WHAT'S TECHNOLOGY TREND NOW

5G + WI-FI 6 + INCREDIBLE NETWORK INFRASTRUCTURE

Emerging Network Technologies

for the future of
Wireless Connectivity

DECEMBER 2021

CONTENT

APPLICATION OF 5G IN SMART CAMPUS

EMERGING TECHNOLOGIES ON NETWORK INFRASTRUCTURE

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

CREDIT TO
ANG YI QIN (A21EC0163)
YEW RUI XIANG (A21EC0149)
LAU YEE CHI (A21EC0042)
FONG KHAH KHEH (A21EC0026)

SMART PUBLIC TRANSPORTATION SYSTEM

SMART TRANSPORT? HOW CAN IT BE DONE?

On Campus, most of the students will likely take public transportation like a bus to reach their destinations in a faster way. However, students might need to wait for the bus to come which causes wastage of time. Besides, much more time will be wasted since students may not know the location of the bus at that particular time and which bus stop to wait for. Therefore, one of the applications of 5G can be applied in Smart Campus is Smart Public Transportation System. By applying this technology, the wastage of time by waiting a long time for getting on the bus can be avoided. Meanwhile, students on campus will be notified by smartphone apps which enables students to check the current location of 5G-connected autonomous buses and their arrival times. By using satellite GPS tracker available in the system, the students are provided with the information about the current location of nearest buses approaching the stop.

(Ilya Brovashov, 2019)

The student are able to track the location of buses at anytime through smartphone apps.

AUTONOMOUS BUSES

(Park Jae Jin, 2020)

For the autonomous buses equipped with advanced computing, wireless communication using 5G technology, and global navigation satellite system (GNSS), smart buses can be monitored and coordinated meticulously to ensure bus services are performing within standards. Furthermore, real-time live surveillance by 360 degree-camera is implemented on autonomous buses as one of the strategies to ensure buses' security and safety of passengers.

BENEFITS OF SMART PUBLIC TRANSPORTATION

Safer: By using IoT and 5G technology in this system, autonomous transportation systems can decrease the occurrence of accidents. It is because the system is able to avoid accidents due to over-speed and fatigued drivers since computers are not distracted or fatigued.

Smart Transportation is better managed: Smart Public Transportation System involves data collection which is responsible for management. Not only provides detailed information from raw data but also helps administrators to have better monitoring operations, either in track maintenance needs or identifying key sources of problems needed to be fixed.

Smart Transportation is more efficient: It becomes more effective with better management. Because smart transportation makes better use of the resources available, it can increase efficiency not only for public transportation services, but also student's work efficiency.

Environmental-friendly: Autonomous buses use electricity to power and operate instead of using non recyclable energy resources like fossil fuels which causes lots of emission of harmful gases.

REFLECTION

From the site as a university student, the application of 5G in Smart Campus like Smart Public Transportation System prompts our university lives to become more convenient and efficient in doing work. Compared to traditional buses available now in our campus, it might not be as efficient compared to 5G-connected buses in Smart Transportation since manual driving always has limitations in some way either because of compatibility of transport or fatigueness of drivers. On the other hand, these autonomous buses have solved the key sources of problems in manual driving which may result in accidents because of drivers' mistakes. From another point of environment's sight, this smart system helps in ensuring a cleaner ecosystem and reduces carbon footprint by preventing emission of harmful gases. Overall, the Smart Public Transportation System gives plenty of benefits for us as students and currently some universities in foerign countries are demonstrating this 5G application in the progress of Smart Campus by improving student services. To end this reflection about application in Smart Campus, we would like to provide an interesting example of Smart Transportation demonstrating (in testing status) in the United States: In University of Michigan, Mechanical Engineering professor Huei Peng serves as the director of Mcity which is a public-private partnership between the university and the city of Ann Arbor. With their corporations, Mcity is invented with the purpose to develop smart, automated technologies to power transportation such as driverless vehicles. Within Mcity, participants can test theories and collect data. (Katerine Manning, 2020).

"EMERGING TECHNOLOGY ON NETWORK INFRASTRUCTURE" (COMMSCOPE MALAYSIA)

Network infrastructure refers to the hardware and software resources of a network that enable network or internet connectivity, communication, business operations and management of an enterprise network. System's network infrastructure is made up of anything involved in the network from the servers to the wireless router. It provides an effective communication path and service between users, processes, applications, services and external networks or the internet. Meanwhile, due to this pandemic Covid-19, a new normal comes with big changes in different fields which result in much pressure to improve performance in network infrastructure since more requirements need to be fulfilled like higher asset utilization and better security in order to improve guest services. Thus, a sustainable network infrastructure is essential for emerging technology in different fields.

What devices are used?

1. **Access point**: A wireless access point (WAP) is a networking device that allows the wireless-capable devices connected to a wired network. It is easier and simpler to install wireless access points within a wired network to connect all the computers or devices than to use wires and cables. With radio transmitters and antennae as its feature, it is able to facilitate connectivity between devices and the Internet or a network. Not only providing connectivity to users, nowadays wireless access points are embedded to other wireless protocols like Bluetooth protocols and ZigBee protocols for different uses and different purposes. Another fact, Wi-Fi standards are the same for all manufacturers but Access Points are different from different brands since the architecture inside Access Point is different.

Wireless access point

2. **Wireless edge:** A piece of hardware that controls data flow at the boundary between two networks is known as an edge device. Edge devices are able to provide an entry point into enterprise or service provider core networks and also provide the connections into carrier and service provider networks. For example, routers, routing switches, integrated access devices (IADs), multiplexers, and so on.

Miller Edge RB-G-K10 Wireless Edge Kit

3. **Switch**: A switch is networking hardware that receives incoming data packets and redirects them to their destination devices on a local area network (LAN). Switches are able to limit the traffic to or from each port. This makes each device connected to the switch have a sufficient amount of bandwidth. However, the firewall and logging capabilities that routers do are not provided by switches.

Cisco network switch

Cisco wireless LAN controller

4. **WLAN controller**: A WLAN is a wireless architecture which monitors and manages wireless access points in bulk that allows wireless devices to connect to the network. Similar to an amplifier for a stereo system, it boosts the signal of the router to allow many devices to go on the network from farther distances away. It also gave the ability to hold all the data and information which related to the network to the network manager.

Where can this be applied? Smart Campus

Similar to Smart City, Smart Campus requires advanced network infrastructure applied on physical infrastructure in order to create a situational awareness for student services to provide supportive and engaging experiences by using IoT devices to connect buildings, vehicles, people and things. 3 categories are divided in Smart Campus; Smart Living, Smart Learning and Smart Security, where all of these categories are prompting a greater student experience in Campus life. For instance for Smart Living, there are lots of IoT devices like Smart Lightning, Smart Thermostat and Smart ID cards used in students' daily routine, which prompt a convenient and greener campus. However, one of the prerequisites for Smart Campus is "Connectivity Anywhere and Everywhere".

In other words, everything or anything has to be connected. In this condition, the wall-mounted Access Points, switches and IoT platforms are required to perform an "All in ONE" living environment. Furthermore, a network controller might be needed to centralise all the Access Points and switches by unified network management, instead of using a traditional network management system which requires a WLAN controller to centralize all the Access Points available. However, while there are lots of devices needed to be connected, it will cause difficulty of administrator's management especially in the security field. For this problem, AI/ML-driven analytics and assurance plays an important role to help administrators to take quick action by providing insights and predictions. For example, AI/ML-driven analytics and assurance operate Configuration Change Analysis for monitoring and analyzing impact of configuration changes to network KPIs, also Network Health Monitoring for monitoring SLA categories and thresholds etc. Overall, all those methods and strategies help to create a sustainable network infrastructure in Smart Campus in order to give superior campus experience.

Reflection

From the talk, we realised that high efficiency in the network infrastructure is very important nowadays. Many people and domains rely on network infrastructure to connect among the people for different purposes such as business, education and communication. The advances in the network infrastructure give a high potential in our country's development. A strong network infrastructure will improve the efficiency, scalability and security of network. For instance, the network infrastructure becomes the backbone of a healthy business. All of the business activities from administration to employee productivity to customer satisfaction rely on the network. Without it, it will be difficult for communication with clients or customers. Others than that, with stong network infrastructure, we also can have smart campus so that we can connect to the network everywhere and learn online anywhere. Therefore, network infrastructure plays a significant role in our daily life. Without it, we can not connect with other people conveniently and efficiently. Thus, the growth in network infrastructure will bring more convenience to our future.

5G, WI-FI6 AND EMERGING NETWORK TECHNOLOGIES (HUAWEI)

Wi-Fi 6 and *5G* are the technologies that are involved in 4IR. 5G in Malaysia is not really moving forward yet but Korea and USA launched 5G technology already.

5G Technology

5G is a fifth-generation wireless technology system. It has high bandwidth and low latency to allow users to experience superfast speed and a reliable network. The speed of 5G is faster than the previous generation and comparable to those delivered via fiber optic cables. It also has a greater capacity which can support millions of devices, advancing areas such as IoT and AI. Due to the faster transmission of 5G, movies or videos will take seconds to finish downloading.

Wi-Fi 6

Wi-Fi 6 is widely available including in Malaysia. It has been verified for 3 years. Wi-Fi 6 (802.11ax) is a new standard Wi-Fi that is fully compatible with all your Wi-Fi devices. Wi-Fi 6 can reach a maximum transmission speed of 9.6Gbps (in Malaysia). It has large bandwidth, low latency, IoT oriented energy saving and anti-interference. Wi-Fi 6 supports gigabit broadband promotion that is one Gigabit per second to your mobile or PC. Therefore, it brings more efficient and faster data transfer, allows us to enjoy the 4K video smoothly and lightning fast downloads for larger files.

Device used in 5G and Wi-Fi 6

Huawei AirEngine Wi-Fi 6 Technologies At-A-Glance

Huawei's AirEngine products are designed to build all-wireless and high-quality network environments for enterprises or productions with highest performance. It provides the most stable experience by their remarkable innovations in antenna (Smart Antenna), broadband and radio algorithms technologies. Besides, Huawei AirEngine can be the most comprehensive IoT Apps since Wi-Fi 6 provides a fully connected, all-wireless environment which enables enterprises to accelerate their digital transformation journey in deploying IoT technologies. In the perspective of security, Huawei AirEngine can be one of the most secure AP since it includes independent radio for scanning, hardware encryption and dual-signature boot, building a more secure environment for enterprises as their campus network access way.

Virtual Reality Applied 5G Technology in Education Field

Nowadays, Virtual Reality or VR has become one of the trend especially in technology markets whereby the consumer VR market worldwide is set to reach $2.6 billion by the end of 2020. (Christo Petrov, 2021) Virtual reality not only important in experiences in technology and entertainment, but also in education field. How and what way? Virtual reality can improve education by providing memorable and immersive experiences. In someway, virtual reality can engage and inspire students in a unique and powerful way. So why virtual reality needs 5G and what can 5G do? 5G technology actually provides high throughput for retina experience in virtual reality by high resolution for retina experience per eye and 6 angles for full-view panoramic video. For lecturers in school, they can be one of the content producers for learning courses and virtual reality can be a broadcast platform to stream live videos while carrying up teaching session. By including 5G technology in virtual reality, students are able to have a totally different learning mode, so-called immersive learning mode which is new for them and this actually provides a virtual learning place (virtual classroom) which can stimulate actual face-to-face learning during this pandemic Covid-19. Not only that, 5G technology which offers low latency avoid motion sickness due to the delay between sending and receiving information. In other word, it provides better virtual experience on spot as MTP (Motion-to-Photon) delay is minimized to 20 ms. Long and short of it, 5G enabled virtual reality based virtual education which helps students with excellent resources all over the country/world.

(Rohan Robert, 2019)

(Triton Infotech, 2019)

REFLECTION

From the talk, we can know that our world is entering the era of 5G and wifi6. With higher latency, greater capacity and wider bandwidth, we all can use these benefits to make our daily life more convenient and effective. We can use these technologies to watch 4K videos and even 8K videos smoothly. It also allows us to download a large file with a faster network speed. Even Though 5G has not fully rolled out yet in Malaysia, it has launched in some countries already. We can know that 5G is a very important element for a country to move toward 4IR. Both 5G and Wi-Fi 6 allows connecting more mission critical IoT devices reliably via wireless. Both also offer enhanced mobile broadband for immersive experience via augmented and virtual reality. 5G and Wi-Fi 6 introduce the new era of wireless access. The convergence enables us to do work everywhere and offers us a better user experience. As a result, the development of Wi-Fi 6 and 5G can make our country realise the smart cities and smart classrooms as well as allow our country to become the leader in 4IR.