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How 5G technology helps in creating a smart campus?

03-04 : EMERGING TECHNOLOGY ON NETWORK INFRASTRUCTURE

How does technology make life better in terms of infrastructure?

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05-06 : 5G, WI-FI6 AND EMERGING NETWORK TECHNOLOGIES

Why are they important?

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CATCH SOME WAVES IN

APPLICATION OF 5G IN SMART CAMPUS

As the world keeps going forward so thus technology, the emergence of 5G technology has truly brought a brand new of possibilities in many of the industries such as medical, business, education and many more. In recent year, many universities has integrate 5G technologies in their campus to provide the student with best technology and education.

WHAT IS 5G?

We must first know what is 5G to truly understand its properties and application to improve our life. 5G is the latest generation of cellular technology that is capable to transmit data much faster and have a better reaction speed than its predecessor, 4G significantly.

HOW DO 5G WORK?

Radio frequencies (also known as spectrum) are used in wireless communications systems to transmit data over long distances. 5G is similar to 4G, however it uses higher radio frequencies that are less crowded. This enables it to transport more data at a much faster rate.

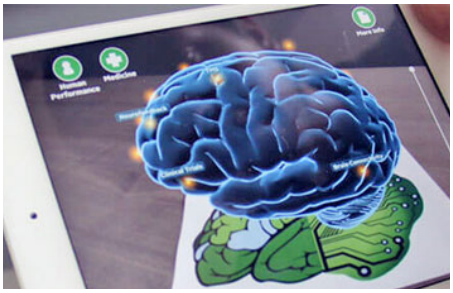
APPLICATION OF 5G TECHNOLOGY

As we know, 5G provides much faster internet and reaction speed as such it surely improves a lot of aspect of our life. In the entertainment industry, people can download movies in mere seconds and streaming a video will no longer face lagging issues. In business, companies can use the advantage of 5G to transition their business online smoothly and without any problems. The focus of the topic is education, 5G can be applied in such many ways that are the use of A.I. in the school systems, auto-driven transportation in the campus, and a lot more but the ones that I want to highlight are VR and AR.

APPLICATION OF VR AND AR IN SMART CAMPUS

VIRTUAL REALITY AND 5G

Virtual reality has been around for a long time but it was never truly be use of it full potential or be properly adapted to the study co curriculum. Virtual reality allows student to experience a situation without even be there themselves this feature are truly beneficial for medical student to practice surgery or engineering student in a site. Virtual reality are also much cheaper in term of cost compare to traditional practice but the past technology has being hindering VR to be carry in as it require a fast reaction speed and data transmission. 5G are the missing piece of the puzzle as with it VR can be fully carry out in the campus. Thanks to its fast reaction speed, the simulation will be much accurate and detail and it may help the student to prepare for the situation in real life. 5G also allows students to experience the full VR experience like never before. The graphic of the are a bit unrealistic and cartoony, 5G helps in creating a much more realistic looking simulation that will help students especially medical students for the real surgery experience in the future.



AUGMENTED REALITY BREAKTHROUGHS THROUGH 5G IN CAMPUS

Augmented reality technology is often being underestimated compared to its counterpart, the VR as most thought it is irrelevant to be applied in the education system. Nevertheless, AR technology has finally gained the recognition it deserves with the introduction of 5G. In smart campus, AR has been used as extra material for students to further understand the lesson and at the same time make learning much more fun as AR let student interact with the learning material from a new perspective. This help student to learn faster and have a better memorization of that subject as human tend much better visual memory. 5G has brought the true potential of AR in education because of the need for high-speed data transmission in AR to fully give the most realistic interaction between student and the learning material as it enables the student to view the learning material in 3D and made various interchange to the lesson material. In conclusion, AR in education and with 5G as its catalyst, it clearly has the potential to be a very interesting and effective intervention that will revolutionize the educational system for at least the next 100 years. It is also isn't just elementary school that will be affected; higher education and training systems will also be affected with various possibilities it can bring.

REFLECTION

From this study, we know that the application of 5G in smart campuses that is VR and AR has tremendously restructured learning methods and greatly improve the student learning capability. It enhances student creativity and learning skills by opening a new perspective for students to see. Although, VR and AR are still a relatively new technology in the education aspect but we can see how huge the potential of these technologies is. Educational institutes should seek the opportunity to further explore this technology as both of these technologies will surely help the progression of future generations towards success.

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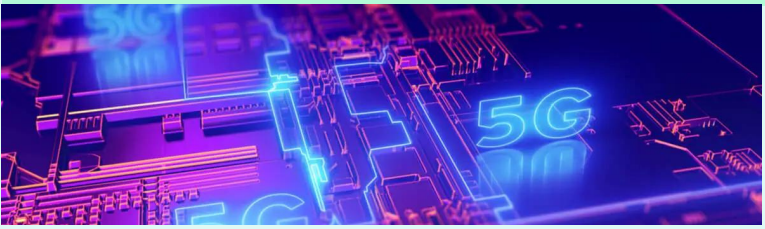
EMERGING TECHNOLOGY ON NETWORK INFRASTRUCTURE

BY MR GOH BIH DER
(SYSTEMS ENGINEER FROM COMMSCOPE)



As a worldwide network infrastructure supplier, CommScope has helped a much better affiliation through the pandemic irruption. They provided unimaginable and astonishing technological inventions and increasingly attempt to improve their performance to the current day to bring folks along. Commscope additionally performs service to remodel the network from the core to the edge-with each wired and wireless connection and there's an easy path for service suppliers to require advantage of the 3 new changes in Wi-Fi technology over the approaching 3 years. At its core is that the key philosophy of finance in extending settled high-capacity and low-latency networks to consumer applications themselves, not simply the access network. All 3 Wi-Fi solutions – dual-band Wi-Fi half dozen and tri-band Wi-Fi 6E and seven – can have an elementary half in making the new platform of reliable high-capacity, low-latency wireless networks that new home services, like VR and AR.

WIRELESS PARADIGM SHIFT

11a | 11b | 11g → 11n → Wi-Fi 5 (11ac) → Wi-Fi 6 (11ax)

Wi-Fi and Access point

Wireless paradigm shift in today's network from theoretical peak speed will become overall network capacity for tomorrow's network.

Wi-Fi 6 solves real problem in state in network capacity (OFDMA, MU-MIMO, BSS coloring), peak throughout increase (1024-QAM), outdoor reliability (Long OFDM symbol) and device battery life (Power efficiencies).

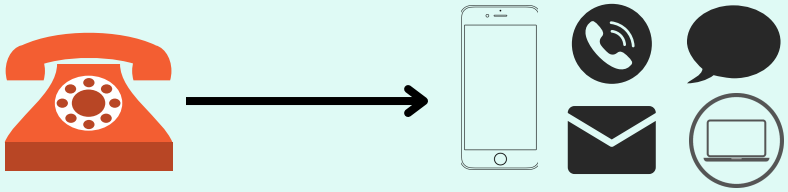
Some Wi-Fi 6 devices in market that popular nowadays are PlayStation 5, Samsung Galaxy Fold, S20, Huawei P40 Pro, iPad Pro, iPhone 11 above and many more.

There is transforming wireless communication from a wired telephone to Converged Communications Device with numerous applications and from Wireless Access Point to Converged Access Point with various capabilities.The example we can see there must have an access point in front of the class so that students can use it to connect the device with the access point to get into the data center and this is the way to get the Internet terminated so that you can use to access the Internet.

Wi-Fi 6 have already solves many problems

- Network capacity (OFDMA & MU-MIMO)
- Devices battery life
- Peak throughput increase (1024 -QAM)
- Outdoor reliability (Long OFMD Symbol)
- Enhanced Wi-Fi coexistence (BSS Coloring)

Transforming technology wireless communication



Multi-gigabit Technology

Trends Driving Enterprise Network Traffic

- Rapid increases in Wi-Fi speeds
- IoT devices/ Smart Buildings
- 10x Increases in wired edge speeds (multigigabit /802.3bz)
- Cloud applications and video streaming

Networking technology easy to deploy budget-friendly solution can allow us to increase the network speed and bandwidth just only by using our existing cables. Multi-gigabit technology magnifies the speed by increasing the sampling rate which can affect increasing our speed to 2.5 gigabits, less or beyond. Multi-gigabit switch technology is able to support more than 5gbps port in the switch to maximize the performance for the access point.

Unified Network Management

Source : https://www.cisco.com/c/en/us/solutions/enterprise-networks/what-is-a-network-controller.html

"Why do we need a controller?"

We must use the controller to centralize management not only for all these access points together but also for switches. Network Controller can perform all in ONE without using WLAN Controller anymore.

LOCAL AREA NETWORK → WIRELESS LOCAL AREA Network → IoT Access Network

Internet of Thing (IoT)

The evolution of network starting from 1970s that using LAN (Local Area Network) to 1990s utilizing WLAN (Wireless Local Area Network) to IoT Access Networks in 2010s

Implementing IoT technology in daily use bring advantages to reduce cost in hiring labor work, enhanced customer experience, increase efficiency & productivity, and also increase business opportunity.

CHALLENGES TO FACE WHEN IMPLEMENT IoT :

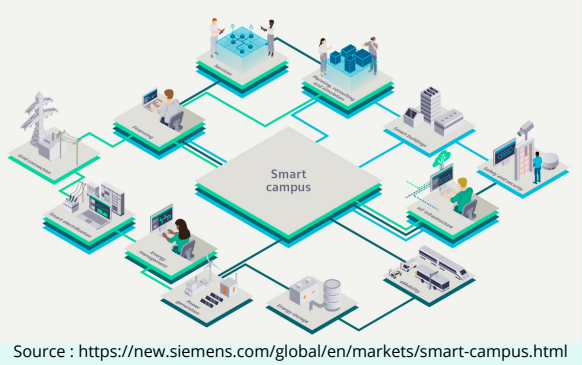
The major drawbacks that you will experience with IoT is security, connectivity and compatibility.

In security, as the data being stored through online, the possibilities to be found by hackers is high and to prevent the leakage of data, IoT devices must do information sharing with top-notch encryption. Next, power consumption of the Wi-Fi system is highly needed for better connectivity. Currently, there is no international standard compatibility for tagging and monitoring equipment but we can use USB, Bluetooth and others.

Cloud Analytics

It is too complex for human to manage as 42% of network professionals spend too much time troubleshooting. For the rest 38%, network professionals cannot proactively identify work performance issues. #1-ranking of Wireless as the top network challenge

"Moving forward, organizations won't be able to rely on acts on individual heroism but rather will need to evolve to more automated, self optimizing, and healing network environments" -ESG Network prediction for 2020



Source : https://new.siemens.com/global/en/markets/smart-campus.html

Smart Campus

A smart city places physical infrastructure on its network infrastructure create situational awareness for new services, lower costs & public safety using IoT to connect buildings, vehicles, people and things.

Attract and Retain Students with Smart Campus for Greater student experiences

Smart Campus separated into 3 categories of:

- Smart Living that exploit the whole campus using smart ID cards, In-building LTE, smart lighting, wayfinding, personal networks, smart parking/transit, and also IPTV stands for Internet Protocol Television.
- Smart Learning that include flexible learning spaces, digital portals, virtual labs, distance learning, lecture capture and library of the future.
- Smart Security that manage the safety of campus surroundings with CCTV & VMS, connected entry, tracking assets, sound detection and motion detection.

Facilities offered by Commscope

CommScope provides the switches to link up all the land connectivities and they also have the controller to centralize all the types of equipment. CommScope also provides some of the software as a service solution to their customer. The indoor and outdoor wireless access point also one of the facilities provided by CommScope. The access point can support more devices and covers a high-density environment with a better speed. The latest wireless access point have highest performance, highest throughput and highest capacity .

REFLECTION

Digital transformation is the most needed way to implement technology today. As we all know during the pandemic, we are ordered to stay at home because of the lockdown and not be able to go outside shopping for groceries or even exercise. So by using the technology that is provided we can survive for a long time by using automation. Everything we do must be in online method, from learning in school, doing our work, buying groceries or even to release stress for example watch movies, play games and so on.

Next , there is much demand for digital transformation, the most important part is in the terms of security. To make all these things happen functional and benefit the needs of the environment, people are daring to invest or use something safe and useful for them. if something is not safe to use, it does the consumer not to believe and lose interest in digital transformation and the world will not be progressive. In conclusion, the innovation of the technology on infrastructure is really important to make sure we are moving onwards and the aim is to make people's life more compatible.

5G, WI-FI 6 AND EMERGING NETWORK TECHNOLOGIES (HUAWEI)

By Mr. Nicholas Yong (Executive Industry Solution Manager for Asia Pacific Region)

As we all know, Huawei is one of the leading global providers of information and communication technology (ICT) infrastructure and smart devices worldwide. So, this article is about the use of 5G and Wi-Fi 6 in Huawei technology as these two type of technologies are important in enabling better data transmission in the future.

Before we go any further into this topic, let us know what are the functions of 5G and Wi-Fi 6 instead of the existing data transmission technology. 5G and Wi-Fi 6 both provide higher data rates to support the new ones applications and network capacity enhancement with capabilities to connect more users and devices. They also bring the promise of dramatically better performance to users, mobile, employees and organizations.

5G

5G is the next fifth generation of wireless technology systems. It provides speeds faster than any previous generation, comparable to those delivered via fiber-optic cables.

It also enables a new kind of network where it is designed to connect virtually everyone and everything together including machines, objects and devices.

Early testing of this technology shows real-world speeds of 700-3025 Mbps (3.025 Gbps), which consumers may experience once 5G becomes commercially available. Movies that took minutes to download with 4G will take seconds with 5G.

5G devices allow low latency, so it allows faster transmission for larger data streams. Next, it is more reliable, enabling better data transmission for data in extreme conditions. Finally, 5G is more flexible than Wi-Fi and can support a wider network of devices, sensors and wearables.

> VR will be a killer application of 5G
>
> ~ Mark Zuckerberg (Keynotes in MWC 2016)

Virtual reality (VR) is a simulation experience that can be similar or completely different from the real world. It requires the use of computer technology to create a simulation environment. 5G technology is also important in VR as it requires high processing power for retina experience and low latency to avoid motion sickness.

5G can foster new opportunities and benefits such as Smart Tourism as it requires new technology applications for future generations. It allows travelers to stream live their experience at any time over the 5G network. It also enhances the tour guide's Mobile App experience and the visitor experience through next -generation AR and VR apps.

Next, the advanced 5G Industrial Park encourages the establishment of high-tech industries, thus creating local employment opportunities. This is because High-Tech Parks equipped with a fully connected and smart 5G industrial park platform will attract high-tech inverters. Thus, diversifying the economy through the development of high-tech industries and in turn creating employment opportunities for the younger generation.

Finally, 5G can also enables AR/VR-based Virtual Education that helps students with nationwide outstanding resources.

This shows that with the development of 5G technology, many positive changes can be obtained, especially in the improvement of the country's economy and the improvement of a country's learning system.

Wi-Fi 6

Wi-Fi 6 is the next generation standard in Wi-Fi technology. Wi-Fi 6 also known as "Wi-Fi AX" or "Wi-Fi 802.11ax" is built-in and enhanced on the current Wi-Fi 802.11ac standard. Wi-Fi 6 was originally built in response to the increasing number of devices in the world. In fact, Wi-Fi 6 has been certified for over three years i.e. since 2017 but the Wi-Fi Alliance started Wi-Fi 6 certification for commercial use in 2019.

Wi-Fi 6 gives us many advantages as it supports gigabit bandwidth promotion i.e. 1Gbit/s to mobile phones or pcs, fast download or cloud backup experience as 1K QAM/160M/frame length/subcarrier optimization which increases bandwidth by 2.8 times. It also provides a high-speed top link and bottom link experience, with actual rates in excess of 1Gbit/s. Wi-Fi 6 increases bandwidth by three factors namely spatial stream, sub-carrier quantity, symbol duration and coding mode by increasing the number and rate of spatial stream for each factor.

Furthermore, Wi-Fi 6 also improves coverage such as full coverage of 5Ghz signals. The RF optimization of the Wi-Fi 6 chip increases TX power and sensitivity under the same signal quality, thus improving omnidirectional performance and coverage when connecting to traditional Wi-Fi 5 STAs.

In addition, Wi-Fi 6 also provides new video services such as multi-screen IPTV, online education, VR and e-Sports with OFDMA/BSS anti-interference and reduced latency coloring and it also supports the evolution of home value-added services.

Lastly, Wi-Fi 6 supports a better multi-user experience as more than 100 terminals are connected and terminal power consumption is reduced by 30%. It also enhances the entrance position as a smart home control center.

5G and Wi-Fi 6 in HUAWEI

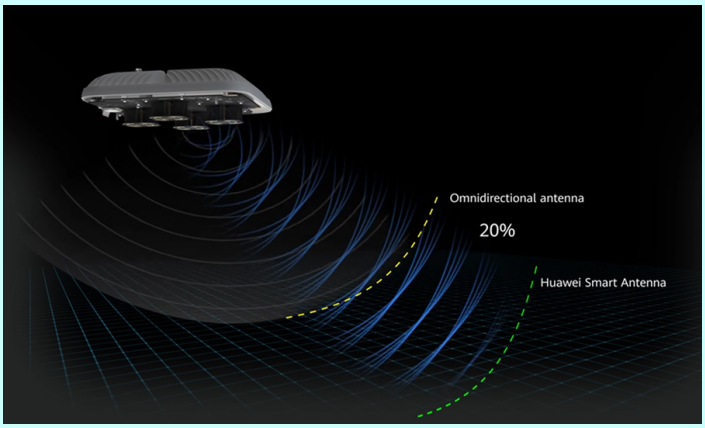
Huawei AirEngine Wi-Fi 6

Huawei AirEngine also uses Wi-Fi 6 technology. The use of Wi-Fi 6 makes it the highest performance as it uses 16x16 MU-MIMO. Second, it also allows the most stable experience of smart antennas, dynamic turbo, loss-free roaming, SmartRadio radio calibration algorithm and co-scheduling via MU-MIMO and OFDMA. Next, it contains the most comprehensive IoT applications as it has three built-in slots for IoT modules, has IoT expansion via a USB port and also an IoT chip ready. Lastly, it's most secure because it has an independent radio for scanning, hardware encryption and dual-signature boot. Huawei AirEngine Wi-Fi-6 is also the world's first 10Gbps Wi-Fi with a PHY rate of 10.75Gbps which is the fastest Wi-Fi 6 AP ever. This shows that Huawei is doing a great job in finding a better Wi-Fi 6 experience using their own technology.

Source: https://www.huawei.com/en/news/2020/2/huawei-airengine-wifi-6-products

Huawei Smart Antenna

5G also participates in Huawei's technology by Smart Antenna which increases SNR by expanding the coverage radius by 20%. 5G technology also makes SmartRadio enable 10ms of ultra low latency and lossless roaming.



Source: https://e.huawei.com/en/products/enterprise-networking/wlan/wifi-6/new-products-launch

Difference between 5G and Wi-Fi 6

Source: https://moniem-tech.com/questions/what-is-the-best-5g-or-wifi-6/

Reflection

From this, we know that 5G and Wi-Fi 6 give us many advantages especially in the face of ever-evolving technological developments. The existence of these two technologies greatly simplifies our tasks whether in terms of learning, working or doing daily works. It makes tasks can be done quickly in a limited time. With the availability of these two technologies, it can also provide changes to the learning system in schools and also provide economic growth through tourism with the existence of high-tech industries. Thus, the presence of these two technologies acts as a complement so that we can take advantage of them in every job in order to help in providing opportunities and solutions in every problem we face.