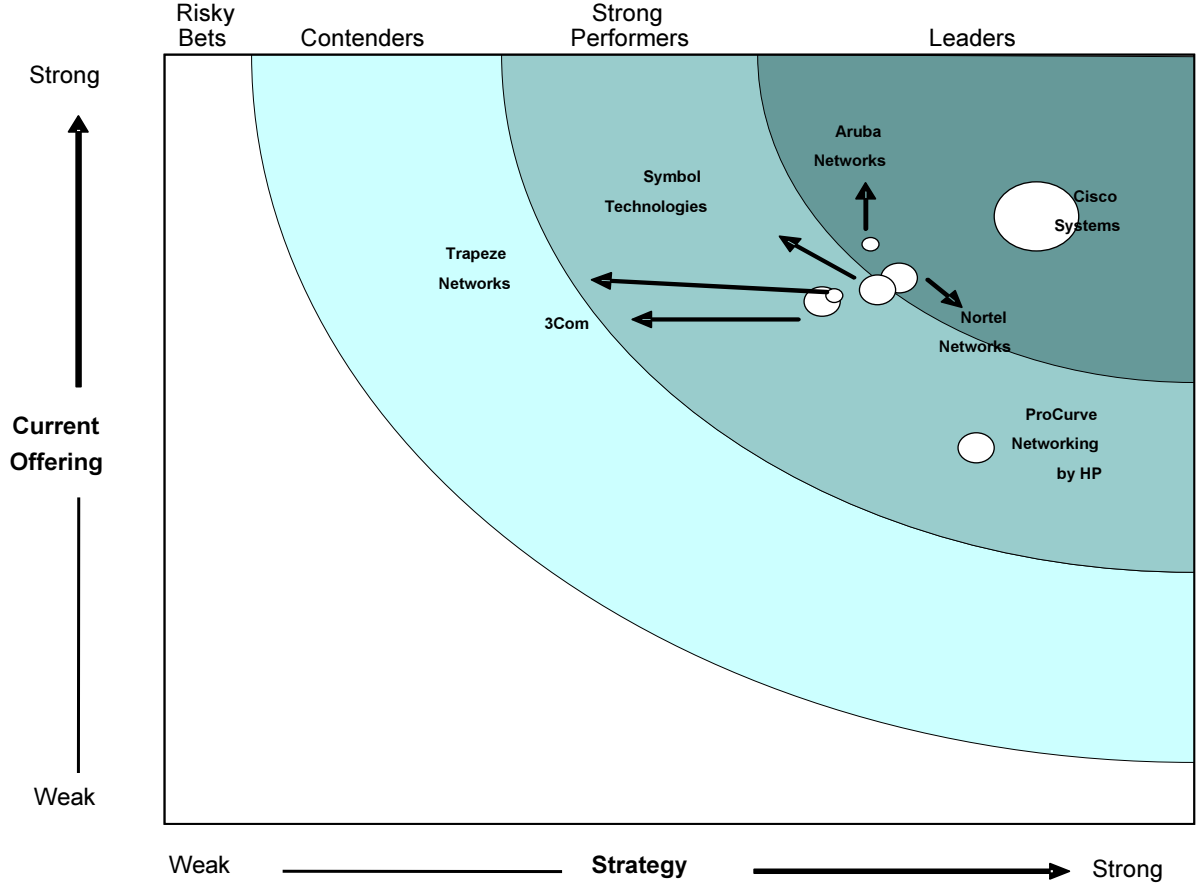


Gartner – Magic Quadrant WLAN Solutions



Source: Gartner Dataquest (September 2006)

Forrester Research WLAN Solutions Scorecard



© 2005, Forrester Research, Inc. All rights reserved. Forrester, Forrester Oval Program, Forrester Wave, WholeView 2, Technographics, and TechRankings are trademarks of Forrester Research, Inc. All other trademarks are the property of their respective companies. Forrester clients may make one attributed copy or slide of each figure contained herein. Additional reproduction is strictly prohibited. For additional reproduction rights and usage information, go to www.forrester.com. Information is based on best available resources. Opinions reflect judgment at the time and are subject to change.



The Consumer Reports of Our Industry

- Network Computing ran a front page article, “Why Not Cisco?”
- Key endorsement of the Cisco wireless strategy and product capabilities
- “Sooner or later, a pervasive, manageable, secure wireless LAN will be table stakes for enterprises.”

*Dave Molta
Network Computing*

Network
Computing
For IT By IT

WHY **NOT** CISCO



The Right Pieces for Success

- Global Support Organization
 - 24-hour, global access to a team of expert engineers
 - 120 countries geographic coverage
 - Technical Support Services - 390+ CCIEs
 - Onsite field engineers
- Global Partnerships
 - 200,000 World Wide Partners
 - 4000 Specialization Badges
 - IBM, Intel, HP, EDS, CG&Y, Microsoft
- Full Services Portfolio - Lifecycle Support
 - Advisory Services
 - Advanced Services
 - Technical Support Services



Cisco Market Statistics

59% WLAN Market Share = 6.5 times more share than nearest competitor (Symbol)



Cisco will remain the leader

Cisco spends more on Wireless R&D than the combined revenue of our two top competitors



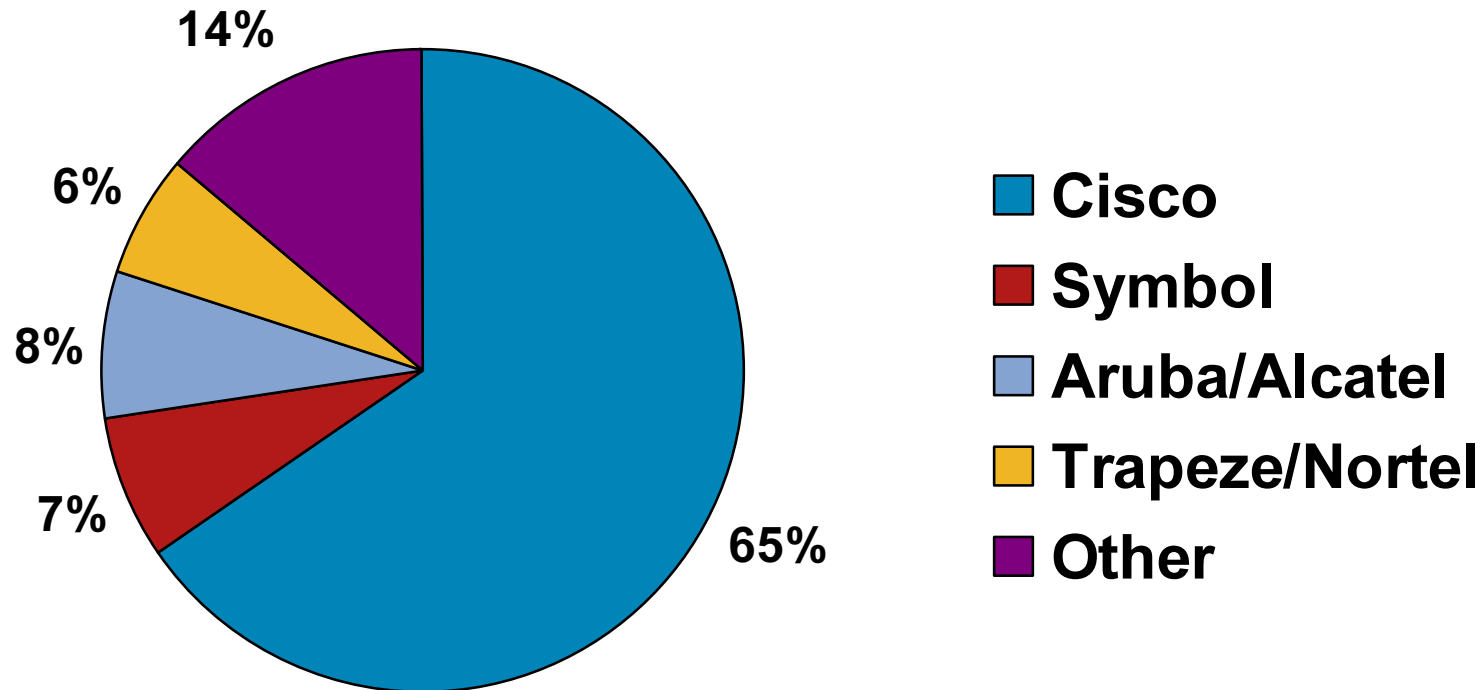
Cisco will continue to securely innovate

Top 3 Cisco Advanced Technology with continued focus on WLAN growth



Cisco will deliver what customers need

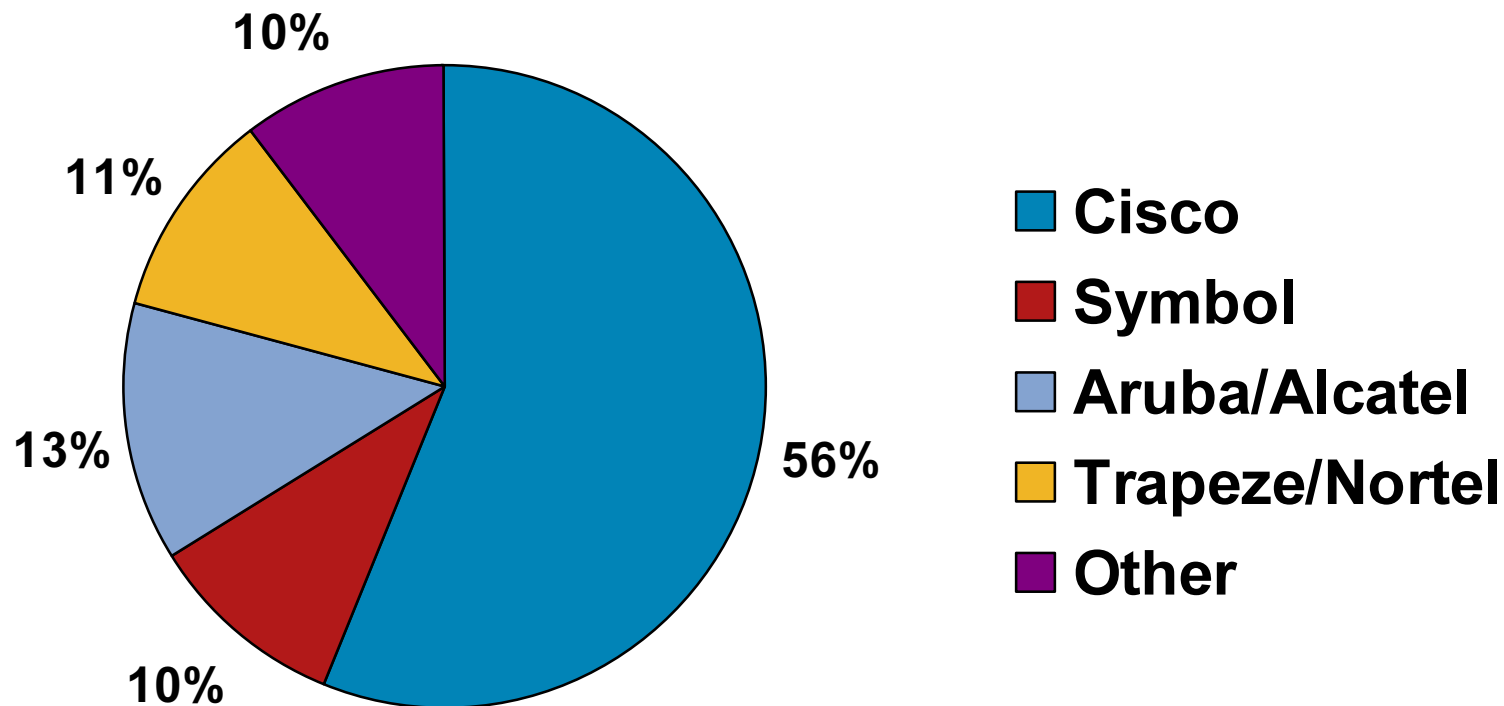
Enterprise WLAN Market Share – Q3 CY 2006



- Cisco: 35% q/q growth; 56% y/y growth
- Cisco: 6% market share gain q/q,

Source: Dell'Oro Group, Cisco --- Enterprise Access Points, Wireless Switches and Controllers

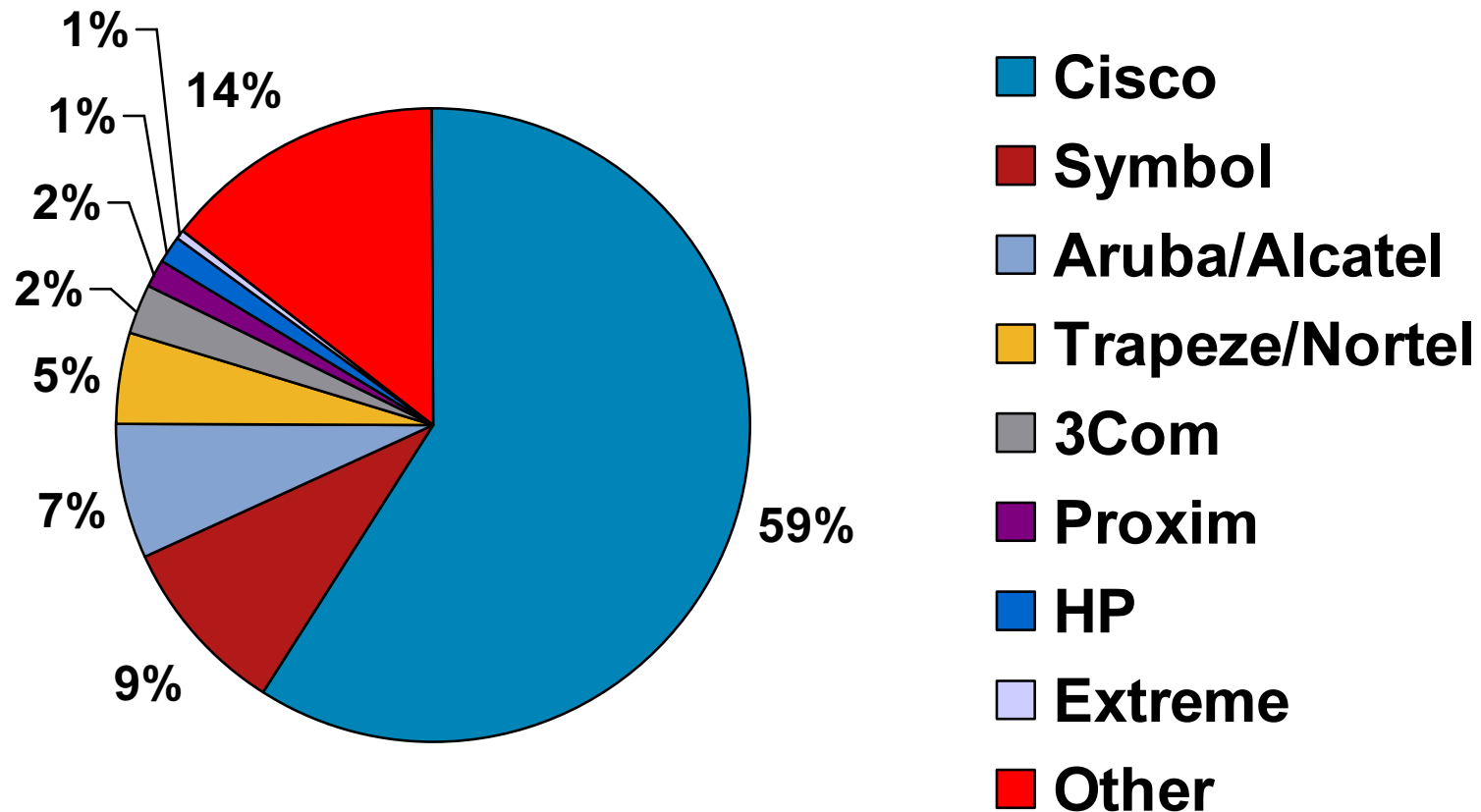
Controller Market Share – Q3 CY 2006



- Cisco achieves breakthrough market share gains (16% q/q, 34% y/y)

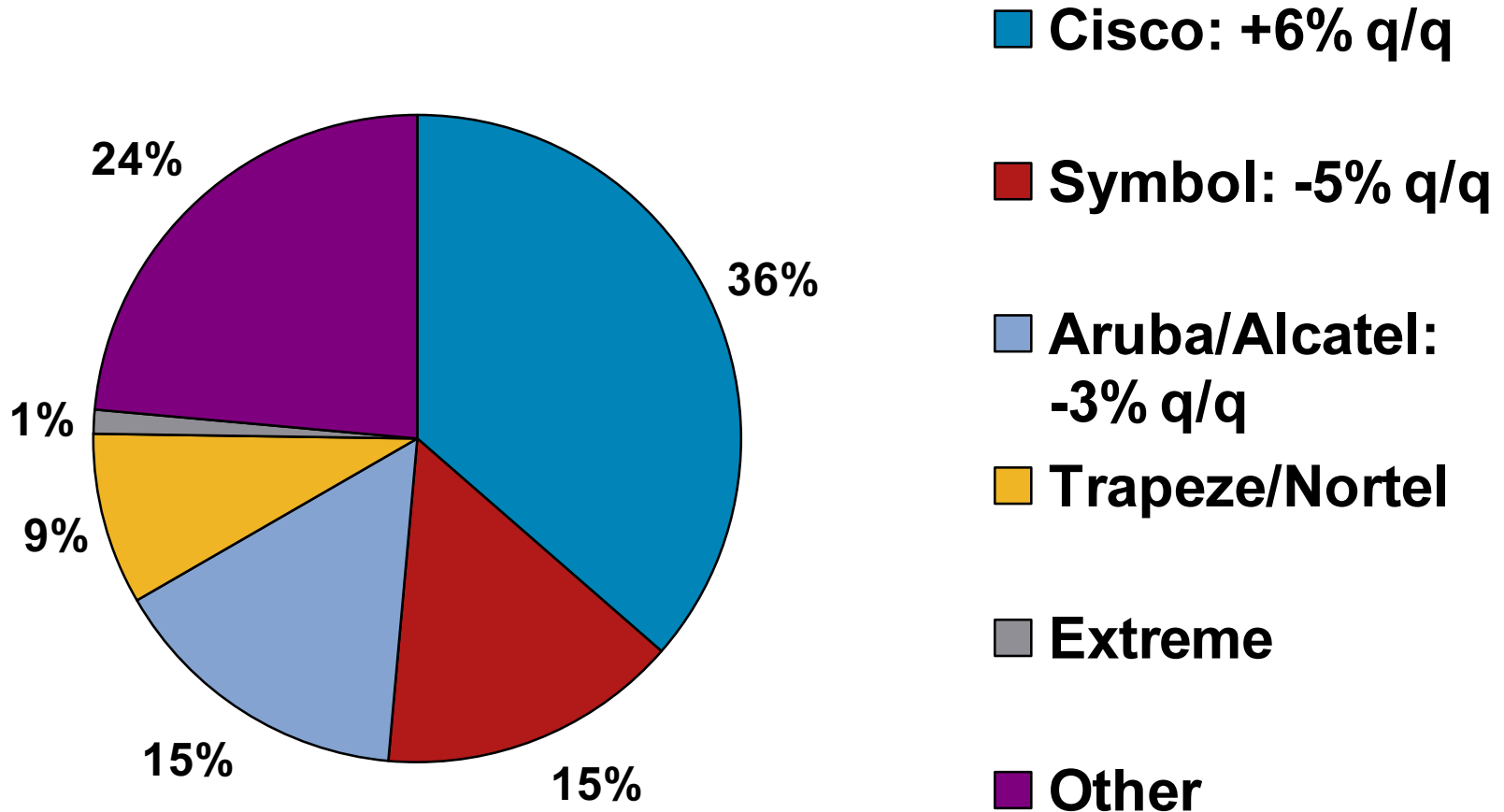
Source: Dell'Oro Group, Cisco --- Enterprise Access Points, Wireless Switches and Controllers

The Enterprise WLAN Market Leader: Q4 CY 2005



Source: Dell'Oro Group, Cisco --- Enterprise Access Points, Wireless Switches and Controllers

Expanding WLAN Controller Market Share: Q4 CY 2005



Source: Dell'Oro Group, Cisco --- Wireless Switches and Controllers

Most Publicly Recognized Industry Platform

Product Awards



Head-to-Head Bakeoffs



Best of Show



The Cisco Wireless Strategy

