

# Ruckus vs Cisco

## SOLUTION OVERVIEW



May 2015

### Ruckus Core Values

- Predictable wireless connections
- Maximum capacity and reliability
- RF innovation
- Ease of use, intuitive setup
- High value solutions at low cost

### Cisco Core Values

- Unified Architecture
- Competitive performance
- End-to-end infrastructure
- Company stability
- Deployment services expertise

### Questions to Consider

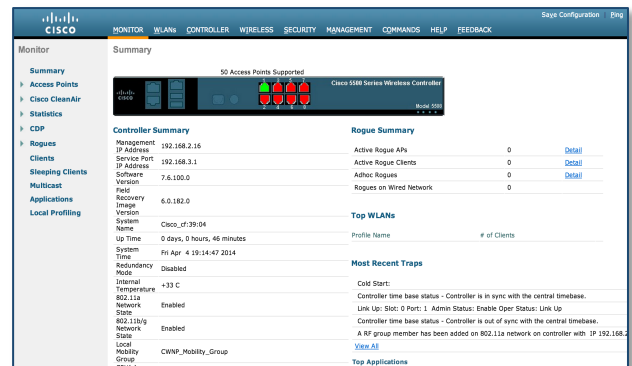
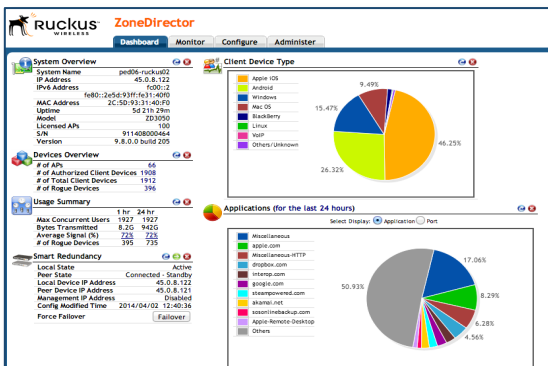
- Would your users be more productive with better performance and reliability?
- Is total solution cost over time an important decision criteria?
- Is ease of use a key issue for your IT staff?
- Do you want a Wi-Fi implementation that adapts to fix RF problems for you?
- Would these features add value to your network?
  - Adaptive antenna patterns
  - Mobile app management
  - Integrated zero-touch user onboarding
  - Band balancing
  - Zero-touch mesh
  - Adaptive channel selection
  - Per-user PSK
  - Time-based SSIDs
  - Integrated client test tools

### Ruckus Solutions

- ZoneFlex or SCG appliances
- Full lineup of indoor and outdoor APs and bridges
- SmartCell Insight analytics and reporting
- SPoT cloud LBS service
- FlexMaster NMS

### Cisco Solutions

- AireOS or IOS WLAN Controllers (WLC)
- Full lineup of indoor and some outdoor APs
- MSE location appliance
- Cisco Prime Infrastructure NMS
- IOS Converged Ethernet switches
- Identity Services Engine (ISE) policy control



## Wireless Controllers

### Ruckus

- Full range of wireless controllers scaling from the entry level ZoneDirector 1200 which supports up to 75 AP's, all the way up to the SmartCell™ Gateway controller which, with available clustering support, is capable of managing tens of thousands of AP's and providing access for hundreds of thousands of mobile devices



- SmartCell™ Gateway 200  
Single SCG 200 - up to 10,000 APs, up to 100,000 clients.  
20-Gbps aggregate throughput  
SCG 200 cluster of 4 - up to 30,000 Aps, up to 300,000 clients

Key functions:

- Support for Hotspot 2.0
- WISPr 1.0 authentication
- Built in Element Management System (EMS)
- REST API with JSON format
- Bonjour Gateway
- RBAC

- Virtual
  - Virtual SmartZone
  - High Scale (vSZ-H) - up to 10,000 APs, up to 100,000 clients
  - vSZ-H cluster of 4 - up to 30,000 Aps, up to 300,000 clients
- ZoneDirector Controllers
  - ZoneDirector 1200 – up to 75 Aps, 2000 clients
  - ZoneDirector 3000 – up to 500 Aps, 10000 clients
  - ZoneDirector 5000 – up to 1000 APs, 20000 clients
- SmartZone 100 – up to 1024 Aps, 25000 clients

### Cisco

- Extensive range of standalone controllers, controller modules for network switches, virtual controllers, converged access switches with integrated wireless controllers
- Controllers with Central switching and FlexConnect™ Modes:



- Cisco 8540 – 6000 APs, 64000 clients, 40-Gbps throughput optimized for 802.11ac Wave2 performance
- Cisco 8510 - 6000 APs, 64000 clients, 2x10 GE ports

Integrated services

- Application Visibility and Control
- Policy classification engine
- Location-aware Bonjour and Chromecast

Cisco 5760 - 1000 APs, 12000 clients

Cisco 5500 – 500 APs, 7000 clients

Cisco 2500 – up to 75 APs, 1000 clients

Controller Modules:

ISR G2 – up to 200 APs, 3000 clients

WiSM2 – up to 1000 APs, 15000 clients

- FlexConnect Mode capable:
  - Flex 7500 – 6000 APs, 64000 clients
- Virtual
  - Virtual Wireless Controller – 200 APs, 6000 clients
- Converged Access Switches
  - Catalyst 3650 Series - 25 APs, 1000 clients
  - Catalyst 3850 Series - 50 APs, 2000 clients

## Important Takeaways

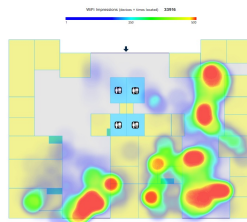
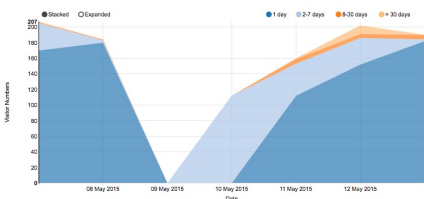
Ruckus wireless controllers address deployments of any size i.e. from a very small Field Sales Office to a Managed Service Provider solution. Clustered SCG 200s offer one of the highest scalability levels and are available in an appliance form factor as well as a virtual controller. EMS functions are built-in and integration via REST API is supported.

Cisco has wide range of wireless controllers and large selection of network routing and switching products, in combination there are additional options for converged access solutions as well as for plug-in modules. Following that path may lock customers to the hardware and features specific to the Cisco switches and complicate infrastructure upgrades in the future.

## Mobility Services

### Ruckus SPoT

- Ruckus Smart Positioning Technology (SPoT™) is a solution for providing presence or location metrics for Wi-Fi enabled devices
- SPoT Levels of service:  
SPoT Point – with venue calibration expected 5-8m accuracy with 90% confidence, ~10m accuracy without calibration  
SPoT Presence – device positioning at the AP proximity accuracy level
- SPoT Architecture advantages:  
Up to near-real-time positioning with selectable update intervals  
Cloud-based SPoT Location Engine – subscription service with virtually unlimited scalability  
Virtual SPoT (vSPoT) - a standalone instance as a customer hosted deployment option  
SPoT Engagement API – RESTful with JSON
- Location detection using Wi-Fi probes and data packets
- SPoT Analytics:  
Traffic visualization heat-map  
Real-time and historical data  
Graphs on unique visitors, average dwell time, repeat visitors



### Cisco CMX

- Cisco Connected Mobile Experiences (CMX) is a modular solution that includes combination of technologies for enhancing Wi-Fi based mobility services. CMX is built on the Cisco Mobility Services Engine (MSE) platform.
- Key components:  
Location services for Wi-Fi devices, RFID tags, RF interferers; open API  
CMX Connect - on-boarding platform, location enabled captive portal for guest access  
CMX Analytics – Wi-Fi based location analytics with an API option  
CMX for Facebook Wi-Fi – venue Wi-Fi access with Facebook credentials check-in, automatic access for returning users  
Wireless Intrusion Prevention System

#### Cisco MSE Facts

Virtual or Physical appliance  
REST API  
CMX Base License  
CMX Advanced License  
License for Adaptive wIPS  
CMX SDK for location aware applications

- MSE scalability levels for CMX 10
- Low-end vMSE – 2000 APs, 25000 tracked devices
  - Standard vMSE – 5000 APs, 75000 tracked devices
  - High-end vMSE – 10000 APs, 150000 tracked devices
  - MSE 3365 appliance – 10000 APs for CMX, 150000 tracked devices

- Methods for Wi-Fi location detection include signal strength triangulation, FastLocate with probing and data packets, presence

## What to Consider

Ruckus SPoT offers true cloud architecture without extra software to deploy and with minimal configuration on wireless controllers and in the cloud. The Cisco claims on MSE scalability levels for the number of tracked devices come with exceptions i.e. maximum limits have to be reduced depending on user behavior and location technology implementation; enabling Cisco FastLocate requires the Wireless Security Modules in participating APs, it also significantly lowers MSE capacity to handle large number of tracked devices. Additionally, MSE has complex licensing structure for enablement different CMX services, it offers no subscription option for a cloud based service.

## 11ac Performance

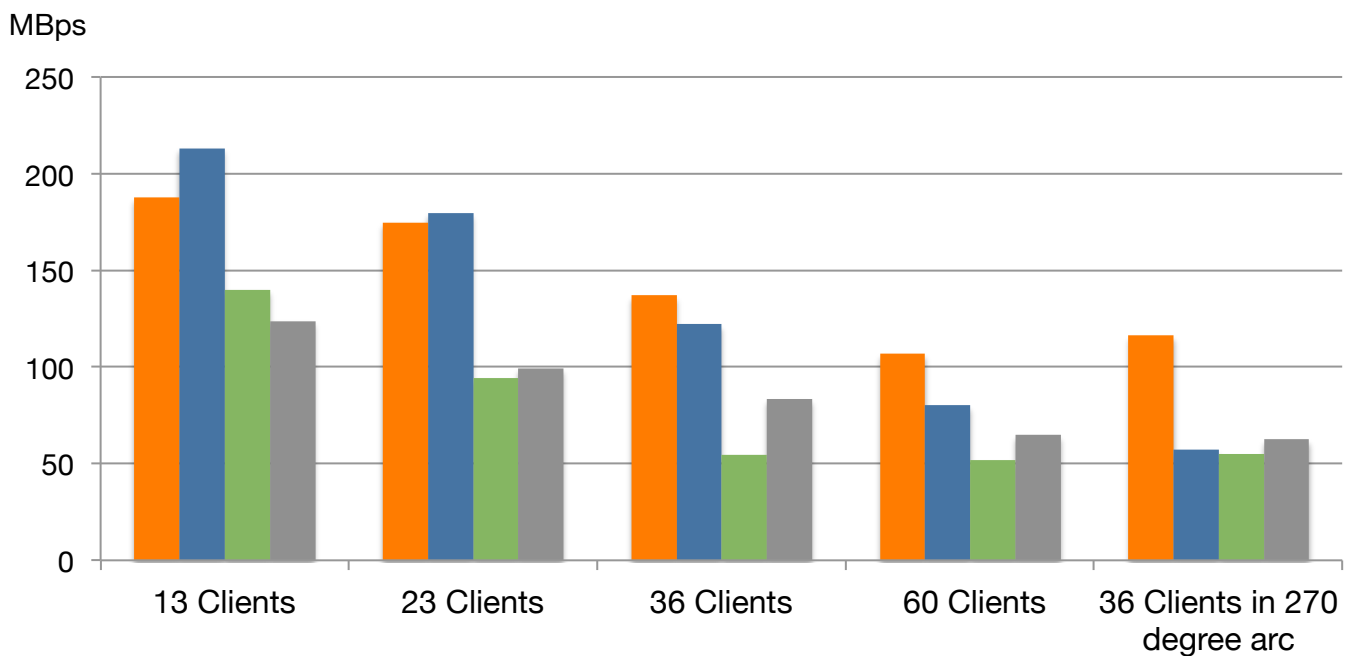
**What:** Croatian Academic and Research Network (CARNet) conducted independent Wi-Fi performance testing with top 802.11n and 802.11ac APs from different vendors within real classroom environment

**How:** Downlink TCP throughput tests using 1 MB file and IxChariot. Mix of 802.11ac and 802.11n dual-band clients placed inside of ~39ft by ~33ft classroom with AP outside the classroom separated by a drywall with 5dB loss

**Why:** By testing traffic patterns with multiple clients, we can accurately measure an AP's ability to handle real-world mixed traffic types and maintain high-quality performance as load increases

### Multi-Client Downlink Tests by CARNet

■ Ruckus R700 11ac 3x3:3 ■ Ruckus R500 11ac 2x2:2 ■ Cisco 1700 11ac 3x3:2 ■ Cisco 2700 11ac 3x4:3



# Ruckus vs Cisco

## 11AC PERFORMANCE



May 2015

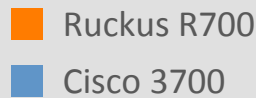
### 11ac Performance

What : Ruckus R700 vs Cisco 3700 11ac access points supporting MacBook Pro (11ac or 11n) laptops

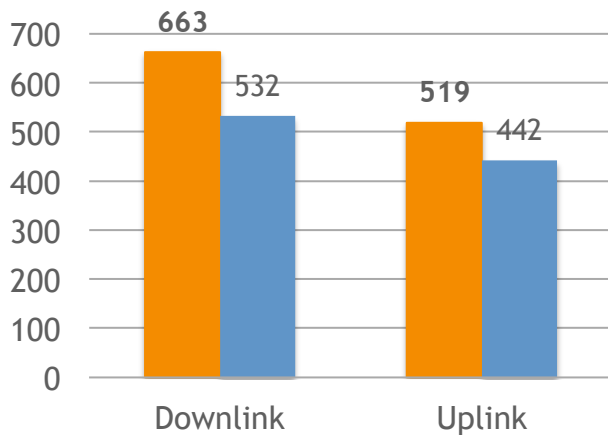
How : Test downlink and uplink at multiple distances using Chariot high throughput script

Why : Maximum per client performance has a direct affect on WLAN service quality:

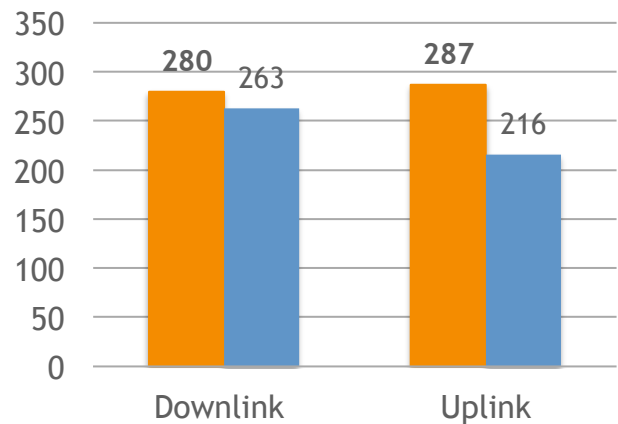
- High throughput at range enables fixed wired clients to transition to wireless only
- With the right solution, mobile devices can have reliable service at all ranges
- Efficient airtime utilization increases capacity and maximizes spectrum resources
- Clients are on and off the medium faster, improving battery life for mobiles



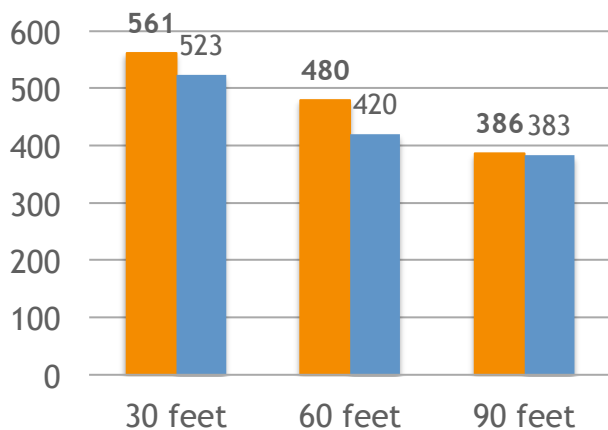
#### MacBook Pro 11ac TCP Throughput (Mbps)



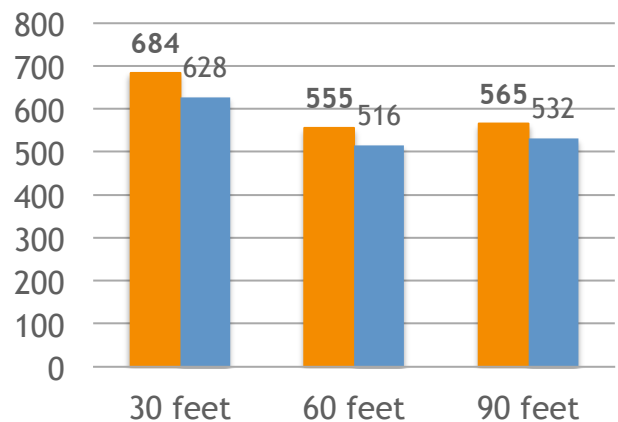
#### MacBook Pro 11n TCP Throughput (Mbps)



#### MacBook Pro 11ac Uplink TCP Throughput (Mbps)



#### MacBook Pro 11ac Downlink TCP Throughput (Mbps)



# Ruckus vs Cisco

HIGH-DENSITY PERFORMANCE



May 2015

## 11ac Performance

What : Ruckus R700 vs Cisco 3700 11ac access points supporting 50 clients (11ac and 11n)

How : Test downlink, uplink, and bi-directional TCP traffic using Chariot high throughput script

Why : Many enterprises depend on APs to deliver reliable high performance Wi-Fi at scale:

- Demonstrates an AP's ability to handle load from mixed client types and capabilities
- Efficient airtime utilization increases capacity and maximizes spectrum resources
- More clients can be supported by fewer APs, which simplifies deployment and lowers cost
- Enterprises can be confident in their ability to handle high density or BYOD

1 AP

Ruckus R700



Cisco 3700



50 Clients

40 iPads

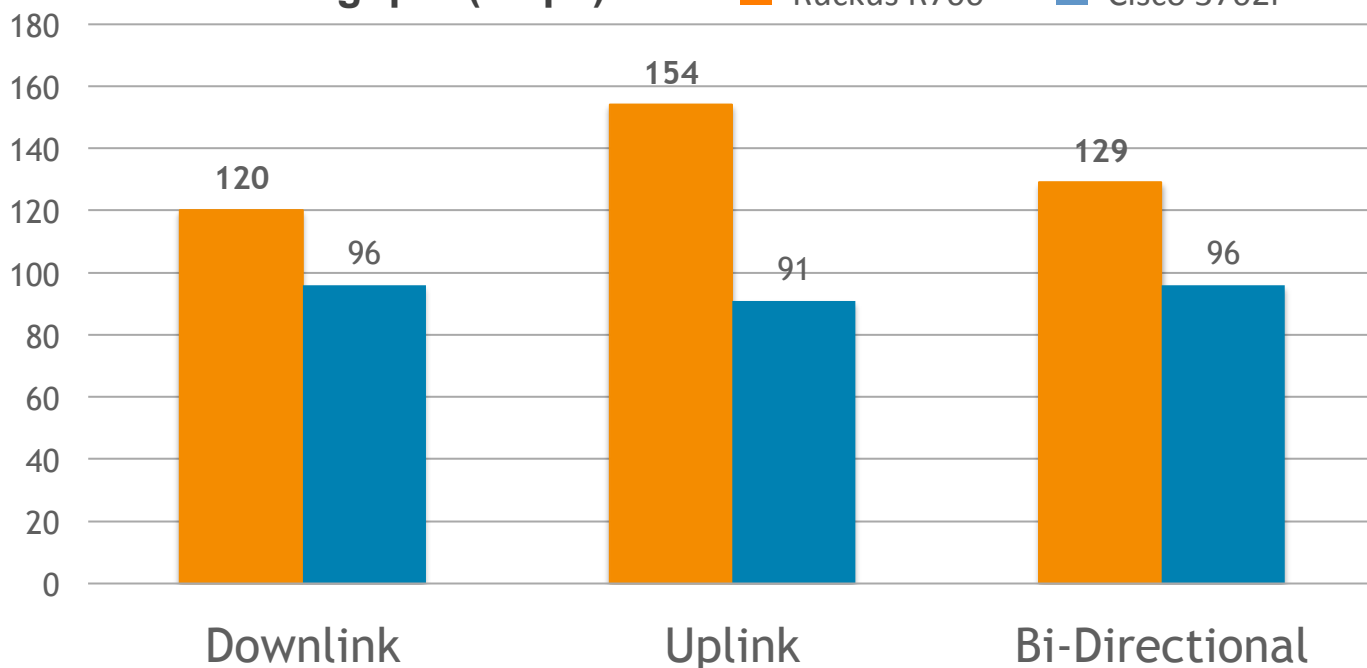
10 MacBooks



## TCP Throughput (Mbps)

Ruckus R700

Cisco 3702i



# Ruckus vs Cisco

LOW-COST 11n PERFORMANCE



May 2015

## Low Cost 11n Performance

What : Ruckus R300 vs Cisco 700 11n (2x2) access points supporting 30 clients (11n iPad Mini)

How : Test downlink, uplink, and bi-directional TCP traffic using Chariot high throughput script

Why : Many enterprises want low-cost APs that can still deliver high performance Wi-Fi at scale:

- Efficient airtime utilization increases capacity and maximizes spectrum resources
- More clients can be supported by fewer APs, which simplifies deployment and lowers cost
- Enterprises can be confident in their ability to handle high density or BYOD
- Customers know

1 AP

Ruckus R300



Cisco 702i



30 Clients

2.4 GHz  
10 iPads



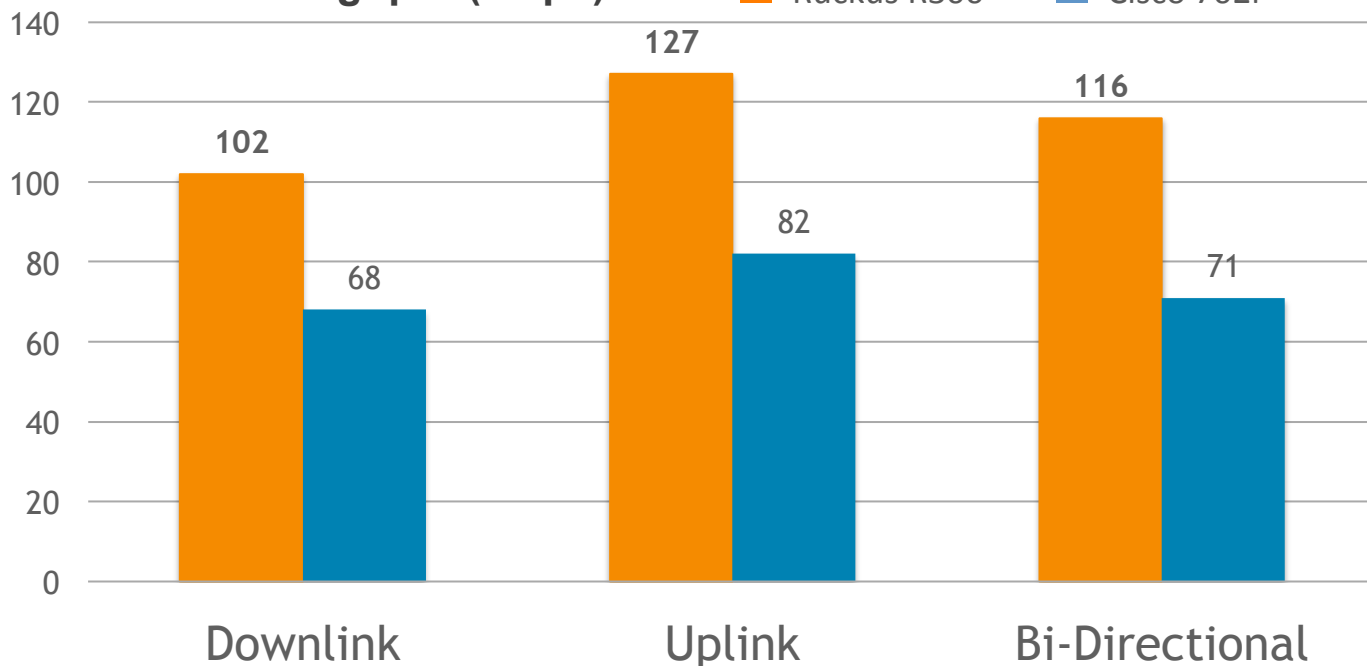
5 GHz  
20 iPads



## TCP Throughput (Mbps)

Ruckus R300

Cisco 702i



# Ruckus vs Cisco

RELIABLE PERFORMANCE

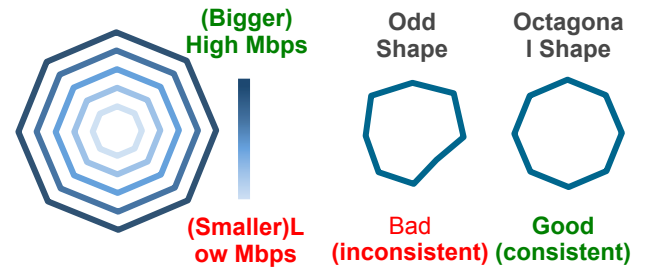


May 2015

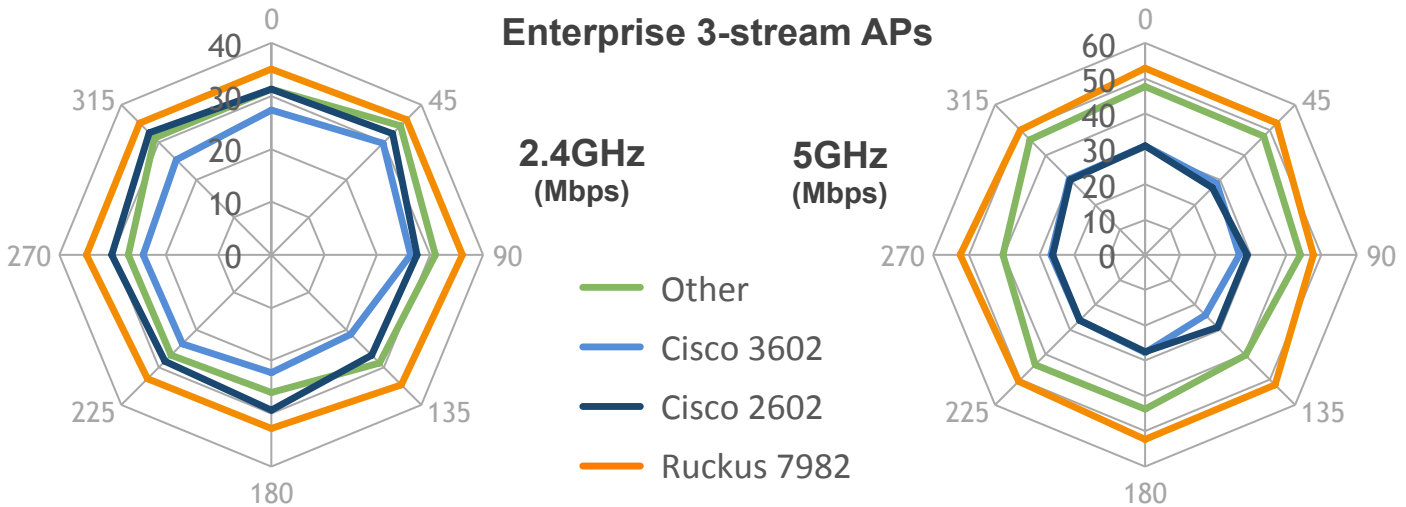
**What :** Ruckus vs Cisco 11n uplink performance consistency  
**How :** Test uplink throughput. Rotate iPad by 45° and repeat.  
**Why :** Users hold mobile devices in different orientations:

- Well-designed APs perform consistently regardless of how the mobile device is held or positioned
- Uplink performance is increasingly important
- Antenna systems should maintain strong and stable receive behavior with a predictable user experience

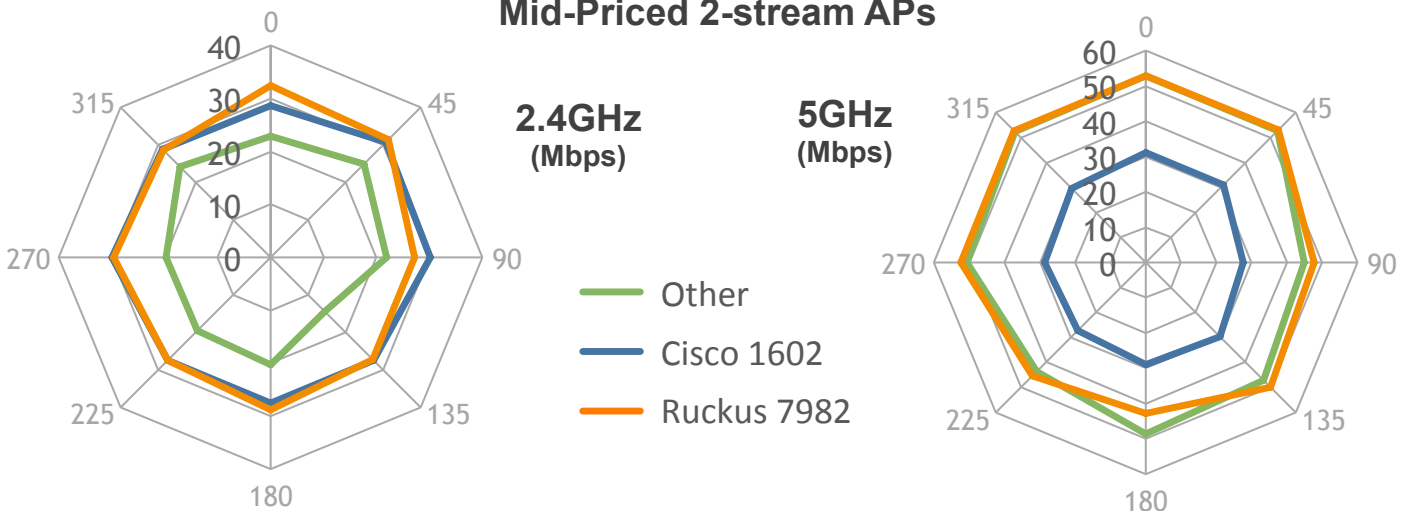
## UNDERSTANDING THE RESULTS



### Enterprise 3-stream APs



### Mid-Priced 2-stream APs





# Ruckus vs Cisco

RELIABLE PERFORMANCE

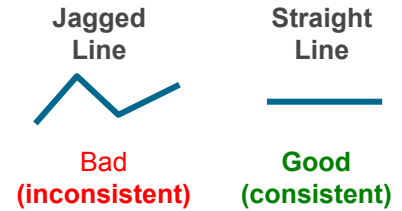


May 2015

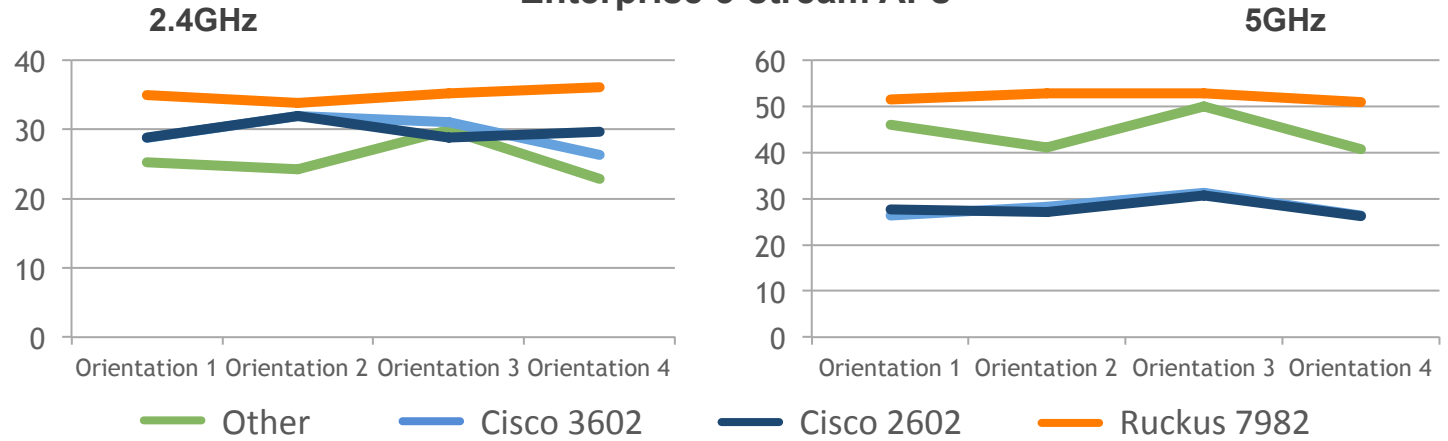
**What :** Ruckus vs Cisco 11n uplink performance consistency  
**How :** Test uplink throughput with multiple client orientations  
**Why :** Users hold mobile devices in different orientations:

- Well-designed APs perform well in all mobile device orientations
- Antenna systems should maintain strong and stable behavior with a predictable user experience across both radio bands

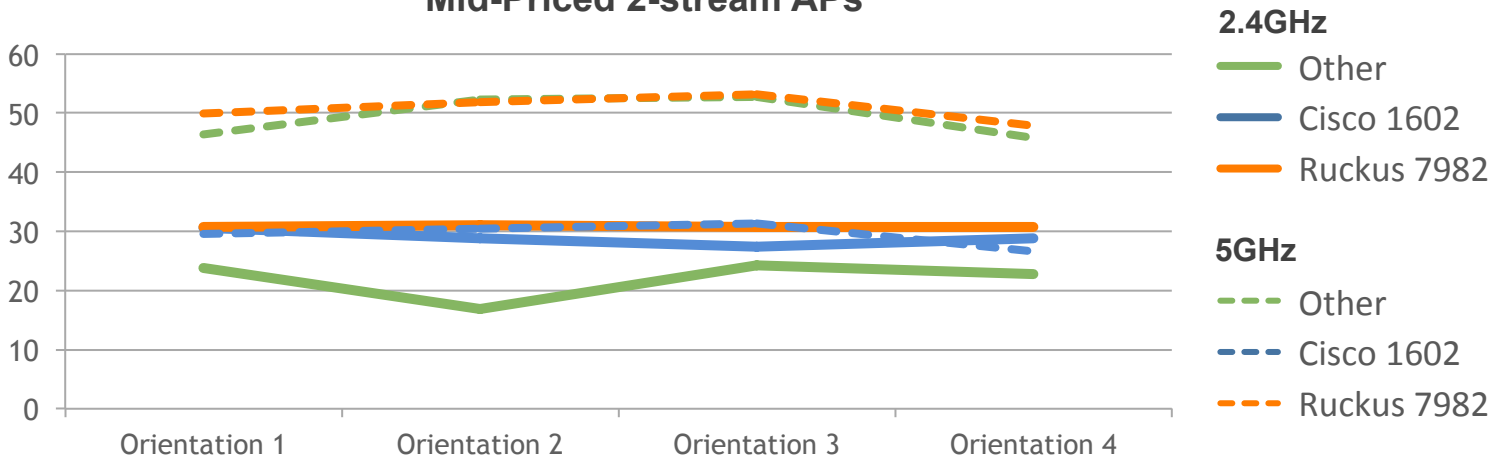
## UNDERSTANDING THE RESULTS



### Enterprise 3-stream APs



### Mid-Priced 2-stream APs



# Ruckus vs Cisco

## CISCO CLAIMS



May 2015

Feature	Cisco Claim	Ruckus Response
<b>CleanAir</b>	CleanAir is an RF spectrum visibility/monitoring/reporting technology that is built into Cisco's Wi-Fi chip ASICs. Coming from a long history of leading spectrum intelligence (as far back as the Cognio acquisition), CleanAir provides interference detection, mitigation, location, and classification capabilities in a distributed platform as part of the network infrastructure.	CleanAir is a good solution for spectrum monitoring after a problem, but the bigger issue with interference is how it affects connectivity and how a system can adapt in real-time. Ruckus BeamFlex and ChannelFly optimize Wi-Fi stability in the presence of interference and adapt to RF changes to optimize RF for each user. We also include spectrum monitoring and capacity reporting tools in the administrator dashboard as well as mobile apps with vivid spectrum displays for troubleshooting. Cisco also requires MSE server and Prime for many CleanAir features.
<b>ClientLink</b>	ClientLink is a proprietary implicit beamforming technique that improves signal quality, throughput, and reliability for all clients by using extra transmit antennas to provide signal combining at the client. It is backward compatible with pre-11n devices and does not require client support, feedback, or calibration.	In independent testing, ClientLink has shown to provide no performance gain, and may actually harm performance due to the lack of client feedback and calibration. All types of chip-based TxBF require a tradeoff in spatial streams and provide no value to multi-stream devices. Implicit TxBF in 11n has many caveats that the IEEE highlights (but Cisco ignores) while 802.11ac abandoned implicit TxBF entirely because explicit TxBF with client feedback works more reliably.
<b>Videostream</b>	VideoStream offers an array of video management features to optimize video delivery across the WLAN. Features include multicast-to-unicast conversion, resource reservation control, and video traffic prioritization.	VideoStream requires the administrator to do a lot of the heavy lifting for configuration of priority. Mcast to Ucast conversion is supported by Ruckus along with CAC, but Cisco is missing heuristics to detect and prioritize multicast application flows automatically. Ruckus also optimizes overall WLAN utilization.
<b>Wireless Mesh</b>	Cisco's experience in outdoor Wi-Fi networking enables them to extend Wi-Fi networks to areas where wiring is difficult or costly. Cisco provides flexible deployment models, fast and easy installation, and simple management with a unified Cisco outdoor and indoor mesh protocol.	Cisco's mesh solution has numerous problems. First, since mesh is a fixed "AP mode" with Cisco, wired APs cannot use mesh as a backhaul failover method if their wired connection fails. Second, mesh is not supported in FlexConnect mode, in which traffic is bridged locally by the AP. Third, Cisco has only static antennas, so the RF link on a given radio is optimized either for mesh backhaul or client connectivity, not both—compare with directional adaptation of BeamFlex. Finally, Cisco's path selection algorithm runs only every 15 minutes, and has very slow convergence if a mesh path fails.
<b>RRM</b>	Cisco's RRM software acts as a built-in RF engineer to provide real-time RF management of the wireless network. RRM monitors and adjusts for traffic load, interference, noise, and coverage, and attempts to optimize coverage and capacity. It periodically reconfigures RF characteristics, such as transmit power control (TPC) and dynamic channel assignment (DCA), and also provides coverage hold detection and correction.	Cisco's RRM function has many knobs and dials for admin tuning, but RRM is often difficult to tune for consistency across a large organization. TPC is almost always unnecessary, and Cisco's channel selection is a purely passive background scanning technique, which assesses channel quality by seeing less than 0.2% of all traffic on a given channel. Ruckus provides options for RRM using background scanning (akin to Cisco) or ChannelFly, which performs active real-time channel testing and selection, evaluating channel capacity with a convergence time less than 15 seconds. Cisco's RRM algorithm runs every 10 minutes
<b>Adaptive WIPS</b>	Cisco's Adaptive Wireless Intrusion Prevention System (WIPS) provides wireless-specific network threat detection and mitigation against malicious attacks security vulnerabilities, and sources of performance disruption. It also provides the ability to visualize, analyze, and identify wireless threats, and centrally manage mitigation and resolution of security/performance issues.	Complex WIPS solutions like Cisco's are almost always misconfigured or underutilized, especially for enterprises with small non-specialist IT staffs. Typically, the more "advanced" WIPS solutions will detect more DOS attacks (of which there are always more) and provide more alerts (with lots of false positives), but cannot prevent most attacks. Ruckus provides essential WIPS features (rogue detection/mitigation, wired-side correlation, mitigation, rogue DHCP detection, excessive auth request blocking, and more) in a built-in package that enterprises will use. Cisco's WIPS also requires an MSE appliance as well as Prime for management, which adds cost and complexity.

# Ruckus vs Cisco

## CISCO CLAIMS



May 2015

Feature	Cisco Claim	Ruckus Response
<b>CMX</b>	A combination of multiple features, Cisco's Connected Mobile Experience (CMX) is a way to utilize network and location intelligence from the Cisco MSE to personalize the interactions and experiences of users on a network. This includes CMX venue analytics, easy guest access and customized landing experiences with CMX Connect, social login with CMX for Facebook Wi-Fi, and engagement with CMX Engage.	Cisco's CMX solution is fairly comprehensive, as you'd expect from Cisco. One notable drawback is the requirement for a dedicated Cisco' MSE appliance for each of the CMX services (e.g. CMX for Facebook Wi-Fi requires its own MSE appliance and cannot support multiple services on one appliance). Distributed sites also each require an appliance and service, adding cost and complexity. Further, Cisco's location engine itself is less accurate (8-10m) than Ruckus's (5-8m) at 90% confidence. Finally, Ruckus' location and engagement solution is cloud-based, making it more scalable for long-term data analytics, friendlier to distributed organizations, and more cost effective with better analytics features.
<b>ISE</b>	Cisco's Identity Services Engine (ISE) provides a central point of policy management and enforcement for network devices. Key features include accurate ID of users/devices; onboarding, provisioning; and securing devices; centralized, context-aware policy management to control user access; security compliance; integration with MDM/MAM providers.	Where ISE is critical to deployments, certain components of the ISE architecture (such as RADIUS and 802.1X) can be leveraged for third-party (i.e. Ruckus) WLAN solutions. But for the majority of customers, ISE functionality can be offered to enterprises both by native Ruckus features (Zero-IT, client fingerprinting, role-based policies, DPSK, and more) and through partnerships with best-of-breed 3 <sup>rd</sup> party solutions: MDM/MAM, network-based next-generation firewalls, IDSs, and NAC, user directory services, content filters, and many others.
<b>AVC</b>	Cisco's application layer visibility stems from a Cisco-designed NBAR2 (network-based application recognition 2) engine, which is a next-generation DPI approach to app visibility. Recognizing over 1000 applications, AVC improves quality of service via application-level optimization and control, proactive monitoring of end-to-end traffic, better network management and planning with greater visibility, and prioritization of critical business apps.	The major value of L7 visibility is to provide admin insight to user applications. Ruckus supports this function and reports app usage per AP/user/network/app; Ruckus also integrates controls to deny unwanted traffic and prioritize critical traffic. Cisco's AVC requires data tunneling through the controller, which makes it untenable for FlexConnect or distributed sites, whereas Ruckus' L7 features operate directly in the AP. But most enterprises look outside their WLAN provider for best-of-breed L7 solutions (e.g. Palo Alto Networks) to cover the entire network (wired and wireless). Ruckus integrates with these solutions to extend their more specialized solutions (e.g. extensive application signatures, SSL decryption, robust compute, focused expertise with continuous upgrades, etc) to Wi-Fi traffic without duplicating effort on the WLAN config.
<b>High Density Experience</b>	With the demand of mobile devices and high-density venues, Cisco has a new feature package called "High Density Experience" designed to maximize capacity and efficiency in these environments. It is comprised of multiple features, including CleanAir 80 MHz, ClientLink 3.0, RF Noise Reduction, Smart Roam, and RF Turbo Performance.	High-density is a Ruckus' specialty due to features like BeamFlex, ChannelFly, PD-MRC, SmartCast, SmartRoam, band balancing, load balancing, scalable RF design, custom scheduling and queuing software, and much more. High density competitive performance consistently shows a unique advantage for Ruckus. Cisco's high density experience feature set may improve their solution, but some components are misguided. First, 80 MHz are not recommended in high density, and CleanAir can't solve the problems of Wi-Fi contention. ClientLink has proven to have little benefit. Cisco's smartroam feature sounds akin to Ruckus' feature (of the same name) to steer clients to the best AP.
<b>Modular Hardware</b>	Cisco's 11ac strategy enables customers to buy an AP now with a module slot and then upgrade to 11ac in the future by purchasing a modular 11ac hardware radio and a software upgrade to the AP. This type of investment protection allows customers to buy premium products today when their buying cycles occur and then upgrade to the forthcoming technologies in the future when requirements, budgets, and timelines allow. This provides confidence that a purchase today will not outdate too soon.	The only Cisco APs to offer modules are high-priced APs, at \$1,495. Modules then cost \$495, making the total investment nearly the same price as buying a purpose-built Ruckus AP now and then another one in the future with the newer technology. Adding a module to a 3-4 year old AP (typically when modules are available) tries to extend the life of an AP with older hardware components like CPU, RAM, flash, and antenna designs. Further, modules require additional power to operate, have constrained physical designs based on space limitations, potential compatibility issues, and Cisco's modules have always exhibited poorer performance than purpose-built designs (from Cisco and Ruckus). Labor time/cost of module installation is another critical concern.

# Ruckus vs Cisco

## RUCKUS FEATURES



May 2015

Feature	Ruckus Feature	Cisco Solution
<b>Adaptive Antenna (BeamFlex)</b>	Ruckus intelligently adapts transmissions using directional antenna patterns that maximize signal quality, minimize interference, and benefit reliability and capacity.	ClientLink is chip-based TxBF that provides little-to-no real-world performance gain, requires tradeoffs with spatial multiplexing, and doesn't work for multi-stream users.
<b>Active Channel Selection (ChannelFly)</b>	Ruckus actively operates on and measures channel capacity for each channel, collecting valid, real-use statistics and increasing capacity for the entire WLAN.	Cisco's RRM algorithm passively measures channel quality by going off-channel, capturing less than 0.1% of traffic on a channel.
<b>Native User Onboarding (Zero-IT Activation)</b>	Built-in to the Ruckus solution is an onboarding tool that auto-provisions client devices with a connection profile. Easy access with no admin intervention.	By combining Cisco WLAN and ISE and then integrating with non-Cisco backend solutions, Cisco offers an expensive and complex onboarding option for enterprises.
<b>Per-User PSK (DPSK™)</b>	Dynamic PSK technology allows Ruckus customers to provision a unique PSK for each user. It's secure, scalable, and easy to provision and manage.	Cisco does not offer a per-user PSK option and requires tradeoffs between PSK or 802.1X.
<b>SmartMesh Networking</b>	SmartMesh is enabled by adaptive BeamFlex antennas, capacity-based path selection, adaptive wire failover, self-healing and -forming algorithms, and one-click setup.	Cisco's offers mesh as a static AP mode, with deployment limitations. No antenna adaptation, slow convergence, no wire failover, and complex setup.
<b>Polarization Diversity with MRC</b>	Smart antenna design by Ruckus incorporates by horizontal and vertical adaptive polarization to match client device orientation and improve predictability.	Due to ClientLink design limitations, Cisco's antenna orientations are all vertical, leaving a lot to be desired for portable clients with variable orientations.
<b>Application-detection (voice/video) heuristics</b>	In addition to L7 features, Ruckus SmartCast profiles applications and re-prioritizes or de-prioritizes specific types of voice/video traffic to improve reliability.	Cisco's AVC feature includes some prioritization components, but requires a lot of configuration and tuning by administrators to get it right.
<b>Ease of Use</b>	Ruckus features are designed to be automated, self-learning, self-optimizing, and adaptive. This improves solution performance and reliability with low IT overhead.	Focusing on large enterprises, Cisco's solution may be useful to experts, but most features require admin education and expertise for optimization.
<b>Band Balancing</b>	Controlling user connectivity to preferred bands in high capacity environments enables the solution to maximize capacity and intelligently spread client load.	Cisco's BandSelect is a band steering feature that attempts to steer all dual-band clients to 5 GHz, regardless of capacity and client load.
<b>Spectrum Analysis</b>	Available in the ZD GUI as well as a mobile application for Android, with Real-Time FFT, duty cycle, and spectrogram visualizations.	Strong spectrum visuals, but may require additional solution components (MSE and Cisco Prime) to maximize all features.
<b>Time-based SSID Schedule</b>	Offers user-configurable WLAN schedules, making some SSIDs only available when desired.	No SSID schedules offered.
<b>Integrated Test Tools</b>	Administrators often need to test connectivity and link quality between APs and clients. Integrated speedtest tools enable them to easily do so.	No integrated speed or reliability test tools for clients or APs. Requires third-party test tools.
<b>Mobile Apps</b>	Enhancing "ease of use," Ruckus has designed mobile apps for site survey validation, throughput and reliability tests, and system monitoring/management/configuration.	No ease of use apps to improve management, performance testing, or planning/deployment.

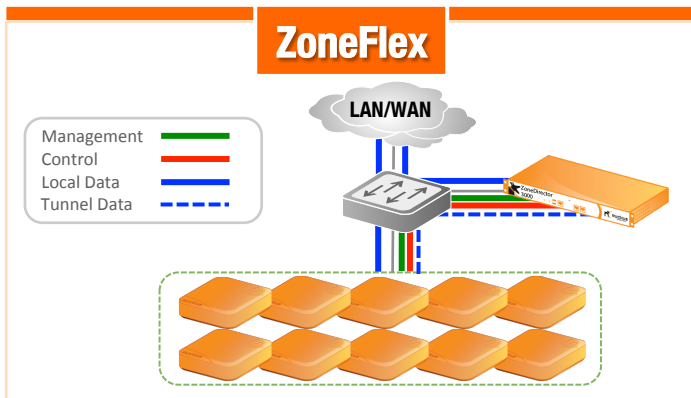
# Ruckus vs Cisco

## ARCHITECTURE OVERVIEW



May 2015

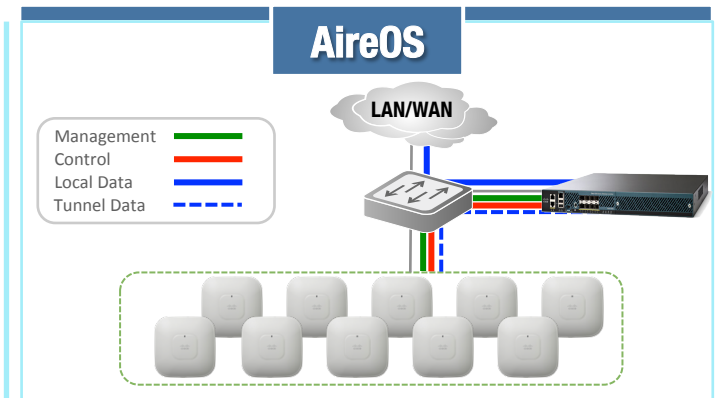
### Ruckus Architecture



#### Ruckus ZoneFlex

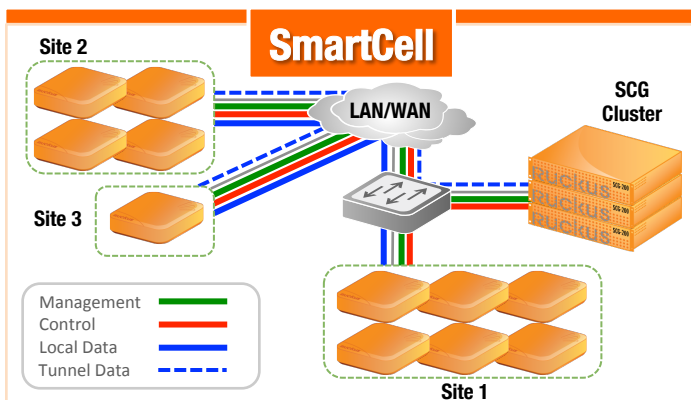
- Easy to setup, manage, optimize, and upgrade
- ZoneDirector appliance(s) are both scalable AND cost effective
- Designed for distributed data, but enables tunneling as needed (guests, voice, L3 mobility)
- Industry-leading features (BeamFlex, Zero-IT, DPSK, ChannelFly, SmartMesh, SmartCast)

### Cisco Architecture



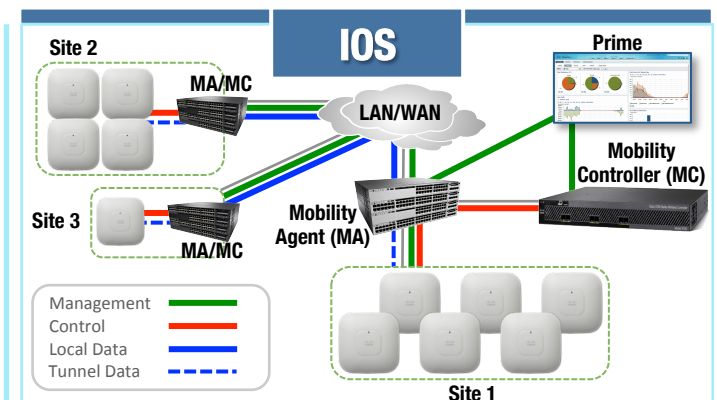
#### Cisco AireOS

- Fully centralized data path; potential bottleneck and leads to greater need for redundancy
- More expensive to scale for next-gen speeds
- AP modes are static and sacrifice flexibility (mesh, FlexConnect, local, spectrum, etc.)
- Not converged with Cisco IOS architecture
- No multi-tenancy in any Cisco architectures



#### Ruckus SmartCell Architecture

- Ultra scalable SCG clusters support tens of thousands of APs
- Fully redundant management, control, and data planes with failover/handoff; distributed AP operation if SCG cluster is unreachable
- Flexible distributed or centralized data path, including multiple “northbound” options: L2/L3 over GRE, 1Q VLAN, 3G/4G packet gateways
- Intuitive zone-based AP setup and configuration
- Multi-tenant framework for managed services



#### IOS Converged Access

- New Cisco architecture with goal of converging with IOS operating system and framework
- Immature solution development, lacking many features of AireOS and Ruckus solutions
- Poor management options with primitive GUI and weak support by Prime
- Fractured architecture requires multiple control points for scale, mobility, RRM
- Unnecessarily weds Wi-Fi/Ethernet, promotes vendor lock, forces tradeoffs in upgrade cycles

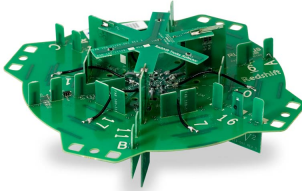
# Ruckus vs Cisco

## SOLUTION OVERVIEW



May 2015

### Ruckus RF Optimization



BeamFlex is a custom multi-element antenna array that adaptively selects the best antenna pattern(s) for each user and each individual packet

- Improves SNR (up to 9 dB) and RF reliability
- Works at the same time as TxBF or spatial multiplexing on the same chain
- Directional power control reduces interference
- Fewer APs are required to support a network
- MRC with polarization diversity (PD-MRC) adapts to client antenna polarization

### Cisco RF Design



Cisco ClientLink is a proprietary form of implicit TxBF that attempts to phase-align transmitted signals without client calibration or feedback

- Cannot do spatial multiplexing with same radio chains
- Does not work well with clients in motion
- Real-world testing shows no demonstrable benefit
- Still sends RF energy omni-directionally, causing interference with neighboring APs
- Offers no benefit to multi-stream clients

### Investment Awareness

- Does the RF system automatically learn and adapt its operating behavior to the RF environment?
- Will the APs provide a reliable onramp to your network and its mission-critical services?
- Can your solution handle future capacity and performance demands, dynamic radio environments, or RF interference?

### Ruckus Challenge

Don't take our word for it. Set up our system, set up their system, and put the rhetoric to the test.

- Is it easy for your admins to use?
- Does it meet your performance and reliability requirements?
  - In your environment
  - With your applications
  - With your devices
- How long does it take to setup the management system, connect an AP, configure a guest and secure corporate network and connect a device?

### Ruckus Support

- As a Wi-Fi centric company, we can commit to focusing on the features, performance, and reliability that matter to your users.
- As a smaller company, we can acknowledge and respond to your feature requests and support requirements more efficiently.
- The future of our solution will not be controlled by and tied to other business units that must be sustained as technologies evolve.

# Ruckus vs Cisco

RUCKUS IN THE REAL WORLD



May 2015

## City of San Jose



“Our previous Wi-Fi network was based on older technology and was simply no longer a viable infrastructure for delivering the robust, high-performance service users have come to expect within Silicon Valley. Fast and reliable wireless connectivity is no longer negotiable – it has become table stakes when trying to attract world-class events and businesses that want to come to San José. Recent technology advances in wireless signal controls and smart Wi-Fi meshing made by Ruckus enable us to deliver just that.”

*Vijay Sammeta, Chief Information Officer*

### Satisfied Customers



### Ruckus Highlights

- Publicly traded on NYSE (RKUS)
- Formed: June 2004
- Customers 52,000+
- Solution Partners: 11,000+
- Worldwide market share leader in service provider Wi-Fi segment for both unit shipments and revenue (Dell'Oro)
- Recognized as leader in IDC MarketScape enterprise WLAN 2013-2014 vendor analysis