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Connect with Innovation™

Whitepaper

Next Generation Gigabit WiFi - 802.11ac

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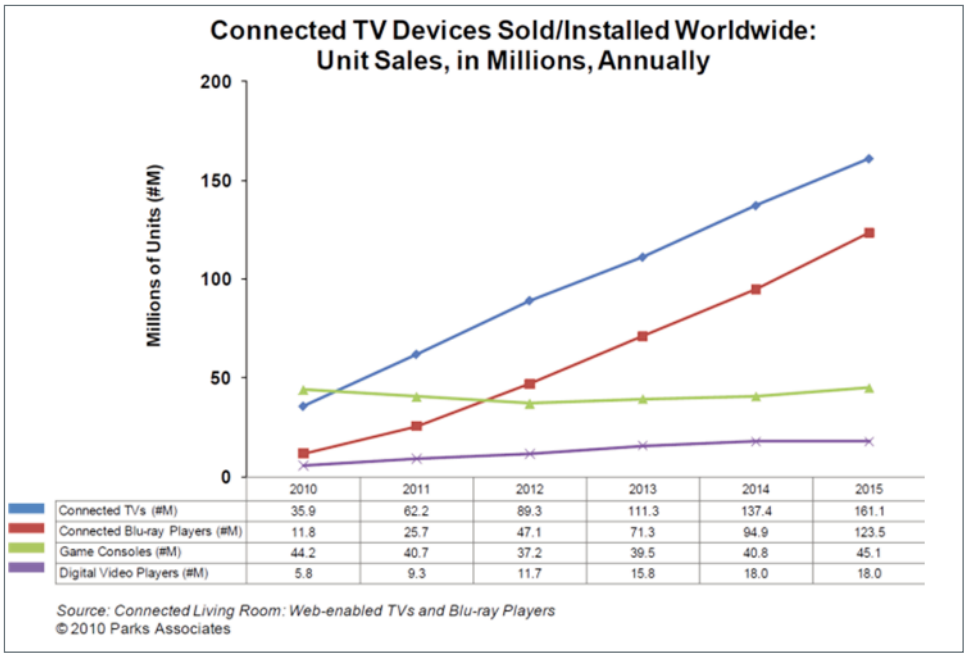
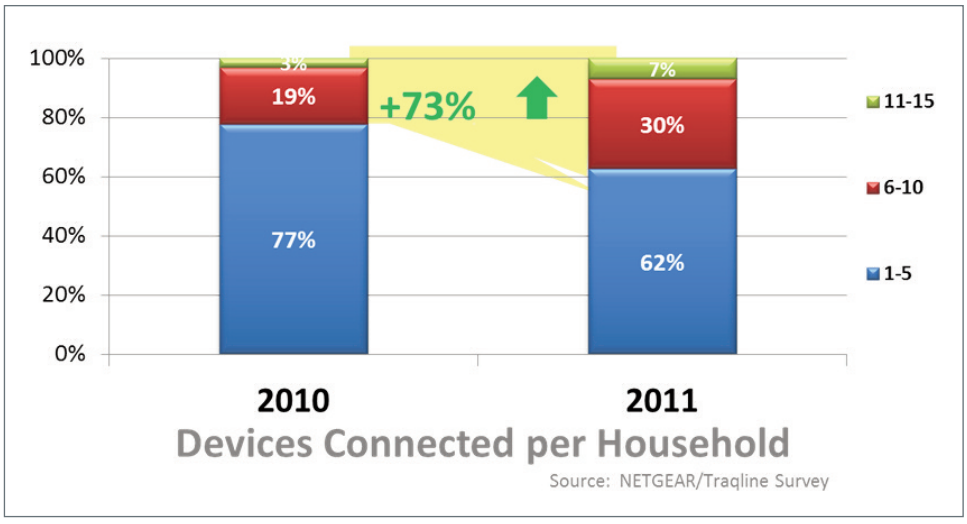
The first WiFi-enabled devices were introduced in 1997. For the first time, we were liberated from a physical Internet connection and free to move about the room, while maintaining connectivity. With this new found freedom came an extraordinary expansion of uses. Over the years, WiFi has become ubiquitous on laptop computers, tablets, televisions, video game consoles, and smart phones.

Wireless Performance Drivers

The evolution of wireless use cases, coupled with the extraordinary growth in the number of wireless devices, has created the demand for even more wireless speed and range. Currently, there are 25 million subscribers to video streaming services such as Netflix, and untold others using free services such as YouTube for video streaming. In addition, the growing number of screens inside the home from computers, Internet enabled TVs, tablets, and smart-phones – many of which run bandwidth-intensive applications such as HD video – further drives the requirements for higher performance wireless and more reliable connections.



	2010	2011	2012	2013	2014	2015
Connected TVs (#M)	35.9	62.2	89.3	111.3	137.4	161.1
Connected Blu-ray Players (#M)	11.8	25.7	47.1	71.3	94.9	123.5
Game Consoles (#M)	44.2	40.7	37.2	39.5	40.8	45.1
Digital Video Players (#M)	5.8	9.3	11.7	15.8	18.0	18.0



802.11ac – A New Wireless Standard

To meet these growing needs from the ever growing proliferation of WiFi devices, there is a new wireless standard under development. The new standard, known as 802.11ac, promises extraordinary improvements in speed, reliability, and quality.

Speed

The array of multimedia use cases and increasing number of devices commands greater performance. The most powerful 802.11n devices cap out today at a maximum link rate of 450 megabits per second at close range, with declining performance as the range increases. In contrast, the new 802.11ac standard can achieve more than three times the performance of the current standard, with speeds up to 1.35 Gigabits per second. What's more, 802.11ac has the capability to maintain a higher level of performance at any range, compared with its predecessors.

This increase in speed is achieved by providing wider frequency bands, faster processing, and multiple antennas. Think of it in terms of an automotive highway, where a transition is made from a highway with four lanes to one with eight lanes, while simultaneously upgrading to a Ferrari on an auto-bahn highway with no speed limit. The result is faster traffic and significantly reduced congestion to enable a decrease in overall travel time.

Today's WiFi

3x speed with 802.11ac

The 3X speed improvement achieved by the new standard means that the 450 Mbps performance from today's fastest 3 antenna 802.11n device can be achieved by single antenna 802.11ac device – with similar power consumption. This means that a typical tablet with single antenna 802.11n 150Mbps WiFi can now support 450 Mbps with 802.11ac – without any increase in power consumption or decrease in battery life.

Wireless Performance Comparison		
Antenna Configuration	**802.11n**	**802.11ac**
Single Stream (1x1)	150 Mbps	450 Mbps
Dual Stream (2x2)	300 Mbps	900 Mbps
Three Stream (3x3)	Three Stream (3x3)	1.3 Gbps

Reliability

Speed is largely irrelevant if the connection lacks reliability. For example, most users have experienced the irritating video buffering during video playback, which causes frozen or jittery screens. By increasing the bandwidth capacity and improved processing, 802.11ac enables far more bandwidth to be available for consumption by wireless devices, which helps avoid interference, and improves the speed for demanding applications such as hi-definition video streaming. The result is more effective coverage with fewer dead zones.

Another feature that is expected to boost the reliability of the connection at required speed and range is the much improved "beamforming" standard, which provides directional signal transmission and reception. Previous standards can only receive and transmit omnidirectional signals, which are subject to significant levels of interference, due to the fact that the signals are transmitted indiscriminately in every possible direction. With beamforming, there's an understanding of the relative location of the device, and the signal is correspondingly strengthened in that direction.

Quality

In addition to its increased capacity and range, the 802.11ac standard operates in the 5 GHz wireless spectrum, which is less prone to interference. Though more widespread in usage (all 802.11b and g devices operate exclusively in the 2.4 GHz spectrum), 2.4 GHz only has three non-overlapping channels for transmission, which are crowded due to the vast number of interfering devices, including other WiFi access points, microwave ovens, cordless phones, Bluetooth devices, and baby monitors. As a result, the environment is noisy, which increases interference and degrades performance. In contrast, the 5 GHz channel is much cleaner with less interference, with 23 non-overlapping channels – 8 times more than what is available in the 2.4 GHz spectrum – which makes it far more suitable for applications such as video streaming and gaming, which are very sensitive to packet loss and delays.

In Summary

Key advantages of 802.11ac over 802.11n:

- Gigabit speed wireless with approximately 3 times the performance of 802.11n
- Better performance at any range with fewer dead spots
- More reliable connections for media streaming with beam-forming
- More WiFi bandwidth on your mobile
- Only utilizes the 5 GHz Band, which is less prone to interference
- Backward compatible to 802.11 a & n, which also use the 5 GHz band

What are the Practical Advantages of 802.11ac?

So we've discussed the main advantages of the standard – speed, reliability, and quality. But apart from the "cool factor", or advancement solely for the sake of advancement, why should a user consider moving to the new standard? What needs can it meet better or more easily than the current standard? The answer is that the new standard has two main advantages for the everyday user – it improves current use cases and paves the way for future use cases.

First, 802.11ac improves existing uses cases such as HD video streaming. Netflix, Hulu, Vudu, and other popular streaming sites command a great deal of bandwidth. Streaming HD video over a wireless connection that lacks the required bandwidth can result in choppy video playback, which greatly diminishes the user experience. A growing number of consumers today are streaming video from their home media libraries, as well as from Netflix, Amazon, and other subscription services – either directly to their networked television, or through their Blu-ray player, game console, or digital video player. 802.11ac will significantly enhance the user experience by improving the playback quality to any point throughout the house. With 802.11ac, for the first time wireless will provide similar performance as wired Gigabit connections.

Another area of concern that will be addressed by 802.11ac is the WiFi performance for mobile devices like smartphones and tablets. Dropped connections, poor quality connections, and limited mobility are major areas of frustration for users today. 802.11ac solves these problems by significantly improving range and providing 3 times the performance, while preserving the battery life.

In addition to meeting today's growing needs such as streaming video, the new standard will also enable a variety of new use cases such as simultaneous HD video streams to multiple receivers, wireless displays, and large file wireless transfers. It's also better equipped to handle the seemingly boundless growth in the number and type of WiFi devices (even many appliances are becoming WiFi equipped), as well as the corresponding traffic that comes with that growth. In short, 802.11ac will have the capability to handle our insatiable demand for robust, high speed connectivity – from a wide range of devices.

When Will 802.11ac Be Available?

The first 802.11ac devices should begin shipping during the second half of 2012. Leading chip manufacturers should have pre-standard 802.11ac silicon available at that time, followed by further software enhancements, which will further improve performance and ensure interoperability.

NETGEAR – Technology Innovation and Leadership

NETGEAR is a trusted leader in both wired and wireless networking, and was one of the first providers of 802.11n products. NETGEAR continues its leadership position with 802.11ac – the Next Generation WiFi Standard – by designing products that deliver the performance, reliability, and quality that customers have come to expect from NETGEAR.

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