Network Technologies

ASSIGNMENT 3, DECEMBER 11, 2021

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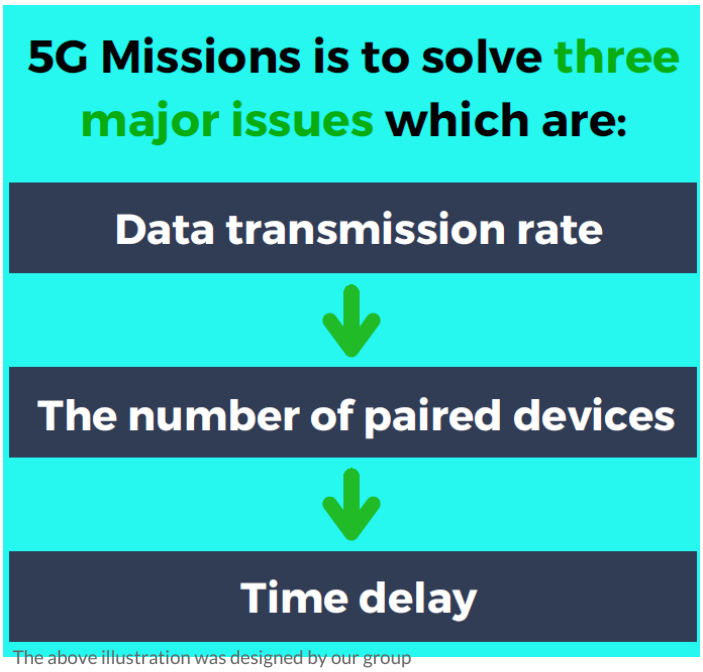
WHAT IS SMART CAMPUS ?

Introduction

In the past few years and due to the advancements happening in the technological world, the current 4G LTE service is not capable of keeping up with those advancements. This resulted in the creation of a new system which is 5G. This new 5G system has a wide range of implementation in diverse fields, one of which is **Smart campuses.**

Smart Campus is an improved, technology-driven infrastructureconnected through the internet so as to ease communication andengagement of individuals, applications, and devices. It enablesuniversities to make decisions based on relative insights in addition toexpanding resources and enhancing security.



The above illustration was designed by our group

5G applications on smart campuses depend on diverse technology fields mainly ICT. This technology will benefit the campus in several sections such as iLearning, iSocial, iManagement, iGovernance, iHealth, and iGrean.

LEARNING MANAGEMENT SYSTEM

PURPOSE AND HOW IT WORKS

It has the purpose of satisfying the need of managing teaching activities by recording the related data like the course information, the meetings schedule, the attendance, the group creation, the project discussion, and the execution of the tasks.

Moreover, learning management systems play a vital role in providing the proper channels for communicating between lecturers with students, lecturers with their colleagues, and lecturers with their coordinators. This would consequently improve the productivity of each individual because of the existing common environment that creates incredible chemistry between them.

Figure 1 Learning Management System. Adapted from 'Lms learning management system vector image' . Retrieved from 7 December 2021, from https://www.vectorstock.com/royalty-free-vector/lms-learning-management-system-vector-8212398

One application of 5G in smart campuses is the Learning Management System It is meant by the activities management of online learning through technological devices like PC and/ or mobiles. This management system takes part in connecting lecturers and students in direct and indirect ways.

One more thing the 5G service would help in learning management systems is the accuracy of the data transmitted which subsequently generates an in-depth analysis of the whole learning outcomes helping in the assessment of the good parts and those needing development.

Characteristics

- Responsive design: it displays different designs for different types of devices so that each design suits the aspects of the several devices.
- User-friendly interface: easy to navigate. The alignment fits the needs of the university as well as the users.
- Support services: Learning management systems must have support teams where users can contact them whenever they have a problem.
- Artificial intelligence: learning management system can be helped with AI suggesting the proper courses and topics for the certain people they are suited for.
- Cloud-based: Most of the learning management systems are hosted in cloud computing software.

Insights

Learning management systems plays an extremely important role in developing the digital life of smart campuses and this will be helped by the system of the 5G network and IoT (Internet of things) field. This is because learning management systems have massive constructions that could even cover a whole city rather than a smart campus and this would be very difficult, if not impossible for the previous versions of networks to handle. Learning management systems have tremendous advantages helping to improve the smart campus.

Some examples of that are that Learning management systems provide users with permanent access to electronic learning materials so that learners, as well as educators, can access that information stored in databases at any time and anywhere. Moreover, learning management systems brings down the cost of learning to a reasonable amount. Spares educational constructions different costs say a university wants to make a webinar so instead of printing 20 papers for each instructor and learner, they could simply upload them in the management system. There are, of course, some drawbacks of learningmanagement systems such that it requires a certain level of programming knowledge and it can not be handled by individuals who have low or no experience with programming. However, the probability of getting benefits out of learningmanagement systems still outmatches the probability of not being useful.

Example of popular Learning Management Systems that are available :

Figure 2 Learning Management Systems. Adapted from 'Learning Management System (LMS) Design' . Retrieved from 7 December 2021, from https://www.css-oc.com/services/lms

Advantages of learning system management

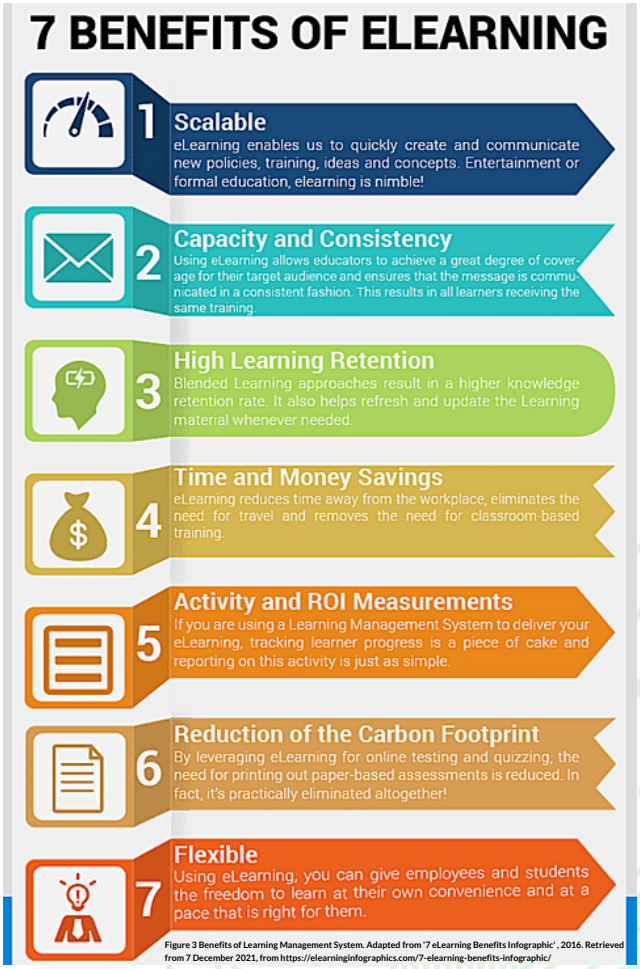


Figure 3 Benefits of Learning Management System. Adapted from '7 eLearning Benefits Infographic' , 2016. Retrieved from 7 December 2021, from https://elearninginfographics.com/7-elearning-benefits-infographic/

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Emerging Technology on Network Infrastructure

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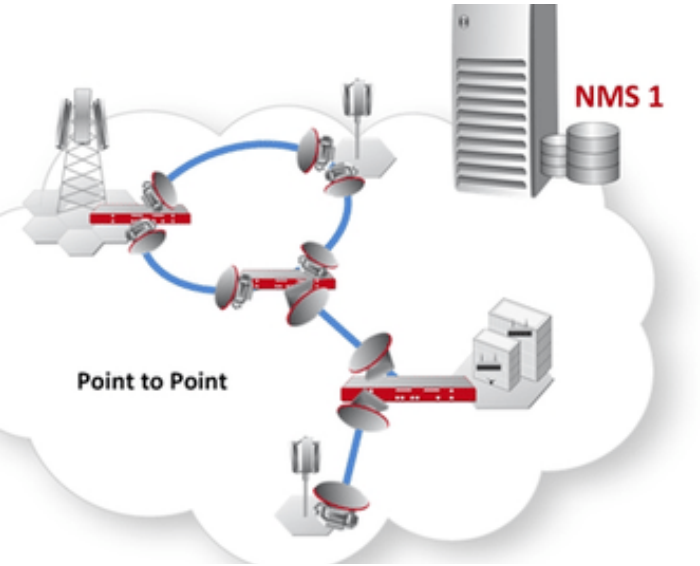
Pandemic Impact on the IT world

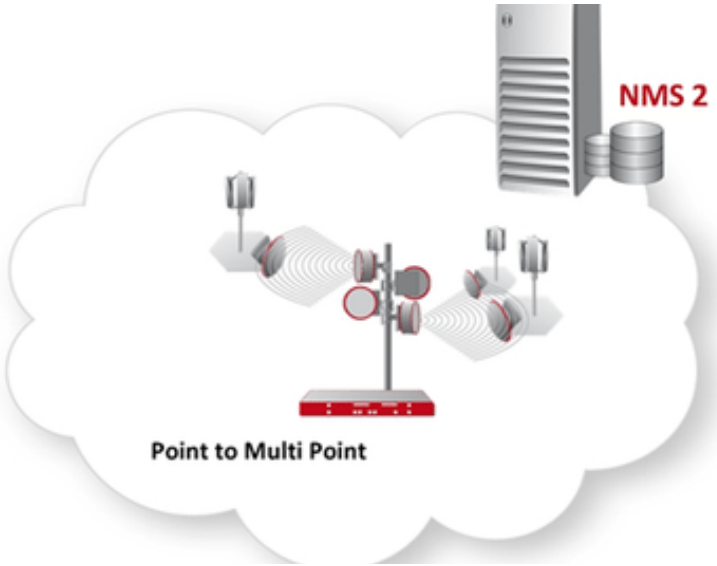
During the pre-pandemic of covid-19 employees were going to work every day normally, students went to school/universities and people went to shopping malls regularly as nothing is going on. After things got serious, all these new features like remote working, hybrid studying/teaching, etc. And so, more companies chose to use the more working environments, which resulted in the acceleration in the digital transformation, many businesses doing FB Live to sell items and digital transformation. Which also forced the countries to upgrade their broadband connectivity range, areas, and speed to cover these features. And so, for these working environments, IT Infrastructure platforms have been implemented to remotely manage these environments.

This has improved the performance by utilizing assets/costs and safety. Thus, better security was implemented especially for wireless devices as they have security multiple concerns. Moreover, this has improved the guest services, for example, smart robots, better hospitality, etc.

Network Infrastructure

ISPs, Wireless routers, mobile phones, laptops are all part of the Network Infrastructure. All the devices connected, connect through their own IoT protocol or a wireless network. Mobile phones connect wirelessly, while the access point connects mobile phones wirelessly, they have one cable connected to the switches which have a wired connection to the core switch. The core switch is located in the data centres, which is where we can access the internet, data centres also have servers and firewalls





Source of photo: https://snmpcenter.com/wp-content/uploads/2013/09/vertical-management-silos.png

Unified Network Management

The administration of both wired and wireless networks via a single interface is known as unified network management. When we have many access points and switches, in a normal environment we may have dedicated wireless controllers to manage all these access points.

UTM campus may have more than 2000 access points, so it would be a challenge for IT administrators to manage the entire network, hence that's why there is a centralized controller to manage all these pieces of equipment in a single platform.

Multigigabit technology

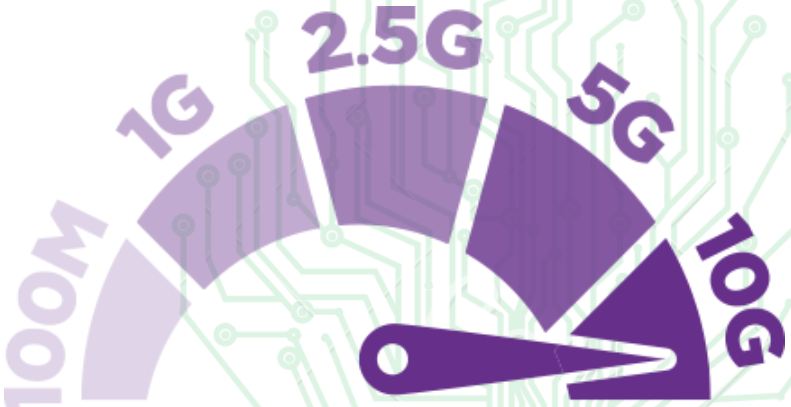
Wi-Fi 6E is the latest wireless technology, it increases the efficiency of data transmitting which increases the upload/download speed, improves the communication between the access points and wireless devices by using MU-MIMO which allows access points to communicate with multiple devices instead of one at a time. It also uses TWT technology which allows devices to negotiate when and how often they send and receive data. It's able to carry 10-bits instead of 8. Finally, it uses BSS coloring which vastly increases the performance. Wi-Fi6E is currently not available in Malaysia but soon, it will be regularly used.

REFLECTION ON THE TALK

Wi-Fi 6E features a higher efficiency and better communication between wireless access points and the devices. It also uses a feature called MU-MIMO which enables the use of multiple devices simultaneously. It also has a 10-bits per second performance and is equipped with BSS coloring.

The Internet of Things is a broad term that refers to the interconnected devices and systems that are used to communicate with each other.

The rise of Internet of Things (IoT) has raised concerns about its privacy and security. However, this is not an issue that can be solved easil



Source of photo: https://blog.netgear.com/wp-content/uploads/2021/04/img-33.png

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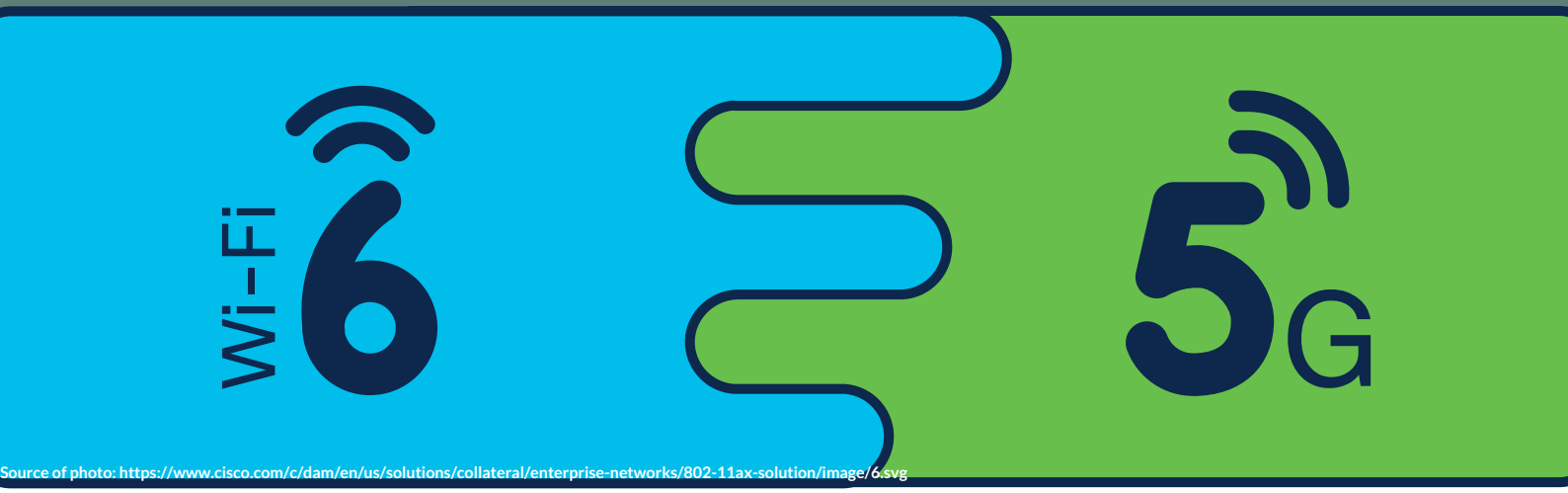
5G, Wifi6 and Emerging Network Technologies



Source of photo: https://www.cisco.com/c/dam/en/us/solutions/collateral/enterprise-networks/802-11ax-solution/image/6.svg

What is 5G and WIFI6?

5G is the latest generation of cellular wireless technology aiming to improve the speed, reliability, availability, and capacity of the network. It gives users the opportunity to experience real-time communication with other individuals, or even devices. Compared to 4G LTE (the previous version of cellular wireless technology), 5G has diverse additional properties that 4G did not use to have. It, for instance, supports new services that require a high capability of elevating mobile broadband like mission-critical communications services and IoT.

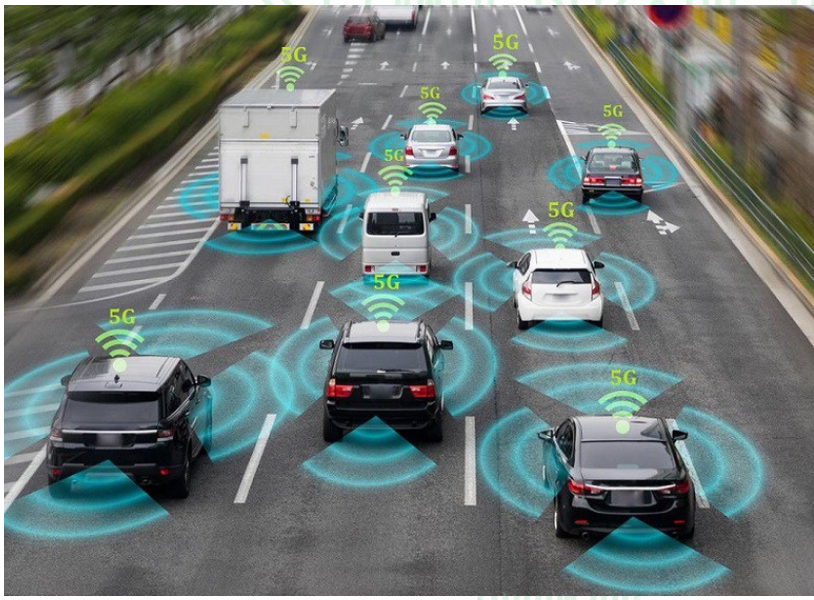
While 5G is the newest cellular wireless technology, WIFI 6 is the newest version of the Wi-Fi and is also referred to as 802.11ax. It is basically a faster, more productive version of the past Wi-Fi generations people use. In comparison to Wi-Fi 5, Wi-Fi 6 delivers four times the capacity in addition to a massive lower latency of approximately 75%. Wi-Fi technology needs to be implemented in adaptable devices so as to get the best experience of max speed, latency, and full capacity.

Potential applications and devices used

One of the most anticipated 5G applications is autonomous vehicles. Vehicle technology is fast improving to assist the future of autonomous vehicles. In order to realize the autonomous vehicle future, various advancements in-vehicle technology, network speed, data throughput, and machine learning must all come together. Owing to the drastically reduced latency, 5G networks will be a huge enabler for autonomous vehicles since vehicles will be able to reply 10-100 times faster than on existing cellular networks.

For example, assume a car going at 35 mph has to receive a signal in order to avoid colliding with an object. An automobile would go roughly 4 feet or 1.2 meters with current 4G latency of around 100 milliseconds. However, due to the 5G delay of roughly 10 milliseconds the car would have only driven 5 inches (12 cm). The difference is enormous and could save people's lives.

Huawei is the leading company in Wi-Fi 6 market. Huawei led the market in implementing the first enterprise-class Wi-Fi 6 network in Shanghai in 2018 with its AirEngine Wi-Fi 6. The clients were able to create the best Wi-Fi 6 networks with no coverage gaps, no wait time, and no packet loss while traveling. This enables a transition to a fully wireless campus era in every industry, including digital education, digital airports, omnichannel finance, smart healthcare, smart government, and smart manufacturing. Huawei AirEngine Wi-Fi 6 has now been deployed across the world such as Spain, Italy, Switzerland, Belgium, South Africa, China, and India.



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Examples of domains:

5G

5G has enabled internet connections to be stable and far faster than its ancestor 4G LTE. The use of the internet has been increasing day by day, especially after the recent pandemic. And so, 5G was implemented in order to allow multitasking without lag, disconnections, or extended loading time. For instance, students can be in a meeting, while sharing the screen/webcam with no issues, even if there are multiple users connected.

Source of photo: https://www.southwestern.edu/live/image/gid/30/width/1000/38256_shutterstock_1708152400_2.rev.1600285376.jpg

WIFI6

The ultra-low latency provided by Wi-Fi 6 makes things a lot easier and sometimes this low latency is compulsory. In an airport, for example, the lower latency means that there will be more accurate planning/communication, thus, lower risks. Most of the airports have already switched to Wi-Fi 6 which proves how useful and important it can be.

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Reflection on the talk

the top potential for 5G in the industrial application had also been explained by the speaker, which is 5G smart medical, 5G live broadcast, 5G smart education, and many more. The speaker then proceeded to explain about 5G. As mentioned by the speaker, 5G has two important aspects, which are high bandwidth and low latency. It also has an increased RSSI, which is 3dB. Last but not the least, it also has a magnificent interference suppression, which is 15dB. In essence, it can be said that the speaker, Mr. Nicholas has provided a very informative and condensed talk regarding the 5G and Wi-Fi 6 technology. He has mentioned how 5G will be able to give an enhanced mobile broadband experience which will allow us to have low latency communication and also massive machine type communications which will allow the existence and implementation of smart cities and campuses. Lastly, it is hoped that the implementation and usage of 5G and Wi-Fi 6 will be widely used in Malaysia country very soon, in order for everyone to benefit from it, and also so that Malaysia will be a country that is well known and recognized for its expertise in the technology field. To look into this further, the speaker had provided a list of core technology charts, of Wi-Fi 6 versus Wi-Fi 5. As mentioned by the speaker, Wi-Fi 6 has more performance capability compared to Wi-Fi 4 and Wi-Fi 5. For example, a smart campus that uses 5G and Wi-Fi 6 will surely help to improve the lifestyle of the students and staff in a campus niche.

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