

Multimedia for the Enterprise Wireless LAN: *Exploring Key Requirements*

A Farpoint Group Technical Note

Document FPG 2010-451.1
November 2010



While it can be agreed that the era of multimedia on PCs began about 20 years ago with the addition of sound cards and CD-ROMs, it quickly became clear that support for the real-time delivery of digital media would be a core requirement for the LAN. After all, every other form of information is (and has been for some time) delivered via a network today, and static media, including optical discs, are fading in importance as many new subscriber units lacking these peripherals, including handsets and tablets, gain acceptance and even favor in corporate environments. And, of course, as the wireless LAN continues its rapid evolution to the role of default and even primary access in the enterprise, the requirement for multimedia information delivery is necessitating additional advances in the architecture, design, and implementation of enterprise-class WLAN products. Indeed, we are now seeing the term *multimedia grade* being used to describe WLAN infrastructure capable of handling large volumes of multimedia data, and even the formation of a new cross-industry Multimedia-Grade Working Group [<http://multimediagrade.com/>], who have defined a broad set of requirements in a White Paper available at their site.

We use the term *multimedia* in general to describe any digital information with a time-bounded component. The original definition of multimedia, the inclusion of data objects beyond simple text, is no longer adequate to scope IT requirements today. Rather, multimedia is characterized by the requirement for data objects including voice and streaming video to be processed in such a manner that the fidelity and flow of this data is preserved. Interruptions due to a lack of capacity, radio interference, or other factors is simply not acceptable - as voice over IP over Wi-Fi (VoFi) and video over Wi-Fi (VidFi) become more common, user requirements are simple: there should be *no* difference in performance between communication over wire and communication over a wireless LAN. User expectations are identical in both cases.

While use of the term multimedia originally centered on (and, of course, still plays a major role in) entertainment applications, the importance of multimedia in corporate environments cannot be overstated. Farpoint Group has been encouraging our end-user clients for some time to include telephony in their WLAN deployment plans, this recommendation motivated by the same factors that have enabled the success of the WLAN overall – cost reduction, anytime/anywhere convenience, and the increasing availability of inexpensive subscriber units (including many cellular handsets) supporting voice and video on the WLAN. Just as it is extremely unlikely that one will find a notebook computer for sale today that does not include Wi-Fi, it is also increasingly uncommon to find enterprise-class smartphones that do not include Wi-Fi as well. We believe that the increasing popularity of unified communications coupled with the fundamental need for mobility satisfied by the wireless LAN will further motivate the rollout of VoFi in corporate settings, eventually leading to ubiquity. Similarly, video is increasing in both popularity and utility as well. In educational settings, for example, video is a key instructional and reference medium, and students at all levels are famous consumers of video for recreational and entertainment purposes as well. Indeed, voice and video will, we believe, become very common across essentially all venues and WLAN applications going forward.

But such demand represents a new challenge for the enterprise WLAN, which has traditionally been driven by requirements for simple coverage and increasing but non-time-bounded capacity. Adding that time-bounded component requires new facilities beyond the overprovisioning at least partially enabled by 802.11n.

Multimedia on the WLAN: Key Requirements

Successful implementations of multimedia services on the enterprise WLAN requires the availability of a number of key facilities, as follows:

- *CoS/QoS* – Class of Service and Quality of Service have been implemented in enterprise-class WLAN systems for some time, with an emphasis on both 802.11e/WMM and the use of VLANs. While both of these facilities can add significant value, WMM is easily spoofed, and VLANs extend to the wired network and can be very complex to manage. While the key here is bandwidth and latency policy definition and management, implementations must be end-to-end. And with the WLAN now the new edge of the enterprise network, key facilities must be implemented here. In fact, we believe that robust CoS/QoS capabilities in the WLAN mitigate the need for complex structures at the network core, which can be refocused to provide the capacity required via simple (and increasingly inexpensive) overprovisioning. The WLAN itself becomes responsible for application fingerprinting (identifying specific traffic types by address or behavior) and session prioritization. Multicast optimization, common in enterprise-class WLANs today, is also often of value here.
- *Airtime fairness* – With the CoS/QoS emphasis in WLAN infrastructure, it is critical that solutions effective in multimedia environments be sensitive to the needs of different classes of data. Time-bounded traffic usually cannot tolerate latency of more than a few tens of milliseconds, with the best results obtained when this latency is reduced to the greatest degree possible. Intelligent, load-sensitive traffic scheduling and shaping is thus a core requirement for success in multimedia-intensive environments. For more information on this subject see Farpoint Group Technical Note 2008-341.1, *Advances in Wireless Infrastructure Control: Optimizing Client Behavior for Improved Network Performance*.
- *Interference management* – Interference is often a fact of life in the unlicensed bands used by Wi-Fi systems, with even the traditionally-underpopulated 5 GHz. bands now seeing significant traffic. Recent advances in technology produced a number of standalone (notebook-PC-based) spectrum analysis tools aimed specifically at Wi-Fi applications, enabling what Farpoint Group calls *spectral assurance*. But the even more recent (and even more exciting) addition of spectral assurance capabilities to WLAN infrastructure systems enables automatic remediation of situations that would otherwise severely degrade multimedia (and, of course, other) traffic.

- *Scalability* – It's also critical that enterprise solutions scale over time, so the addition of multimedia services is likely to result in demands for additional coverage and capacity that eventually present system-wide. Non-disruptive growth is therefore essential, when adding to or augmenting a WLAN footprint, or upgrading to newer technology like 802.11n. And, of course, user and client mobility is always a factor in wireless LAN operations – and thus network load can change quite dramatically with both time and roaming, necessitating additional tuning and/or additions to infrastructure.
- *Management* – And, as we universally so state, management console functionality is critical in improving reliability, operations productivity, the (perhaps automated) tuning noted above, and, of course, ultimately the productivity of all users of the enterprise WLAN – the reason that such capability is installed in the first place.

Finally, it is important to keep in mind that the wireless LAN typically represents only the edge of the network, and it is of course vital that provisioning and interconnection and at and to the core take into account the increasing presence of multimedia traffic. The rapidly decreasing cost of gigabit Ethernet, and networking equipment in general, makes it easy, however, to supply the capacity required here for a successful multimedia operation.

Exploring WLAN-Based Multimedia: A Few Experiments

We recently visited enterprise wireless LAN leader Aruba Networks to discuss the concept of multimedia on the WLAN in more detail. While there, we took advantage of the availability of demo systems in their new Executive Briefing Center to set up three simple tests to examine the impact of multimedia on the corporate WLAN and to explore the architectural features of Aruba's products designed to facilitate multimedia-based services. While these tests were of necessity small in scale, they did allow us to see the benefits of a number of key capabilities implemented by Aruba today. All of the following tests used an Aruba 3600 controller, and a single AP125 access point on one 20-MHz. 802.11n/g/b channel.

Test 1: The Multi-SSID Problem

A common technique used to isolate and prioritize different classes of traffic, and one that we ourselves have often used over the years, is the dedication of specific traffic types to a single ID. Most enterprise-class APs can simulate multiple SSIDs, so logistically this solution is easy. But there is some evidence that the overhead (in terms of additional management traffic, including beacon frames) involved in applying multiple SSIDs may affect multimedia performance, at the very least because of the loss of capacity due to per-SSID overhead inherent in this technique.

We therefore (see Figure 1) set out to construct a simple test to see how this approach might affect voice quality. For this test we used IXIA’s IxChariot to simulate a single voice client, with a 30-second run. The result here was a MOS score of 4.19, which is more than acceptable and indicates excellent voice quality. We then ran this test again, this time adding a single simultaneous 35 MB data transfer. The MOS dropped minutely to 4.05. Adding a second 40 MB UDP stream dropped the MOS to 3.14, which is still acceptable.

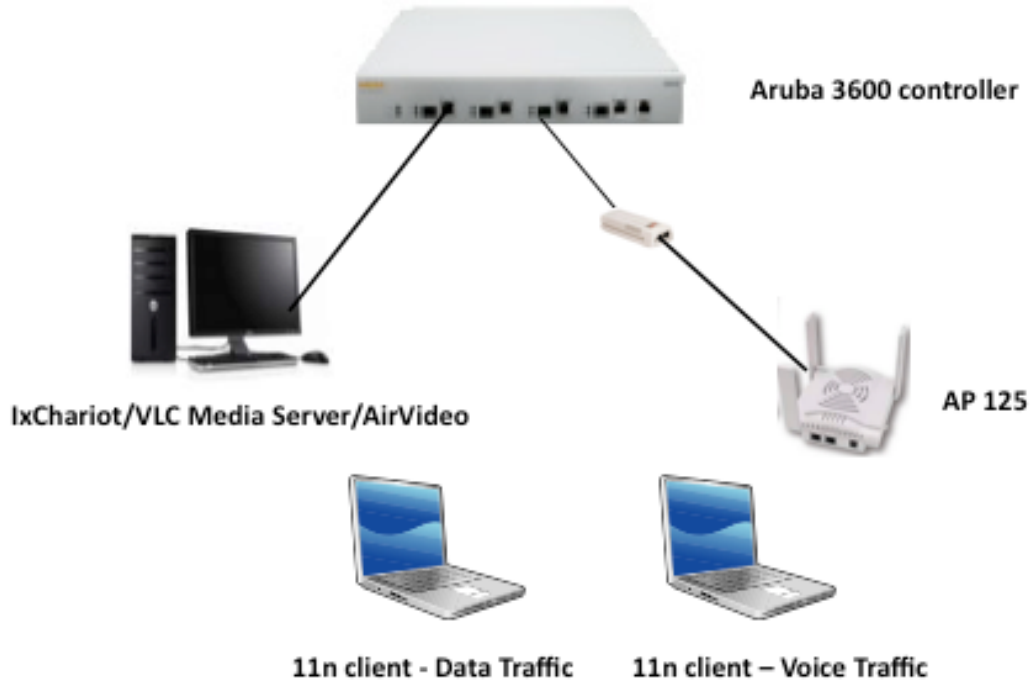


Figure 1 – The equipment configuration for Test 1, designed to explore the negative impact on capacity of multiple SSIDs made available but otherwise unused. *Source:* Aruba Networks/ Farpoint Group.

We then brought up an additional seven SSIDs, with no associated clients. We immediately noticed that channel utilization had jumped from 23% in the idle case with one SSID, to 35% (there were in fact 27 total SSIDs detected, at various distances from our test facility). We also turned Aruba’s traffic prioritization off, an unrealistic setting designed to simulate more common implementations dependent upon multiple SSIDs. Running the single voice plus 35 MB data test above under these conditions resulted in a MOS of 1.47, which would be unacceptable under any circumstances. The reason for this result is that the additional overhead of multiple SSIDs resulted in less attention for time-critical traffic.

We thus concluded that the multiple-SSID technique may in fact produce unacceptable results for multimedia (and, for that matter, much other) traffic. While this may be implementation- and tuning-specific, it makes sense that if traffic can be prioritized on a single SSID, overall system capacity and multimedia performance should improve.

Test 2: Application Prioritization and Airtime Fairness

Our second test (see Figure 2) involved the same infrastructure, but this time with video traffic to two .11n iPads , a .11g iPhone, and a notebook running VLC over .11b, all on Channel 11. All connected to the same video source, and all ran flawlessly (based on the subjective analysis of simply watching the video), the result here attributed to Aruba's ARM (Adaptive Radio Management) technology. We then added a simultaneous 120 MB data stream via an 802.11n client in order to oversubscribe the channel. Channel utilization zoomed from 40% to 70%, but all video streams continued to run without error.

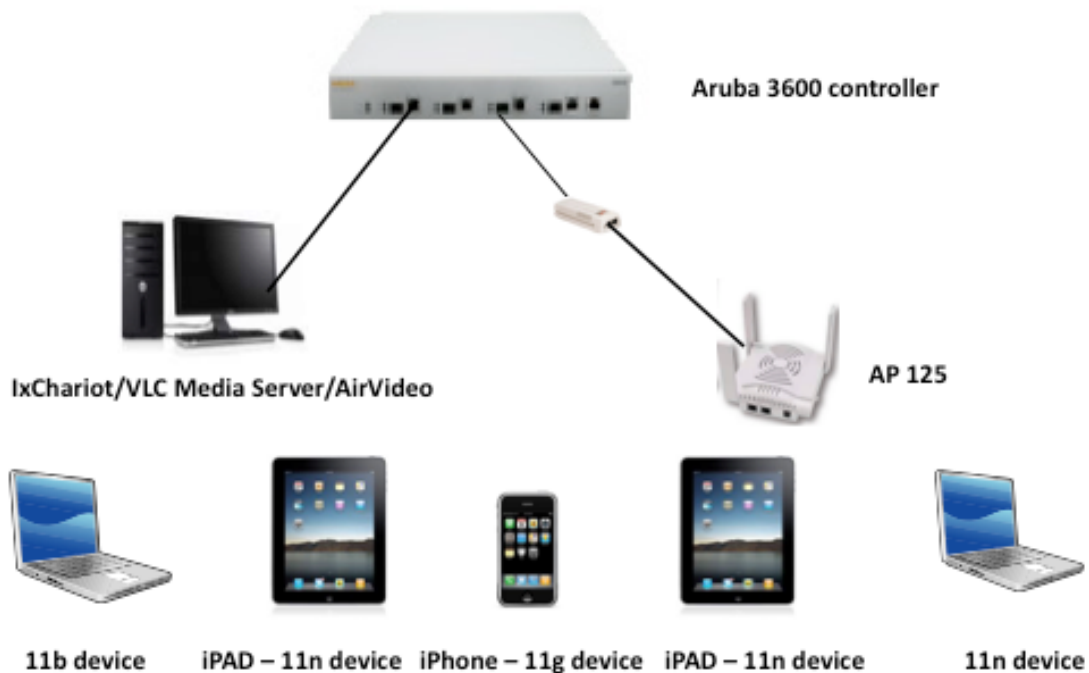


Figure 2 – Test configuration for Test 2. The 802.11n-based notebook was used to inject high-volume data traffic to determine if Aruba's ARM technology could successfully prioritize multimedia traffic, which has a low tolerance for latency. *Source: Aruba Networks/Farpoint Group.*

The key here was to create a rule for Aruba's Policy Enforcement Firewall to enable Port 45631 for video. Video was subsequently recognized, categorized, and prioritized automatically, and properly forwarded even under conditions of extreme loading. Note also that WMM was not a factor at all in these test, again reinforcing our conclusion that WLAN system architecture and features are much more important than this Layer-2 protocol.

Test 3: Interference

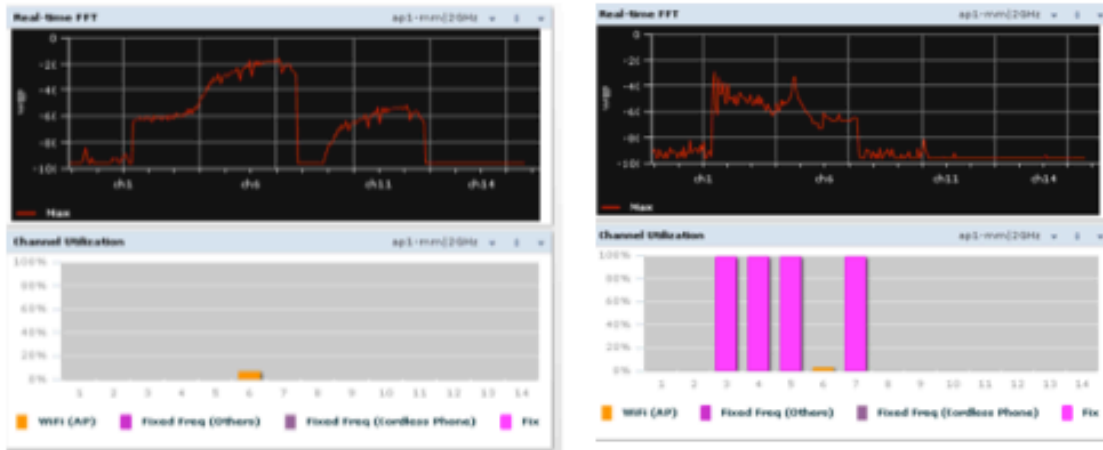
Finally, we decided to take advantage of Aruba's recently-available (on all of their 802.11n APs designed for campus, as opposed to remote, use) spectral analysis capability

to evaluate the role of interference on video performance. As we noted above, spectral assurance (and now, with its integration into WLAN infrastructure, remediation) are key functions that we believe will quickly become essential to all enterprise-class WLAN operations. Previous experience with interference as a factor in Wi-Fi-based video (see our Technical Note FPG 2006-329.3, *The Effects of Interference on Video Over Wi-Fi Traffic*) showed that ordinary, consumer-grade radio-based products can have a devastating effect on video performance. Thus the potential in integrated, continuous, and fast-acting detection and remediation capabilities should have a significant benefit for video applications on the wireless LAN.



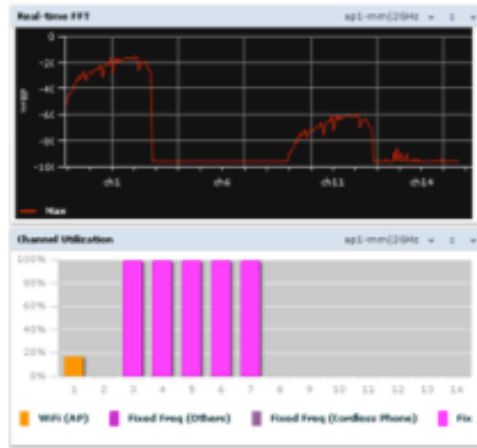
Figure 3a – The configuration for Test 3, which evaluated Aruba’s remediation capabilities when faced with interference from the Terk transmitter. *Source:* Aruba Networks/Farpoint Group.

For this test (Figure 3a), we used the two iPads and video stream from Test 2 above, operating in this case on Channel 6, but this time subject to interference from a Terk LF30S wireless video transmitter. Past experience shows this device to be extremely disruptive to all Wi-Fi traffic around Channel 6. Thanks to Aruba’s detection and remediation mechanism however, the AP was automatically switched to Channel 1 – *with no visible disruption to the video stream* (Figure 3b). Watching closely, we noticed no artifacts or other errors of any form. The TCP protocol and buffering involved helped, of course, but this form of interference otherwise would have quickly and completely disrupted both video streams. In this case, the latency for channel switching was set to 16 seconds. A lower value could have been used, and we expect that a slightly higher value also would have made no difference. We would like to follow up this test at some point with a low-level 802.11 packet-trace and re-association analysis, but, on a purely subjective basis, we were quite impressed with the results here.



AP is on channel 6

Interference on Channel 6



AP moves to Channel 1 in 16 sec

Figure 3b – Screen shots from Aruba’s management console show the presence of interference on Channel 6, and the subsequent automatic reassignment of the AP to Channel 1 after a predetermined period. *Source:* Aruba Networks/Farpoint Group.

Implications Going Forward

We very much appreciate the opportunity to gain access to Aruba’s products for the testing described in this document. Again, of necessity these tests were limited in scope given our impromptu request for access. But they do indicate to us a number of important conclusions. First, multimedia is easily supportable on a wireless LAN if such is properly equipped and configured. In many ways, multimedia, especially video, represents the worst of all worlds – potentially large data objects with very tight timing constraints. But, as we saw here, the Aruba equipment was more than up to the challenge. And second, even if multimedia is not currently a requirement (although, over time, we expect that it

will be for almost every enterprise WLAN installation), the facilities we have discussed here have tremendous value regardless.

Multimedia on the WLAN is an area of active investigation and innovation, and we expect continuing progress in this domain. But, at least for now, we are very pleased to see at least one vendor placing an emphasis on this important capability, and look forward to additional progress in multimedia on the wireless LAN in coming days.



Ashland MA USA

508-881-6467

www.farpointgroup.com

info@farpointgroup.com

The information and analysis contained in this document are based upon actual testing and publicly-available information sources believed to be correct as of the date of publication. Farpoint Group assumes no liability for any inaccuracies that may be present herein. Revisions to this document may be issued, without notice, from time to time.

Copyright 2010 – All rights reserved

Permission to reproduce and distribute this document is granted provided this copyright notice is included and that no modifications are made to the original.