Lab Testing Summary Report

May 2013
Report 130508

Product Category:

Wireless Controllers

Vendor Tested:

Cisco Catalyst 3850
Cisco WLC 5760
Aruba 7240

Products Tested:

Cisco Catalyst 3850
Cisco WLC 5760
Aruba 7240

Key findings and conclusions:

- For typical IMIX traffic, Cisco WLC 5760 is 6 times faster and provides 8 times the forwarding rate as compared to the Aruba 7240 controller.
- Cisco Catalyst 3850 unified access switch provides for 40Gbps wireless controller performance and outperformed Aruba’s 7240 controller at all packet sizes.
- UADP (Unified Access Data Plane) programmable ASIC architecture provides strict priority queuing for mission-critical applications during periods of oversubscription. This crucial functionality is unique to Cisco.
- Downloadable policy from ISE provides simple and granular network access control for the Cisco WLC 5760 and Catalyst 3850 switch for enabling a unified BYOD experience.
- Cisco proves to be 330% more efficient at data center power consumption for delivering the same throughput capacity.

Cisco engaged Miercom to evaluate the WLC 5760 Wireless Controller, the Catalyst 3850 Switch with an integrated wireless controller and the Aruba 7240 Wireless Controller. These three devices were evaluated for performance and forwarding capabilities.

To benchmark these products, Miercom used IMIX and varied packet size traffic to determine throughput and forwarding capability of the controller data plane. Additionally, QoS functionality for high priority applications in times of over subscription and downloadable policy management using Cisco Identity Services Engine (ISE) were validated. Competitive products will be referred to as WLC 5760, Catalyst 3850 and Aruba 7240.

Both Cisco devices are based on the new Cisco Unified Access Data Plane (UADP) ASIC. The UADP programmable ASIC provides strict priority QoS implemented in hardware resulting in consistent granular QoS control, and enables downloadable policy to be applied to both

Figure 1: Cisco IMIX Performance Comparison between Cisco WLC 5760, Catalyst 3850, and Aruba 7240

Source: Miercom, May 2013

Cisco WLC 5760 throughput was six times greater than Aruba 7240 during handling wireless traffic using IMIX traffic load.
wired and wired infrastructure, simplifying life for network administrators.

Aruba 7240 Wireless Controller supports 40Gbps of throughput. In comparison, Cisco WLC 5760 wireless LAN controller can handle 60Gbps of throughput, and the Catalyst 3850 switch supports up to 40Gbps of wireless throughput.

Figure 1 on page 1 shows the comparison throughput with IMIX traffic. Cisco WLC 5760 achieved 50Gbps, Cisco Catalyst 3850 reached 37Gbps, and Aruba 7240 attained 8Gbps. Compared to Aruba 7240, Cisco WLC 5760 provides 625% better throughput and Cisco Catalyst 3850 delivers 460% better throughput.

Performance

Cisco Catalyst 3850, WLC 5760 and Aruba 7240 were tested for throughput using RFC 2544. For the Cisco devices, lightweight access point simulators were used instead of actual LAPs to inject nearly 100% line rate traffic. The Aruba 7240 was tested connected directly to the Spirent Testing Center, Cisco Catalyst 3850 and WLC 5760 do encapsulation and de-encapsulation for bidirectional traffic, while Aruba 7240 does not.

All three wireless controllers tested could maintain maximum throughput with larger frames, however the equation changes completely for smaller frame sizes. See Figure 2. With smaller frame sizes, Catalyst 3850 and WLC 5760 provided more than 70% of line rate, while Aruba only achieved less than 15% of line rate.

In this test, a 1420-byte frame size was used to avoid fragmentation that is caused by encapsulation overhead caused by the lightweight access point simulator. The protocol overhead includes IP and UDP headers for CAPWAP tunneling, CAPWAP header, and 802.11 headers.

Cisco’s ability to handle more traffic throughput for small sized frames is based on the new programmable ASIC called UADP ASIC. Aruba 7200 series uses multiple network processors. Dedicated hardware, such as ASIC, is faster than a network processor. Networking devices from Cisco with UADP ASIC provide better frame transmission. Production environments use small to middle sized frames. See Figure 3 on page 3. Regardless of the frame size, the network process on an Aruba 7240 controller cannot scale with the increase in number of packets, resulting in lower throughput at smaller frame sizes. Because of expected growth of gigabit wireless networking on each access point, the number of supported access points and aggregate throughput of a wireless controller will be important factors. Throughput literally determines the number of 802.11ac lightweight access points in production environments.

Throughput testing used IMIX traffic, common for measuring throughput in a real-world environment. With IMIX traffic, different frame sizes with different ratios are transmitted. The three controllers were also tested with IMIX-based throughput. See Table 1 on page 3 on Ratio of IP Packet Sizes used in this IMIX test.

Quality of Service

Aruba 7240 and Cisco WLC 5760 were tested for QoS during high volume traffic. Mean Opinion Score (MOS) describes whether the voice or video communication experience is acceptable for use using a numerical range between one and five. Five is perfect, three is passable, two is poor, and one is impossible to communicate. Normal land line

![Figure 2: Line Utilization](image-url)

Source: Miercom, May 2013

Cisco WLC 5760 wireless controller and Catalyst 3850 switch with integrated wireless controller both demonstrate superior throughput by percent of line rate compared to the Aruba 7240 controller.
level is around 4.3. Because testing of actual VoIP traffic and listening and evaluating is subjective, the IxChariot of Ixia Testing Tool is used for MOS grading.

Without background traffic, both Aruba 7240 and Cisco WLC 5760 could successfully transmit 10 simultaneous G.711u codec voice calls with acceptable call quality. Once background traffic is injected into Aruba 7240, it lost 7.4% of VoIP traffic. As a result, this caused a reduction in the MOS score to 1.31 which is unacceptable. When background traffic was injected into Cisco WLC 5760, 100% of VoIP traffic went through and MOS remained the same. See Figure 4.

### Video Quality of Service Testing

QoS was also tested for higher bandwidth application by transmitting video on the Aruba 7240 and Cisco WLC 5760 and measuring image quality, in the presence of high volume of background traffic.

With two client computers accessing the network via wireless access points, a video was played and screen captured while running a high volume of background traffic. Screen captures show Quality of Service in Figure 5 on page 4.

A computer using Aruba 7240 wireless controller and an AP-135 lightweight access point showed a distorted video presentation. The client that used Cisco WLC 5760 wireless controller and a Cisco 3602i lightweight AP had no reduction in video quality.
Throughout QoS testing, Cisco WLC 5760 showed reliable transmission of traffic which was properly prioritized. The voice and video traffic used in the testing was labeled to expedite forward. In contrast, the Aruba 7240 controller lost a large amount of traffic as it was unable to honor the expedite forwarding label under simultaneously applied heavy data load tests. Cisco’s UADP ASIC architecture and QoS buffering ensured transmission of mission critical applications, while the Aruba product, based on a network processor, had issues providing QoS during heavier background traffic loads.

### Data Center Efficiency

Optimizing the overall power efficiency of the data center requires minimizing power level and consumption at every level within the infrastructure. With gigabit Wi-Fi, wireless controllers sitting in the data center needs to handle much more data than before, and this could possibly lead to additional controllers. For handling 50 Gbps of IMIX traffic on a wireless network, seven Aruba 7240 controllers are needed in comparison to just a single Cisco WLC 5760, resulting in seven times more Rack Unit (RU) space in the data center. From datasheets, each Aruba 7240 consumes about 165 watts of power, as compared to 350 watts for a Cisco WLC 5760. In the power comparison graph of Figure 6, Cisco is 330% more efficient for equivalent throughput performance and delivers more Gbps/watt. This is important as each watt of power consumed in the data center requires further cooling capacity, escalating the costs even further.

#### Unified Network Policy Management by Downloadable ACL

Network policy management is complex due to various modes of network access devices, such as wired, wireless, and VPN. The types of clients, such

![Figure 5: Captures of Video Playing on Client Computers during Network Congestion](Source: Cisco, May 2013)

In the first capture, there is a significant drop of video quality during 60% background traffic on the Aruba 7240. No drop in video quality is observed in the second capture during 83% background traffic on the Cisco WLC 5760.

![Figure 6: Data Center Power Comparison](Source: Miercom, May 2013)

Cisco WLC 5760 is 330% more efficient for equivalent throughput performance and delivers more Gbps/Watt.
BYOD devices add to the complex mix. Conventional network policy implementation has evolved, based on the development of network technology. A common implementation of network policy, ACLs are now divided into other classifications, such as Standard and Extended ACL, Dynamic ACL, Reflexive ACL, Time-based ACL, Context-based ACL, and so on. These network policies have to be implemented on each network device. This becomes a complex task for network managers. Cisco WLC 5760 and Catalyst 3850 support downloadable ACL policy. We tested the capability of pushing a policy ACL from Cisco Identity Service Engine (ISE) without manually configuring it on the access device. This becomes a complex task for network managers. Cisco WLC 5760 and Catalyst 3850 support downloadable ACL policy. We tested the capability of pushing a policy ACL from Cisco Identity Service Engine (ISE) without manually configuring it on the access device. ISE has a centralized management of context-based network policy enforcement based on criteria such as who, what, when, where, and how. It can apply different policies on user or device type basis. This test focused on creating an ACL on the ISE server and applying the policy to both Cisco WLC 5760 (wired and wireless) and Catalyst 3850 (wired) using the downloadable ACL, simplifying life for a network administrator.

We verified that the downloadable ACL was an efficient management tool for ACL-based network policy implementation. These policies can be saved or modified at the ISE server. The policies can then be applied to individual network infrastructure devices that have downloadable ACL capability. ISE defines policy criteria based upon user, device type, and lightweight access point being used. Cisco ISE GUI control panel shows integrated reporting functions to visualize auditing and reporting about network policy. Centralized network policy, provided by downloadable ACLs from ISE reduces this complexity and gives granular network access permission control of the Cisco Catalyst 3850, WLC 5760 and other network devices that support downloadable ACLs. Figure 7 shows the configuration for downloadable policy on the ISE.

**Bottom Line**

Cisco wireless concentrator products demonstrated truly exceptional performance and capacity beyond that of competitive products based on Miercom hands-on testing validation. Both products tested achieve high throughput and scalability for a wide range of packet sizes tested. Cisco solutions delivered aggregate wireless throughput at their advertised capacity, whereas the competitive product could only handle a fraction of its capacity. This translates into fewer controllers at the data center, for providing the same throughput capacity, further pushing your data center efficiency.

Unlike its competition, excellent voice and video quality under heavy load were observed with the Cisco solutions.
How We Did It

The Cisco WLC 5760 and Aruba 7240 wireless controllers and the Cisco Catalyst 3850 switch were tested for throughput, validation of QoS, validation of better performance of UADP ASIC relative to a network processor, capability of downloadable policy management with ISE, and B-W ration on two SSIDs.

Products tested: Cisco Catalyst 3850, fixed GE access switch, version 03.02.01.SE; Cisco WLAN 5760, 60Gbps wireless controller, version 03.02.01.SE; and Aruba 7240, 40Gbps Wireless Controller, version 6.2.1.0.

Spirent Test Center was used for the RFC load testing. In the case of the Cisco Access Controller tests, the traffic was routed through the lightweight wireless controller simulators. For the Aruba tests, the traffic was routed directly through the Aruba controller.

Ixia IxChariot was used for the Voice QoS testing, simulating real life voice calls, in the presence of background traffic generated by the Spirent Test Center. The access points used in this test case were Aruba AP-135 and Cisco 3602i. Video QoS Testing was performed using VLC media player as the streaming application on Apple MacBook Pro Laptops. Both the QoS Tests were performed under similar RF conditions. The lightweight wireless controller simulator provided upstream CAPWAP IP/UDP encapsulation and traffic was de-capsulated at either Cisco WLC 5760 or Cisco Catalyst 3850.

The testing network was supported by Cisco Nexus 7000 and Cisco Catalyst 6000 switches.

The tests in this report are intended to be reproducible for customers who wish to recreate them with the appropriate test and measurement equipment. Current or prospective customers interested in repeating these results may contact reviews@miercom.com for details on the configurations applied to the Device Under Test and test tools used in this evaluation. Miercom recommends customers conduct their own needs analysis study and test specifically for the expected environment for product deployment before making a product selection.
Miercom Performance Verified

We are very pleased to present Cisco the Miercom Performance Verified Certification for the Cisco Catalyst 3850 and the Cisco WLC 5760 products.

Cisco wireless concentrator products demonstrated truly exceptional performance and capacity beyond that of competitive products based on Miercom hands-on testing validation. Along with providing excellent voice and video quality under heavy load, both products tested achieve high throughput and scalability for a wide range of packet sizes tested. Cisco solutions proved more aggregate wireless throughput at their advertised capacity, whereas the competitive product proved only a fraction of its capacity.

About Miercom’s Product Testing Services

Miercom has hundreds of product-comparison analyses published over the years in leading network trade periodicals including Network World, Business Communications Review, Tech Web - NoJitter, Communications News, xchange, Internet Telephony and other leading publications. Miercom’s reputation as the leading, independent product test center is unquestioned.

Miercom’s private test services include competitive product analyses, as well as individual product evaluations. Miercom features comprehensive certification and test programs including: Certified Interoperable, Certified Reliable, Certified Secure and Certified Green. Products may also be evaluated under the NetWORKS As Advertised program, the industry’s most thorough and trusted assessment for product usability and performance.