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A Report on One day workshop on
"Next-Gen Networking Technologies: Exploring 5G, SDN and NFV"
Organised by Department of Computer Science & Technology
07th February 2024

Organized by Mr. M. Shankar, Assistant professor ,Dept. of CST; Mr. S. Srikantarao, Assistant professor ,Dept. of CST, MITS Madanapalle
Submitted by Mr. Srikantarao S, Assistant Professor, Department of CST.
Resource Person: Dr. M Shanmugam, Assistant professor, CSE, Pondicherry University
Participants: II year CST Students
Attendance: 70 CST STUDENTS
Venue: Lab-10 Circular Block , MITS
Mode: Offline

Report Received on 14.02.2024

Department of Computer Science & Technology, has organized one day workshop on "**Next-Gen Networking Technologies: Exploring 5G,SDN and NFV** " on 07-02-2024 (Wednesday), 10:00 AM to 5 PM

Objective:
The aim of this workshop is that students has to know about comprehensive overview and updated solutions related to 5G network using SDN and NFV. Firstly, they presented the 5G service quality and business requirements followed by a description of 5G network softwarization including essential concepts, history and different use cases. Secondly, they provide a demonstration of 5G network slicing technology enablers including SDN, NFV, MEC, cloud/Fog computing etc. Then, they have given an overview of different industrial initiatives and projects that are pushing forward the adoption of SDN and NFV in accelerating 5G network slicing. At last a comparison of various 5G architectural approaches in terms of practical implementations, technology adoptions and deployment strategies is presented.

Welcome Address:
        The Programme started at 10.00 AM**, Mr. M.Shankar**, Assistant Professor, Department of CST, MITS, Madanapalle gave few words about the event with a grand welcome to the Resource Person, HOD, Faculty members and participants and thanked organizers and participants for organizing this event.

Resource Person Introduction:
Mr. Srikantarao S, Assistant Professor, Department of CST, MITS, Madanapalle conveyed his greetings to Resource person, Management, Principal, Vice Principals, Deans, all the HODs, Faculty members for giving this opportunity for conducting offline workshop. Then he introduced the resource person **Dr. M Shanmugam** to the gathering and read about his achievements.

Dr. M Shanmugam started the session by extending his heartily thanks to the participants organizing members, HOD, Principal and Management of MITS, Madanapalle for giving him opportunity to share his knowledge and experience in **"Next-Gen Networking Technologies: Exploring 5G,SDN and NFV ".**

Importance of 5G networks in Internet era:
Fifth generation (5G) networks are projected to bring a major transformation to the current fourth-generation network to support the billions of devices that will be connected to the Internet. 5G networks will enable new and powerful capabilities to support high-speed data rates, better connectivity and system capacity that are critical in designing applications in virtual reality, augmented reality and mobile online gaming etc.

Overview of 5G networks and its advantages:
Increased demand in traffic along with higher bandwidth requirements are reasons to upgrade the fourth generation (4G) network architecture with the new fifth-generation (5G) network. The 5G network can provide high data rates and improved reliability with low delay and latency while supporting high mobility of users.

Advantages of 5G networks:

- Greater speed in transmissions
- Lower latency & Increased Bandwidth
- Greater number of connected devices
- Network slicing
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Overview of Software Defined Network (SDN) and network function virtualisation (NFV) :

SDN stands for Software Defined Network which is a networking architecture approach. It enables the control and management of the network using software applications. Through Software Defined Network (SDN) networking behaviour of the entire network and its devices are programmed in a centrally controlled manner through software applications using open APIs.

Recent technologies, such as software-defined networking (SDN) and network function virtualisation (NFV), have made addressing such issues possible without the need to upgrade the physical infrastructure. Using these technologies also enhances network flexibility and scalability.

SDN and NFV can be used as the key components in the architecture of the 5G network, and using these technologies allows the network to be separated into different slices, which can then be dedicated to different use cases, such as Internet of things (IoT), smartphones applications and intelligent vehicles. This feature of creating network slices that correspond to the demands of each service can be a major differentiating feature of the next generation 5G network.

**The resource person delivered his workshop on following topics:**

Introduction to 5G: 5G wireless technology is meant to deliver higher multi-Gbps peak data speeds, ultra-low latency, more reliability, massive network capacity, increased availability, and a more uniform user experience to more users. Higher performance and improved efficiency empower new user experiences and connect new industries. They explained the major components of 5G.
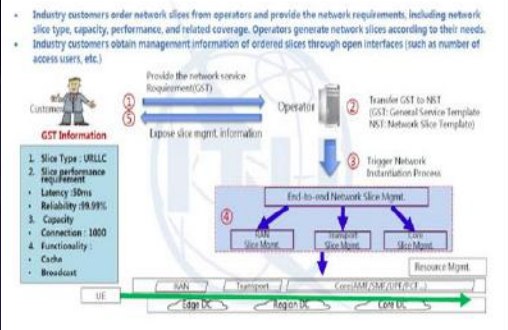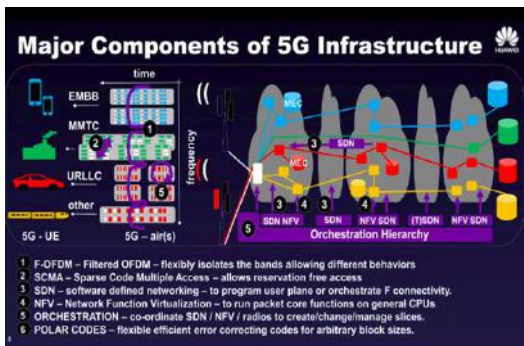

5G network slicing technology: They explained and demonstrated the slice creation process. Network slicing allows sharing of the physical network infrastructure resources into independent virtual networks thereby giving an illusion of multiple logically separate end-to-end networks, each bound by their own SLAs, service quality and performance guarantees to meet the desired set of requirements. While it is being officially defined for 5G, there is no reason that a proprietary implementation for earlier generations (2G, 3G or 4G) or Wi-Fi cannot be created.

Implementation steps:

1. Industry customers order network slices from operators and provide the network requirements, including network slice type, capacity, performance, and related coverage. Operators generate network slices according to their needs. Provide the network service requirement as General Service Template (GST).
2. Transfer GST to NST (Network Slice Template)
3. Trigger Network Instantiation Process
4. Allocate the necessary resources and create the slice.
5. Expose slice management information. Industry customers obtain management information of ordered slices through open interfaces (such as number of access users, etc.).
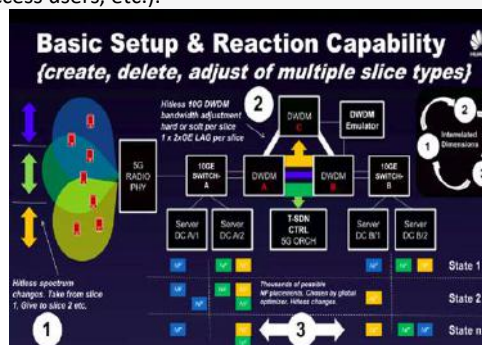

They showed how LTE (Long Term Evolution) and 5G network sliced and offering more speed in power grid industry as an example.
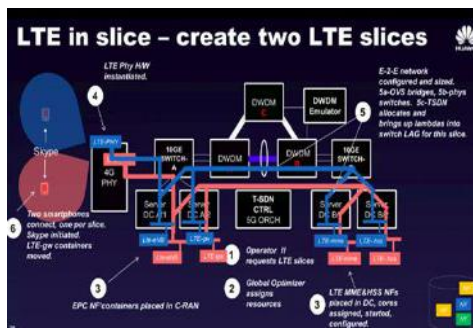
For each specific requirement, a slicing template is generated that is translated to an actual slice.
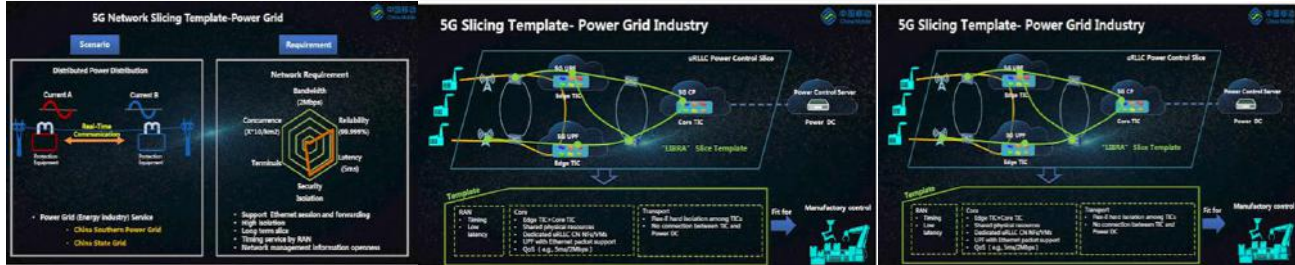
The Network requirement for AR Gaming is high reliability, low latency and high density of devices. This translates to main RAN requirement of low jitter and latency; Transport requirement of Isolation between TICs (telecom integrated cloud) and finally Core QoS requirement of 80 ms latency and 2 Mbps guaranteed bit rate.
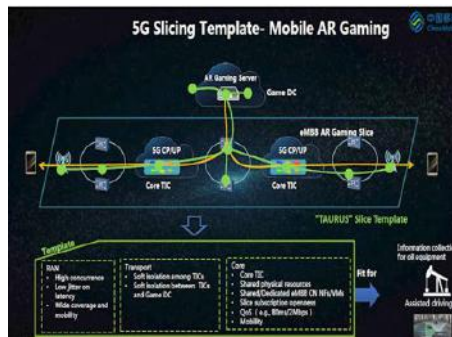
Challenges in implementing 5g networks:

- Frequency band and Spectrum availability issues
- Approach for 5G network deployment
- Mobile devices at the user end need to be upgraded
- Managing expenses involved in 5G network deployment
- 5G network deployment challenges with security and privacy concerns

Overview of Software-Defined Networking (SDN):

It is an approach to networking that uses software-based controllers or application programming interfaces (APIs) to communicate with underlying hardware infrastructure and direct traffic on a network. This model differs from that of traditional networks, which use dedicated hardware devices (i.e., routers and switches) to control network traffic. SDN can create and control a virtual network – or control a traditional hardware – via software.

Fundamentals of Network functions virtualization (NFV):

It is the replacement of network appliance hardware with virtual machines. The virtual machines use a hypervisor to run networking software and processes such as routing and load balancing.

SDN is primarily focused on the control and management of network traffic flows. NFV is focused on the virtualization and management of network functions. SDN separates the control plane (which determines how traffic is routed) from the data plane (which handles the actual transmission of data), allowing for more flexible and programmable network management. Where as NFV virtualizes network functions such as routing, switching, firewalling, and load balancing, allowing these functions to be deployed and managed as software-based virtual network functions (VNFs).

Queries and Feedback session:

- Students asked few queries on how to overcome the main challenges for 5G networks, privacy challenges and security solutions for 5G networks, network planning and network slicing in 5G network technologies.
- Students given feedback on the Online workshop and said they felt happy for involving in this type of session as they got clear picture about 5G networks and its benefits.

Outcomes from this workshop are:

- Students thoroughly understood the basic concepts of 5g network
- 5G network implementations, network slicing, challenges and opportunities
- How Software-Defined Networks (SDN) Works
- What is Network Functions Virtualization (NFV)?
- Difference between SDN and NFV
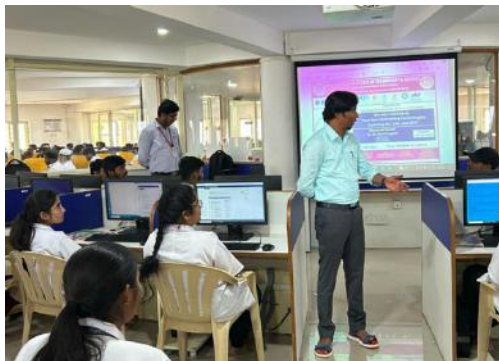
The session ended by **Dr. M. Sreedevi, Professor, Head of the Department/CST, MITS,** thanking the resource person, faculty members and students by expressed her gratitude to the Management and Principal for giving permission and financial support to organize this programme.

Vote of Thanks: The session was concluded at 5 PM followed by a vote of thanks, given by **Mr. Srikantarao S**, Assistant Professor, Department of CST, MITS, Madanapalle.