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Chandigarh College of Engg. & Tech.
CCET

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DIGITAL OUTLET

The CCET ACM Tech Magazine

DISCOVER INSIDE

Gaming With EyeWire
Mapping The Mysteries of the Brain

Active Queue Management
Improving Network Performance

ACM CCET
MOBILE APP
GET IT ON PLAYSTORE

PUBLISHED BY
CCET ACM STUDENT CHAPTER
CCET, DEGREE WING
SECTOR 26, CHANDIGARH

OUR MISSION & VISION

Our Mission is to advance computing education and research, fostering innovation and collaboration globally. Through our bi-monthly digital outlet, we provide a platform for sharing knowledge and addressing societal challenges. We empower individuals within the computing community, promoting excellence and continuous learning.

Our Vision is to lead the forefront of computing's evolution, driving innovation and ethical practices that benefit all. We envision a dynamic global community where collaboration across disciplines sparks transformative solutions to society's most pressing challenges. ACM is committed to championing equitable access to computing's advantages worldwide. Through our magazine and platforms, we aim to inspire and inform, empowering computing professionals with invaluable resources and fostering a future where technology serves humanity's highest aspirations.

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A NOTE FROM OUR MENTORS

Our mission at CCET is not only to produce engineering graduates but to produce engineering minds.

Dr. Manpreet Singh
Principal CCET (Degree Wing)

ACM CCET provides student a great opportunity to learn scientific and practical approach of computer science.

Dr. Sunil K. Singh
Professor and HOD, CSE | Faculty Mentor

Every person should be provided with an opportunity to learn and explore the field of computer science.

Er. Sudhakar Kumar
Assistant Professor, CSE | Faculty Sponsor

CCET ACM Student chapter is a group of people with similar interests and goals in computer science. Together, this platform focuses on the growth and development at not only personal but professional level also as it has a unique learning environment.

Akash Sharma
UG Scholar, 6th Semester, CSE | Chairperson, CASC

ACM-W Student Chapter of CCET aims to promote women in technology. As a member of this community, you will have the opportunity to collaborate with others who share similar interests and explore different areas of computing in order to advance in them.

Anureet Chhabra
UG Scholar, 6th Semester, CSE | Chairperson, CASC-W

CCET ACM STUDENT CHAPTER

- Research and Development
- Student Speaker Program
- Competitive Coding
- Designing & Digital Art
- Internship and Career Opportunity

ABOUT ACM

ACM boosts up the potential and talent, supporting the overall development needs of the students to facilitate a structured path from education to employment. Our Chapter CASC focuses on all the aspects of growth and development towards computer technologies and various different fields. Overall, we at CCET ACM Student Chapter, through collaboration and engagement in a plethora of technical activities and projects, envision building a community of like-minded people who love to code, share their views, technical experiences, and have fun.

We have been trying to encourage more women to join the computing field, so we started an ACM-W Chapter to increase the morale of women. CASC launched an app which aimed at maintaining decorum of reading among CS members and sharing their ideas.

CCET ACM-W STUDENT CHAPTER

Research and Development

Student Speaker Program

Competitive Coding

Designing & Digital Art

Internship and Career Opportunity

ABOUT ACM-W

The CCET ACM-W was founded in October 2021 with an aim to empower women in the field of computing and increase the global visibility of women in the field of research as well as development. We provide a platform for like-minded people so that they can grow together and contribute to the community in a way that shapes a better world. Our chapter was founded to encourage students, especially women, to work in the field of computing. The chapter's main goal is to create even opportunities and a positive environment for students, where they can work to develop themselves professionally. We at the ACM Student chapter aim to build a globally visible platform where like-minded people can collaborate and develop in their field of interest.

CASC'S RECENT ACHIEVEMENTS

PAPERS PUBLISHED IN ICSPN 2022

CCET-ACM and ACMW provides an environment with emphasis on research and development and aims to be at par with recent trends and innovative approaches in the field of computer science. Recently the research papers witten by some of the bright minds of CASC were published in the International Conference on Cyber Security, Privacy and Networking (ICSPN 2022) as a part of the Lecture Notes in Networks and Systems book series. The list of selected papers is as follows::

1. **Sustainable Framework for Metaverse Security and Privacy**: Opportunities and Challenges - By Manraj Singh, Sunil K. Singh, Sudhakar Kumar, Uday Madan & Tamanna Maan

2. **Security of Android Banking Mobile Apps: Challenges and Opportunities** - By Akash Sharma, S.K Singh, Sudhakar Kumar, Anureet Chhabra

3. **Automated Machine Learning (AutoML): The Future of Computational Intelligence** - By Gopal Mengi, S.K. Singh, Sudhakar Kumar, Deepak Mahto, Anamika Sharma

INTERNATIONAL CONFERENCE
ON
CYBER SECURITY, PRIVACY AND NETWORKING
(ICSPN-2022)

Certification of participation

This is to certify that the paper entitled "**Sustainable framework for metaverse security and privacy : opportunities and challenges**" by "**Manraj Singh, Sunil K. Singh, Sudhakar Kumar, Uday Madan and Tamanna Maan**" has been presented in the International Conference on Cyber Security, Privacy and Networking (ICSPN-2022) organized during September 09-11, 2022 in Thailand, (Online Mode)

Nadia Nedjah | Gregorio Martínez Pérez | Brij B. Gupta | Dragan Peraković

PAPER PUBLISHED IN 41ST IEEE CONFERENCE

IEEE
IEEE CTSoc
CONSUMER TECHNOLOGY SOCIETY

The 2023 IEEE International Conference on Consumer Electronics (ICCE 2023)

Certificate of Participation

Fuzzy Based Clustering of Consumers' Big Data in Industrial Applications

Akash Sharma

Sreeraman Rajan
2023 ICCE Executive Chair

Wen-Chung Kao
President, IEEE Consumer Technology Society

Akash Sharma (Chairperson ACM) wrote a research paper titled "**Fuzzy Based Clustering of Consumers' Big Data in Industrial Applications**", which got published in the esteemed conference: **41st IEEE International Conference on Consumer Electronics (ICCE 2023), Las Vegas, USA**.

The paper proposes innovative clustering techniques for extracting valuable information from big data in consumer electronics to improve user personalization, including Fuzzy-Neuro and Ensemble Clustering.

OUTSTANDING WEBSITE AWARD

CCET ACM Student Chapter (CASC) won the title of "Outstanding Website" at the national level by ACM India at Bhopal during the ACM Annual Summit. The award was received by Student Chapter Faculty Sponsor Er. Sudhakar Kumar (Assistant Professor, CSE) along with two student representatives Anureet Chabbra (Chairperson CASC-W), Uday Madan (Secretary, CASC).

UGC - Sponsored

UGC University Grants Commission

One Day Online Workshop on National Education Policy (NEP-2020) on the Topic "Technology Use and Integration" on dt. 09th December, 2022

Being Organized by
UGC-HUMAN RESOURCE DEVELOPMENT CENTRE
IN COLLABORATION WITH
DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Dr. Sunil K. Singh
Professor and HOD
Chandigarh College of Engineering and Technology, Chandigarh
TIME : 09:45 AM TO 11:15 AM

Dr. Neeraj Gupta
Dean, School of Architecture and
Central University of Rajasthan, Kishangarh (Raj.)
TIME : 11:30 AM TO 01:00 PM

Dr. Anita Dua
Professor, Department of Biochemistry,
Institute of Integrated and Honors Studies
Kurukshetra University, Kurukshetra
TIME 02:30 PM TO 04:00 PM

Prof. Rajender Nath
Chairperson,
Dept. of Computer Science & Applications
K.U. Kurukshetra

Dr. Pardeep Kumar
Organizing Secretary,
Dept. of Computer Science & Applications
K.U. Kurukshetra

Prof. Manjula Chaudhary
Director, UGC-HRDC,
K.U. Kurukshetra

Dr. Sunil Kumar
Dy. Director, UGC-HRDC
K.U. Kurukshetra

WORKSHOP UNDER NEP

One Day Online Workshop on National Education Policy (NEP-2020) on the Topic "Technology Use and Integration" was organized by UGC-Human Resource Development Centre in collaboration with Department of Computer Science and Applications Kurukshetra University, Kurukshetra. Dr. Sunil K. Singh (Professor and HOD) Chandigarh College of Engineering and Technology was invited as one of the keynote speakers in the event.

ACM INDIA SUMMIT

On **20th and 21st January, 2023**, CASC got the opportunity to attend the ACM India summit that took place from 20th to 21st January, 2023 at IISER, Pune. The event was attended by **Dr. Sunil K Singh(HOD CSE), and Akash Sharma(Chairperson CASC)**. The event was well-received by those in attendance and provided a valuable opportunity for attendees to connect with one another and learn from industry leaders.

PAPERS SELECTED IN ICTA INTERNATIONAL CONFERENCE

Recently the research papers witten by some of the bright minds of CASC were selected for presentation in the International Conference On Technological Advancement 2023 which was held in Swami Vivekanand Institute of Engineering & Technology, Banur, Punjab. The conference was attended by the students of CASC and were facilitated for their work. The list of selected papers is as follows:

1. **The Role of Site Reliability Engineering in Sustainable Development** - By Sehajveer Singh, Kartik, Japan Ajit Singh Gandhi, Sudhakar Kumar

2. **Efficient and Sustainable desalination using IOT, Cloud Computing, Embedded Systems and Nanotechnology** - By Mehak Preet, Avneet Kaur, Ravinder Saini and Pooja Rai

3. **IoT Integration for Sustainable and Smart Farming Ecosystems** - By Krish Kathuria, Kanishk Nagpal, Pooja Rai, Ravinder Saini

4. **Smart Healthcare and MIoT** - By Nirbhay Singh Sandhu, Siddharth Singh Khati, Dr. Sunil K. Singh

ICTA 2023 INTERNATIONAL CONFERENCE

Scopus

Certificate

THIS IS TO CERTIFY THAT

KANISHK NAGPAL

OF Chandigarh College of Eng. & Tech., CHD COLLEGE/UNIVERSITY

HAS PARTICIPATED/PRESENTED HIS/HER PAPER ENTITLED

IoT Integration for Sustainable and Smart Farming Ecosystem

IN INTERNATIONAL CONFERENCE ON TECHNOLOGICAL ADVANCEMENTS STEPPING TOWARDS SUSTAINABLE DEVELOPMENT

8TH – 9TH FEBURARY AT SVIET,BANUR, CHANDIGARH

Mr. Ashwani Garg (Chairman, SVIET) | Mr. Ashok Garg (President, SVIET) | Dr. Pankaj Garg (Conference Secretary, ICTA'23) | Dr. Shashi Jawla (Conference Chairperson, ICTA'23)

1ST RUNNER UP AT CALL FOR ARTICLES : ECON 101

unstop

Certificate of Excellence

This is to certify that
Tarun

of Chandigarh College of Engineering and Technology (CCET), Chandigarh is the Runner-up of Call For Articles: Econ 101 (January Edition) organised by Indian Institute of Management (IIM), Rohtak

An article titled **"Green Economics: Sustainable Economics"** written by Tarun Vats (Vice - Chairperson ACM) bagged 2nd postion in **Call For Articles : ECON 101** organized by **A₹thashastra, the Economics Club of IIM Rohtak.** A₹thashastra invites articles from all the students, corporates, professors, and research scholars across India for its monthly magazine - Econ 101.

PAPERS SELECTED IN SYSCOM 2022

Recently the research papers witten by some of the bright minds of CASC were selected in the International Conference On Smart Sysytems and Advanced Computing SysCom 2022. The conference was attended by the students of CASC and were facilitated for their work. The list of selected papers is as follows:

1. **Application of Green IoT in digital oilfields for achieving sustainability in the OnG Industry** - By Soumya Sharma, Sunil K. Singh, Krish Kathuria, Tarun Vats.

2. **Blockchain based Election System using Fingerprint Recognition** - By Uday Madan, Sunil K. Singh, Mehak Preet, Akash Sharma and Himanshu Setia.

3. **An IoT based Smart Healthcare Gadget: Attempt to Promote the Idea of Smart Healthcare Systems** - By Aishita Sharma, Sunil K. Singh, Sudhakar Kumar, Soumya Sharma, Kartik Dalal and Anureet Chhabbra.

4. **Smart Healthcare and MIoT** - By Nirbhay Singh Sandhu, Siddharth Singh Khati, Dr. Sunil K. Singh.

International Conference on Smart Systems and Advanced Computing

SysCom 2022

CERTIFICATE OF PARTICIPATION

This is to certify that the paper entitled "Application of Green IoT in digital oilfields for achieving sustainability in the OnG industry" by " Soumya Sharma, Sunil K Singh, Sudhakar Kumar, Krish Kathuria and Tarun Vats" has been presented in the International Conference on Smart Systems and Advanced Computing (SysCom-2022) organized during December 30-31, 2022 in Macau, China, (Online Mode)

Nadia Nedjah | Gregorio Martinez Perez | Brij B. Gupta | Kwok Tai Chui | Justin Zhang

2ND RUNNER UP AT SAMHITA 8.0

The team led by Tarun Vats (Vice - Chairperson ACM) has been awarded third prize in the article writing contest on the theme "**Digitainability: The way ahead**" in the **Samhita 8.0- The annual Supply Chain and Operations Newsletter under Prabodhan'23** organized by **Goa Institute of Management (GIM), Goa.** The team comprised of Tarun and Manraj Singh of CSE 3rd year. A total of 80+ teams participated in the contest which was conducted in the online mode.

TALK WITH ALUMNI

27th December, 2022

Event Details

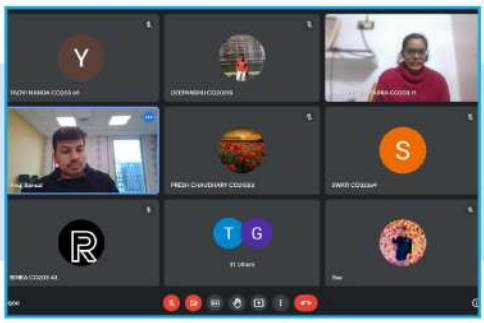
CCET-ACM and ACM-W student chapters organized "Talk with alumni". The session was conducted by Mr. Ayush Basral (SDE Amazon) and Mr. Anuj Bansal (SWE Microsoft). The session was aimed at guiding students towards various upcoming opportunities in the IT sector and cracking interviews in product based companies. The workshop was organized by the ACM and ACM-W Student chapter of CCET (Degree Wing) on 27th December 2022, under the guidance of Faculty Mentor and CSE HOD, Dr. Sunil K. Singh and Faculty Sponsor Mr. Sudhakar Kumar under the AICTE SPICE scheme.

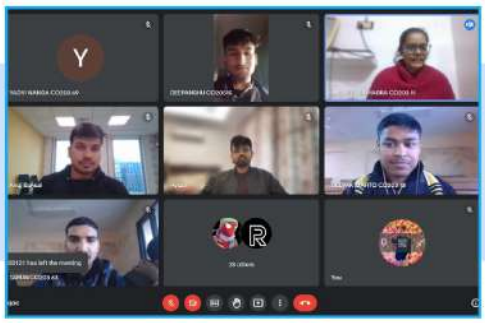
Speakers

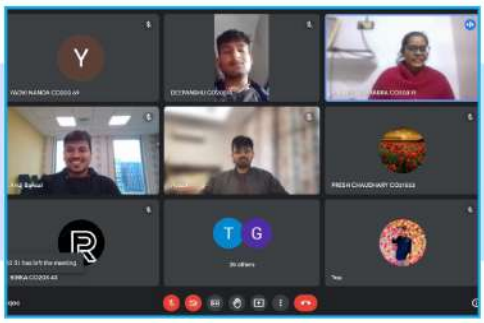
Mr. Ayush Basral
SDE, Amazon

Mr. Anuj Bansal
SWE, Microsoft

Event Gallery







TALK ON GOOGLE SUMMER OF CODE

28th December, 2022

Event Details

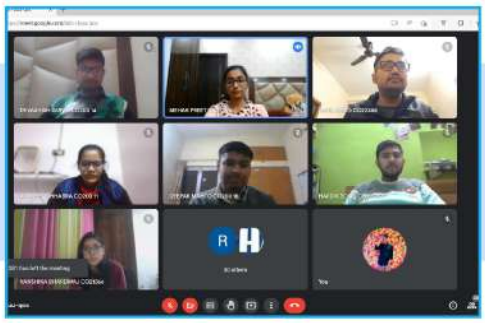
CCET-ACM and ACM-W student chapters organized "Talk Regarding Google Summer of Code". The session was conducted by **Yashika Jothwani(GSoC' 22 Contributor)** and **Khyati Saini(GSoC' 22 and GSoC' 21 Contributor)**. The session was aimed at guiding students towards GSoC 2023. The workshop was organized by the ACM and ACM-W Student chapter of CCET (Degree Wing) on 28th December 2022, under the guidance of Faculty Mentor and CSE HOD, Dr. Sunil K. Singh and Faculty Sponsor Mr. Sudhakar Kumar under the AICTE SPICE scheme.

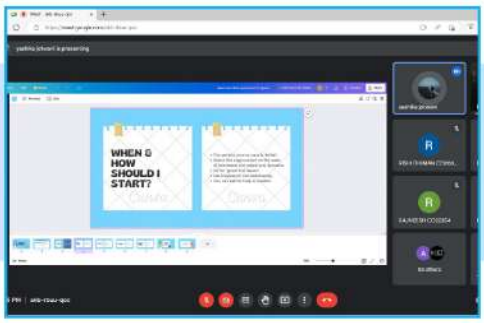
Speakers

Yashika Jothwani
GSoC' 22 Contributor

Khyati Saini
GSoC' 2021, 22 Contributor

Event Gallery



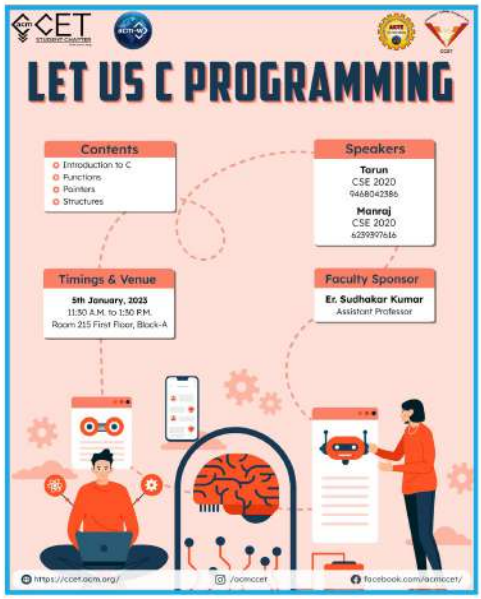


LET US C PROGRAMMING

5th January, 2023

Event Details

CCET ACM ACM & ACM-W student chapter (CASC) conducted a session on C programming on 5th January, 2023. The session focused on concepts, principles, and applications of C programming language, functions, pointers and structures etc. Students were exposed to the real-time problem-solving on the concepts they learned during the session. The speakers of the event were Manraj Singh and Tarun Vats from 3rd year CSE.

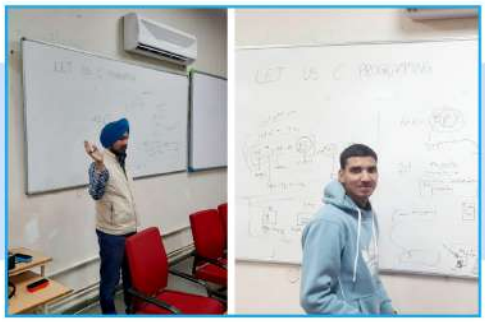


Speakers

Tarun Vats
CSE, 2020

Manraj Singh
CSE, 2020

Event Gallery



SESSION ON C++ STL

7th January, 2023

Event Details

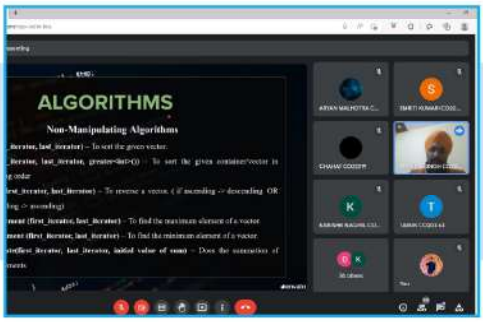
CCET-ACM and ACM-W student chapters organized "C++ STL". The session was conducted by Manraj Singh and Tarun Vats from the department of Computer Science and Engineering. The session was aimed at introducing the fundamentals of C++ Standard Template Library. The workshop was organized by the ACM and ACM-W Student chapter of CCET (Degree Wing) on 7th of January, 2023, under the guidance of Faculty Mentor and CSE HOD, Dr. Sunil K. Singh and Faculty Sponsor Mr. Sudhakar Kumar under the AICTE SPICE scheme.

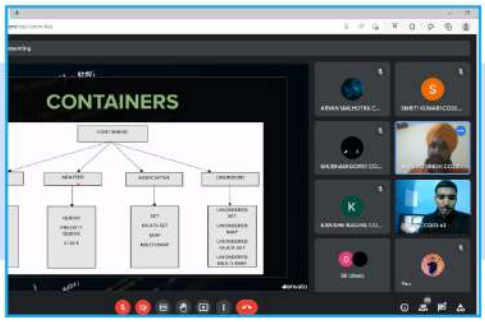
Speakers

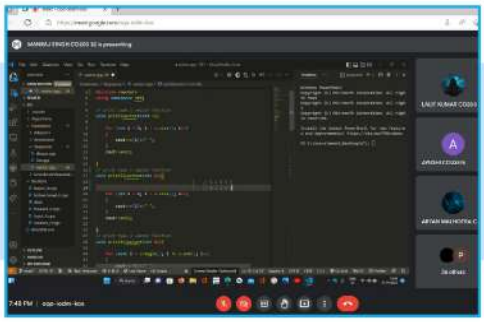
Tarun Vats
CSE, 2020

Manraj Singh
CSE, 2020

Event Gallery







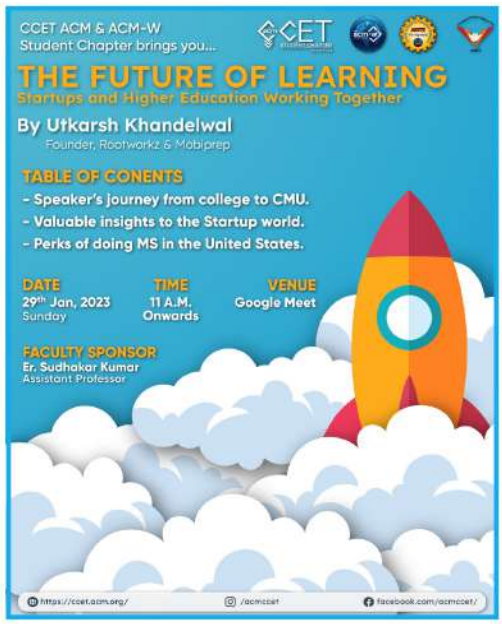
THE FUTURE OF LEARNING

STARTUPS AND HIGHER EDUCATION WORKING TOGETHER

29th January, 2023

Event Details

In this session students gained valuable insights on start-up success and mastering your career path from our college alumnus, Mr. Utkarsh Khandelwal. He shared his journey, including starting Rootworkz and Mobiprep and currently studying at CMU for a master's degree, it serves as a reminder to never stop striving for our goals and to pursue our dreams with passion..

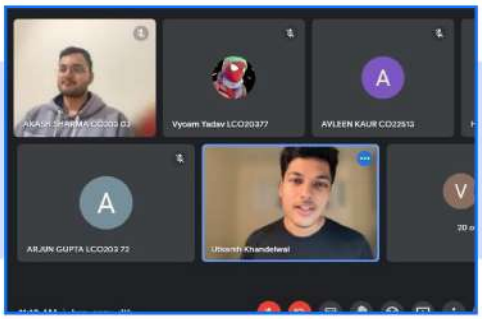


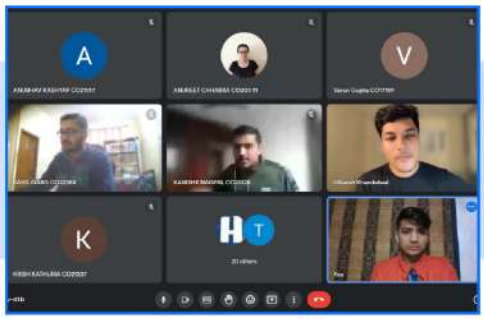
Speaker

Utkarsh Khandelwal
Founder, Mobiprep & Rootworkz

The session was conducted by Mr. Utkarsh Khandelwal who is currently pursuing MS in software management from CMU. He is a Stanford alumnus and also the founder of Rootworkz technology and Mobiprep.

Event Gallery





GAMING WITH EYEWIRE: MAPPING THE MYSTERIES OF THE BRAIN

Aarya Aishwaryam, CO22501 - ECE 2022

The human brain is an enigma, consisting of approximately 80 billion neurons, with millions of miles of axons and dendrites connecting them. It takes a significant amount of time and effort for neuroscientists to reconstruct a single cell.

Seung Lab developed Eyewire to expedite the pace of research in neuroscience. This online game uses crowdsourced data analysis of brain neurons, which takes advantage of something even more powerful than a supercomputer — the human brain's pattern recognition ability. By leveraging this capability, a team of scientists, developers, and designers are transforming EyeWire into a gaming platform to help map the brain. An interest in puzzles and curiosity about the brain is all that players require to play this game. A scientific background is not needed.

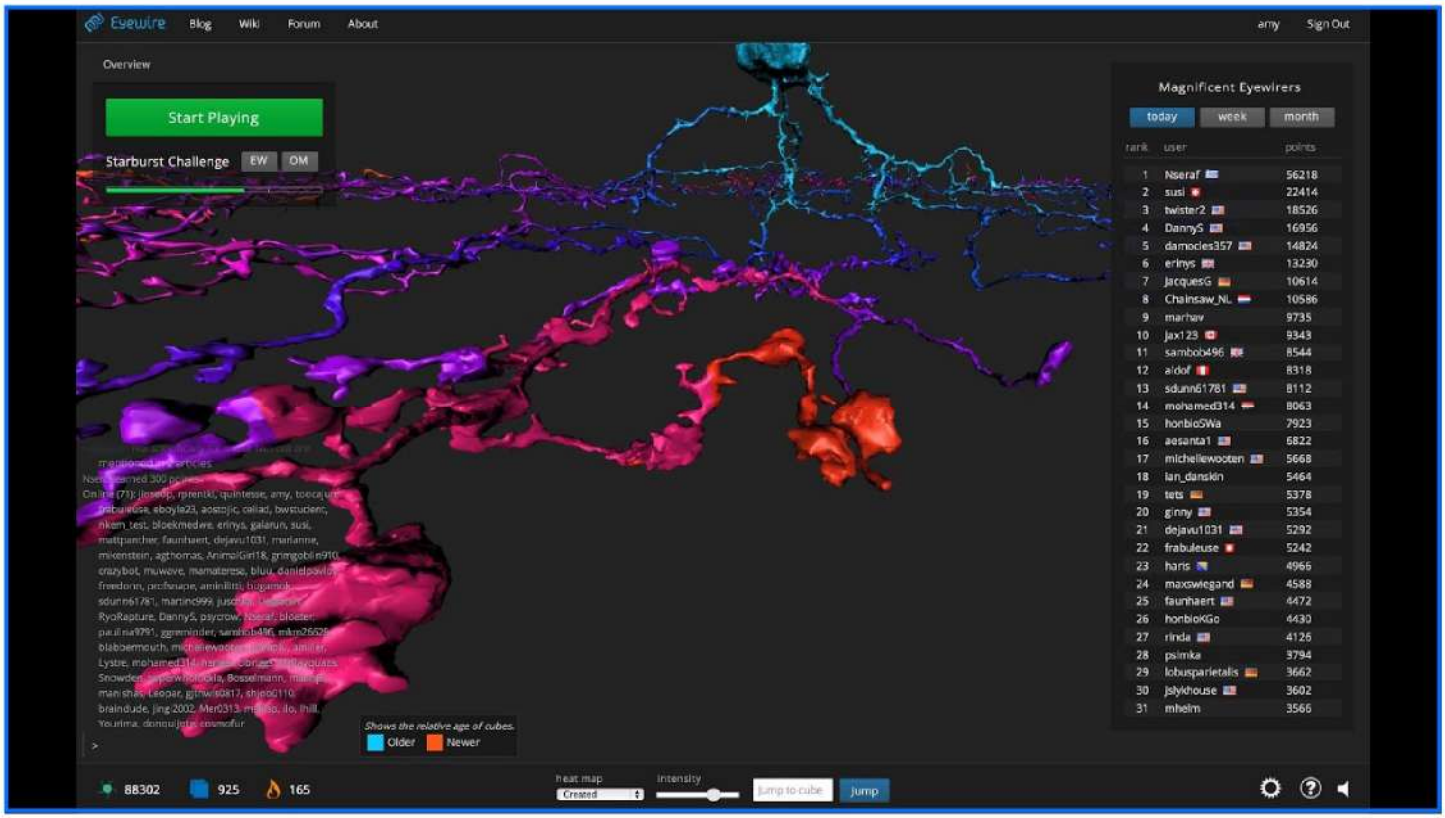
Eyewire has its basis in mapping the retina and the central nervous system, and plays a vital role in motion processing. The objective is to map neurons, which helps researchers identify new synapses and cell types. Players reconstruct the neuron's branches from one end of the "cube" to the other and use an artificial intelligence algorithm to make connections that the algorithm might have missed.

The case study of EyeWire provides valuable insights into the implementation of citizen science and crowdsourcing initiatives. One key finding is the importance of building a strong community and investing in community engagement. This involves incorporating elements of fun, such as community chat features, and leveraging social media platforms like Facebook and Twitter to maintain a cohesive and engaged group of participants.

Effective communication is also crucial for sustaining and improving citizen science projects. Utilizing external resources such as blog posts and social media to disseminate relevant and engaging information can help to maintain and expand the community. Additionally, building flexibility into the project allows for continuous improvement, such as removing unengaging elements and taking suggestions from participants. By actively listening to the

needs and desires of citizen scientists, projects like EyeWire can continue to mature and thrive.

Today, EyeWire has garnered immense popularity. Over 200,000 individuals across 150 nations have participated in the game. The collected data will aid scientists in comprehending how the retina processes visual information. Furthermore, the knowledge derived from EyeWire can assist engineers in enhancing the fundamental computational technology, potentially making it advanced enough to detect brain "miswirings" responsible for disorders such as autism and schizophrenia.



THE RISE OF SERVERLESS COMPUTING

Mehak Preet, CO21343 - CSE 2021

Introduction

Serverless computing refers to a model of cloud computing where the cloud provider manages the infrastructure and automatically allocates resources as needed to run and scale applications. In serverless computing, developers only need to write and deploy their code without having to worry about the underlying infrastructure, such as servers and networking. Serverless computing is becoming more popular because it offers several benefits to developers and businesses. Firstly, it reduces the operational burden of managing infrastructure, allowing developers to focus more on writing and improving the code. Secondly, it enables efficient use of resources, as the cloud provider automatically allocates and scales resources based on demand, which can result in cost savings for businesses. Lastly, it enables faster deployment and iteration of applications, as developers can easily update their code and deploy new versions without worrying about the underlying infrastructure. These benefits have made serverless computing an attractive option for businesses of all sizes, from startups to large enterprises.

How serverless computing works

A. Overview of serverless architecture

Serverless architecture is built on top of cloud computing infrastructure where the cloud provider manages the underlying servers, storage, and networking. In serverless architecture, applications are composed of small, stateless functions that are triggered by events such as HTTP requests or changes in a data stream. Each function is designed to perform a specific task and can be deployed independently, enabling developers to build applications as a set of loosely coupled services.

B. Functions-as-a-Service (FaaS)

Functions-as-a-Service (FaaS) is a key component of serverless architecture. It is a cloud computing model where developers can write and deploy code in the form of small, stateless functions that are triggered by events. FaaS providers, such as AWS Lambda, Google Cloud Functions, and Microsoft Azure Functions, handle the infrastructure, scaling, and availability of the functions, allowing developers to focus on writing code.

Examples of Serverless Computing

• Amazon Web Services (AWS) Lambda: A popular serverless computing platform that allows developers to write and run code in response to events such as changes to data in Amazon S3, DynamoDB, or Kinesis. Lambda supports multiple program-

ming languages and integrates with other AWS services.

• Microsoft Azure Functions: A serverless computing platform that allows developers to write and run code in response to events such as changes to data in Azure Storage, Cosmos DB, or Event Hub. Azure Functions supports multiple programming languages and integrates with other Azure services.

• Google Cloud Functions: A serverless computing platform that allows developers to write and run code in response to events such as changes to data in Google Cloud Storage, Pub/Sub, or Firebase. Cloud Functions supports multiple programming languages and integrates with other Google Cloud services.

• Other use cases for serverless computing: Building chatbots, processing images and videos in real-time, processing data from IoT devices, and building static websites on a content delivery network.

Serverless computing provides a cost-effective, scalable, and efficient way to deploy applications and services. With the examples listed above, it's easy to see how serverless computing can be used to build various applications, from chatbots to processing data in real-time, and hosting static websites.

Advantages of serverless computing

• Reduced costs: Serverless computing can result in cost savings for businesses as they only pay for the resources that they use. With serverless computing, businesses don't need to invest upfront in infrastructure and don't need to worry about maintenance and management of the infrastructure. The cloud provider automatically allocates and scales resources based on demand, which leads to efficient resource utilization and lower costs.

• Increased scalability: Serverless computing allows for automatic scaling of applications. The cloud provider handles the scaling of the infrastructure based on demand, which means that applications can handle sudden spikes in traffic without any manual intervention. This can result in improved user experience and reduced downtime for businesses.

• Faster time to market: Serverless computing enables faster deployment and iteration of applications. Developers can easily update their code and deploy new versions without worrying about the underlying infrastructure. This can result in faster time to market for businesses, enabling them to quickly respond to changing market conditions and customer needs.

• Improved developer productivity: Serverless computing reduces the operational burden on developers, allowing them to focus more on writing and improving the code. With serverless computing, developers don't need to worry about managing infrastructure, which reduces the amount of time spent on maintenance and troubleshooting. This can result in improved developer productivity and faster develop-

ment cycles. Additionally, serverless computing allows developers to write code in their preferred programming language and use familiar tools, which can further improve their productivity.

Challenges and limitations of serverless computing

• Cold start times: One of the challenges of serverless computing is the issue of cold start times. When a function is invoked for the first time or after a period of inactivity, the cloud provider needs to create a new instance of the function. This can result in increased latency, which canimpact the user experience. However, this issue can be mitigated through careful design andoptimization of functions.

• Monitoring and debugging: Serverless computing can make it more challenging to monitor and debug applications. Traditional monitoring tools may not be applicable to serverless environments, and debugging can be difficult due to the distributed nature of serverless applications. However, cloud providers offer monitoring and logging tools that can help developers monitor and troubleshoot their applications.

• Resource constraints: Serverless computing can be subject to resource constraints, such as memory limits and maximum execution times. This can limit the types of applications that can be run on serverless platforms, and developers need to carefully consider these constraints when designing their applications.

• Vendor lock-in: Serverless computing can also be subject to vendor lock-in, where applications are tightly coupled to a specific cloud provider's platform. This can make it challenging to switch to a different provider or migrate applications to an on-premises environment. However, open-source frameworks such as Apache OpenWhisk and Knative are available, which offer a degree of portability and

reduce the risk of vendor lock-in.

Future of serverless computing

The serverless computing market is expected to continue to grow rapidly in the coming years. Serverless computing is evolving rapidly, and new technologies and trends are emerging. For example, edge computing and serverless computing are becoming increasingly intertwined, enabling applications to run closer to end-users and devices. Additionally, machine learning and artificial intelligence are being integrated into serverless platforms, allowing for more powerful and sophisticated applications. Serverless computing offers numerous opportunities for businesses, such as reduced costs, increased scalability, and faster time to market. However, there are also challenges that need to be addressed, such as cold start times and vendor lock-in. As serverless computing continues to evolve, businesses and developers will need to keep up with the latest trends and technologies to take advantage of the opportunities and overcome the challenges.

Conclusion

In conclusion, serverless computing is becoming more popular due to its ability to help businesses reduce costs and improve productivity. It is a cloud computing model where the cloud provider takes care of server management, enabling developers to focus solely on writing and deploying code. Serverless computing offers several advantages to businesses, including reduced costs, increased scalability, faster time to market, and improved developer productivity. While there are challenges and limitations to serverless computing, the future looks promising, with predicted growth in adoption and evolving technologies driving further innovation in this field.

THE TRANSFORMER MODEL IN NEURAL NETWORKS: A BREAKTHROUGH IN NLP

Akash Sharma, CO20303 - CSE 2020 | Anureet Chhabra, CO20311 - CSE 2020

The Transformer model is a type of neural network architecture that has revolutionized the field of natural language processing (NLP). Introduced in 2017, the Transformer model has been used to achieve state-of-the-art performance on a wide range of NLP tasks, including machine translation, language modeling, and question-answering. In this article, we will explore the Transformer model, its architecture, and its impact on NLP.

What is the Transformer Model?

The Transformer model is a type of neural network architecture that uses self-attention mechanisms to process input sequences. Unlike traditional sequence-to-sequence models, which use recurrent neural networks (RNNs) or convolutional neural networks (CNNs), the Transformer model does not rely on a fixed-length context window. Instead, it allows the model to dynamically attend to different parts of the input sequence during processing, making it highly effective at handling long sequences. The Transformer model is based on the concept of self-attention, which allows the model to attend to different parts of the input sequence when encoding or decoding. This is achieved through a mechanism known as the attention mechanism, which assigns weights to different parts of the input sequence based on their relevance to the current processing step. This allows the model to give more weight to important parts of the input sequence while ignoring irrelevant parts.

Transformer Architecture

The Transformer model is made up of two main components: the encoder and the decoder. The encoder processes the input sequence and produces a sequence of hidden states, while the decoder takes the encoder output and generates the output sequence. Both the encoder and decoder are composed of multiple layers, each of which contains a self-attention layer and a feed-forward neural network. The self-attention layer in the Transformer model allows the model to weigh the importance of different parts of the input sequence when encoding or decoding. This is done by computing a dot product between the query, key, and value vectors for each position in the input sequence. The resulting attention scores are then used to compute a weighted sum of the values, which forms the output of the self-attention layer.

Impact on NLP

The Transformer model has had a significant impact on the field of NLP. It has been

used to achieve state-of-the-art results on various NLP tasks, including machine translation, language modeling, and question-answering. One of the key advantages of the Transformer model is its ability to handle long input sequences, making it particularly effective for tasks that require processing of long text inputs.

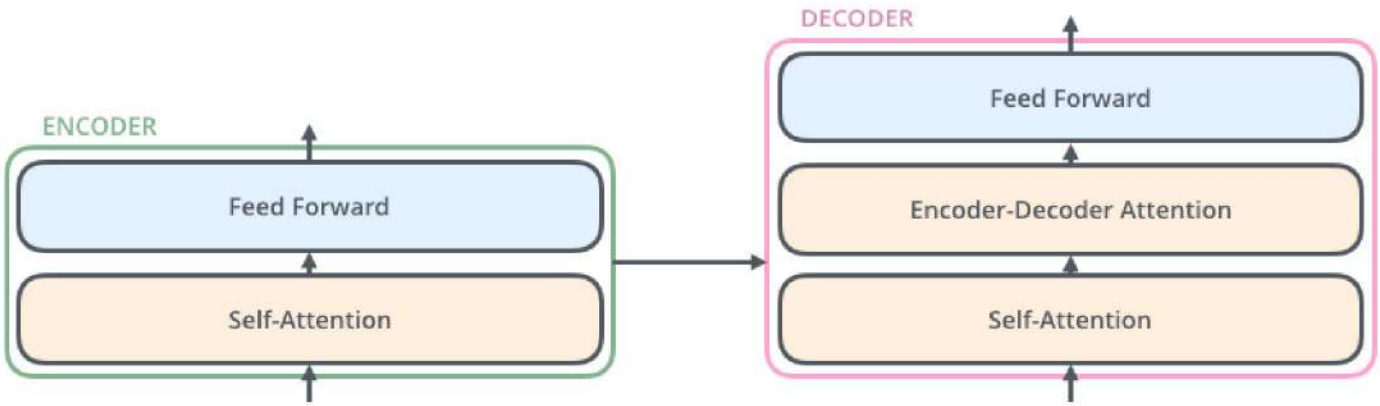
Application of Transformer Model in Chatgpt

ChatGPT, a language model developed by OpenAI, uses the Transformer model architecture as its basis for generating responses to user queries. ChatGPT is a pre-trained model that has been trained on vast amounts of text data, including books, articles, and websites, to develop a deep understanding of language and the nuances of human conversation. When a user inputs a query into ChatGPT, the model uses the Transformer architecture to process the query and generate a response. The self-attention mechanism in the Transformer allows the model to attend to different parts of the input sequence, enabling it to generate responses that are contextually relevant and coherent.

ChatGPT is also fine-tuned on specific domains, such as customer service or technical support, to improve its performance on specific tasks. This fine-tuning process involves training the model on a smaller dataset of domain-specific text data, allowing it to learn the nuances of language and phrasing specific to that domain. Overall, the Transformer model architecture in ChatGPT allows the model to generate human-like responses to user queries, making it a powerful tool for natural language processing and conversational AI.

Conclusion

The Transformer model is a breakthrough in the field of NLP, offering a new approach to sequence modeling that has proven to be highly effective on a wide range of tasks. Its self-attention mechanism allows the model to dynamically attend to different parts of the input sequence, making it particularly effective for processing long text inputs. With continued research and development, it is likely that the Transformer model will continue to have a significant impact on the field of NLP in the coming years



WHY IS FUNCTIONAL PROGRAMMING POPULAR?

Harshit Dubey, CO20321 - CSE 2020

Why is functional programming popular? Functional programming has become increasingly popular in recent years due to its unique approach to problem-solving. Unlike traditional imperative programming, functional programming involves composing functions to execute tasks, emphasizing the computation of functions rather than the execution of statements. This style of programming also prioritizes using immutable data and avoiding side effects.

One of the key benefits of functional programming is that it simplifies the process of understanding and reasoning about code. By placing an emphasis on immutability and purity, functional programming reduces the number of variables and state changes that a programmer must keep track of. This makes it easier to comprehend what a program is doing and to anticipate its behavior, which is particularly important for large-scale systems where code complexity can become overwhelming.

Another advantage of functional programming is that it is well-suited to parallel and concurrent programming. Because functional programs do not rely on mutable state, they can be easily parallelized without the risk of concurrency issues like race conditions. This can lead to significant performance improvements, especially for systems with multicore processors and distributed computing.

Functional programming also places a strong focus on type systems, resulting in functional programming languages with static type systems that can catch errors during compilation. This focus can result in more reliable and maintainable code, as well as better tools for code analysis and refactoring.

Haskell is one of the most popular functional programming languages and is known for being a "pure" functional programming language. This means that Haskell strictly enforces immutability and purity, making it an excellent choice for academic research and experimentation, as well as building reliable and maintainable software. Other popular functional programming languages include Scala, Clojure, and F#, which are often used in industry for building high-performance, scalable, and distributed systems.

Functional programming also encourages a more declarative style of programming where programmers describe what they

want a program to do rather than how to do it. This results in code that is easier to read and understand, as well as being more maintainable and reusable.

Despite the benefits, it's important to recognize that functional programming isn't always the best approach. In situations where mutable state is necessary, such as in interactive user interfaces or file systems, imperative programming may be more natural and efficient.

In conclusion, the popularity of functional programming can be attributed to its emphasis on immutability, purity, parallelism, and strong type systems. These features make it easier to reason about code, write more reliable and maintainable software, and build high-performance and scalable systems. While it may not be the best choice for every situation, functional programming is a valuable tool for modern software developers

ZERO TRUST ARCHITECTURE

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Zero trust network architecture is a security model that assumes that all network traffic, both internal and external, is untrusted and should be verified before being allowed to access resources. This contrasts with traditional network security models, which assume that traffic coming from inside the network is trusted and only external traffic needs to be verified. In a zero-trust network, all users, devices, and applications must be authenticated and authorized before they can access network resources. This authentication and authorization process is typically based on multiple factors, such as user credentials, device health, and the context of the request. To enforce the zero-trust model, network segmentation is used to create micro-perimeters around specific resources or groups of resources. These micro-perimeters are protected by security controls, such as firewalls, intrusion detection and prevention systems, and security information and event management systems.

In addition to network segmentation, zero trust networks also use a variety of other security technologies and practices, such as:

- Multi-factor authentication: requiring users to provide multiple forms of identification, such as a password and a fingerprint or a security token, to access network resources.
- Device management: ensuring that only authorized and secure devices are allowed to connect to the network.
- Secure access service edge (SASE): An emerging technology that combines network functions such as software defined wide area network, firewall, and security services with other features such as Zero Trust Network Access (ZTNA) and Cloud Access Security Broker (CASB) to provide a secure and more flexible way to access to cloud-based apps and services.
- Network visibility: monitoring all network traffic to detect and respond to security threats.
- Continuous monitoring: continuously monitoring the network and devices for security threats and vulnerabilities.

Why should an organization use zero trust architecture?

There are several reasons why an organization may choose to implement zero trust architecture:

- Protection against advanced threats: Zero trust architecture assumes that all network traffic is untrusted and verifies the identity and trustworthiness of all users, devices, and applications before allowing them to access network resources. This helps to

protect against advanced threats, such as malware, phishing, and insider attacks, which can bypass traditional security controls.

• Improved security for remote workers: With the increasing number of remote workers, traditional network security models based on perimeter security are no longer effective. Zero trust architecture allows organizations to secure access to network resources for remote workers, regardless of their location, by continuously verifying their identity and trustworthiness.

• Better compliance: Zero trust architecture can help organizations meet compliance requirements by providing granular visibility and control over network access, and by enforcing security policies based on user, device, and application attributes.

• Cost-effective: Zero trust architecture can help organizations reduce the costs associated with security by eliminating the need for expensive and complex security solutions, such as VPNs. Instead, it focuses on verifying the identity and trustworthiness of all network traffic, which can be accomplished using a combination of existing security technologies and best practices.

• Flexibility: Zero trust architecture can also provide organizations with more flexibility in how they access and use network resources, by allowing them to use a variety of different devices, applications, and cloud services, while still maintaining security.

• Scalability: The Zero Trust approach can be scaled to fit different sizes of organizations, from small to large enterprise.

Overall, Zero Trust architecture is a comprehensive and dynamic approach to network security that can help organizations protect against advanced threats, improve security for remote workers, meet compliance requirements, and reduce costs. Zero Trust Network architecture is a comprehensive and dynamic approach to network security that aims to protect against both internal and external threats by continuously verifying the identity and trustworthiness of all users, devices, and applications, regardless of their location.

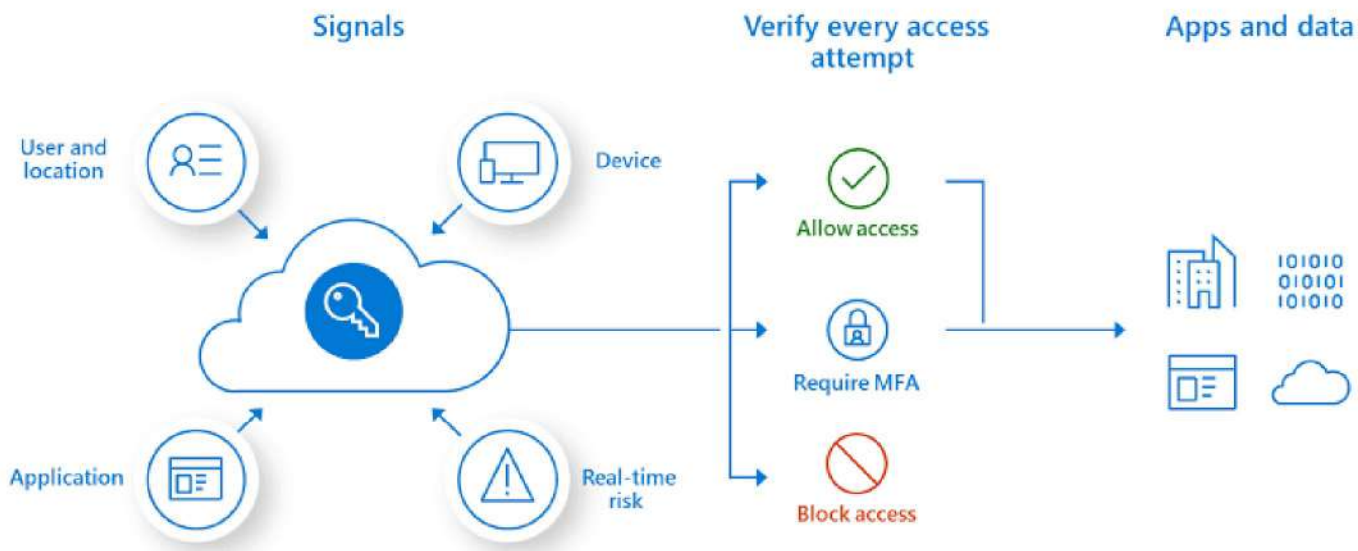


Fig 1.1 Zero Trust Architecture

EDGE ARTIFICIAL INTELLIGENCE

Vanshika Bhardwaj, CO21366 - CSE 2021

INTRODUCTION

Edge AI refers to the installation of AI software on hardware throughout the real world. The reason it's termed "edge AI" is because, as opposed to being done centrally in a cloud computing facility or private data centre, the AI computation is done close to the user at the edge of the network, close to where the data is located.

The edge of the network can refer to any area because the internet is accessible everywhere. It might be a department shop, factory, hospital, or one of the gadgets we see every day, like traffic lights, robots, and phones.

ARCHITECTURE

The majority of edge devices, like the Raspberry Pi, include RAM and a 64-bit processor. The memory of edge devices consists of 1-4GB RAM because they are designed to have minimal processing requirements. However, some edge devices can update RAM to higher memory to support models that need a lot of computational power for face identification. SD card slots and HDMI input and output ports are present. A connector for ethernet connectivity and power supply are also included on edge devices.

It is important to note that input and output devices like cameras and screens are made expressly to function with edge devices. For instance, Pi Camera is made to function with Raspberry Pi in order to record high-definition photos and videos.

EDGE AI PLATFORMS

• AWS GREENGRASS: AWS Greengrass is an open source platform which manages IoT edge devices.It offers assistance with designing, implementing, and managing edge device models. For support, Greengrass cloud services are connected to edge devices running the Greengrass software.

• AZURE IOT EDGE: The IOT Edge solution from Azure offers a cloud management platform so that edge devices can access and use Azure services and packages.

• GOOGLE DISTRIBUTED CLOUD EDGE: Google offers cloud services on edge devices through its distributed cloud edge. Google, which also offers hardware solutions, fully manages it. With Google AI and analytics, it provides real-time data analyses.

BENEFITS OF EDGE AI

• DATA SECURITY AND PRIVACY: The majority of data processing for edge AI operations is done locally on an edge device. Therefore, less information is transmitted to the cloud and other external sites. As a result, there is a lower chance that data will be misused or treated improperly.

• LESS POWER CONSUMPTION: Edge AI conserves energy because it processes data locally. The power needs for executing AI at the edge are far lower than in cloud data centres thanks to the highly efficient power consumption of edge computing devices.

• REDUCTION IN BANDWIDTH AND CLOUD COST: Edge AI processes the majority of its data locally, delivering less data over the internet and conserving a significant amount of Internet bandwidth. Additionally, cloud-based AI services might be expensive. With Edge AI, you are able to employ pricey cloud resources as a data store for post-processing rather than for in-the-moment field work.

APPLICATIONS

• SMART AI VISION: Live video analytics and other computer vision applications are part of Smart AI Vision, which powers AI vision systems across several industries. For the purpose of powering cutting-edge computer vision applications, Intel created specialized coprocessors known as Visual Processing Units.

• AI HEALTHCARE: Applications for AI in healthcare, including remote surgery, diagnostics, and monitoring of patients' vital signs, are mostly dependent on edge devices that conduct AI at the edge. A remote platform allows medical professionals to control surgical instruments from a location where they feel secure and comfortable.

• ENTERTAINMENT: Virtual reality, augmented reality, and mixed reality applications for entertainment include streaming video to virtual reality goggles. By transferring processing from the glasses to edge servers close to the end device, the size of such glasses can be decreased. For instance, Microsoft just unveiled HoloLens, a holographic computer mounted on a

headsetz that enables augmented reality. Microsoft plans to use the HoloLens to create industry-standard computing, data analysis, medical imaging, and edge gaming technologies.

SHORTCOMES OF EDGE AI

• LOSS OF DATA: A feature of Edge AI systems to keep in mind is their ability to discard unnecessary input (as they should), but in order to do this well, they require a thorough grasp of what is and is not important. The Edge AI's analysis will be flawed if any spilled data is pertinent. Data loss can be prevented by carefully planning and programming an Edge AI system.

• MACHINE VARIATION: There's a significant variation in machine types that are compatible with Edge AI programming, some of which are not so compatible with each other. Unfortunately, it's likely for-faults and failures to happen when incompatible machines work together.

CONCLUSION

A feature of Edge AI systems to keep in mind is their ability to discard unnecessary data, but in order to do this successfully, they require a thorough grasp of what is and is not important. The Edge AI's analysis will be flawed if any spilled data is pertinent.

Data loss can be prevented by carefully planning and programming an Edge AI system.

ACTIVE QUEUE MANAGEMENT: IMPROVING NETWORK PERFORMANCE

Manraj Singh, CO20332 - CSE 2020

In today's fast-paced and interconnected world, efficient and reliable communication is essential. The internet has become an indispensable tool for communication, but it is also a shared resource that can be easily congested. This congestion leads to slow response times and reduced network performance, which can be frustrating for users and detrimental to businesses. Active Queue Management (AQM) is a technique that can help alleviate these problems by managing the flow of traffic on the network.

What is Active Queue Management (AQM)?

Active Queue Management is a set of techniques used by network administrators to manage the congestion of data packets in a network. AQM systems work by monitoring the network and adjusting the transmission rates of data packets to prevent congestion . AQM algorithms measure the level of congestion in the network and take actions to prevent congestion from occurring, by slowing down the rate of data transmission to prevent the queues from becoming full. This proactive approach allows the network to operate more efficiently and effectively.

How Does AQM Work?

The basic principle of AQM is to keep the number of packets in the queue at a manageable level. When the number of packets in the queue reaches a certain threshold, the AQM algorithm will start dropping packets. The goal is to drop packets before the queue becomes completely full, which is a signal that the network is congested. By dropping packets early, the AQM algorithm

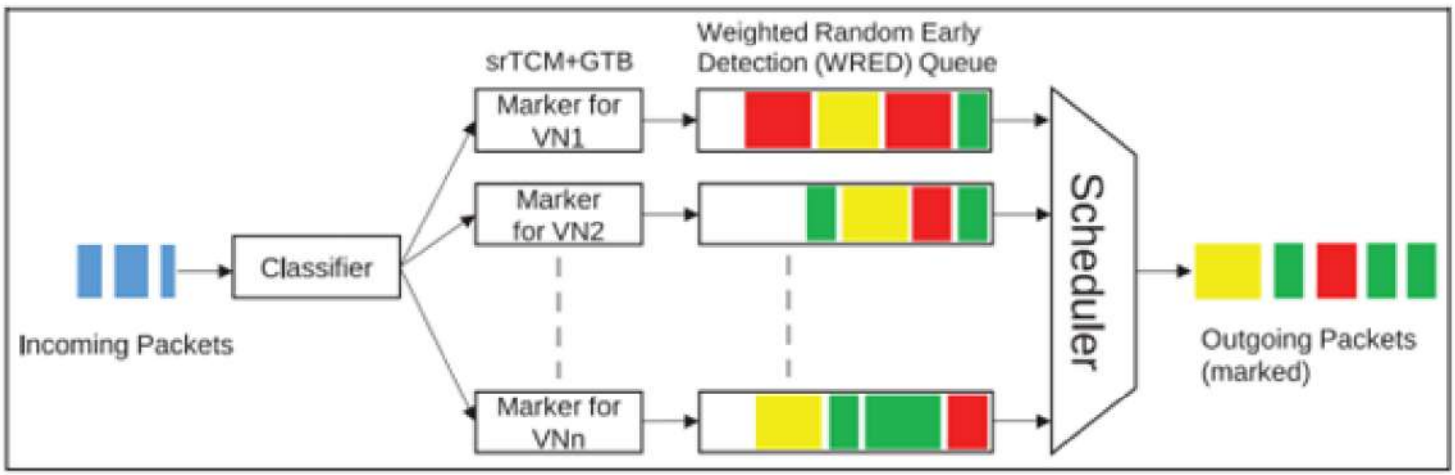


Figure 1 : Active queue management

can prevent the network from becoming congested, and thus prevent the negative effects of congestion, such as increased latency, jitter, and packet loss.

Different types of AQM algorithms use different techniques to achieve this goal. Some algorithms use a simple technique known as Random Early Detection (RED), which drops packets randomly when the queue reaches a certain threshold. Other algorithms, such as Stochastic Fairness Queueing (SFQ) and Deficit Round Robin (DRR), aim to provide fair access to the network for different flows and prioritize real-time traffic such as voice and video.

Benefits of AQM

AQM can provide numerous benefits for networks of all sizes. Here are a few:

1. Reduced Latency: Active Queue Management algorithms can help to reduce network latency, which is the time it takes for data to travel from one point to another. By managing the flow of traffic and preventing congestion, AQM algorithms can help to ensure that data packets arrive at their destination quickly, reducing latency.

2. Improved Network Throughput: By reducing congestion and ensuring that data packets are transmitted efficiently, AQM can help to improve the overall throughput of a network. This means that the network can handle more traffic and transmit more data in a given amount of time.

3. Better User Experience: By reducing latency and improving network throughput, AQM can help to provide a better user experience. This means that users can access the internet more quickly, download files faster, and stream videos without buffering.

4. Improved Fairness: AQM algorithms such as SFQ and DRR can help to ensure that all users have equal access to the network. This can be especially important in large networks where multiple users may be competing for resources.

Conclusion

Active Queue Management is a powerful technique that can help to improve network performance and reduce congestion. By proactively managing the flow of traffic on the network, AQM algorithms can help to reduce latency, improve throughput, and provide a better user experience. With the increasing importance of the internet in our daily lives, AQM is becoming an essential tool for network administrators. As networks continue to grow and become more complex, AQM will become even more important for ensuring that the internet remains a reliable and efficient tool for communication.

BLOCKCHAIN TECHNOLOGY

Aishita, CO21305 - CSE 2021

Abstract

Blockchain is the growing technology that has the potential to revolutionize various industries, including healthcare, finance sector ad many more. It is basically a distributed, decentralised ledger that enables a number users to record and validate their transactions without the need of following the traditional approach of having a central authority. The article discusses about the fundamentals of this technology followed by its application and drawbacks.

Introduction

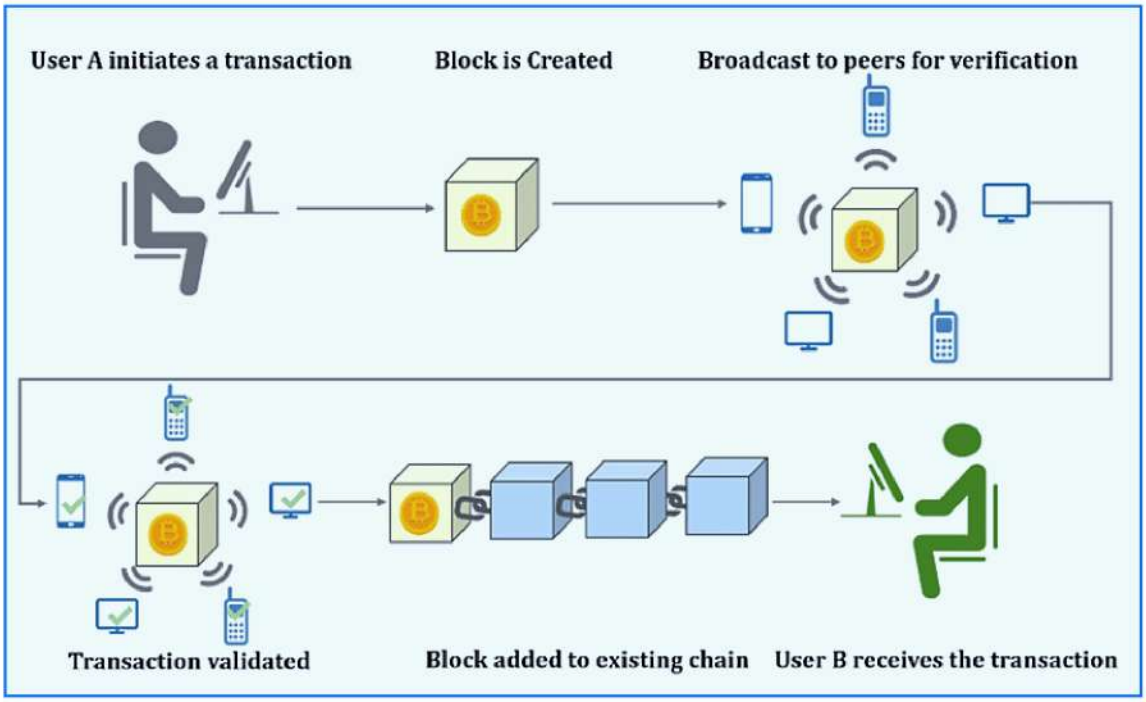
Blockchain is a digital ledger technology that makes record-keeping safe, transparent, and decentralized possible. In a blockchain system, information is maintained in a chain of blocks, each of which has a distinct code. The system's built-in features, helps in stopping unauthorised transaction submissions. This makes changing or tampering with data stored on the blockchain nearly impossible. Since no single entity has control over the data due to the decentralised nature of the blockchain, i.e., no single authority has the ultimate control over the database it is immune to restriction and manipulation. Blockchain technology is most widely used in the world of cryptocurrencies like Bitcoin and Ethereum. This sector of cryptocurrencies extensively uses blockchain technology to securely record transactions.

Apart from this sector the technology is widely spreading in area of healthcare industry, supply chain management systems and many more as discussed in later part of the article.

Working

When a transaction is initiated over a blockchain network, a block is created to represent that transaction. This block is formed to represent a transaction that a user starts via a blockchain network. Important details including the sender and recipient addresses, the data being sent, and a timestamp are all included in this block. The peer-to-peer network, which is composed of a collection of computers known as nodes that take part in the validation of transactions, broadcasts the block after it has been formed. For instance, the process of validating a transaction involves making sure the sender has enough cryptocurrency to finish the transaction and that the transaction complies with the network's rules. This is accomplished through a consensus protocol, which is a collection of guidelines and procedures which aims to find a method to find agreement of all the nodes over the validity of a transaction. A new block of data for the ledger is creat-

ed after a transaction is merged with other validated transactions. The newly created blocks are secure and bound to the previous blocks hence forming a chained structure.



Features

• Decentralized: It is a decentralized technology, which implies that it operates without a central authority. This allows multiple parties to participate in the network and validate transactions without relying on a single governing body.

• Immutable: Once a block is added to the blockchain, it cannot be modified or deleted.

• Transparent: All the transactions recorded on the blockchain are visible to every other participant in the network hence creating a transparent record of all activities on the network.

• Secure: Blockchain uses advanced techniques to secure the network and protect against unauthorized access and hacking attempts.

Consensus protocols: Every blockchain has a consensus to assist the network in reaching choices quickly and impartially. Consensus is a decision-making technique that helps the network's active nodes swiftly come to a consensus and ensures the system runs smoothly.

Applications of Blockchain Technology

• Financial Services: The financial services sector is where blockchain technology plays a significant role. A safe and transparent system for payments, settlements, and other financial transactions can be developed using blockchain technology. This can help in lowering expenses and boosting productivity, as well as enhancing security and decrease the chance of fraud.

• Healthcare: A safe and open system forstoring and exchanging medical records can be created using blockchain technology. This can raise the standard of treat-

ment, lower expenses, and help in maintaining confidentiality of patient's record.

• Supply chain management: Blockchain technology can be utilised to provide a safe and open management system that tracks the movement of commodities. Costs can be decreased, efficiency can be increased, and accountability can also be enhanced.

• Identity management: By offering a safe and decentralised database for identification data, blockchain technology can be utilised to enhance identity management. This can lower fraud, protect against identity theft, and enhance data privacy.

Challenges

While blockchain has the potential to transform various industries, it also faces several challenges. One of the biggest challenges is scalability. Since blockchain is a decentralized network, it can be slow andexpensive to process large numbers of transactions. This can limit its potential applications, particularly in industries that require high volumes of transactions. Regulatory uncertainty is also a major concern as many governments and regulatory bodies are trying to determine how to regulate blockchain, as it can create uncertainty for businesses and investors.

Conclusion:

Decentralization, transparency, and security are some of its primary characteristics of blockchain which make it an attractive option for companies and investors seeking to boost productivity, cut expenses and promote transparency.

5G AND THE FUTURE OF OPERATIONAL MANAGEMENT AND DIGITAL SUPPLY CHAIN IN INDIA

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5G technology is the next generation of mobile networks that promises to bring about a significant change in the way businesses operate in India. The fifth generation of mobile networks is set to offer faster and more reliable connectivity, which can enable real-time monitoring, automation, and IoT-based solutions. These capabilities have the potential to improve efficiency, reduce costs, and increase transparency in business operations. The growth of the 5G network in India offers a plethora of opportunities and challenges for operational management and digital supply chain management.

The introduction of 5G in India can bring about a new era of digitalization, where businesses can leverage the power of 5G to improve their operations and supply chain management. The faster and more reliable connectivity offered by 5G can enable real-time monitoring, automation and IoT-based solutions, which can help businesses improve their operational efficiency and productivity. Additionally, 5G can also support virtual and augmented reality, which can be used for training and simulation purposes. This can help businesses reduce training costs and improve the effectiveness of training programs.

The digitization of supply chain processes, such as logistics, inventory management, and traceability can also be enabled by 5G. With faster and more reliable connectivity, businesses can implement real-time tracking and monitoring of goods, which can improve the efficiency and transparency of supply chain processes. Additionally, 5G can also support the use of drones and autonomous vehicles for logistics and transportation, which can help businesses improve the efficiency of their supply chain operations.However, along with the opportunities, the implementation of 5G in India also poses several challenges. One of the major challenges is the lack of standardization. Currently, there are several different 5G standards in use around the world, which can make it difficult for Indian businesses to adopt 5G-based solutions. Additionally, there is a lack of awareness and understanding of 5G technology among Indian businesses, which can make it difficult for them to see the potential benefits of 5G. Furthermore, there is also a shortage of skilled professionals in India with the knowledge and expertise to implement 5G-based solutions. Additionally, India's transportation and logistics infrastructure is not well-developed, which can make it difficult for businesses to implement 5G-based logistics solutions.

5G technology can enhance operational efficiency and productivity by enabling automation and real-time monitoring. With faster and more reliable connectivity, businesses can implement IoT-based solutions, such as sensor-based monitoring, which can help improve the efficiency of operations by providing real-time data on equipment performance and identifying potential problems before they occur. Additionally, 5G can support virtual and augmented reality, which can be used for training and simulation purposes. This can help businesses reduce training costs and improve the effectiveness of training programs.

However, there are also several challenges that need to be overcome in order for Indian businesses to fully realize the benefits of 5G in operational management . One of the biggest challenges is the lack of standardization. Currently, there are several different 5G standards in use around the world, which can make it difficult for Indian businesses to adopt 5G-based solutions. Additionally, there is a lack of awareness and understanding of 5G technology among Indian businesses, which can make it difficult for them to see the potential benefits of 5G. Furthermore, there is also a shortage of skilled professionals in India with the knowledge and expertise to implement 5G-based solutions.

5G technology can enable the digitization of supply chain processes, such as logistics, inventory management, and traceability. With faster and more reliable connectivity, businesses can implement real-time tracking and monitoring of goods, which can improve the efficiency and transparency of supply chain processes. Additionally, 5G can support the use of drones and autonomous vehicles for logistics and transportation, which can help businesses improve the efficiency of their supply chain operations.

However, there are also several challenges that need to be overcome in order for Indian businesses to fully realize the bene-

Table 1 Comparison between 5G and previous generations

5G	4G and Earlier
Filter banks-based new waveforms and other cutting-edge technologies	Mostly OFDM-based waveforms and variants
Gbps efficiency	To a few hundred Mbps
A few milliseconds of end-to-end delay	Hundreds of milliseconds of lag from beginning to finish
Support of massive MIMO	SISO and limited MIMO technologies
Support of mm-wave bands up to hundreds GHz	Operation mostly in frequencies below 6 GHz
Supporting a large number of devices effectively in extremely crowded spaces	Support of fewer devices in crowded or densely populated places

fits of 5G in digital supply chain management. One of the biggest challenges is the lack of infrastructure. Currently, India's transportation and logistics infrastructure is not well-developed, which can make it difficult for businesses to implement 5G-based logistics solutions. Additionally, there is a lack of standardization and awareness, which can make it difficult for Indian businesses to adopt 5G-based supply chain solutions.

To better understand the potential benefits of 5G in operational management and digital supply chain, let's look at some real-world examples of companies that have successfully implemented 5G. One example of a company that has successfully implemented 5G in their operational and supply chain management is Chinese tech giant Huawei. Huawei has used 5G to improve the efficiency and transparency of its supply chain processes. The company has implemented 5G-based logistics solutions to improve the efficiency of its last-mile delivery operations. Additionally, Huawei has used 5G to implement real-time monitoring of its manufacturing operations, which has helped the company identify and resolve problems more quickly.

Another example is Indian e-commerce giant Flipkart, which has implemented 5G-based logistics solutions to improve the efficiency of its last-mile delivery operations. Flipkart has used drones to make last-mile deliveries in rural areas where transportation infrastructure is poor. This has helped the company improve the efficiency of its last-mile delivery operations and reduce costs.

In conclusion, 5G technology has the potential to revolutionize the way businesses operate in India, particularly in the areas of operational management and digital supply chain. 5G offers faster and more reliable connectivity, which can enable real-time monitoring, automation, and IoT-based solutions. These capabilities have the potential to improve efficiency,

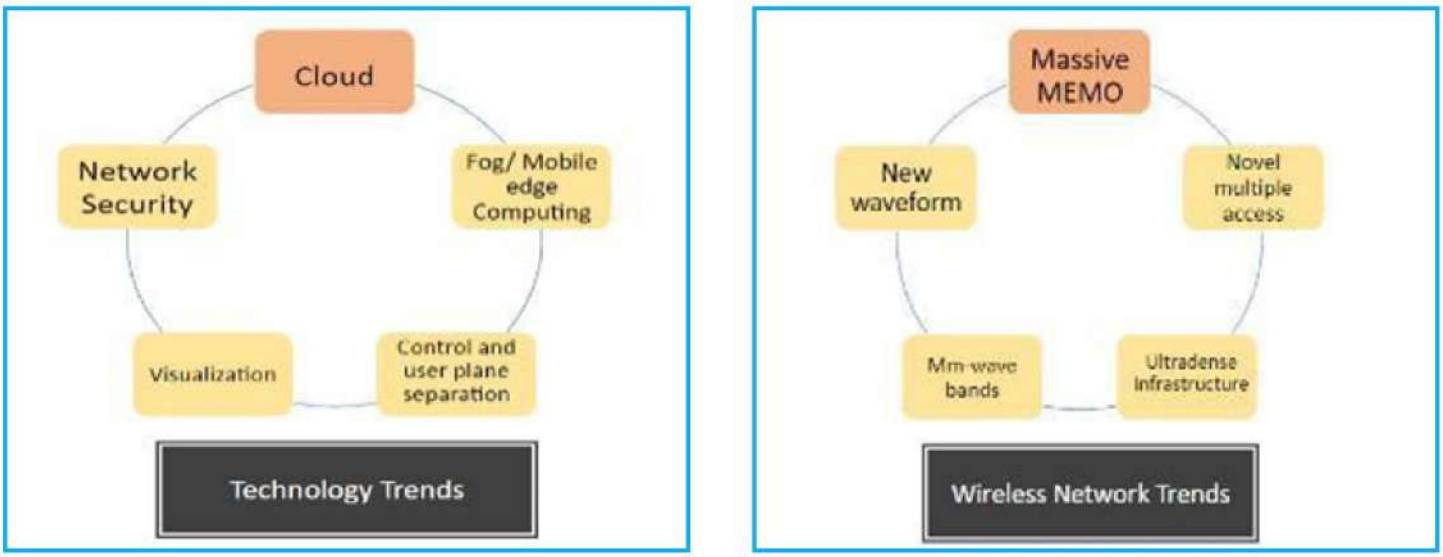

Fig. 1 5G Technology and Wireless Network Trends

reduce costs, and increase transparency in business operations.However, there are also several challenges that need to be overcome in order for Indian businesses to fully realize the benefits of 5G, such as lack of standardization, lack of awareness, of infrastructure. Real-world examples like shortage of skilled professionals and lack Huawei and Flipkart have already implemented 5G and reaped benefits, it's high time Indian businesses start exploring the potential of 5G for their operations and supply chain management.

DIGITAL TWINS

Arjun, LCO20372 - CSE 2020

Have you ever watched a movie where a character creates a virtual version of themselves in a computer game or virtual reality world? Well, that's a bit like what a digital twin is, except it's not just for entertainment purposes.

A digital twin is a virtual replica of a physical object, system, or process. It's created using data from sensors, cameras, and other sources, and it's designed to look and behave exactly like the real thing. The digital twin is essentially a computer-generated clone that can be used to monitor, test, and optimize the physical object it represents.

For example, imagine you're the owner of a large manufacturing plant. You have dozens of machines running around the clock, producing goods for your customers. With a digital twin, you could create a virtual replica of each machine and monitor its performance in real-time. You could see how much energy it's using, how fast it's running, and whether it's operating within safe parameters. This data could be used to optimize the machines' performance, reduce downtime, and prevent breakdowns.

The potential applications for digital twins are vast and varied. They can be used in industries such as manufacturing, healthcare, transportation, and construction. In healthcare, digital twins could be used to create personalized treatment plans for patients by simulating their internal organs and testing different therapies. In transportation, digital twins could be used to optimize vehicle performance and predict maintenance needs. And in construction, digital twins could be used to create virtual models of buildings and infrastructure projects, which could be used to optimize design, reduce costs, and improve sustainability.

One of the most exciting things about digital twin technology is its potential to revolutionize the way we design and manage complex systems. With a digital twin, we can simulate different scenarios, test new ideas, and identify potential problems before they occur. This can help us make better decisions, improve performance, and reduce costs.

So, there you have it – a digital twin is a virtual replica of a physical object or system that can be used to monitor, test, and optimize its performance. It's a fascinating new technology with the potential to change the way we think about and

interact with the physical world.

Types of Digital Twins

There are several different types of digital twins, each with specific applications and benefits. A "static" digital twin is a replica of an existing physical asset that is used to optimize performance, while a "dynamic" digital twin is a replica of an asset that is in use and can be used to monitor and predict performance in real-time. A hybrid digital twin combines both static and dynamic models, and a composite digital twin integrates multiple digital twins into a single system.

Applications of Digital Twin Technology

• Manufacturing and Industrial Sectors Digital twin technology has been used in the manufacturing and industrial sectors for predictive maintenance, quality control, and process optimization. By creating a virtual replica of an asset, organizations can simulate different scenarios and identify potential problems before they occur, leading to increased efficiency and cost savings. The use of digital twin technology in these industries has been found to improve overall performance, predict maintenance needs, and make better decisions.

• Transportation Industry In the transportation industry, digital twin technology can be used to optimize vehicle performance, improve battery life, and predict maintenance needs. For example, in the case of electric vehicles, digital twin technology can be used to create a virtual replica of the battery, which can be used to analyze and predict its performance over time. By simulating different usage scenarios, organizations can identify patterns of battery degradation and take steps to prevent or delay it. This can lead to increased battery life, improved vehicle performance, and ultimately increased customer satisfaction.

• Healthcare Industry In the healthcare industry, digital twin technology has been used for remote patient monitoring, surgi

cal training, and personalized medicine. Virtual reality simulations of surgeries can be used to train surgeons and prepare them for complex procedures. Additionally, digital twin technology has been used to create virtual replicas of patients, which can be used to personalize treatment plans and improve outcomes.

• Building Sustainable Infrastructure Digital twin technology is also being used to build more sustainable infrastructure. By creating virtual replicas of buildings and other structures, organizations can simulate different scenarios to identify energy savings and improve overall sustainability. This has the potential to reduce greenhouse gas emissions and create more efficient and sustainable cities.

• Energy and EV Industry The energy industry is also adopting digital twin technology to optimize operations and improve efficiency. Digital twins can be used to monitor and predict the performance of energy assets, such as wind turbines and solar panels. In the electric vehicle industry, digital twin technology can be used tosimulate battery performance and optimize charging infrastructure. This has the potential to reduce energy consumption, increase the use of renewable energy, and improve overall sustainability.

Conclusion

Digital twin technology is a revolutionary new technology with great potential in various industries. By creating virtual replicas of physical assets, organizations can simulate different scenarios, identify potential problems before they occur, and make better decisions. The use of digital twin technology in manufacturing, transportation, healthcare, and energy has been found to improve overall performance, predict maintenance needs, and reduce costs. As the technology continues to evolve, it is likely that digital twin technology will play an increasingly important role in shaping the future of various industries.

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