802.11ac
Breaking the Gigabit Barrier

The trends toward the use of BYOD devices, in addition to beyond Gigabit bandwidth demand requirements for WiFi services has been fundamental reason for emergence of 802.11ac technology. Therefore, it is inevitable to realize 802.11ac WiFi technology deployment is gaining speed in realization, recognition, and popularity.

7-28 Gbps?
802.11ad
538%
2013

433/866/1300 Mbps
802.11ac
288%
(to 6.93 Gbps)
2013

300/450/600 Mbps
802.11n
833%
2009

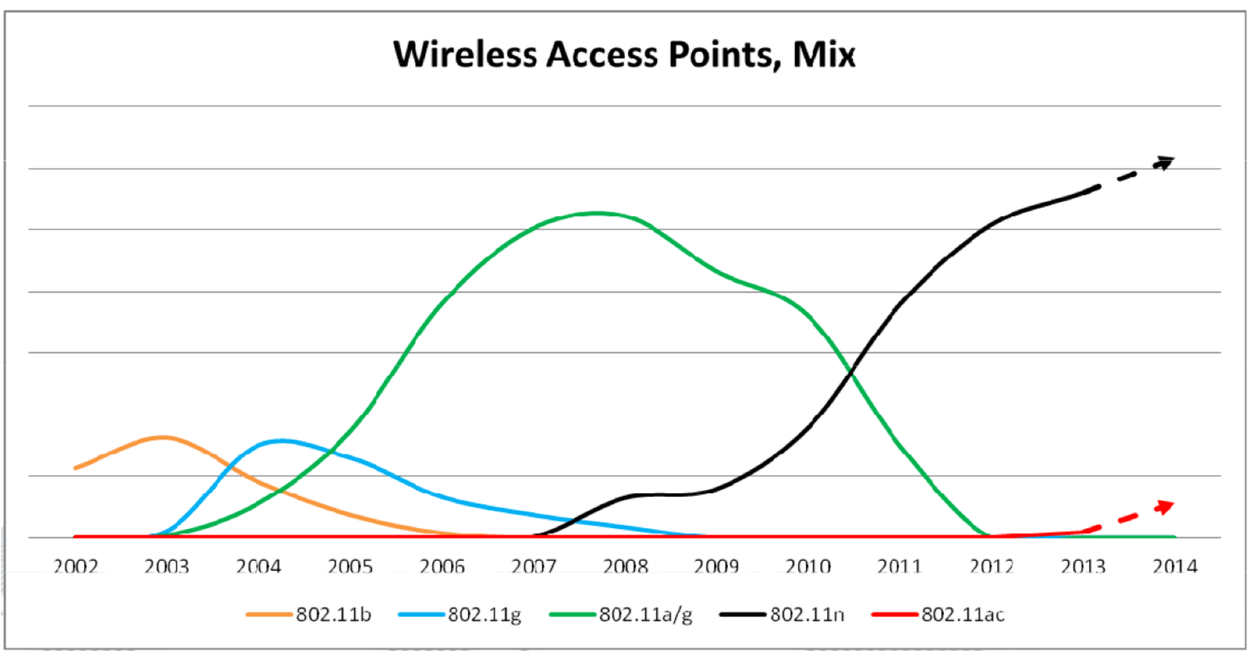
54 Mbps
802.11g/a
490%
2003

11 Mbps
802.11b
550%
1999

1-2 Mbps
802.11 1997
100%
1991

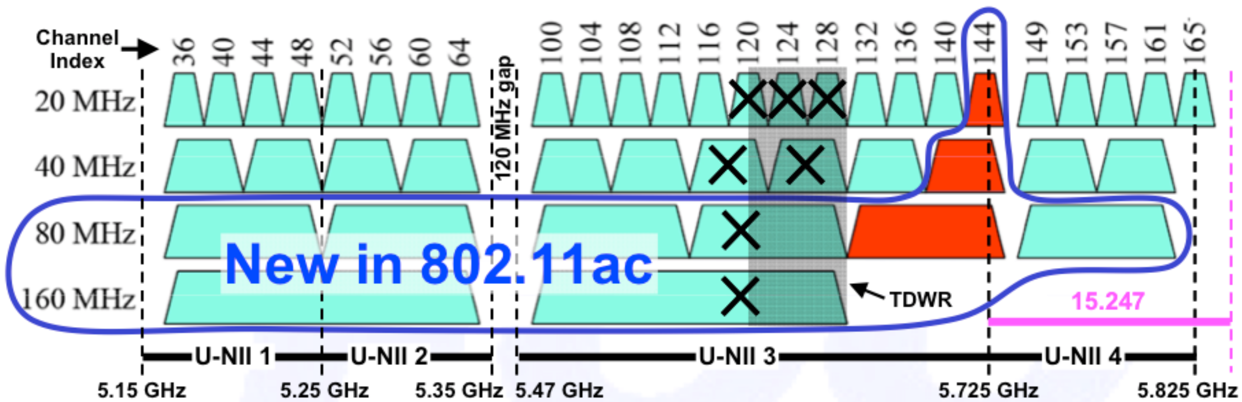
<1 Mbps
Proprietary
1989

Within the 802.11 family, there are also trends based on technology, with 802.11n as a mature WiFi standard, while 802.11ac is heading towards the next evolution in the wireless platform. Therefore, it is of utmost importance for the WiFi network engineers, designer, and network owners to understand facts about this technology, and how to harness its enormous power.

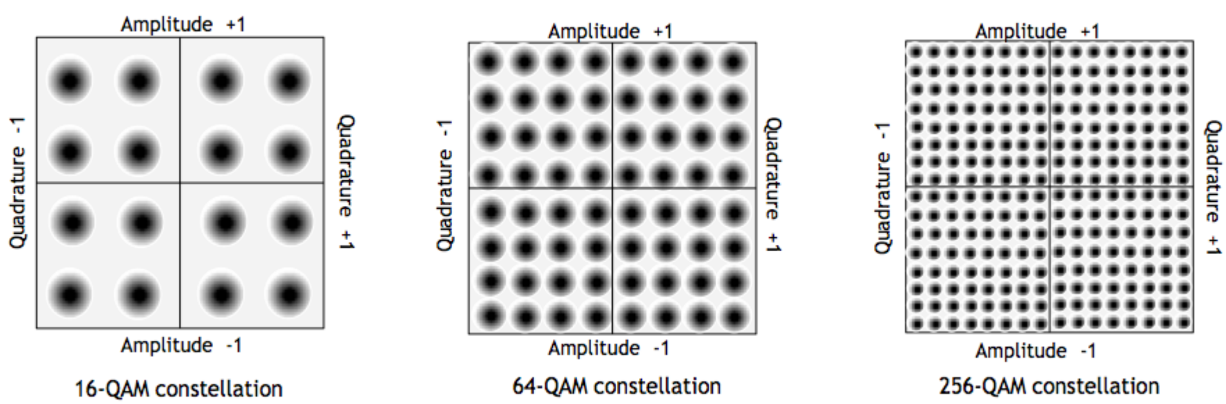


Facts about 802.11ac

Where 802.11n could run on 20 MHz or 40 MHz channels, 802.11ac can be deployed on 20-, 40-, 80-, and 160-MHz channels. Bigger channels translate into more potential bits per second, but it also means there will be fewer channels available. That is something network managers, designers, and owners will have to take into account in their planning.

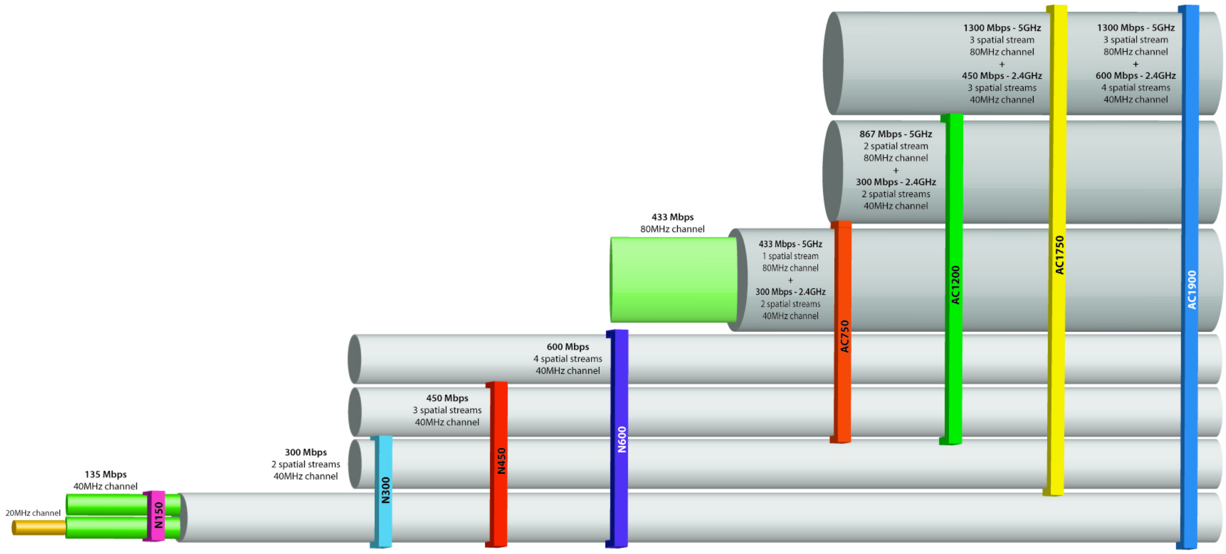


To pack more bits into the available radio spectrum, 802.11ac also uses a more efficient coding system. 802.11a, g, and n, 802.11ac use OFDM signal encoding. While, 802.11a, g, and n have fully utilized the 64-QAM (six-bits per symbol) encoding, the 802.11ac defines modulation of up to 256-QAM (eight-bits per symbol), which translates into 33% increase in efficiency !

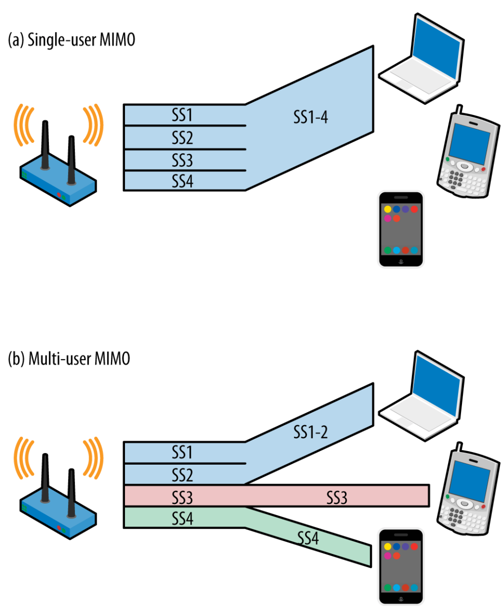


Constellation diagrams for 16-, 64-, 256-QAM

As we try to send more bits per cycle of radio bandwidth, the probability of error increases. Thus, some of these bits are used to provide forward error correction to improve the reliability of the transmission.



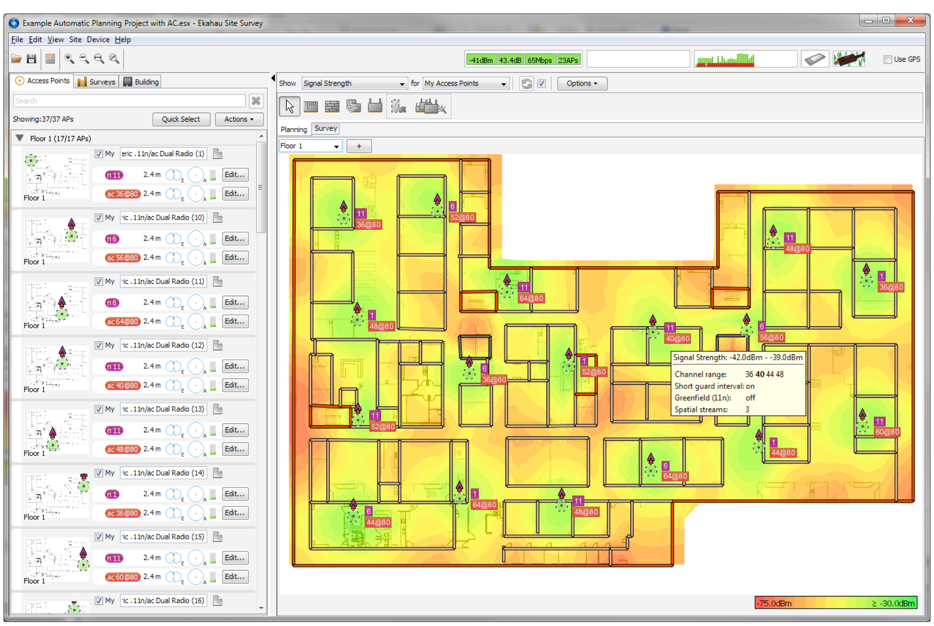
802.11ac also adds important enhancements to the multiple input-multiple output (MIMO) capability. MIMO allows a transmitter to send multiple simultaneous data streams over the same radio channel, and it was first included in the 802.11n standard. However, where 802.11n can send up to four-streams (most existing products use a max of two or three), 802.11ac can go to eight-streams. Eight streams at 866.7 Mbps adds up to a phenomenal total maximum data rate of 6.934 Gbps, versus a maximum of 600 Mbps for 802.11n. In other words, we're looking at a 10x increase in capacity!



Spatial streams or so called Spatial multiplexing (seen abbreviated SM or SMX) is a transmission technique in MIMO wireless communications to transmit independent and separately encoded data signals, so-called streams, from each of the multiple transmit antennas. 802.11ac devices can use up to eight streams versus four streams for 802.11n.

Data Rates for Different Wireless Configurations			
No. of spatial streams	Channel spectral width (MHz)	802.11ac Modulation Scheme MCS 8/9*	802.11n Modulation Scheme MCS 7
1	20	86.7 Mb/s	72.3 Mb/s
1	40	200 Mb/s	150 Mb/s
2	40	400 Mb/s	300 Mb/s
4	40	800 Mb/s	600 Mb/s
1	80	433 Mb/s	N/A
2	80	867 Mb/s	N/A
3	80	1.3 Gb/s	N/A
4	80	1.69 Gb/s	N/A
1	160*	867 Mb/s	N/A
4	160*	3.39 Gb/s	N/A
8*	160*	6.77 Gb/s	N/A
* Optional feature			

As mentioned before bigger channels translate into more potential bits per second, which lead to fewer available channels. That's something network managers will have to take into account in their WiFi network design and planning process. The use of proper WiFi design, planning and trouble shooting software would greatly assist network designer in bringing customer requirements into a well designed wireless network, and in the shortest possible time frame. Additionally, by using the right software the guess work of WiFi network deployment is virtually eliminated.



So far we have talked about the 802.11ac wireless technology key points. One of the most important factors which most designers miss within the above is the wired portion of Network design! With emergence of Wave 1 and Wave 2, the expected data rate would lie anywhere between 1.3 to nearly 7 Gbps range. Considering CAT-6 (250 MHz) having a maximum throughput of 1 Gbps , it is obvious that it will not be able to support bandwidth demand requirements of 802.11ac standard. This is an overlooked fact by most WiFi designers.
To able to future proof upgrades or new installations of 802.11ac, it is essential that the wired portion of the infrastructure would be able to support data rates of up to 10 Gbps. Currently the wired infrastructure standard that would support 10 Gbps is CAT-6A (550 MHz). Additionally, for outdoor AP installation proper industrial grade Structured Cabling solution has to be utilized, as not paying attention to environmental factors will severely hinder WiFi performance. More over, considering the fact the network edge would need to run on CAT-6A standard, it is evident that the core should be able to support 40 or even 100 Gbps bandwidths. And to support 40 and 100 Gbps, network designers need to consider the use of CAT-8 (the new proposed standard running at 2 GHz) on copper cabling, or OM3 and OM4 for Fibre Optic Cabling and using MPO technology between core and the edge. Furthermore, test and certification of the wired infrastructure becomes essential part of the over all planning, to insure adherence to TIA or ISO wired communication standards. The certification of infrastructure will provide the end user assurance on the correct standard specified use of structured cabling solution, conforming to ISO or TIA limit length specification, as well as proper termination procedures and workman ship.

Conclusion:
It is expected that enterprise class vendors will take advantage of 802.11ac technology to introduce more enterprise level services with higher bandwidth and capacity to their users. It should be noted that for planning and design stage of 802.11ac technology, close attention to use of tools such as WiFi Survey and planning software, in addition to wired segment consideration will be an integral part of WLAN system architecture and design, which would lead to operational of success of 802.11ac technology within the enterprise.

It is a very important to point, while it’s possible, for example, to add-on an 802.11ac radio to some 802.11n access points, the best price/performance and perhaps even the best performance overall is much more likely to be achieved with enterprise-class products engineered end-to-end for 802.11ac technology.
Nonetheless, we are looking forward to meaningful improvements in overall wireless performance, especially in terms of capacity, with next generation 802.11ac and 802.11ad technologies. We must caution again that extending range will be desirable in only a restricted set of cases, and that dense deployments focused on capacity will continue to be a key to success.

And we expect to see large numbers of single-and two-stream 802.11ac clients as handsets and tablets continue on their path to becoming the dominant access devices in the majority of enterprise applications. It is evident that deployment of 802.11ac for beyond gigabit-class service, will see a considerable growth with the next few years.

Regardless, 802.11ac is clearly now the trend for the future. While upgrades will take some time, Advanced Network Devices believes that it is important to begin preparing the organizational network for the arrival of this new technology. Properly planned and executed, this transition can be easy for network operations staff, and smooth / transparent for users.

To know more information about the details please do not hesitate to contact our us at any time.

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