Migrating and Deploying 802.11ac

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Introduction

Today's world offers us a plethora of new mobile devices and consumer-based electronics such as smartphones, tablets, laptops, gaming consoles, smart televisions and digital signage displays, all requiring Wi-Fi connectivity. These devices are application-centric and the delivery of multimedia content to these devices has seen a large increase in network traffic within the home and enterprise networks.

Devices such as smartphones, tablets and laptops have now become indispensable tools which users carry with them at all times, including to and from home and workplaces. As a result we are now seeing that the use of Bring Your Own Devices (BYOD) is an increasing trend in enterprise, with users using their own devices to carry out their day to day business.

The table below shows examples of common applications and their typical bandwidth requirements. With multiple clients associated to Access Points (APs), users simultaneously using some of the application services mentioned below would soon experience a degraded level of service.

Application	**Bandwidth**
Video Call - Skype / Apple FaceTime	1Mbps - 2Mbps
Video Conference - Group Video	4Mbps – 8Mbps
Virtual Desktops - VMware View / Citrix	1Mbps - 2Mbps
Audio Streaming - Spotify, Pandora, online radio	100Kbps
Online Video - YouTube, Catchup Services, Netflix	2Mbps – 4Mbps

Online Video - 1080P H.264 Codec	1.5Mbps – 4Mbps

The provision of sufficient wireless bandwidth will prove to be a challenge in enterprise environments. 802.11n has become a standard interface supporting typical data rates of up to 450Mbps.

802.11ac, with its multi-spatial streams and its greater wireless range, is the next stage in improving the performance of your network.

The purpose of this paper is to focus on Gigabit Wi-Fi known as 802.11ac and to provide a level of guidance towards migrating to 802.11ac.

Overview of 802.11ac

With the first wave of 802.11ac access points available from various vendors, now for the first time it is possible to surpass connectivity speeds beyond 1Gbps, thus tripling the performance of 802.11n. This is expected to increase eventually to a maximum throughput of 1.7 Gbps with Wave 2 hardware expected from vendors in late 2014 to early 2015.

The main differences between 802.11n and 802.11ac:

	802.11n	**802.11ac**
Frequency Band	2.4 GHz and 5 GHz frequency bands	5 GHz frequency band only
Multi user MIMO	Single user transmission only	Multi user transmission
Spatial Streams	Supports up to four spatial streams	Supports up to eight spatial streams
Channel Width	Supports 20 and 40 MHz channels only	Adds 80 and 160 MHz channels
Modulation	Supports BPSK, QPSK, 16-QAM, and 64-QAM	Adds 256-QAM

Gigabit speeds – The obvious benefit in migrating to 802.11ac is gigabit speeds compared to the current maximum of 450Mbps that 802.11n allows. With multimedia-rich applications and content being available to devices (smartphones and tablets), the vast majority of which

require Wi-Fi, users will be consuming large volumes of bandwidth whilst also having the freedom of being mobile.

Wider Channels **–** 802.11ac gains its higher throughput by using 80Mhz wide channels. This is due to 802.11ac supporting 20, 40 and 80 MHz channels with optional support for 160 MHz channels. 802.11n only supported 20 and 40 MHz channels.

Eight Spatial Streams & Multi-User MIMO **-** Greater available client capacity as 802.11ac supports up to eight spatial streams compared to the four spatial streams in 802.11n. 802.11ac allows for multi-user MIMO to support the simultaneous transmission of multiple frames to multiple client devices.

Beamforming – Increases the link reliability between the AP and client devices as 802.11ac APs are able to identify the source location of the device and increase their antenna power to reduce interference. Beamforming only increases the performance at medium ranges.

Low Latency – 802.11ac promises lower latency than that of 802.11n, bringing benefits especially to streaming applications such as VOIP, video calls, video conferencing, gaming, streaming music and video. Low latency is achieved by reducing the network load - multi-user MIMO enables parallel data transmissions.

Deployment Considerations

To ensure a successful 802.11ac deployment, pre-existing wireless infrastructure requires auditing, evaluating and surveying. IT Network Administrators need to consider the following aspects:

- ***Is pre-existing data cabling suitable***?
  Existing 802.11a/b/g/n wireless access points just require a single network uplink often fed by a PoE switch. 802.11ac is about gigabit Wi-Fi, therefore it is important that existing cabling is CAT6 and that dual network sockets are available as when the new wave of APs roll out there may be APs that require dual uplinks for extra resilience. The other advantage is that you have a spare in case a fault develops in the cabling and the secondary port can be used instead. All new data cable runs for wireless deployment should always include two CAT6 runs.

- ***Budget cost allowance for new 802.11ac APs to be purchased***
  The correct type of APs needs to be chosen for designated areas. As 802.11ac is currently at Wave 1, unit costs are high and you may not have enough funds to directly replace all APs within the organisation. There may be existing hardware that can support 802.11ac snap-in modules such as Cisco 3600 series APs which can be a cost benefit factor.

- ***Is the current backbone infrastructure suitable?***
  The access switches to support 802.11ac APs should have gigabit Ethernet with PoE+ (802.3at) capability for full functionality. If PoE is not present and local power is not available, then suitable power injectors will be required. In order to avoid any degraded network performance it is recommended that local access switches support 10GB uplinks into the core. Also in many large campus-based environments where there is a controller-based deployment, controllers may need to be upgraded and new licenses

may be required to support 802.11ac.

- ***Schedule an upgrade installation program***
  A suitable work schedule should be planned to upgrade to new 802.11ac APs. In large campus-based organisations it is recommended that you upgrade APs building by building, this provides a better end-user experience.

- ***Security planning.***
  802.11ac does not support WEP or TKIP as security options. If your network still supports those security protocols then consider changing the security protocol to WPA2.

- ***Capacity planning and client count***
  Wi-Fi data traffic will increase rapidly with 802.11ac deployment. It is recommended that you evaluate how many mobile devices will need to be supported. As a rule always plan for three devices per user (smartphone, laptop and tablet). An 802.11ac AP can serve 20-30 devices per radio with acceptable network service, dependent on the application.

- ***Applications***
  Identify which key applications will be used. Whether it is HD video streaming or Voice over Wi-Fi, these applications should be tested in active environments. The requirements of the various applications can help to calculate the number of APs required in an environment. High density areas such as library and lecture theatre environments will require additional APs - due to the high volume of associated clients and client activity in confined spaces.

- ***Site Survey***
  Conducting physical passive wireless site surveys is recommended for highlighting signal propagation in the required areas. The survey will help in selecting the correct locations for AP installation.

Summary

802.11ac builds on the success of 802.11n, which is currently the predominant WLAN standard in use. 802.11n brought many improvements in signal propagation, user density and data rates. Due to the rise in consumer and enterprise requirements such as HD video, online gaming, media-centric content, and an increase in smart mobile devices, we are seeing devices that are consuming high levels of bandwidth. Individuals today are carrying multiple devices with a ratio of 3:1 (smartphone, laptops and tablets) that require wireless network connectivity. All of these factors can cause network congestion and service degradation on current wireless networks. 802.11ac addresses these problems with advanced technology improvements and will deliver very high throughput for streaming to multimedia devices, resulting in an increase in user capacity in high-density areas and an increase in range performance and overall improvements to interference.

802.11ac can be integrated into the existing wireless enterprise infrastructure, adding extra bandwidth and enabling higher throughput to support the demands of media-rich applications and the increasing number of Wi-Fi capable devices. The benefits in migrating to 802.11ac are: achieving gigabit speeds, wider channels, up to eight spatial streams, multi-user MIMO, increased throughput, lower latency, beamforming and higher capacity.
