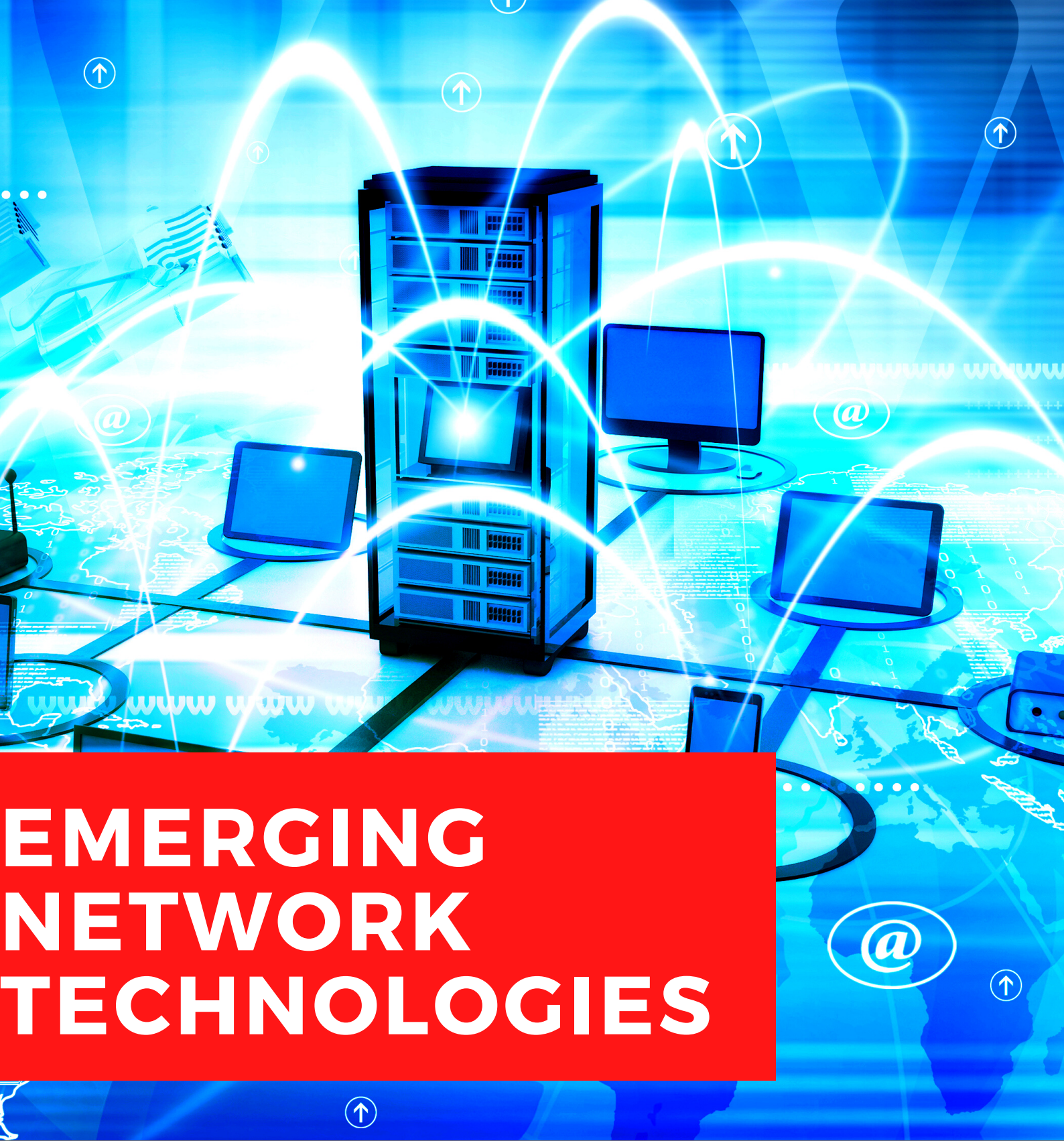

EMERGING NETWORK TECHNOLOGIES

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Topics

1. *Application of 5g in smart campus*
2. *Emerging technology on Network infrastructure*
3. *5g, Wifi 6 and emerging technologies*

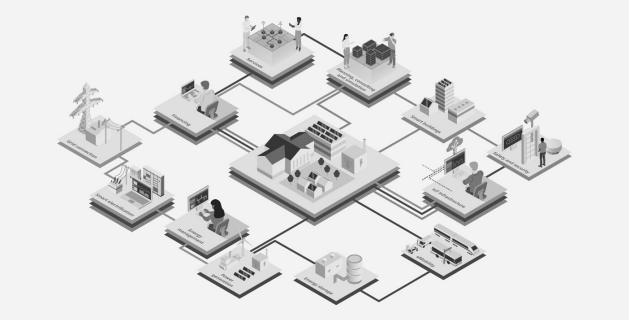
APPLICATION OF 5G IN SMART CAMPUS

A REFLECTION ON 5G TECHNOLOGIES AND SMART CAMPUS BY
ABDULLAH AL KHALID-A21EC4025

A smart campus is a real or virtual setting in which humans and technology-enabled systems interact to provide university stakeholders with more immersive and automated experiences.

Smart campus is consist of 3 important structure-

- **Smart Living**
- **Smart Learning**
- **Smart Security**



THE SMART CAMPUS EXPERIENCE THAT WE CRAVE IS UNBELIEVABLE WITHOUT 5G.
SO 5G IS A MUST FOR THE INFUSTRUCTURE.

5g is the fastest and latest global wireless standard. 5G allows for the creation of a new type of network that connects nearly everyone and everything, including machines, objects, and gadgets.

5G wireless technology aims to provide multi-gigabit per second peak data speeds, ultra-low latency, enhanced dependability, huge network capacity, increased availability, and a more consistent user experience to a larger number of people. Improved performance and efficiency allow for new user experiences and industry connections.

REFLECTION ON 5G IN SMART CAMPUS

By Abdullah Al Khalid

5g is the next-generation technology. 5g adds a new angle of view to how we see, observe, and use.

5g allows both students and educators to stay connected with low latency and reliable connected networks in both indoor and outdoor.

5g requirements will support more applications. With 5g the IOT (Internet Of Things) will get mush enhanced scenario.

- Enhanced Mobile Broadband
- Massive Machine Type Communication
- Ultra-Reliable and Low-Latency communication.

Virtual reality will be one of the most iconic technology enhancements for 5g.

With 5g The VR Invites High throughput and improves motion sickness as the latency is gradually decreased.

5g adds a new meaning to the smart campus. As the enhancement of the network enables a huge number of new applications, students, educators, alumni, parents will be benefited from technological improvement and a secure environment.

With 5g the security and safety will be stronger at the campus.
"We don't know when or where the campus security incident may happen."

Motion detection, Sound detection, Smart locks, led Lights, CCTV cameras on campus the people will be more benefited.

5g also provides students with immersive learning experiences. Flexible learning spaces, Digital portals, Virtual Labs, Distance learning, Lecture capture, Cloud computing, and storage all are part of 5g technology.
5g technology has also broadened the smart living experiences for everyone with smart Id cards, Smart parking spaces & personal networks.

Improvements in the COVID 19:remote wokring by employee, cloud and mobile computing, acceleration of digital transformation, resilient business operation, and high speed broadband connectivity

Post pandemic Improvements : higher utilization, lower utility cost, better security, and improved guest services safety

NETWORK INFRASTRUCTURE

WIFI — Wireless Egde — Access — Core — Data Centre or Cloud

WIRELESS PARADIGM SHIFT

Today's network : Theoretical peak speed, also called (11a,11b,11g,11n)
Tomorrow's network: Overall network capacity, also called (Wifi 6(11ax))

WIFI 6

wifi 6 solves varies of problems:
1- OFDMA (network capacity) more Upload and Download improvement , increase in the speed of transfering data to the wireless devices
2- MU-MIMO (network capacity) appility to comunicate with multiple devices in one time
3- power efficiencies (Device battery life) allow devices negotiat when to recieve the data and when to turn off this will help in saving the battery life
4- 1024-QAM (Peak throughput increase) can carry 10 bits
5- long OFDMA symbol(outdoor reliability , peak throughput increase) increase network performance because of the less interference
6- BSS coloring (networok capacity , enchaced wifi coexistence)

Some of the devices that use WIFI 6 these days

IPHONE 11

PS5

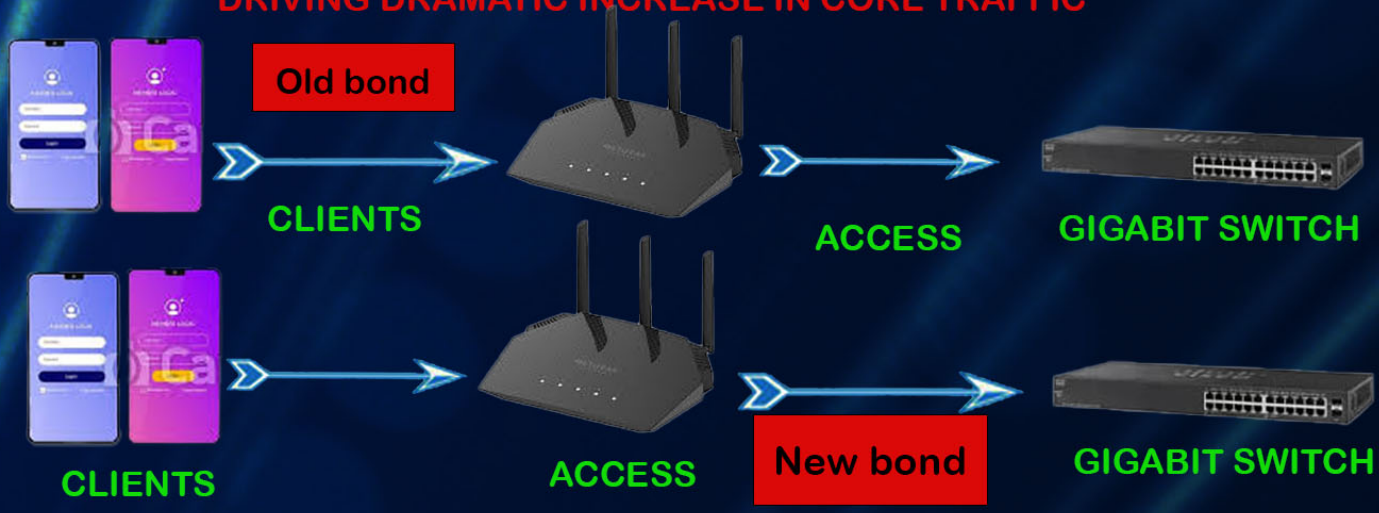
Transforming wireless communication

Refrence design --------> Enterprise AP

Multigigabit Technology

THE CAMPUS CORE IS UNDER STRESS because of : rapid increase in wifi speed, Iot devices and smart buildings, 10X increase in wired edge speed, and cloud applications and video streaming

DRIVING DRAMATIC INCREASE IN CORE TRAFFIC



The new bond helps us to maximize performance easily

Wlan controller : is to manage different Access point

The new design is that there is one big netwrok controller that manage both the (Multigigabit Switch and Access point)

Benefits of implement IoT solutions: cost reduction, enchace customer experiences, increase productivity, and increase businnes opportunities

CHALLENGES WHEN DEPLOYING IoT Solution: connectivity, Security, Compatibility

SMART CAMPUS

Smart living

Smart learning

Smart security

Industrial Talk 6: 5G, Wifi6 and Emerging Network Technologies (HUAWEI)

DONE BY ABDULLAH AL RAFI (A21EC4006)

5G NETWORK

5G is the next generation of wireless technology systems. it provides speeds faster than any previous generation, comparable to those delivered via optic fibers

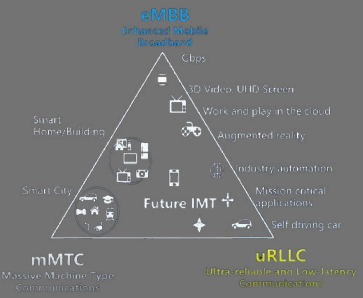
EFFECTS OF 5G

THE EFFECT OF 5G ON THESE SECTORS COULD BE TRANSFORMATIONAL FOR THREE PRIMARY REASONS ONCE IT BECOMES WIDELY AVAILABLE:

1. 5G devices have a lower latency, allowing greater data streams to be transmitted faster.

2. 5G DEVICES ARE MORE RELIABLE, ALLOWING FOR IMPROVED DATA TRANSFER UNDER HARSH CONDITIONS.

3. 5G IS MORE FLEXIBLE THAN Wi-Fi, ENABLING IT TO SUPPORT A LARGER RANGE OF DEVICES, SENSORS, AND APPLICATIONS AND WEARABLES.



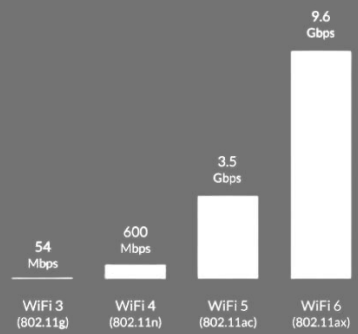
5G SPEED

5G is designed to deliver peak data rates up to 20 Gbps based on IMT-2020 requirements

WIFI 6

WiFi 6 (802.11ax) is the latest generation of WiFi. Building off of the 802.11ac standard for wireless network transmissions, WiFi 6 promises faster throughput speeds, less bandwidth congestion, and WiFi spectrum efficiency.

WIFI 6 SPEED



WiFi 6 delivers faster speeds than the previous two generations of WiFi, but how much faster is it exactly? WiFi 6 is capable of a maximum throughput speed of 9.6 Gbps, compared to 3.5 Gbps on WiFi 5 and 600Mbps on WiFi 4

WIFI 6 ADVANTAGE

There are many significant improvements that are incorporated into WiFi 6 that will make it much more useful to wireless users around the world. Let's take a closer look at some of the advantages of using WiFi 6 technology.

1.Greater data transfer speed:
Each generation of WiFi has provided greater data transfer speed and WiFi 6 is no exception. The theoretical speed of WiFi 6 is 10Gbps

2.Increased battery life:
Another important benefit afforded by the move to WiFi 6 is the increased battery life that devices accessing a WiFi 6 network will enjoy

3.Better performance in congested area:
One way this is accomplished is with a technology known as Orthogonal Frequency Division Multiple Access (OFDMA). This allows a wireless channel to be divided into a number of sub-channels that can each be used to carry data for a different device. This allows a single access point to communicate with more devices simultaneously.

HUAWEI TECNOLOGIES

Huawei AirEngine Wi-Fi 6

• LIGHTNING SPEED: 10 GBPS AND BEYOND
HUAWEI AIRENGINE APS ARE THE INDUSTRY'S ONLY TO PROVIDE 16 SPATIAL STREAMS AND A THROUGHPUT RATE OF UP TO 10.75 GBPS, DELIVERING FIBER-LIKE NETWORK EXPERIENCE FOR HEAVY-TRAFFIC SERVICES SUCH AS AR/VR AND 4K VIDEO.
• MÔRE STABLE COVERAGE: BLIND-SPOT-FREE FULL COVERAGE
HUAWEI AIRENGINE APS HAVE 16 BUILT-IN SMART ANTENNAS AND USE THE 5G BEAMFORMING ALGORITHM, ACHIEVING A 20% GREATER COVERAGE DISTANCE AND STRONGER SIGNALS THAN TRADITIONAL ANTENNAS. THE END RESULT IS BLIND-SPOT-FREE FULL COVERAGE,
• MORE STABLE APPLICATIONS: ASSURED APPLICATION EXPERIENCE
HUAWEI AIRENGINE APS USE THE FIRST-OF-ITS-KIND DYNAMIC TURBO TECHNOLOGY TO DYNAMICALLY DETECT APPLICATION TYPES AND IMPLEMENT HQOS, ACHIEVING ULTRA-LOW 10 MS LATENCY FOR KEY APPLICATIONS AND ENSURING SMOOTH EXPERIENCE OF REAL-TIME APPLICATIONS SUCH AS AR/VR AND VOICE.
• MORE STABLE ROAMING: LOSSLESS ROAMING
LEVERAGING SMARTRADIO LOSSLESS ROAMING TECHNOLOGY, HUAWEI PROACTIVELY OPTIMIZES THE TRADITIONAL ROAMING PROCESS AND ENABLES MOBILE TERMINALS RUNNING HUAWEI EMU OR MAGICUL TO IMPLEMENT MILLISECOND-LEVEL LOSSLESS ROAMING. THIS ENSURES SMOOTH EXPERIENCE OF OFFICE APPLICATIONS SUCH AS VIDEO CONFERENCING AND MANY MORE

Unique Benefits of Huawei AirEngine Wi-Fi 6

• LIGHTNING SPEED: 10 GBPS AND BEYOND
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HUAWEI SMART ANTENA

Smart antennas (also known as adaptive array antennas, digital antenna arrays, multiple antennas and, recently, MIMO) are antenna arrays with smart signal processing algorithms used to identify spatial signal signatures such as the direction of arrival (DOA) of the signal, and use them to calculate beamforming vectors which are used to track and locate the antenna beam on the mobile/target

Smart antenna technology concentrates energy on the receive end by adjusting the transmit parameters on the transmit end to enhance signal coverage and increase wireless Access Point (AP) capacity.

Smart antennas are implemented using beamforming and antenna array technologies. Both technologies leverage combinations of multiple antennas to improve the beams of the transmit signals, thereby improving wireless user experience. By combining the advantages of the two technologies, smart antennas achieve better benefits.

Beamforming Technology

Beamforming, also called transmit Beamforming (TxBF), is a technology that transmits signals to STAs in an energy-focused and directional fashion. It comprehensively improves the quality of signals received by STAs and increases the throughput. Beamforming has been supported since Wi-Fi 4 (802.11n). It can be implemented using multiple common antennas.

In a multi-antenna system, when signals transmitted by different antennas arrive at a location, zero-energy signals may occur if two beams have equal attenuation but opposite phases. Beamforming technology enables two beams to be superimposed with the best effect by pre-compensating the phases of transmit antennas. This approach improves the strength of signals received by STAs, thereby improving user experience.