International Journal of Future Innovative Science and Engineering Research (IJFISER)
Volume – 3, ISSUE – I **ISSN (Online):2454- 1966**

Research Manuscript Title

5th Generation Wi-fi Networking

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March – 2017

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ABSTRACT

It's no secret that wireless communications standards continue to evolve to provide ever- increasing data through put capabilities. Today, two of the hottest wireless standards are IEEE802.11ac in wireless-local-area-network (WLAN) products and 3GPP LTE-Advanced in cellular communications. IEEE 802.11ac is the new draft standard for GigabitWi-Fi.IEEE802.11ac promises data rates of up to 1.73Gbps between an access point and a wireless client. In this paper, we'll take a basic knowledge about IEEE 802.11ac. More specifically, we'll look at how features such as Video Streaming and Data Syncing and Backing Up. Finally, we will look technical detail and its application.

Keywords: *Data Syncing and Backing Up, Video Streaming, Spectrum Changes, Higher-Order Modulation Types.*

1. INTRODUCTION

IEEE 802.11ac is the fifth generation in Wi-Fi networking standards and will bring fast, high quality video streaming and nearly instantaneous data syncing and backup to the notebooks, tablets, and mobile phones that have become our everyday companions. Improvements in transmission speeds will be dramatic. Entry-level IEEE 802.11ac products will provide a data rate of 433 Mbps (megabits per second), which is at least three times faster than that of the most common devices using the current wireless standard, which is IEEE 802.11n. Because the new standard gives manufacturers the flexibility to offer a range of products with different levels of performance, some high-speed IEEE 802.11ac devices will offer wireless transmission in excess of a Gigabit per second—remarkable speeds that put IEEE 802.11ac wireless networks ahead of most wired networks [1].

In addition, there will be dramatic improvements in wireless reliability, range, and coverage. Homes and apartments now plagued with "dead spots" will enjoy vastly improved reception. Faster file transfer also leads to longer battery life in mobile phones. Products based on IEEE 802.11ac will be fully backward compatible with current Wi-Fi devices. Older devices, however, won't be able to take advantage of the improved speeds offered by IEEE 802.11ac. Home networking products containing IEEE 802.11ac adapters are expected in Q3 2012. They will begin appearing in laptops and notebooks for the Christmas 2012 selling season. Mobile phones and tablets—both crucial Wi-Fi markets—are likely to ship with IEEE 802.11ac chips in 2013.

IEEE 802.11ac is the fifth generation of Wi-Fi to come along since Wi-Fi was introduced in 1997. The roll-out of new IEEE 802.11ac devices, like those of previous generations, is expected to take between one and three years, beginning first with home networking products and then working its way to other products as manufacturing costs decline. By 2015, virtually all new Wi-Fi products are expected to be based on IEEE 802.11ac technology, in the same way that nearly all Wi-Fi products on sale today are based on IEEE 802.11n, which is the current standard [2].

2. RELATED WORK

Digital-content consumption is on a steep incline, with video content expected to reach approximately 90 percent of global consumer traffic, according to Cisco's 2011 Visual Networking Index Forecast. At the same time, Internet traffic is shifting rapidly from wired to wireless networks. The increased reliance on wireless networks, the explosion of video consumption and the growing number of wireless devices being used are all putting tremendous stress on legacy 802.11a/b/g/n networks. As a result, consumers are prone to experience deteriorated performance, choppy videos and slower load times [3]. 5G WiFi overcomes this digital content and wireless device challenge. With new innovations that allow for more reliable whole home coverage, 5G WiFi will allow consumers to stream digital content between devices faster, and simultaneously connect more wireless devices to home and enterprise networks, while conserving battery power Although there are many benefits of IEEE 802.11ac technology, it was developed with three main features in mind—video streaming, data syncing, and backup [4].

3. PROBLEM DESCRIPTION

I. VIDEO STREAMING

PCs may have started out as "computers," but increasingly, we are using our PCs—not to mention our mobile phones and tablets—as convenient substitutes for TVs. Video entertainment has become one of the most popular use of electronic devices, so much so that video content from Netflix, Hulu, YouTube, and similar services now constitutes most of the Wi-Fi traffic. But video streaming requires a great deal of bandwidth, many times more than does music. And so, watching video over current Wi-Fi networks can be a frustrating experience. For example, it's common for the picture to freeze because the wireless network simply can't keep up. The problem becomes much worse the further you are from your Wi-Fi access point [5].

II. DATA SYNCING AND BACKING UP

Nearly everyone today makes daily use of multiple devices. The home computer remains the hub for most people, a central repository containing files for work, music, video, games, and more. But we take our mobiles phones with us as we go about our daily lives and need to keep our phones and computers in sync. Unfortunately, that has become a time consuming chore. Ask anyone who tries to download a playlist of music, a new batch of photos, or some recently changed calendar appointments onto a mobile phone while dashing out the door in the morning. With movies, it is even worse. Frequent travelers enjoy spending part of a plane ride catching up on the latest Hollywood release. But they often discover too late that they don't have time for a 20-minute movie transfer from PC to tablet before catching a cab for the airport. The high throughput rates of IEEE 802.11ac will slash all these sync times. You'll be able to put a phone or tablet next to your PC and sync your playlists and calendars in a few seconds. Entire movies can be transferred in minutes. With IEEE 802.11ac, quick, effortless background syncing will soon be as much a part of the mobile phone experience as texting or taking pictures is today [6].

The same is true for backing up our mobile devices, which is becoming an increasingly important task considering how much of our lives we carry around on them. Between calendar entries, text messages, photos, videos, and downloaded applications, losing the data contained on a mobile phone for most people would be as calamitous as losing everything on their computer hard drive. The speed of IEEE 802.11ac will take the hassle out of backing up mobile phones and tablets. Consumers can have peace of mind knowing that they will always have access to their phone data, even if the phone itself is no longer available.

4. PROPOSED SYSTEM

a) SPEED

Entry-level 5G WiFi products will be 450 megabits per second, which is at least three times faster than the most common devices using the current wireless system, 802.11n. And because the new standard gives manufacturers the flexibility to offer a range of products with different levels of performance, some high-speed 802.11ac devices will offer transmission in excess of a gigabit per second -- remarkable speeds that wired networks attained only recently [7].

B) RELIABILITY

5G Wifi offers dramatic improvements in wireless reliability, range and coverage. Homes and apartments now plagued with "dead spots" will enjoy vastly improved reception. But because 802.11ac transmissions start out so much faster than those from earlier networks, you can be, say, 30 feet away from an 802.11ac access point and get the same data throughput that you would if you were 10 feet from an 802.11n transmitter. But 5G Wifi networks, with beam-forming and other innovations, do a much better job in penetrating all forms of building materials, including concrete than its predecessors.

5. RESULTS AND DISCUSSION

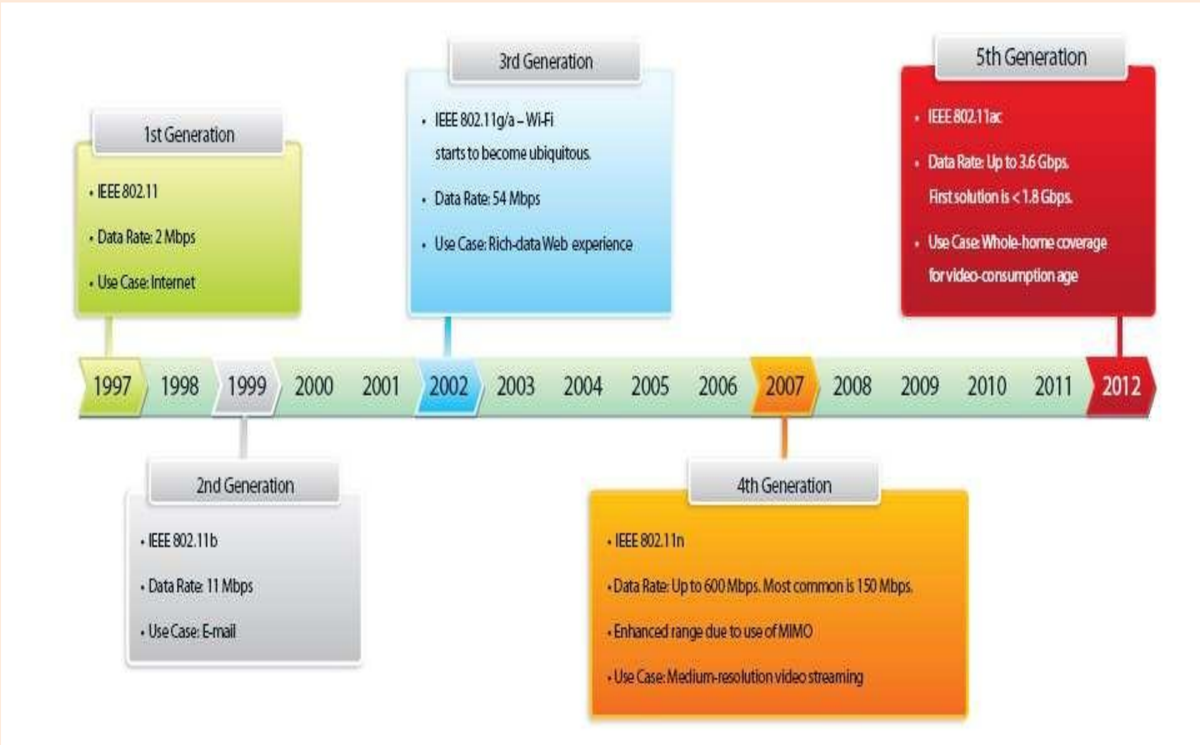
Computers, mobile phones, tablets, networking equipment, and other devices equipped with the new IEEE 802.11ac networking technology will experience connections between three and 10 times faster than is possible today. Wi-Fi coverage will experience less interference, extend to greater distances, and be spread out across a larger coverage area.

Here are some of the ways that IEEE 802.11ac achieves these benefits.

A. *Spectrum Changes*

You may not realize it, but every Wi-Fi device is, in fact, a small radio station, sending and receiving signals over a portion of the radio spectrum just like AM and FM broadcasters. The amount of available spectrum is limited by the laws of physics, and use that spectrum is strictly regulated by international agreements.

Most of today's IEEE 802.11n Wi-Fi devices operate in the 2.4 GHz frequency band. (A frequency band is a slice of the radio spectrum, and the number associated with it tells you where on the spectrum it is located, the same way that the frequencies of radio stations identify their place on the dial.) One problem with current Wi-Fi networks is that the 2.4 GHz band is crowded with many other devices, from baby monitors to Bluetooth headsets to microwave ovens. Because all of these devices are competing for the same limited bandwidth, everyone's Internet connection slows down, just as the traffic on a highway slows down when too many cars are on the road. By contrast, IEEE 802.11ac works exclusively in the much less crowded, or “cleaner,” 5 GHz spectrum. With less competition for the airwaves from other devices, transmission rates shoot up. But IEEE 802.11ac has one other extremely important bandwidth advantage over its predecessor standard: There is simply more room available for Wi-Fi in the 5 GHz band than there is in the2.4 GHz band. Each IEEE 802.11ac communications channel is as much as four times wider than the channels available in IEEE 802.11n. Just like a six-lane freeway can handle more cars than one with two lanes, the wider the available swath of bandwidth, the faster the Wi-Fi connections can operate[3].



B. ***Beamforming***

Beamforming is the ability of a Wi-Fi transmitter to “learn” to avoid inefficient pathways between it and the device it is transmitting to. Beamforming is analogous to a car being able to automatically avoid a highway lane that is full of pot holes. Beamforming is possible in the current generation of IEEE 802.11n products, but many of them did not take advantage of it. With IEEE 802.11ac, beamforming is a standard feature, and all products that implement it will be interoperable and thereby able to operate at maximum range and coverage for the IEEE 802.11ac network.

C. ***Range and Coverage Area***

Wi-Fi transmission rates slow down the further away you are from a transmitter. Absolute top speeds are usually available only within a few dozen yards, with performance gradually tapering off as you move further away. This relationship, which is determined by the laws of physics, is true no matter what network standard is being used, IEEE 802.11ac being no exception. But because IEEE 802.11ac transmissions start out so much faster than those from earlier networks, you can be, say, 30 feet away from an IEEE 802.11ac access point and get the same data throughput that you would if you were 10 away feet from an IEEE 802.11n transmitter.

Many factors affect the coverage area of a network—most notably, the way a structure is built. Concrete walls, ceramic bathroom tile, and metal appliances are more difficult for Wi-Fi signals to penetrate, in contrast to wooden walls with gypsum board, which are easier to penetrate. But signals from IEEE 802.11ac networks, with beam forming and other innovations, do a much better job in penetrating all forms of building materials than do the signals from its predecessor networks. In fact, the ability of IEEE 802.11ac signals to transmit through some concrete walls is expected to help homes in India and China, where concrete is used extensively as a construction material.

D. *Multiple Antennas*

An IEEE 802.11ac Wi-Fi device can contain between one and eight antennas. Transmission speeds increase in direct proportion to the number of antennas. Companies selling computers, mobile phones, networking gear, and other Wi-Fi equipment can choose how many antennas to include, depending on considerations such as their price and performance targets for each product. (This is a lot like car companies offering a model with a choice of four-, six-, or eight-cylinder engines.) Entry-level, price-sensitive networking productscan be built with a single antenna, whereas high performance devices, especially for the enterprise, can be equipped with more antennas.

E. *Higher-Order Modulation Types*

A third mechanism that wireless communications system designers use to increase data rates is higher-order modulation types. As suggested by the Shannon-Hartley theorem, an increase in SNR corresponds to an increase in data throughput. For digital communications systems, higher data rates can be accomplished through use of higher-order modulation types. For systems using quadrature amplitude modulation (QAM), the throughput of the physical channel is directly related to the QAM "order." For example, a 4-QAM channel is capable of 2 bits per symbol, since two is the maximum number of bits that can be represented by four unique symbols [log2(4) = 2] . Similarly, a 16-QAM channel yields 4 bits per symbol and a 64-QAM channel yields 6 bits per symbol.

The new IEEE 802.11ac specification is one of the first consumer wireless standards to allow to 256-QAM. The 256-QAM format yields 8 b per symbol and [log2(256) = 8], thus enabling a 33% higher throughput than a system using only 64-QAM. Of course, the capability of a digital communications channel to use a higher-order modulation type such as 256-QAM requires that a sufficiently high SNR can be sustained. For years, wireless communications systems have used adaptive modulation types—enabling the use of more robust schemes such as QPSK in low SNR environments. As an example, consider the below figure, which illustrates the constellation diagram of a 16-QAM signal under varying SNR conditions.

6. SUMMARY AND CONCLUSION

Wireless networking is widely, and rightly, regarded as a fundamental technology nearly as important as computing itself. One reason for that being true is that the Wi-Fi industry, collectively, has continually pushed the performance envelope of wireless to guarantee that it was keeping up with how people were using first their PCs and, later, their mobile phones and tablets. Watching a high-resolution movie over Wi-Fi was once considered a wild, even unrealistic, fantasy. Soon, with IEEE 802.11ac, millions of people will be doing so every day. Although the future is uncertain, two things are a safe bet. The first is that digital devices will continue to demand ever-greater amounts of data. The second is that the Wi-Fi industry will be keeping pace. Its track record in innovation over the years has been first-rate, and it shows no signs of slowing down now.

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