SOLVING THE STICKY CLIENT PROBLEM IN WIRELESS LANS

Aruba Networks AP-135 and Cisco AP3602i

Conducted at the Aruba Proof-of-Concept Lab
May 2013
Statement of test result confidence

- Aruba makes every attempt to optimize all vendors for performance and follow best practices for configuration as published by the vendor.
- Aruba makes every attempt to make a fair and apples-to-apples comparison, including AP mounting position, client location, transmit power, channel and the latest shipping firmware.
- Aruba ensures the test bed environment to be free of any interference sources. Also, the 802.11 Wi-Fi channels configured are ensured to be consistent when testing 2.4 GHz and 5 GHz bands for all vendors.
- Aruba believes the test results are both repeatable and reproducible in similar testing environments.
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Executive summary

One of the most common challenges for wireless network engineers today is the sticky client problem – those mobile devices that just don’t seem to roam to the best access point (AP). There are not many of these devices, but few of them are enough to cause significant performance degradation for many others. This is simply because the Wi-Fi airtime is shared among all connecting to the wireless LAN (WLAN).

With Wi-Fi, mobile devices have traditionally been in charge of the decision as to when to roam from one AP to the other. But given that they do not have access to real-time information on all mobile devices, all APs and all interference sources within a WLAN – they usually do not pick the best AP to connect to.

Aruba’s ClientMatch technology has been designed to overturn this mobile device behavior. With ClientMatch, the WLAN infrastructure influences and initiates mobile device roaming decisions – during those times when mobile devices are supposed to roam to a better AP and they do not.

ClientMatch does not require any special software on mobile devices and is not specific to any AP model – it is enabled on all Aruba APs and works with any old or new smartphone, tablet or laptop.

It moves mobile devices between different AP radios and Wi-Fi frequencies, without disrupting existing communication. If there an active latency sensitive application session that’s active, ClientMatch can be instructed to delay its decision. Obviously wireless network engineers can choose to turn on ClientMatch in certain locations of their WLAN deployment, as part of the technology adoption cycle.

Since it helps to improve the health of every AP in the WLAN, all mobile devices experience better performance with ClientMatch – and not just the sticky ones. In this report we have summarize how much of a performance improvement it brings to the table.

As part of the benchmarking process, the tests were run and compared with a Cisco WLAN solution. The key highlights from the testing are as follows.

<table>
<thead>
<tr>
<th>Test Scenario</th>
<th>Description</th>
<th>Aruba</th>
<th>Cisco</th>
<th>ClientMatch Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sticky client performance</strong></td>
<td>Performance of a mobile device after it changed its location</td>
<td>18 Mbps</td>
<td>0.4 Mbps</td>
<td>45 times higher</td>
</tr>
<tr>
<td><strong>Total network capacity</strong></td>
<td>Total WLAN throughput measured across four APs after 10 sticky mobile devices changed their location</td>
<td>218 Mbps</td>
<td>116 Mbps</td>
<td>~2 times higher</td>
</tr>
<tr>
<td><strong>First AP capacity</strong></td>
<td>Total throughput measured on the original AP after 10 sticky devices changed their location</td>
<td>61 Mbps</td>
<td>18 Mbps</td>
<td>&gt; 3 times higher</td>
</tr>
</tbody>
</table>

*Table 1. Test results summary*

These test results indicate a significant variation in performance between Aruba and Cisco Wi-Fi products. Customers are advised to exercise their own judgment before making a vendor decision for their Wi-Fi network. The rest of the document provides comprehensive details of the test cases, test bed setup, observations and results collected. Detailed configuration for both vendors is also included in the appendix for easy reference.
## Test environment

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Device</th>
<th>Quantity</th>
<th>Firmware version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aruba</td>
<td>AP-135</td>
<td>1</td>
<td>ArubaOS 6.3</td>
</tr>
<tr>
<td></td>
<td>3600 Mobility Controller</td>
<td>1</td>
<td>ArubaOS 6.3</td>
</tr>
<tr>
<td>Cisco</td>
<td>3602i</td>
<td>1</td>
<td>7.4</td>
</tr>
<tr>
<td></td>
<td>5508 controller</td>
<td>1</td>
<td>7.4</td>
</tr>
</tbody>
</table>

**Table 2. Devices under test**

<table>
<thead>
<tr>
<th>Item</th>
<th>Component</th>
<th>Specifications</th>
<th>Quantity</th>
<th>OS Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Laptops</td>
<td>Dell Latitude (450 Mbps max Wi-Fi rate)</td>
<td>20</td>
<td>Windows 7</td>
</tr>
<tr>
<td></td>
<td>Tablets</td>
<td>Apple iPad (65Mbps max Wi-Fi rate)</td>
<td>20</td>
<td>6.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Samsung Galaxy Tablet (65 Mbps max Wi-Fi rate)</td>
<td>10</td>
<td>4.1</td>
</tr>
<tr>
<td>2</td>
<td>Performance evaluation tools</td>
<td>IxChariot</td>
<td></td>
<td>7.10 SP 3</td>
</tr>
<tr>
<td>3</td>
<td>Access switch</td>
<td>Aruba Mobility Access Switch S3500-48P</td>
<td></td>
<td>7.2</td>
</tr>
<tr>
<td>4</td>
<td>AP mounting type</td>
<td>Ceiling mount</td>
<td></td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Table 3. Test equipment**
Test bed setup

Figure 1 below shows the APs and mobile devices under test. Performance test tools and APs were connected at Layer 2 to the Aruba S3500 Mobility Access Switch. The switch performed DHCP services providing IP addresses to all the devices. Aruba’s ClearPass Policy Manager provided RADIUS authentication services for the Wi-Fi clients.

As highlighted in Figure 1 above, Samsung Galaxy Tablets were discovered to show sticky client behavior: they did not roam to another AP with better signal strength as they changed location, without help from ClientMatch. All test measurements in this report were taken as they changed location between four APs in the WLAN.

Test scenarios

The following scenarios were benchmarked in the Aruba Networks proof-of-concept lab.

Scenario 1: Measuring the performance of the sticky mobile device

This test measured the change in TCP throughput for a sticky Samsung Galaxy Tablet as it changed its location. As the tablet moved from the AP it was connected, Aruba ClientMatch intervened and handed the mobile device off to the next AP – hence allowing it to maintain its network performance.

In the Cisco WLAN, tablet stayed connected to the original AP even if there was a much better AP for it to connect to. As a result, the tablet experienced 94% drop in its total performance.
The following charts summarize the performance of the sticky client on a Cisco and Aruba WLAN – before and after it changed its location.

**Chart 1. Samsung Galaxy tablet on Cisco Wi-Fi**

**Chart 2. Samsung Galaxy tablet on Aruba Wi-Fi with ClientMatch**

As it is clear from the charts above, there is simply a big difference in how well a Samsung Galaxy tablet – and other sticky clients like it – performs when connected to an Aruba WLAN, compared to a Cisco WLAN.
Scenario 2: Measuring the total WLAN performance as sticky clients changed location

The second scenario takes it one step further and measures the total Aruba and Cisco WLAN performance – before and after – as all 10 of the Samsung Galaxy tablets changed their location. In the Aruba WLAN, thanks to ClientMatch, all tablets roamed to closer APs and maintained their performance.

In the Cisco WLAN, none of the tablets roamed to better APs. Accordingly, all APs had to sacrifice network capacity as they served these tablets at low Wi-Fi data rates.

Charts below summarize the total Cisco and Aruba WLAN performance – before and after the tablets changed their location.

**Chart 3. Total performance of Cisco WLAN**

**Chart 4. Total performance of Aruba WLAN with ClientMatch**
Even before the tablets had changed their location, Aruba WLAN commends a big lead in terms of total network capacity. As the sticky clients are moved to a different location, the gap widens and Aruba offers almost twice the capacity compared to the comparable Cisco WLAN.

**Scenario 3: Measuring an AP performance as sticky clients moved away from the AP**

The last scenario looks at the change in performance of an AP as 5 sticky Samsung Galaxy tablets moved away from it. With ClientMatch, Aruba WLAN was quick to hand these tablets over to better suited APs, leaving the original AP to serve five laptops and five Apple iPads.

On the other hand, with Cisco WLAN, Galaxy tablets stayed associated with the first AP they were connected to – forcing the AP to waste its airtime to serve these mobile devices at a greater distance.

Charts below summarize the impact of sticky clients on individual AP capacity as they change their location when connected to an Aruba or Cisco WLAN.

![Chart 4. Total performance on the first Cisco AP](image)

![Chart 5. Total performance on the first Aruba AP, with ClientMatch](image)
What do the tests reveal?

As we design WLANs to support higher density of mobile devices, we must not forget how a sticky few can cause problems for many. If we cannot overcome the sticky client problem and trust mobile devices to make the best decision on when to roam between APs, we might be paying a big price on Wi-Fi performance.

Aruba ClientMatch takes the guesswork out of mobile device behavior on WLANs. When mobile devices are not able to make the call to roam to a better AP, it makes sure that it happens without disrupting any existing communication. With ClientMatch, each and every mobile device on the WLAN achieves predictable performance.

About Aruba Networks, Inc.

Aruba Networks is a leading provider of next-generation network access solutions for the mobile enterprise. The company’s Mobile Virtual Enterprise (MOVE) architecture unifies wired and wireless network infrastructures into one seamless access solution for corporate headquarters, mobile business professionals, remote workers and guests. This unified approach to access networks enables IT organizations and users to securely address the Bring Your Own Device (BYOD) phenomenon, dramatically improving productivity and lowering capital and operational costs.

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