Designing Wireless Networks with Controllers

Identifying Wireless Networking Considerations

Reasons for an RF Site Survey

- Defines RF characteristics in the environment:
  - Discover RF coverage areas.
  - Check for RF interference and issues.
  - Provide RF spectrum analysis.
  - Determine appropriate placement of wireless infrastructure devices.
- Helps define customer requirements

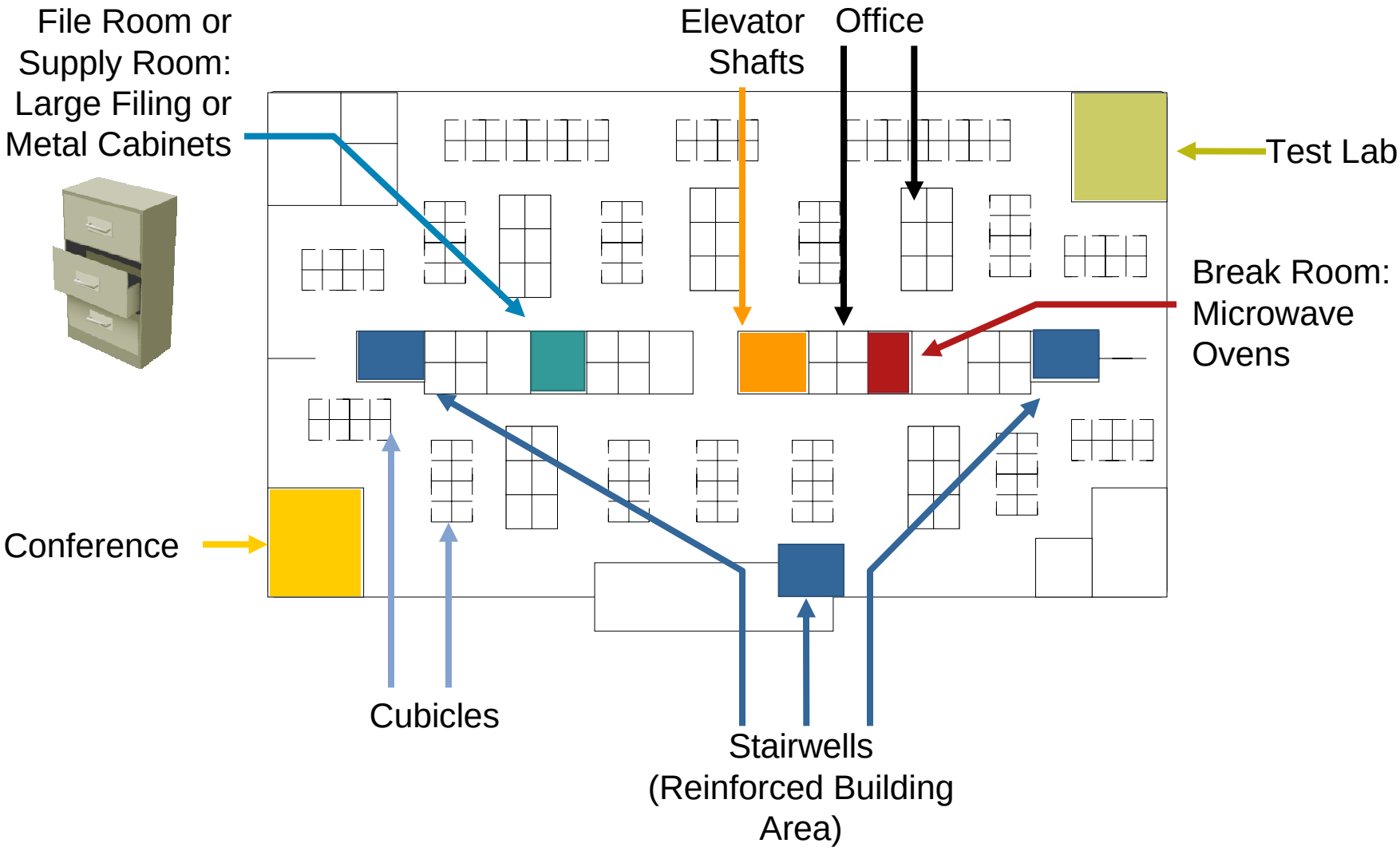
RF Site Survey Process

1. Define customer requirements.
2. Identify coverage areas and user density.
3. Determine preliminary access point locations.
4. Perform the actual surveying.
5. Document the findings.

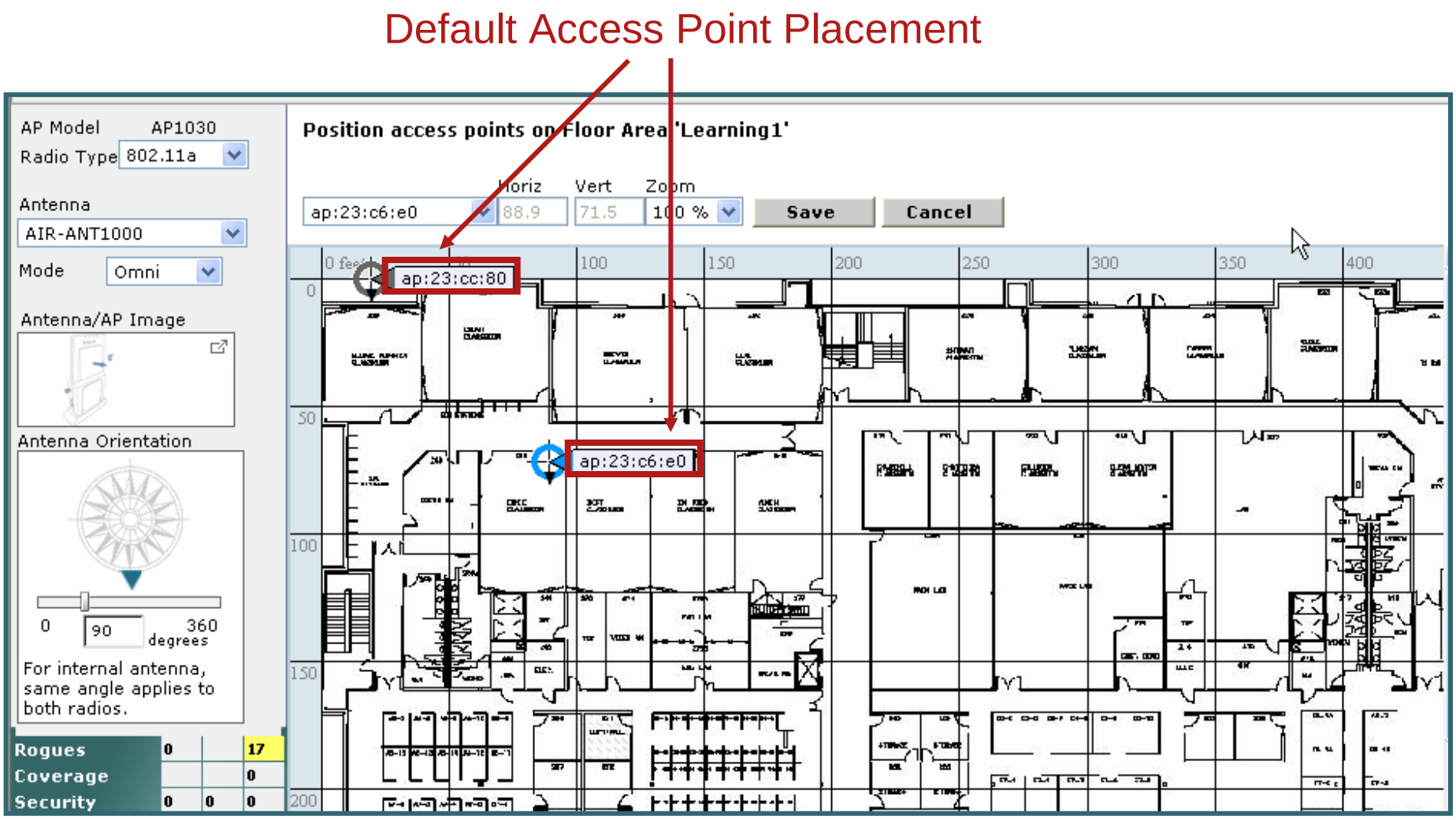
RF Site Survey—Customer Requirements

- What type and number of wireless devices need to be supported?
  - Is there current WLAN or RF equipment in place?
  - Will the WLAN be used only for data?
  - Will wireless phones be supported in the future?
  - Are there peak periods to support?
- Will users be stationary or on the move while using the WLAN?
- Where should wireless coverage support be provided?
- What level of support should be provided?

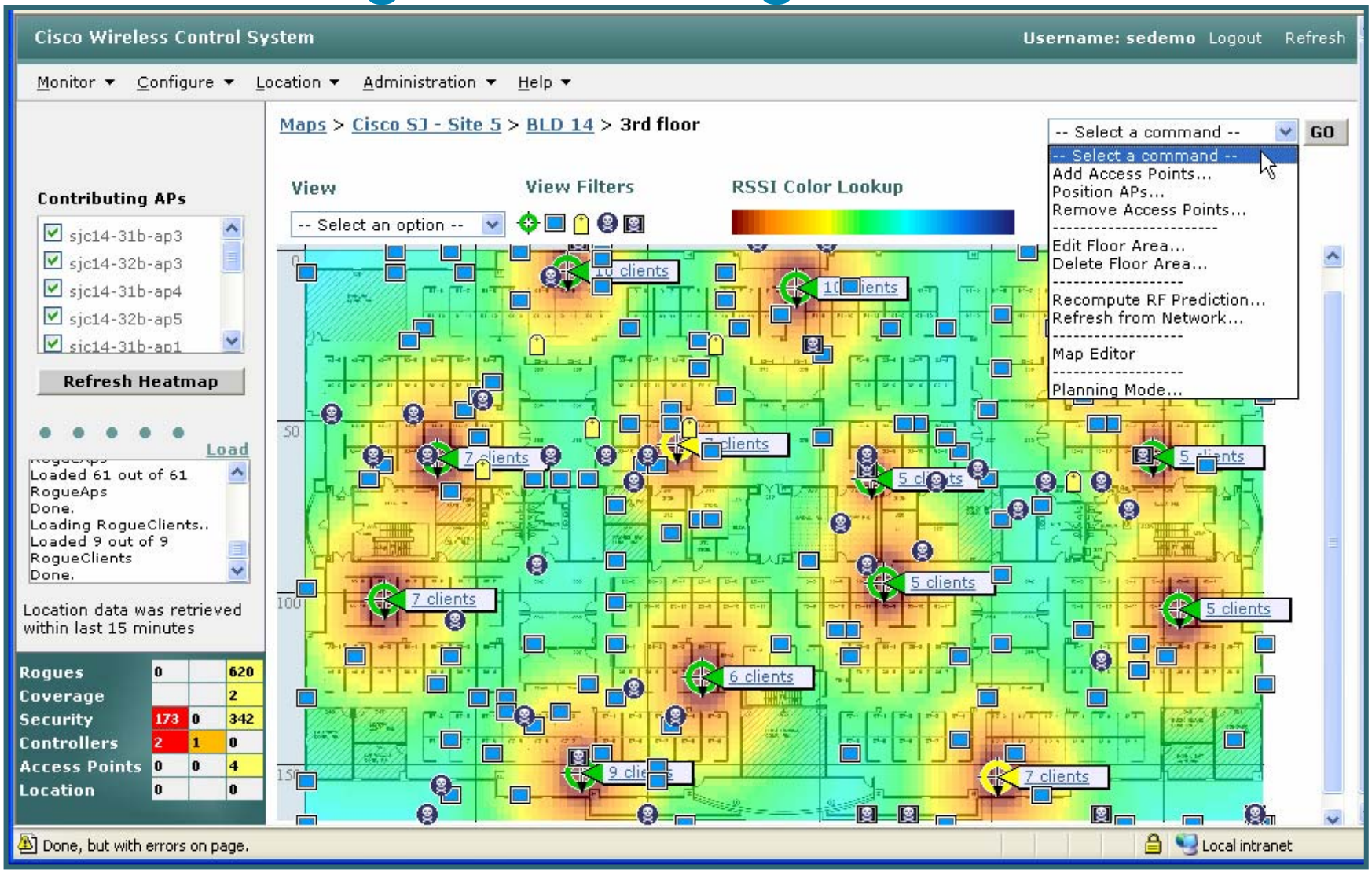
RF Site Survey—Identifying Coverage Areas



Determining Preliminary Access Point Locations



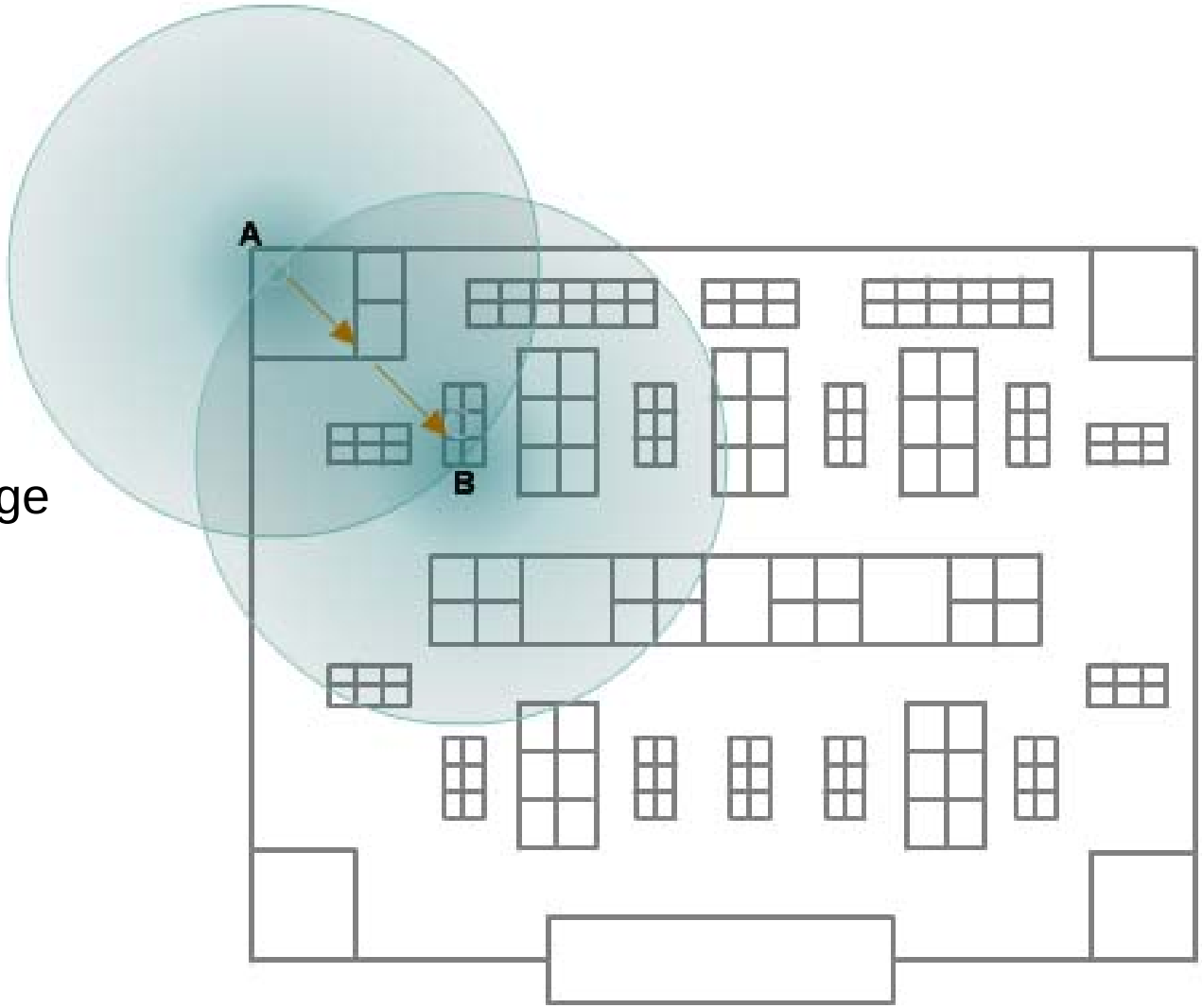
Visualizing RF Coverage



Performing the Site Survey

Use tools and processes to determine coverage:

- Estimate the access point needed using planning.
- Measure attenuation at the corner and edge of coverage areas.
- Determine the coverage range.
- Build the WLAN coverage.
- Identify coverage holes.

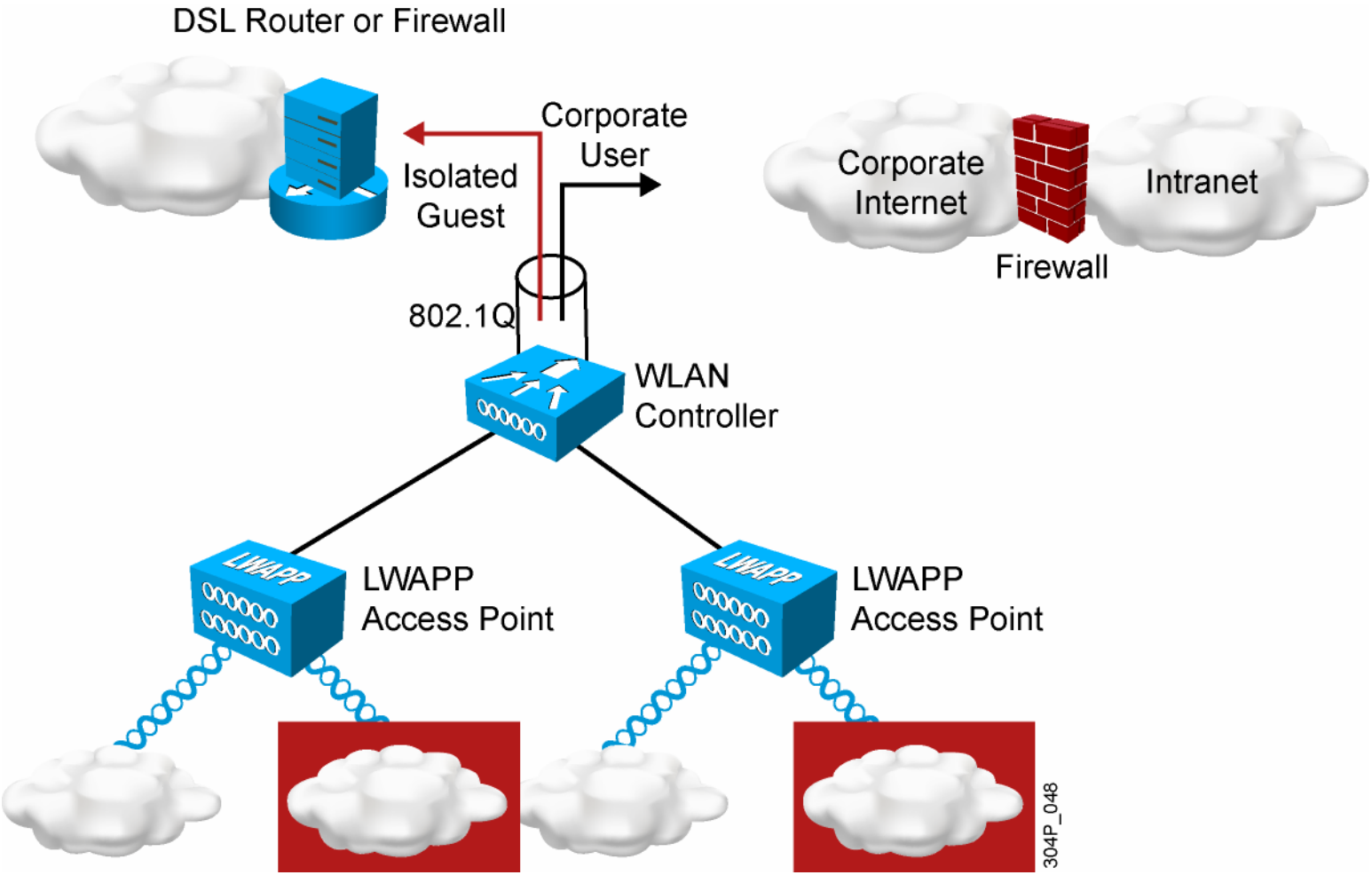


Site Survey Report

All information gathered and developed during the site survey should be included in the report:

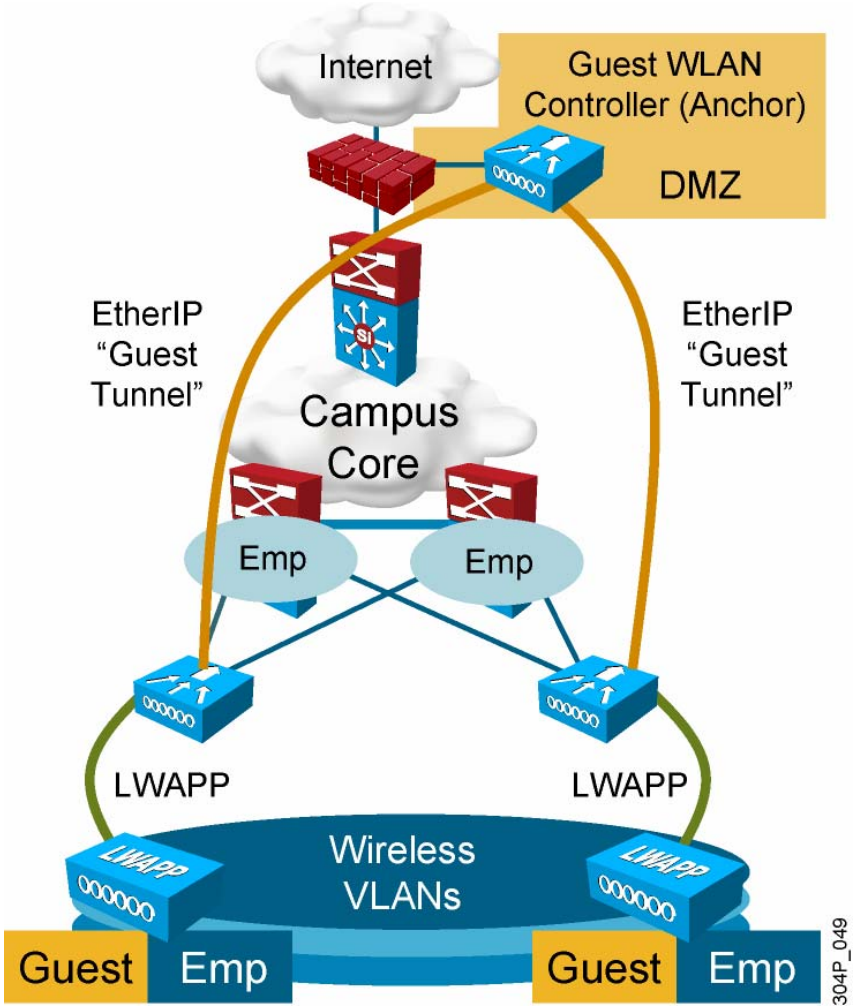
- Detail customer requirements.
- Describe and diagram access point coverage.
  - Be very specific when describing equipment placement locations.
  - Mark areas that are covered as well as those not needing coverage.
- Parts list should include:
  - Access points
  - Antennas
  - Accessories and network components
- Discuss the tools that were used and survey methods.

Supporting Guest Access

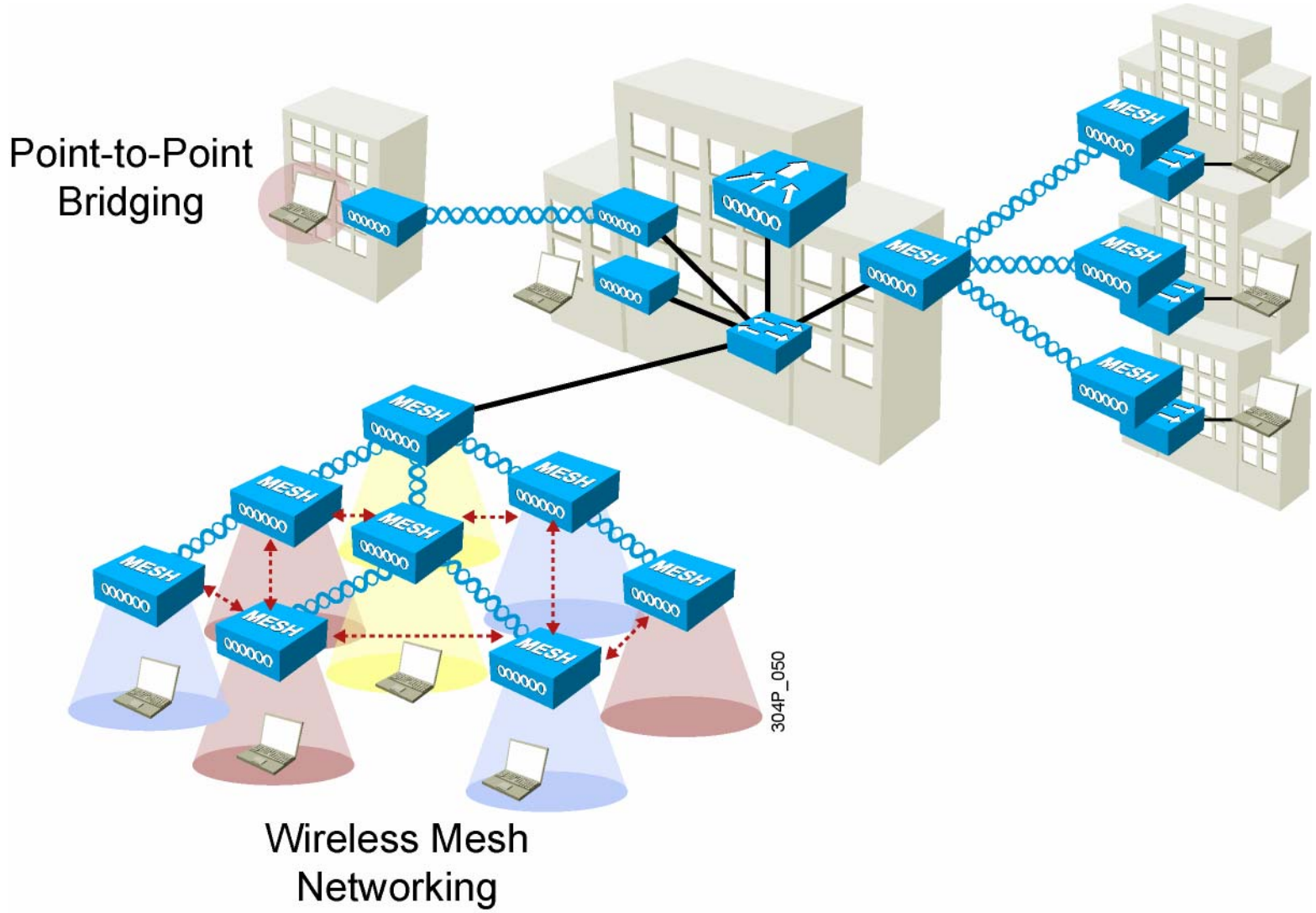


Path Isolation with Ethernet in IP Tunnel

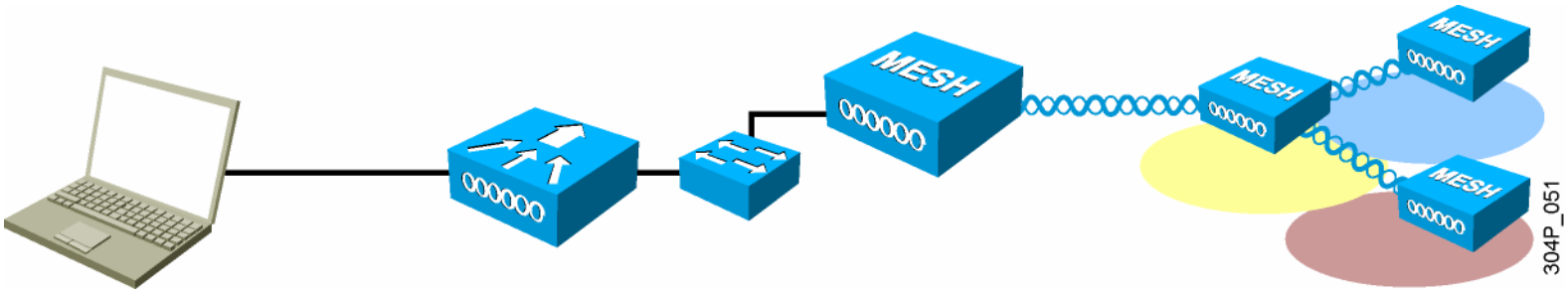
- Use of EtherIP tunnels to logically segment and transport the guest traffic between edge and anchor controllers
- Other traffic (employee for example) still locally bridged on the corresponding VLAN
- No need to define the guest VLANs on the switches connected to the edge controllers
- Original Ethernet frame from guest maintained across LWAPP and EtherIP tunnels
- EtherIP supported across all WLAN controllers
  - 2006 WLC cannot anchor EtherIP connections.



Outdoor Wireless Deployment Options



Outdoor Wireless Mesh Solution Components



Cisco Wireless Control System

- Wireless mesh management system
- Enables network-wide policy configuration and device management
- Supports SNMP and syslog

Cisco Wireless LAN Controller

- Links the wireless mesh access points to the wired network
- Handles RF algorithms and optimization
- Seamless Layer 3 Mobility
- Provides security and mobility management

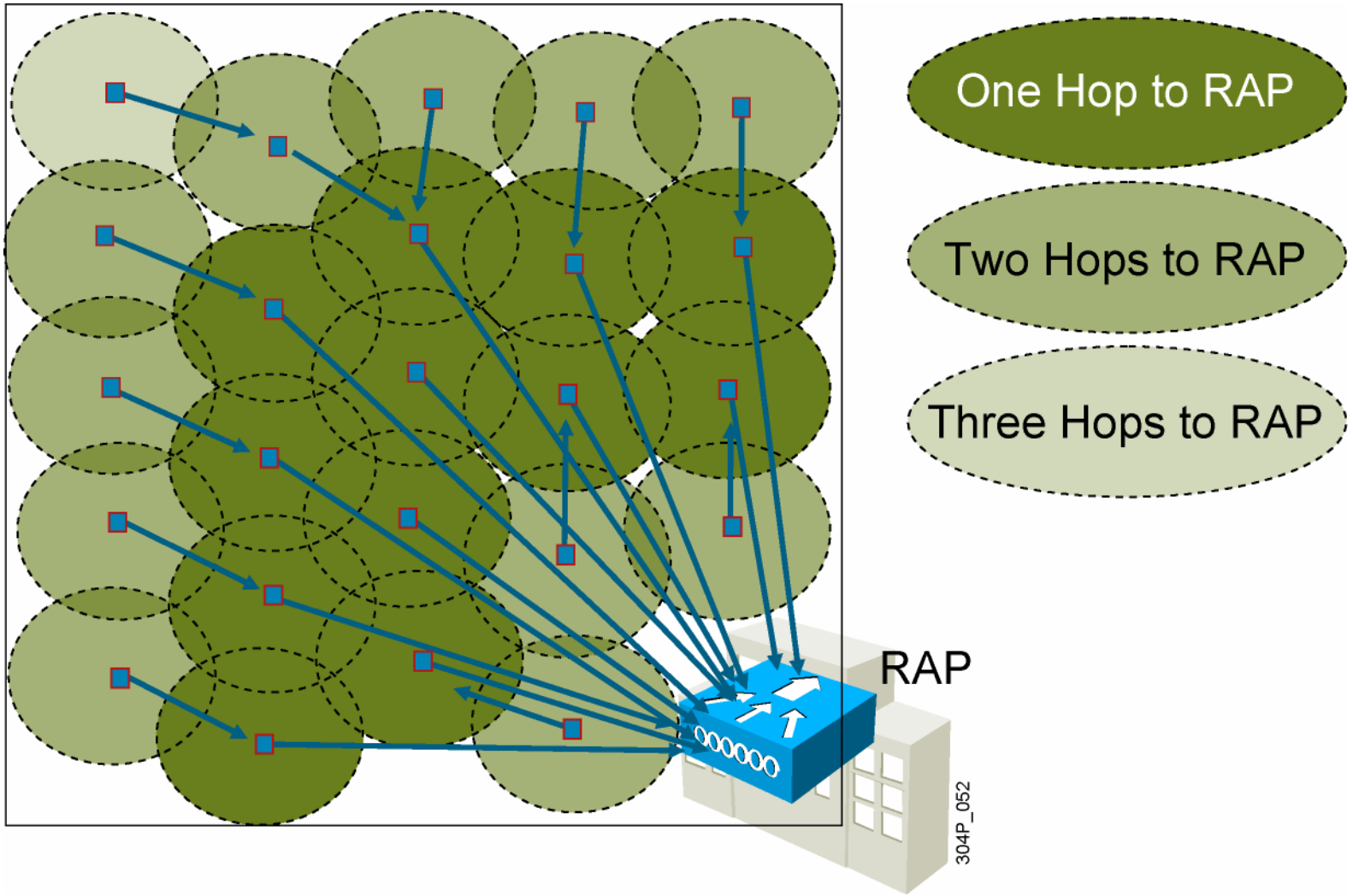
Rooftop Access Point

- Serves as “root” or “gateway” access point to the wired network
- Typically located on rooftops or towers
- Connects up to 32 “pole-top” mesh access points using 802.11a

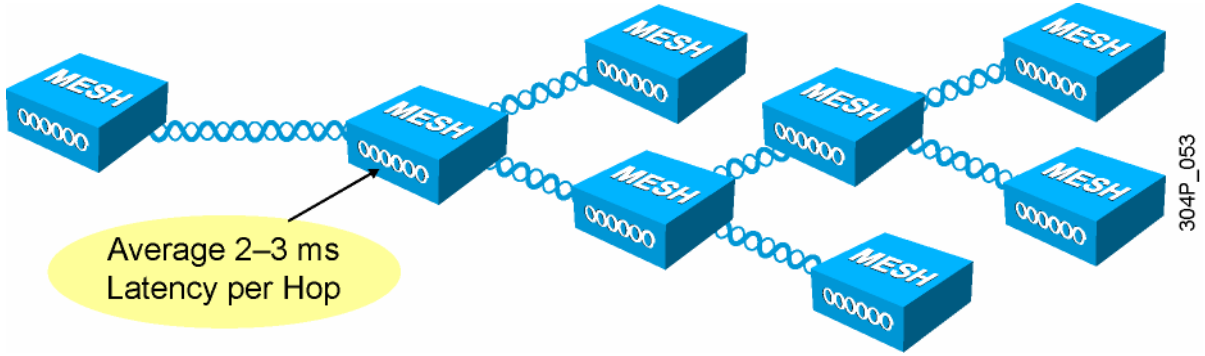
Mesh Access Point

- Provides 802.11b/g client access
- Connects to root access points via 802.11a
- Takes AC or DC power; PoE capable
- Ethernet port for connecting peripheral devices

Example: MAP-to-RAP Connectivity in a Square Mile



Mesh Design Recommendations



Hops	One	Two	Three	Four
Throughput	~10 Mbps	~5 Mbps	~3 Mbps	Up to 1 Mbps*

Latency

- < 10 ms per hop, 1–3 ms is typical

Hops

- Outdoor: Code supports up to eight hops; four or fewer hops are recommended.
- Indoor: One hop is supported.

Nodes per RAP

- One RAP supports up to 32 MAPs; 20 nodes are recommended.

Common Wireless Design Questions

- How many access points are needed?
- Where will the access points be placed?
- How will the access points receive power?
- How many WLCs are needed?
- Where should the WLCs be placed?

LWAPP Access Point Feature Summary

	10x0 Models	1121 AG Models	1130 AG Series	1230 AG Series	1240 AG Series	1300 Series	1500 Series
Autonomous/LWAPP/both	LWAPP	Both	Both	Both	Both	Both (LWAPP in AP mode)	LWAPP
External antenna	Yes	No	No	Yes	Yes	Yes	Yes
Outdoor install	No	No	No	No	No	Yes	Yes
REAP or H-REAP support	REAP	No	H-REAP	No	H-REAP	No	Yes
Dual radio	Yes	No (only g)	Yes	Yes	Yes	No (only g)	Yes
Power (watts)	13	6	15	14	15	N/A	N/A
Memory (Mb)	16	16	32	16	32	16	16
WLANs per radio supported	18	8	8	8	8	8	16

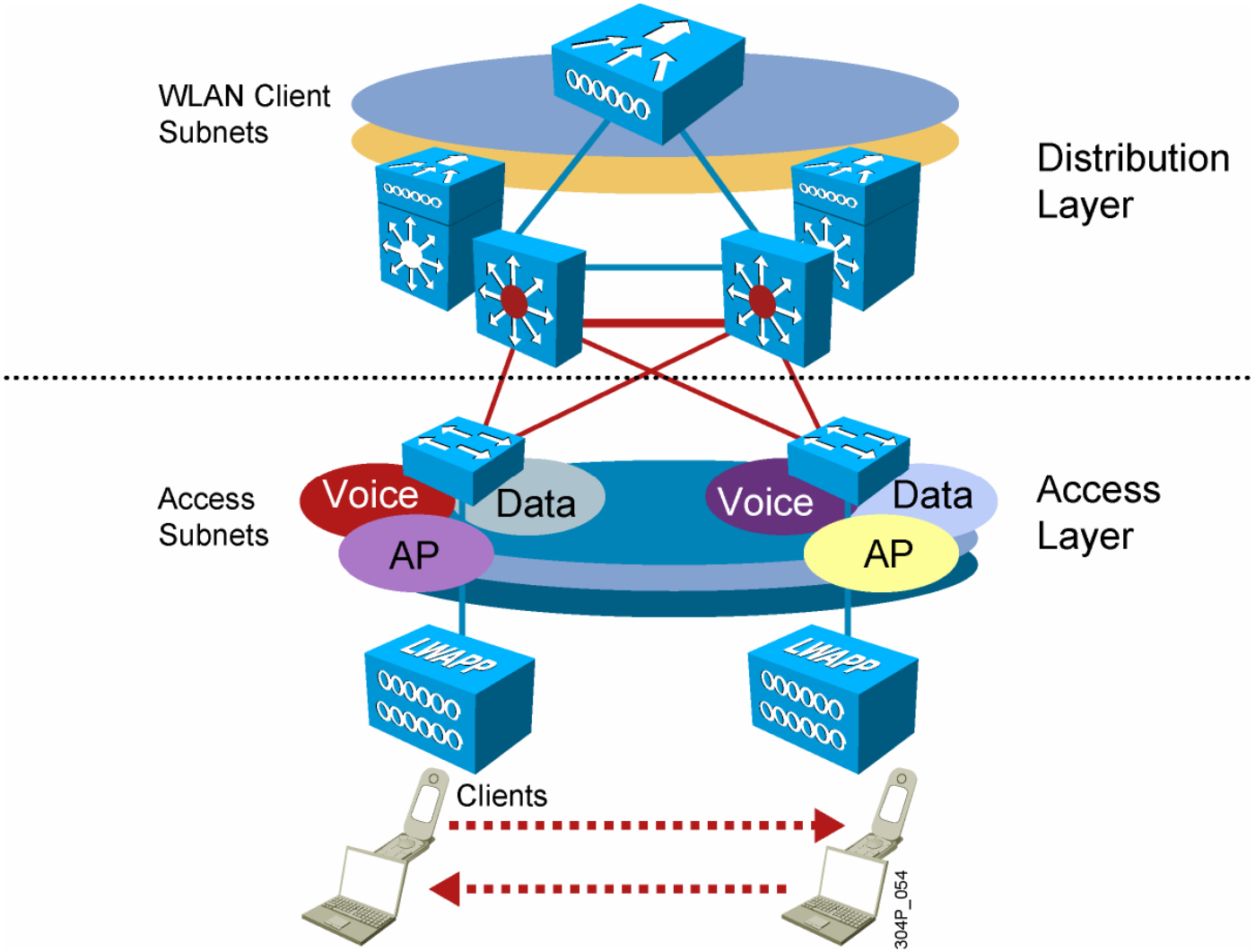
WLAN Controllers and Access Point Support

Part Number (Platform)	No. of Access Points Supported
AIR-WLC2006-K9 (Cisco Wireless LAN Controller appliance)	6
NM-AIR-WLC6-K9 (Cisco Wireless LAN Controller Module for ISRs)	6
WS-C3750G-24WS-S25 (Cisco Catalyst 3750G Integrated Wireless LAN Controller)	25
WS-C3750G-24WS-S50 (Cisco Catalyst 3750G Integrated Wireless LAN Controller)	50
AIR-WLC4402-12-K9 (Cisco Wireless LAN Controller appliance)	12
AIR-WLC4402-25-K9 (Cisco Wireless LAN Controller appliance)	25
AIR-WLC4402-50-K9 (Cisco Wireless LAN Controller appliance)	50
AIR-WLC4402-100-K9 (Cisco Wireless LAN Controller appliance)	100
Cisco Catalyst 6500 Series Wireless Services Module	Up to 300

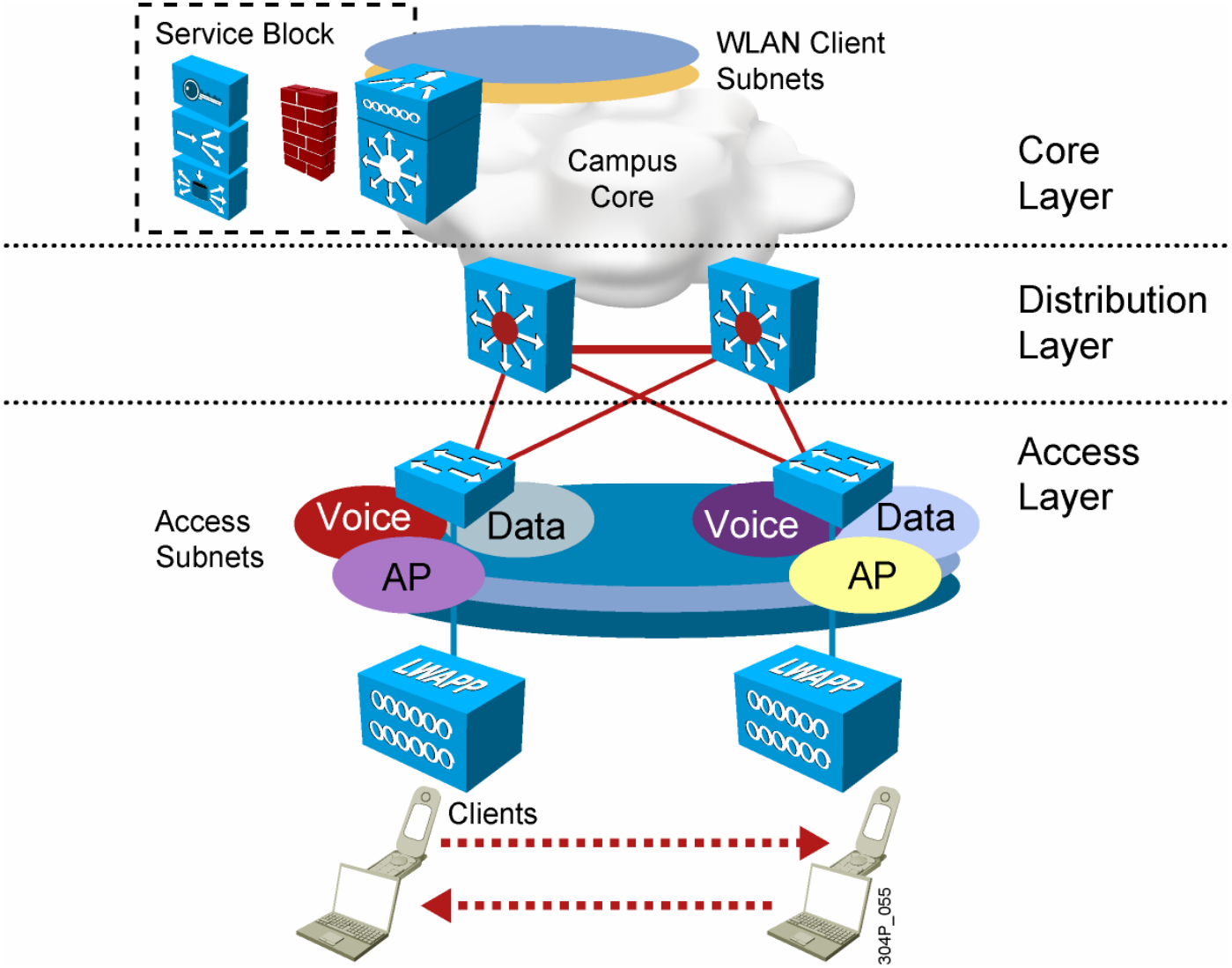
Controller Placement Design

- Minimize intercontroller roaming.
- Implement deterministic redundancy.
- Centralized design supports the integrated platforms.
  - Cisco Catalyst 3750G Integrated Wireless LAN Controller for small-to-medium deployments
  - Cisco WiSM for medium-to-large deployments
- Distributed designs may work well with existing networks.
- General recommendation is to use a centralized design, but decide based on:
  - Current network and policies
  - Growth plans

Example: Distributed WLC Design



Example: Centralized WLC Design



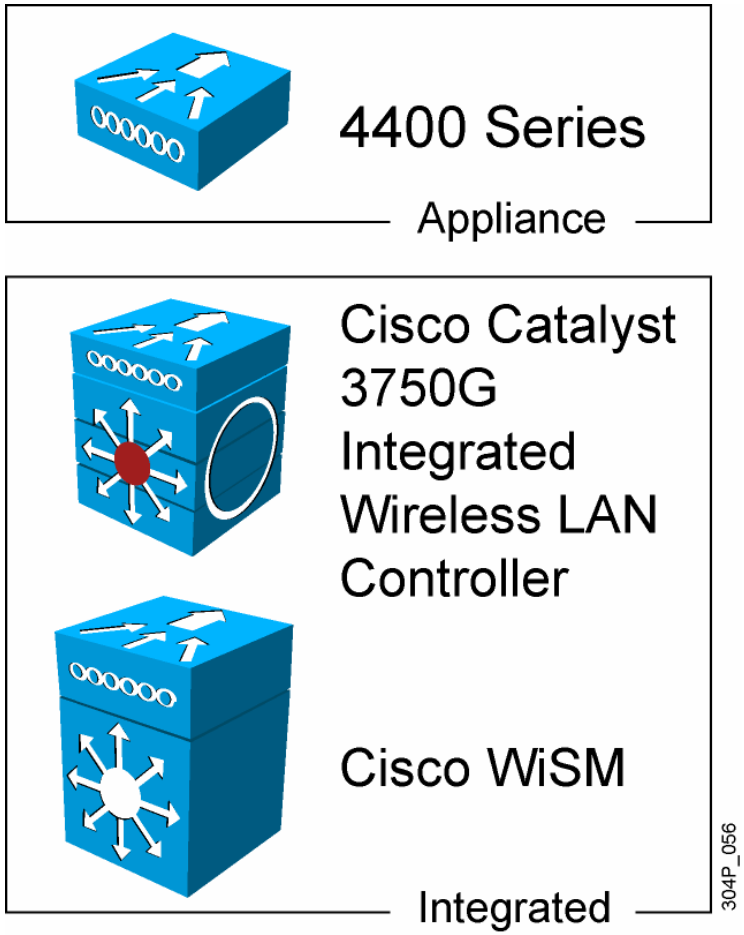
Campus WLC Options

Stand-alone appliance controller

- Routed network on another platform
- 802.1Q trunk to switched or routed network

Integrated controller

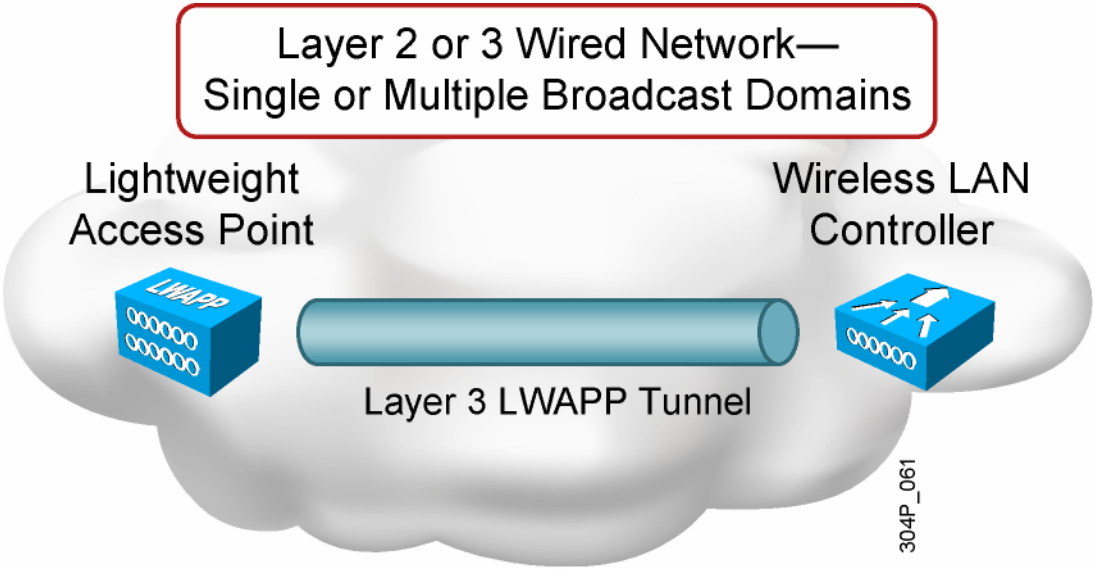
- Routed network can exist on the same platform.
- Layer 2 connection is internal.
- Layer 2 or 3 connection to routed network can be used.



Branch Wireless Network Design Considerations

- Number of access points needed at the branch
  - Availability of switch ports
  - Availability of power
- Controller cost
- WAN bandwidth constraints
  - Latency between the access point and the WLC should not exceed 200 ms RTT.
  - For centralized controllers, use REAP or Hybrid REAP access points.

Local MAC



Access point MAC functions:

- 802.11: Beacons, probe response
- 802.11 control: Packet acknowledgment and transmission
- 802.11e: Frame queuing and packet prioritization
- 802.11i: MAC layer data encryption and decryption
- 802.11 MAC management: Association requests and actions

Controller MAC functions:

- 802.11 proxy association requests and actions
- 802.11e resource reservation
- 802.11i authentication and key management

Remote Edge Access Point

- Lightweight access point designed to be controlled across WAN links:
  - REAP is designed to support remote offices by extending LWAPP control timers.
  - Control traffic is still LWAPP encapsulated and sent to Cisco Wireless LAN Controller.
  - Client data is not LWAPP-encapsulated but is locally bridged.
- All management control and RF management is available when the WAN link is up and connectivity is available to the Cisco Wireless LAN Controller.
- It will continue to provide local connectivity even if the WAN is down.

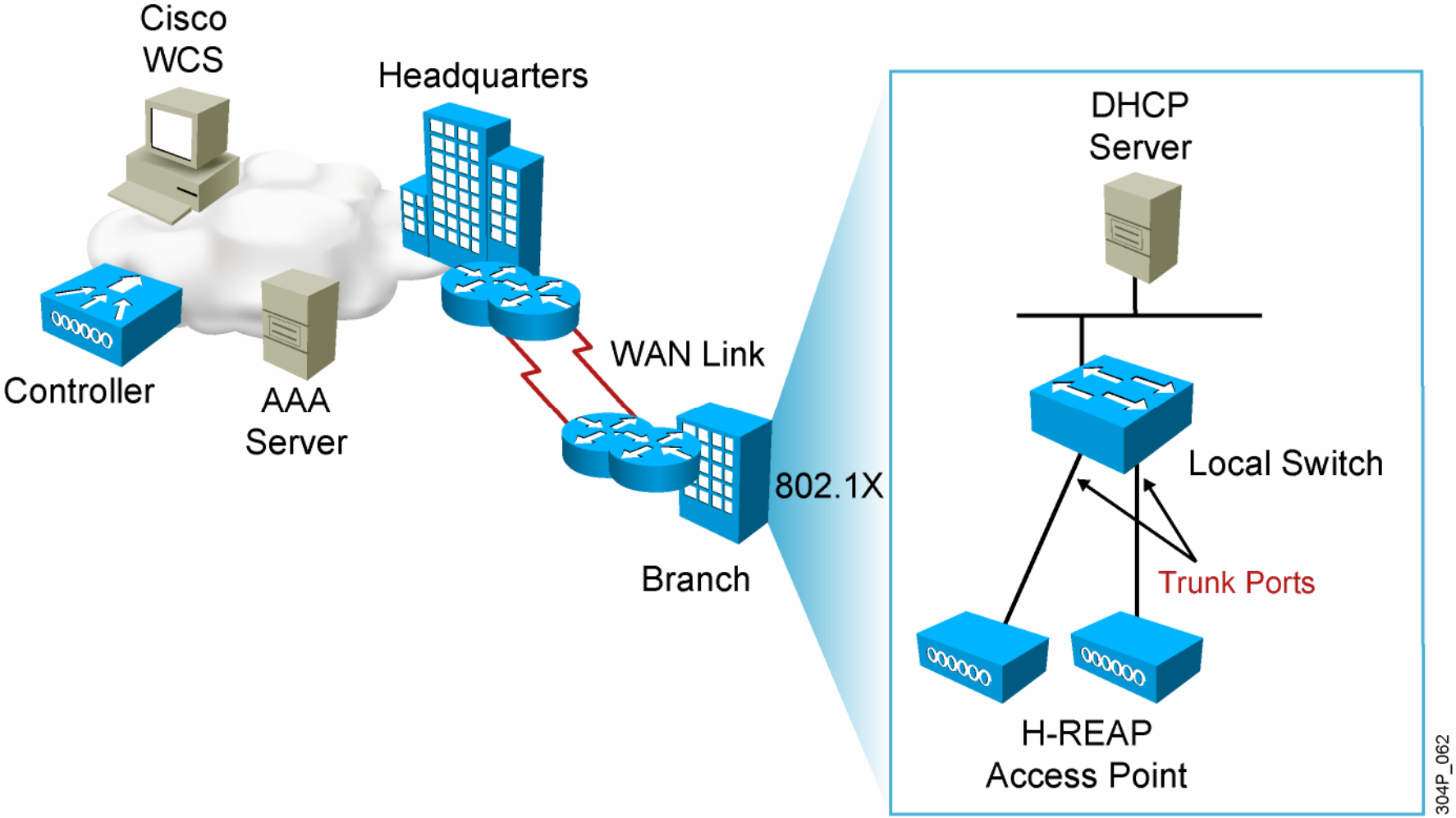
REAP Limitations

- REAP devices do not support 802.1Q trunking. All WLANs terminate on a single subnet.
- If connectivity to the WLC is lost, only WLAN1 is supported. Multiple WLANs are not recommend on REAP devices.
- REAP devices support only Layer 2 security policies.
- REAP devices and clients require a routable IP address provided locally and do not support NAT.

Hybrid REAP

- H-REAP is a solution for small or branch offices and retail on the LWAPP Cisco IOS platforms
- H-REAP supports simultaneous tunneling and local bridging.
  - "Local switching" supports bridging traffic onto local VLANs.
  - "Central switching" supports tunneling traffic to the controller.
- H-REAP provides more security options for the remote site:
  - Stand-alone mode does client authentication by itself. (WPA-PSK, WPA-PSK2)
  - Connected mode uses the controller to complete client authentication. (WPA-PSK, WPA-PSK2, VPNs, L2TP, EAP, and web auth)
- Round-trip latency must not exceed 200 ms between the access point and the controller.
- H-REAP supports NAT and PAT.

Example: H-REAP Deployment



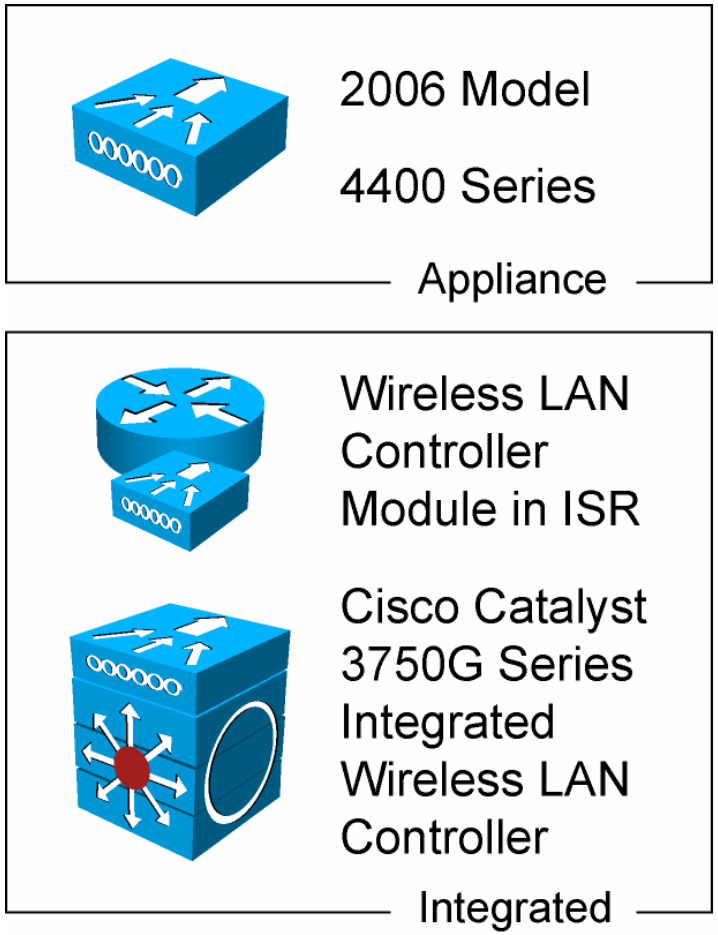
Branch Office WLC Options

Appliance controllers

- Cisco 2006—Support for up to six access points
- Cisco 4402-12, 4402-24

Integrated controller

- Cisco Wireless LAN Controller Module for ISR
- Cisco Catalyst 3750 Series Integrated WLAN Controller (support for 25, 50 access points)



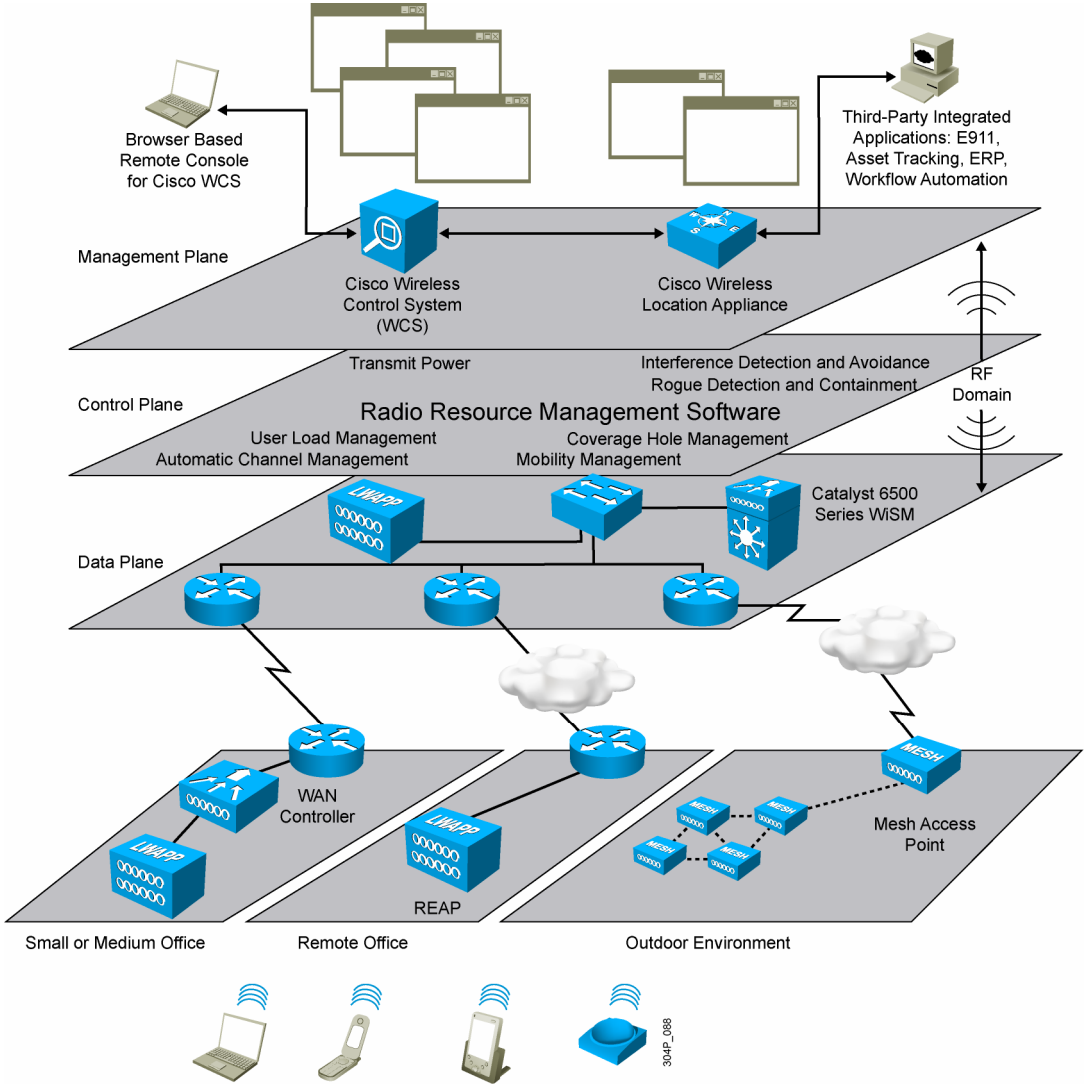
Summary

- An RF site survey is used to determine the RF characteristics of a wireless network and help determine access point placement.
- Guest services are easily supported using EtherIP tunnels in the Cisco Unified Wireless Network.
- Outdoor wireless networks are supported using outdoor access points and Cisco Wireless Mesh Networking access points.
- Campus wireless network design provides RF coverage for wireless clients in the campus using lightweight access points. The access points are managed to Cisco Wireless LAN Controllers.
- Branch wireless network design is provides RF coverage for wireless clients in the branch. Central management of REAP or H-REAP access points can be supported.

Wireless Networking Review

- Define the wireless requirements.
- Conduct an RF site survey to define the RF characteristics in the environment.
- Define access point deployment locations based on the site survey and customer requirements.
- Determine the WLC design:
  - Redundancy (primary, secondary, tertiary)
  - Placement of WLCs in distribution layer
  - Whether remote sites will use local centralized controllers
- Determine the number of mobility groups that you will need.
- Plan how to support internal VLANs and guest access if needed.

Cisco Unified Wireless Network Review



Module Summary

- Cisco Unified Wireless Network architecture centralizes WLAN configuration and control on WLCs that control LWAPP access points.
- The Cisco Unified Wireless Network provides transparent roaming supporting both intracontroller and intercontroller roaming. Deterministic controller redundancy with integrated RRM provides the highest-quality roaming experience.
- An RF survey in a wireless network design determines the characteristics of the wireless network and access point placement to provide optimal RF coverage for wireless clients.