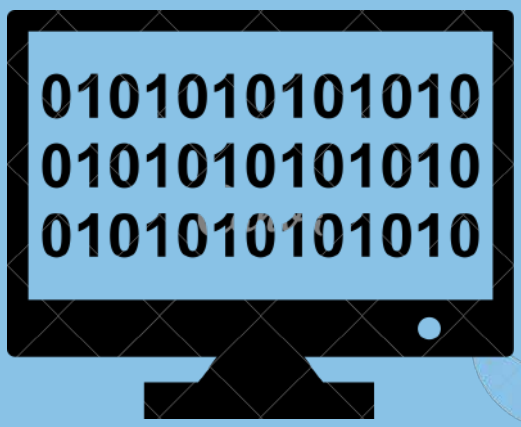
Government Polytechnic, Aurangabad

(An Autonomous Institute of Govt. of Maharashtra-Estd. In 1955)

Government Polytechnic, Osmanpura, Aurangabad - 431005, Maharashtra State, India

Bits & Bytes



Computer Engineering Department presents

TECHNICAL MAGAZINE

2022 - 2023

VOLUME 1 - ISSUE 1

Presented by

Computer Department

Computer Department

Vision

A center of excellence in the domain of Computer Science & Engineering to cultivate "digital artifacts" for society.

Mission

- To impart education in computer hardware and software required for industry and business.
- Developing skills resembling problem solving, interpersonal skill, high order thinking skill and logical reasoning for entrepreneurship and employment.
- Developing values and ethics for lifelong learning in the system environment.

Editorial Team

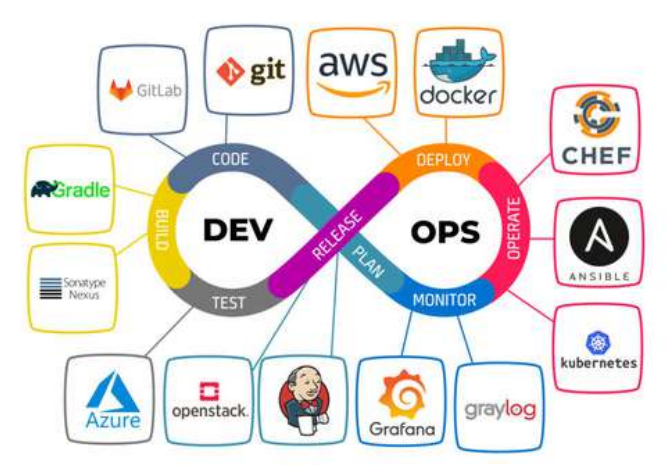
DevOps

ABSTRACT

DevOps entails a set of integrated activities or practices employed in automation and interlink software development processes with IT developers with the aim of building, testing, and releasing deliverables quickly and reliably. Constantly, DevOps has resulted in the use of infinite loops by the developers or practitioners in showing the relationship between development lifecycle phases. Even though the various activities or steps in a DevOps make a loop and flow sequentially, the iteration indicates that the flow must be constantly collaborative and repetitive to improve the entire lifecycle. If well explored by DevOps, various software automation trends could be ready to handle the industry's latest software and technology.

INTRODUCTION

The DevOps concept emerged to bridge the disconnect between the development of software and the deployment of that software into production within large software companies .The main purpose of DevOps is to employ continuous software development processes such as continuous delivery, continuous deployment, and microservices to support an agile software development lifecycle. Other trends in this context are that software is increasingly delivered through the internet, either server-side (e.g. Software-as-a-Service) or as a channel to deliver directly to the customer, and the increasingly pervasive mobile platforms and technologies on which this software runs . These emerging trends support fast and short delivery cycles of



delivering software in the fast-paced dynamic world of the Internet. As such DevOps has been well received in the software engineering community and has received significant attention particularly in the practitioner literature . Annual 'State of DevOps' reports show that the number of DevOps teams has increased from 19% in 2015 to 22% in 2016 to 27% in 2017 . However, as observed in recent studies, despite their growing popularity, there is a lack of empirical research on the actual practice of DevOps beyond a discussion of blog posts and industrial surveys .Beyond very few case studies ,the current literature does not provide much insight on the actual implementation and practices of DevOps and their effectiveness in supporting continuous software development.

WORKING

A DevOps team includes developers and IT operations working collaboratively throughout the product lifecycle, in order to increase the speed and quality of software deployment. It's a new way of working, a cultural shift, that has significant implications for teams and the organizations they work for. Under a DevOps

model, development and operations teams are no longer “siloed.” Sometimes, these two teams merge into a single team where the engineers work across the entire application lifecycle — from development and test to deployment and operations — and have a range of multidisciplinary skills. DevOps teams use tools to automate and accelerate processes, which helps to increase reliability. A DevOps toolchain helps teams tackle important DevOps fundamentals including continuous integration, continuous delivery, automation, and collaboration.

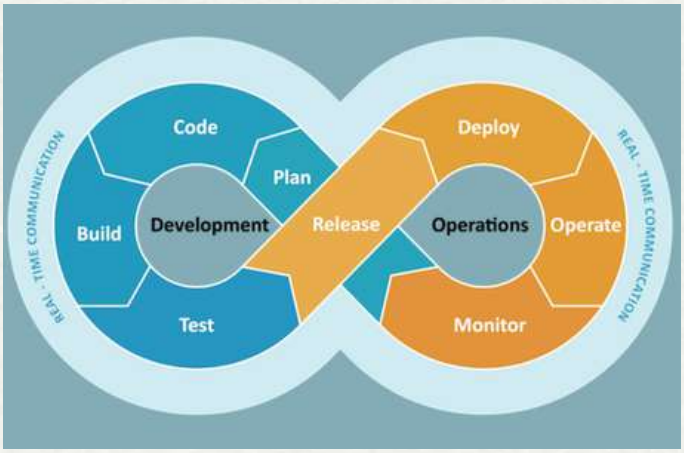
DevOps values are sometimes applied to teams other than development. When security teams adopt a DevOps approach, security is an active and integrated part of the development process. This is called DevSecOps.

L I F E C Y C L E

Because of the continuous nature of DevOps, practitioners use the infinity loop to show how the phases of the DevOps lifecycle relate to each other. Despite appearing to flow sequentially, the loop symbolizes the need for constant collaboration and iterative improvement throughout the entire lifecycle. The DevOps lifecycle consists of eight phases representing the processes, capabilities, and tools needed for development (on the left side of the loop) and operations (on the right side of the loop). Throughout each phase, teams collaborate and communicate to maintain alignment, velocity, and quality.

Discover

Building software is a team sport. In preparation for the upcoming sprint, teams must workshop to explore, organize, and prioritize ideas. Ideas must align to strategic goals and deliver customer impact. Agile can help guide DevOps teams.



Plan

DevOps teams should adopt agile practices to improve speed and quality. Agile is an iterative approach to project management and software development that helps teams break work into smaller pieces to deliver incremental value.

Build

Git is a free and open source version control system. It offers excellent support for branching, merging, and rewriting repository history, which has led to many innovative and powerful workflows and tools for the development build process.

Test

Continuous integration (CI) allows multiple developers to contribute to a single shared repository. When code changes are merged, automated tests are run to ensure correctness before integration. Merging and testing code often help development teams gain reassurance in the quality and predictability of code once deployed.

Deploy

Continuous deployment (CD) allows teams to release features frequently into production in an automated fashion. Teams also have the option to deploy with feature flags, delivering new code to users steadily and methodically rather than all at once. This approach improves velocity, productivity, and sustainability of software development teams.

Operate
Manage the end-to-end delivery of IT services to customers. This includes the practices involved in design, implementation, configuration, deployment, and maintenance of all IT infrastructure that supports an organization's services.

TOOLS USED

The DevOps approach brings collaboration between the software development and operation teams. While DevOps is a culture, the right stack of tools makes it possible to implement DevOps successfully. Some of these tools are:

1. Version Control Tool: Git
Git is perhaps the best and most widely used version control tool in a development era characterized by dynamism and collaboration. Version control provides developers with a means by which they can keep track of all the changes and updates in their codes such that in the event of a mishap, it is quite easy to return to previous version. Git DevOps tool is easy to implement as it is compatible with most protocols including HTTP, SSH, and FTP.

2. Build Tool: Maven
Maven is one of the important DevOps tools for building projects. Unlike the ANT build system, Apache Maven is more than just an automation build framework. It is also designed to manage reporting, documentation, distribution, releases, and dependencies processes. Written in Java language, Maven can build and manage projects written in Java or C#, Ruby, Scala, and other languages using project object model (POM) plugins.

3. Continuous Integration Tool: Jenkins
Jenkins is an integration DevOps tool. For continuous integration (CI), Jenkins stands out as it is designed for both internal and plugin extensions. Jenkins is an open-source Java-based automation CI server that is supported by multiple operating systems including Windows, macOS, and other Unix OSs. Jenkins can also be deployed on cloud-based platforms.

4. Configuration Management Tool: Chef
Configuration management (CM) refers to the maintenance and control of the components of large complex systems in a known, consistent, and determined state throughout the DevOps life cycle. Components of an IT system may include servers, networks, storage, and applications. Chef is an open-source framework, uses a master-agent model and has infrastructure as code (IAC) capabilities to automate the configuration of infrastructure.

5. Configuration Management Tool: Puppet
Puppet is also open-source and uses declarative programming for system configuration, deployments, and server management DevOps tools. It is organized into reusable modules for the speedy setup of pre-configured servers and is compatible with most platforms.

6. Container Platforms: Docker
Container platforms are application solutions that allow developers to build, test, and ship applications in resource-independent environments. Each container comprises a complete runtime environment including the specific application, its libraries, source code, configurations, and all its dependencies. The Docker engine is designed to automate the development, deployment, and management of containerized applications on single nodes. Docker is open-source and compatible with cloud services like AWS, GCP, and Azure Cloud.

CONCLUSION

DevOps is a set of practices, tools, and a cultural philosophy that automate and integrate software development and IT teams, emphasizing team empowerment, communication, collaboration, and technology automation. The DevOps lifecycle is a continuous software development process that employs DevOps best practices to plan, build, integrate, deploy, monitor, operate, and offer continuous feedback throughout the software's lifecycle. DevOps tool is critical for the automation of the software development life cycle. The DevOps approach is evolving at a very fast pace and emerging tools have been designed to incorporate those with little or no programming knowledge, microservices and containerization, and other recent technologies.

Authors:
1. Tanvi Chaudhari
2. Anisha Nemade
3. Sanika Paware
4. Purva Warade

BLOCKCHAIN AND CRYPTOCURRENCY

ABSTRACT

The blockchain technology is a relatively new approach in the field of information technologies. As one of its first implementations, bitcoin as a cryptocurrency has gained a lot of attention. They represent the very core of modern cryptocurrency development. This paper is meant to givea brief introduction to these topics.

Keywords – Bitcoin; blockchain; cryptocurrency;

INTRODUCTION

Bitcoin and blockchain technology have begun to shape and define new aspects in the computer science and information technology. The need for a decentralized money has been exploited more as a theoretical concept, but in the past decade, it became viable, all thanks to the famous paper of Satoshi Nakamoto in 2008, introducing Bitcoin and blockchain technology. While there are controversies about Nakamoto's true identity, one is for sure: he brought something revolutionary to the world, and it is up to the users to decide what they want to do with it. Some will take this opportunity and develop their own application for solving various problems in the society, others will invest money in those ideas or simply trade with ups and downs of the cryptocurrencies' values at the market. In this, we thought of bringing a small introduction to the matter of blockchain and cryptocurrencies. We begin with the life of people in the society without bitcoin or cryptocurrency, and then we go intothe very core of itsfunction. Bitcoin is then cryptocurrency hold majority of the cryptocurrency market capitalization. Of course, as it happens with new technologies, some limitations and problems emerged, and we described them well.

CRYPTOCURRENCY ESSENTIALS

A cryptocurrency, crypto-currency, or crypto is a digital currency designed to work as a medium of exchange through a computer network that is not reliant on any central authority, such as a government or bank, to uphold or maintain it. It is a decentralized system for verifying that the parties to a transaction have the money they claim to have, eliminating the need for traditionalintermediaries, such as banks, when funds are being transferred between two entities. Individual coin ownership records are stored in a digital ledger, which is a computerized database using strong cryptography to secure transaction records, control the creation of additional coins, and verify the transfer of coin ownership. Despite their name, cryptocurrencies are not considered tobe currencies in the traditional sense, and while varying treatments have been applied to them, including classification as commodities, securities, and currencies, cryptocurrencies are generally viewed as a distinct asset class in practice.

Some crypto schemes use validators to maintain the cryptocurrency. In a proof-of-stake model, owners put up their tokens as collateral.

In return, they get authority over the token in proportion to the amount they stake. Generally, these token stakers get additional ownership in the token over time via network fees, newly minted tokens, or other such reward mechanisms.

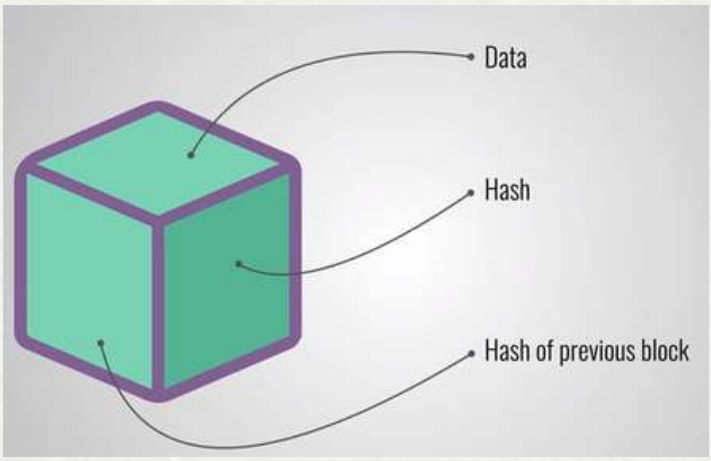
- Cryptocurrency does not exist in physical form (like paper money) and is typically not issued by a central authority. Cryptocurrencies typically use decentralized control as opposed to a central bank digital currency (CBDC).
- When a cryptocurrency is minted, or created prior to issuance, or issued by a single issuer, it is generally considered centralized.

When implemented with decentralized control, each cryptocurrency works through distributed ledger technology, typically a blockchain, that serves as a public financial transaction database.

Traditional asset classes like currencies, commodities, and stocks, as well as macroeconomic factors, have modest exposures to cryptocurrency returns.

The first decentralized cryptocurrency was Bitcoin, which was first released as open-source software in 2009.

As of March 2022, there were more than 9,000 other cryptocurrencies in the marketplace, of which more than 70 had a market capitalization exceeding $1 billion.



BLOCKCHAIN TECHNOLOGY

Blockchain is the underlying technology of bitcoin. Blockchain is a public distributed ledger in which transactions are recorded in chronological order. Any record or transaction added to the blockchain cannot be modified or altered, meaning transactions are safe from hacking. A block is the smallest unit of a blockchain, and it is a container that holds all the transaction details. A block has four fields, or primary attributes:

1. Previous hash: This attribute stores the value of the hash of the previous block, and that's how the blocks are linked to one another.

2. Data: This is the aggregated set of transactions included in this block—the set of transactions that were mined and validated and included in the block.

3. Nonce: In a “proof of work” consensus algorithm, which bitcoin uses, the nonce is a random value used to vary the output of the hash value. Every block is supposed to generate a hash value, and the nonce is the parameter that is used to generate that hash value.

The proof of work is the process of transaction verification done in blockchain. 4. Hash: This is the value obtained by passing the previous hash value, the data and the nonce through the SHA-256 algorithm; it is the digital signature of the block. SHA-256 is a cryptographic hash algorithm that produces a unique 256-bit alphanumeric hash value for any given input, and that is the unique feature of this cryptographic algorithm: Whatever input you give, it will always produce a 256-bit hash.

ADVANTAGES OF BLOCKCHAIN

•Immutability. Blockchain supports immutability, meaning it is impossible to erase or replace recorded data. Therefore, the blockchain prevents data tampering within the network.

• Transparency. Blockchain is decentralized, meaning any network member can verify data recorded into the blockchain. Therefore, the public can trust the network.

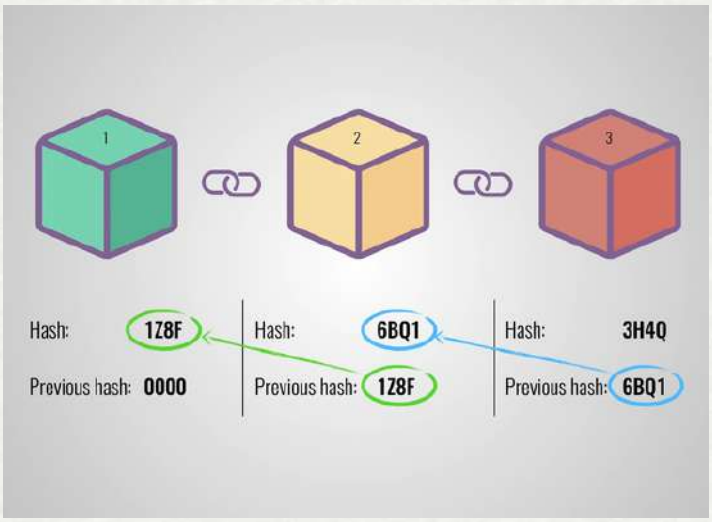
• Censorship. Blockchain technology is free from censorship since it does not have control of any single party. Therefore, no single authority (including governments) can interrupt the operation of the network.

DISADVANTAGES OF BLOCKCHAIN

• Speed and performance. Blockchain is considerably slower than the traditional database because blockchain technology carries out more operations.

• High implementation cost. Blockchain is costlier compared to a traditional database. Additionally, businesses need proper planning and execution to integrate blockchain into their process.

• Data modification. Blockchain technology does not allow easy modification of data once recorded, and it requires rewriting the codes in all of the blocks, which is time-consuming and expensive. The downside of this feature is that it is hard to correct a mistake or make any necessary adjustments.



CONCLUSION

Blockchain is a relatively new technology that is still not widespread in all industries but it is slowly gaining more momentum. Once Blockchain becomes more widespread, it could become a powerful tool for the democratization of data that will encourage transparency and ethical business tactics. And the applications of Blockchain in the world are only increasing with the result of faster transactions, more transparency, and security as well as reduced costs. Who knows, Blockchain may change the world in the future! Bitcoin is the most known and valuable cryptocurrency. It is based on blockchain technology that is intended to promote a trust mechanism in a peer-to-peer network based on the consensus of the majority ofthe nodes.

Authors :

1. Siddhi Vaishnav
2. Vedanti Yerawar

DIGITAL TWIN

INTRODUCTION

A digital twin is a digital representation of a physical object, process, service or environment that behaves and looks like its counterpart in the real-world.

A digital twin can be a digital replica of an object in the physical world, such as a jet engine or wind farms, or even larger items such as buildings or even whole cities, alternatively digital twin technology can be used to replicate processes in order to collect data to predict how they will perform.

A digital twin is, in essence, a computer program that uses real world data to create simulations that can predict how a product or process will perform. These programs can integrate the internet of things (Industry 4.0), artificial intelligence and software analytics to enhance the output.

With the advancement of machine learning and factors such as big data, these virtual models have become a staple in modern engineering to drive innovation and improve performance.

In short, creating one can allow the enhancement of strategic technology trends, prevent costly failures in physical objects and also, by using advanced analytical, monitoring and predictive capabilities, test processes and services.

HOW DOES DIGITAL TWIN TECHNOLOGY WORK?

The life of a digital twin begins with experts in applied mathematics or data science researching the physics and operational data of a physical object or system in order to develop a mathematical model that simulates the original.

The developers who create digital twins ensure that the virtual computer model can receive feedback from sensors that gather data from the real world version. This lets the digital version mimic and simulate what is happening with the original version in real time, creating opportunities to gather insights into performance and any potential problems.A digital twin can be as complex or as simple as you require, with differing amounts of data determining how precisely the model simulates the real world physical version.

The twin can be used with a prototype to offer feedback on the product as it is developed or can even act as a prototype in its own right to model what could occur with a physical version when built.

The concept of digital twins was first put forward by David Gelernter's 1991 book 'Mirror Worlds,' with Michael Grieves of the Florida Institute of Technology going on to apply the concept to manufacturing.

By 2002, Grieves had moved to the University of Michigan when he formally introduced the digital twin concept at a Society of Manufacturing Engineers conference in Troy, Michigan.

However, it was NASA who first embraced the digital twin concept and, in a 2010 Roadmap Report, John Vickers of NASA gave the concept its name. The idea was used to create digital simulations of space capsules and craft for testing.

The digital twin concept spread further still in 2017, when Gartner named it as one of the top 10 strategic technology trends. Since then, the concept has been used in an ever-growing array of industrial applications and processes.

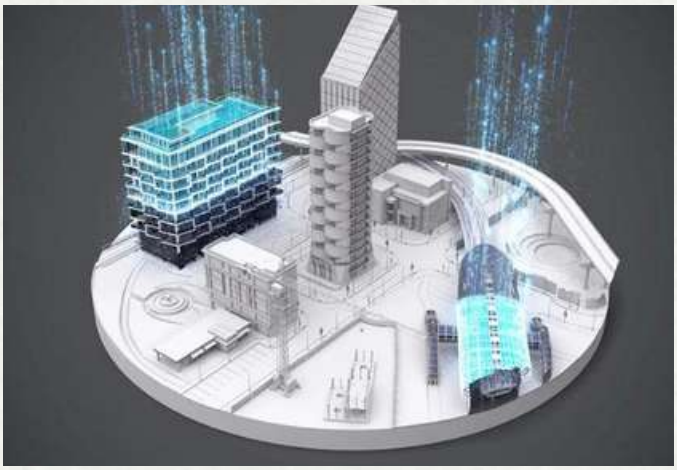
TYPES OF DIGITAL TWIN

Product twins simulate separate objects. For instance, manufacturers use a virtual prototype of a certain product before setting up a production line to analyze how it will perform under various conditions, and what issues may occur. This allows them to make necessary adjustments and create a more efficient design of goods. Afterward, product twins can be used to control product performance in the physical world.

Process twins are responsible for the simulation of processes; for example, manufacturing processes. In a virtual environment, you can create various scenarios of a production process to see what will happen in different situations.

This allows companies to develop the most efficient production methodology. You can further optimize the process using product twins that correspond with every piece of equipment involved. This helps companies perform preventative maintenance, avoiding costly downtimes. Manufacturing operations are made safer, faster and more efficient.

System twins are copies of entire systems (e.g., a factory). They collect massive amounts of operational data produced by devices and products in the system, gain insights and create new business horizons to optimize all the processes and support the system's integrity.



WHEN TO USE IT

Digital twin can be broken down into three broad types, which show the different times when the process can be used:

- Digital Twin Prototype (DTP) - This is undertaken before a physical product is created
- Digital Twin Instance (DTI) – This is done once a product is manufactured in order to run tests on different usage scenarios
- Digital Twin Aggregate (DTA) – This gathers DTI information to determine the capabilities of a product, run prognostics and test operating parameters

DIGITAL TWIN VS. SIMULATION

The terms simulation and digital twin are often used interchangeably, but they are different things. A simulation is designed with a CAD system or similar platform, and can be put through its simulated paces, but may not have a one-to-one analog with a real physical object.

A digital twin, by contrast, is built out of input from IoT sensors on real equipment, which means it replicates a real-world system and changes with that system over time. Simulations tend to be used during the design phase of a product's lifecycle, trying to forecast how a future product will work, whereas a digital twin provides all parts of the business insight into how some product or system they're already using is working now.

HOW ARE DIGITAL TWINS CREATED

Data collection - First of all, researchers have to aggregate a variety of data about an asset: physical properties, appearance, behavior under certain conditions, cooperation with other assets and more.

Modeling - Using the gathered data and modeling software, engineers create a mathematical model that accurately reflects all the specifics of its real-world counterpart. The model has an identical appearance to the corresponding object, including all minor details, and behaves in the same way as the original object. AR, virtual reality and 3D technologies help with visualization.

Integration - Finally, you need to integrate your asset with its digital model to enable continuous monitoring in real time.

To do so, the asset is equipped with sensors and tracking devices that can transmit data to an IoT platform where it will be visualized and analyzed.

CONCLUSION

The growth in Digital Twin use has seen a shift in recent years, facilitated by an increase in the number of published papers and industry leaders investing heavily in developing Digital Twin technology. It would not be possible without the same growth in the AI, IoT and IIoT fields, which are becoming key enablers for Digital Twins.

AI is becoming a component within Digital Twins and exploring where these algorithms can be applied is another avenue of open research. The effects of AI combined with Digital Twin are topics amongst the publications but on a small scale. The exciting and inevitable future research will explore scaling up smaller successful Digital Twin and AI projects.

Author:
1.Savani Sonawane
2.Siddhi Borse
3.Dakshayani Vaishnav

METAVERSE

ABOUT METAVERSE

Metaverse is a virtual space in which user can interact with a computer-generated environment and other users.The internet will eventually evolve into the metaverse, which will come to represent the next major computing platform. combination of augmented, virtual and mixed reality can be metaveraei What is the Metaverse and Where Did the Concept Come From The Metaverse can be traced back to Neal Stephenson and his dystopian cyberpunk novel snow Crash.Which describes a virtual reality dataspace called the matrix.Likekeny place in Reality, the Street is subject to development. Developers can build theirm own all streets feeding off of the main one.

They can build buildings, parks, signs, as well as things that do not exist in Reality.Mark Zuckerberg, the CEO of the newly named Meta (formerly Facebook), estimates it could take five to 10 years before the key features of the metaverse become mainstream.Aspects of the metaverse currently exist. Ultra-fast broadband speed, virtual reality headsets and persistent always-on online words are already up and running, even though they may not be accessible to all.The Metaverse : Where We Are and Where We're Headed

-Zuckerberg recently told tech podcaster Lex Fridman: "We're gone desktop to web to mobile from text to photos to video. But this isn't the end of th line," writes.

- Zuckerberd in a recent letter to his employees. "The next platform will be even more immersive-an embodied internet where you're in the experience, not just looking at it. We call this the metaverse, and it will touch every product we build".

FUTURE OF METAVERSE

Today's Metaverse: Virtual reality as the "digital escape". Over the next few years the futuremetaverse would be something very similar to our real world in many aspects and even replace some real-world activities (like working or hanging out).A lot of people think that virtual reality is an illusion, that it's not real. But i say that it has casual power , it exists outside of our mind, and is not an illusion".

Although it lacks many of the components that would make it a genuinely next-generation digital experience, exciting use cases and applications are already being seen in areas such as Augmented Reality (AR), Virtual Reality (VR), 3D social media platforms, blockchain-based marketplaces, and many others.

METAVERSE PURPOSE

The metaverse project is a virtual world designed to bring users together as in real life, as they can meet and interact with each other. It is a virtual universe where users can use avatars that represent their personality and wishes. The metaverse project is a virtual version of real life except that you can do whatever you want. In this world, it is possible to do activities that we usually do in the real world such as skydiving or shopping for example.

The design of the metaverse aims to have a virtual universe where everyone can interact as in the real world. Thus, players will be able to make purchases or trade in this world. It adds prestige and value to this universe. The metaverse is even economically independent. Indeed, it is not uncommon for users of the platform to make trades (sales and purchase) using real money to trade in the metaverse.The Metaverse is a spatial computing platform that provides digital experiences as an alternative to or replica of the real world,along with its key civilizational aspects.

METAVERSE SIGNIFICANCE

The metaverse is the result of over 30 years of technological progress. It required ubiquitous high-speed internet access. The larger culture needed to be familiar with concepts popularized by video games, such as moving in virtual environments. And, of course, both standard and graphical processing units are required to evolve to their current impressive state. Finally, display technologies used in virtual and augmented reality needed to become lightweight enough to feel natural when worn.

VR HEADSETS

VR headsets have exploded in popularity over the past few years. This is hardly a surprise, given that VR gaming, the metaverse, and similar technologies have also become so popular. VR headsets are one of the best ways to experience these new cutting-edge attractions. You'll soon find out which virtual reality headsets can best fit your particular needs.A VR consists of sensors to track your field of vision and two screens that provide a stereoscopic display.

METAVERSE IMPORTANCE-

The Metaverse is not a single system but a collection of interconnected systems, each with its own rules and capabilities. It is made up of interconnected worlds that are not limited by geographical boundaries, meaning that technically everyone with an internet connection and the right setup can have access to it.

The Metaverse is the next evolution of the internet and is changing how we live, work, and play forever.Moreover, the metaverse is important because it allows people to interact with others that they may never have had the chance to, in a setting, they may not be able to visit. For example, if you work remotely from home in California, but your employer's office is located in New York, you can use the metaverse to sit in the same office, in a shared virtual spaceThe metaverse also allows for a more immersive experience in entertainment, education, and other forms of content all through virtual reality. The virtual environment enables people to communicate with others, share ideas, and create content easily.

CONCLUSION

Metaverse technology is far more advanced than virtual reality, as per the detailed report of differences between the Metaverse vs. virtual reality. Virtual reality is practically one of the basic automation for the advancement of the Metaverse. It grants the consumers to be a part of the metaverse universe. Nevertheless, high-tech VR still has limited power leading to a fixed number of efficient components.

The Metaverse, on the other hand, is a vast and rapidly expanding virtual environment that would be a 3D depiction of the internet and the real virtual world. Users may navigate around virtual 3D environments in the Metaverse in the same way they can browse through different websites. Most essential of all, there is no end to the potential of supporting advanced technologies in the Metaverse.

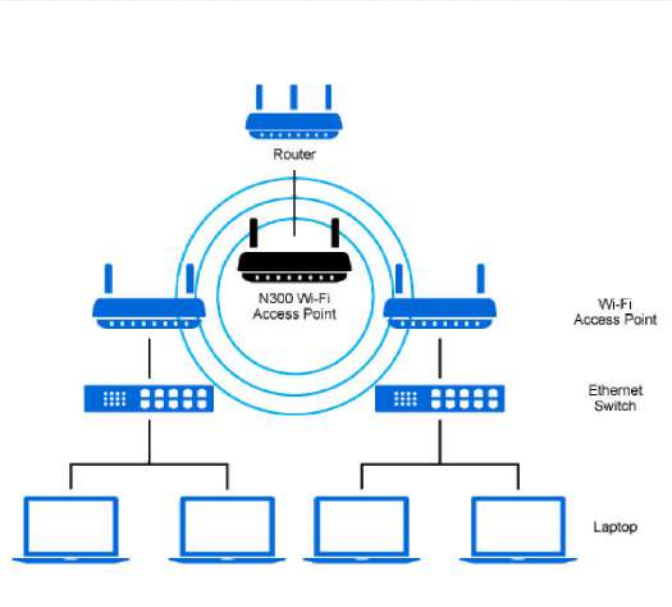
Author:
1.Atharva Kanthak
2.Sneha Bhalerao
3.Renuka Patil

WIRELESS NETWORK SYSTEM

ABSTRACT

Computer networks that are not connected by cables are called wireless networks. They generally use radio waves for communication between the network nodes. They allow devices to be connected to the network while roaming around within the network coverage.

A wireless network refers to a computer network that makes use of Radio Frequency (RF) connections between nodes in the network. Wireless networks are a popular solution for homes, businesses, and telecommunications networks.



INTRODUCTION

There are more subtle technology differences that come in to play between wired and wireless. Most modern wired networks are now “full duplex”, meaning that they can be transmitting/receiving packets in both directions simultaneously. In addition, most wired networks have a dedicated cable that runs to each end user device.

In a Wi-Fi network, the medium (the radio frequency being used for the network) is a shared resource, not just for the users of the network, but often for other technologies as well (Wi-Fi operates in what are called ‘shared’ bands, where many different electronic devices are approved to operate). This has several implications: 1) unlike a wired network, wireless can’t both talk and listen at the same time, it is “half duplex” 2) All users are sharing the same space must take turns to talk 3) everyone can ‘hear’ all traffic going on. This has forced Wi-Fi networks to implement various security measures over the years to protect the confidentiality of information passed wirelessly.

APPLICATIONS OF WSN:

- Internet of Things (IoT)
- Surveillance and Monitoring for security, threat detection
- Environmental temperature, humidity, and air pressure
- Noise Level of the surrounding
- Medical applications like patient monitoring
- Agriculture
- Landslide Detection

CHALLENGES OF WSN:

- WLAN Access Point:

It receives the data which is sent by the Radio nodes wirelessly, generally through the internet.

- Evaluation Software:

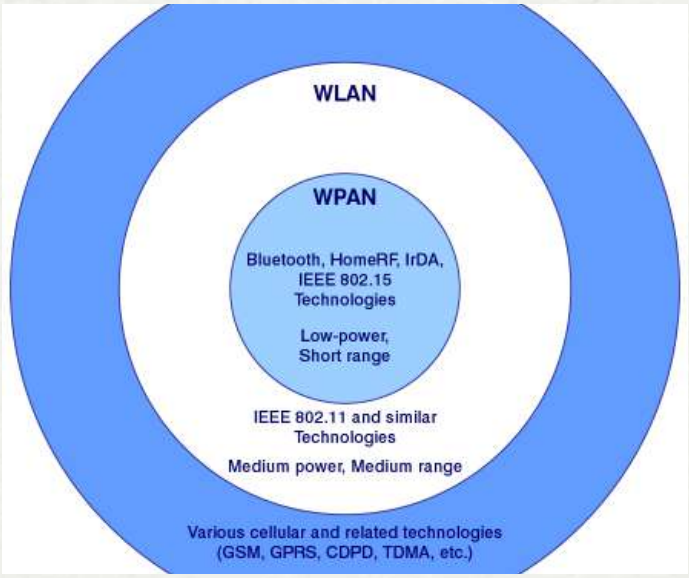
The data received by the WLAN Access Point is processed by a software called as Evaluation Software for presenting the report to the users for further processing of the data which can be used for processing, analysis, storage, and mining of the data.

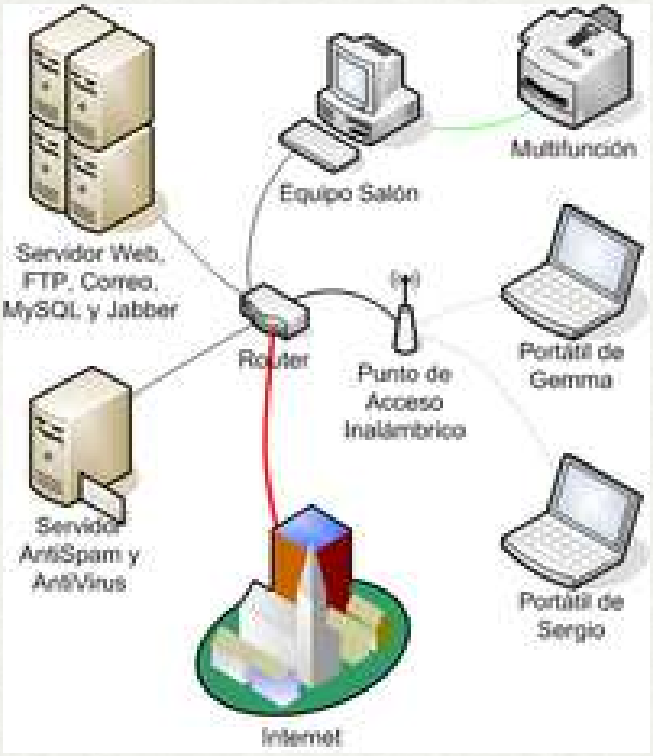
HOW DOES WI-FI NETWORK WORK?

A Wi-Fi based wireless network sends signals using radio waves (cellular phones and radios also transmit over radio waves, but at different frequencies and modulation).

In a typical Wi-Fi network, the AP (Access Point) will advertise the specific network that it offers connectivity to. This is called a Service Set Identifier (SSID) and it is what users see when they look at the list of available networks on their phone or laptops. The AP advertises this by way of transmissions called beacons. The beacon can be thought of as an announcement saying “Hello, I have a network here, if it’s the network you’re looking for, you can join”.

A client device receives the beacon transmitted by the AP and converts the RF signal into digital data, then that data is passed along to the device for interpretation. If the user wants to connect to the network, it can send messages to the AP trying to join and (when security is enabled) providing the proper credentials to prove they have the right to join. These processes are known as Association & Authentication. If either of these fail, the device will not successfully join the network and will be unable to further communicate with the AP.





Assuming all goes well, we come to the part that is the end user’s ultimate goal: passing data. Data from the client (or from the AP to the client) is converted from digital data into an RF modulated signal and transmitted over the air. When received, this is de-modulated, converted back to digital data, and then forwarded along to its destination (often the internet or a resource on the larger internal network).

Wi-Fi communication is only approved to transmit on specific frequencies, in most parts of the world these are the 2.4 GHz and 5 GHz frequency bands, although many countries are now adding 6GHz frequencies as well. These frequency bands are not the same that cellular networks use, so cell phones and Wi-Fi are not in competition for use of the same frequencies. However that does not mean that there are not other technologies that can operate in these bands. In the 2.4GHz band in particular there are many products, including Bluetooth, ZigBee, cordless keyboards, and A/V equipment just to name a small subset that does use the same frequencies and can

Wi-Fi communication is only approved to transmit on specific frequencies, in most parts of the world these are the 2.4 GHz and 5 GHz frequency bands, although many countries are now adding 6GHz frequencies as well. These frequency bands are not the same that cellular networks use, so cell phones and Wi-Fi are not in competition for use of the same frequencies. However that does not mean that there are not other technologies that can operate in these bands. In the 2.4GHz band in particular there are many products, including Bluetooth, ZigBee, cordless keyboards, and A/V equipment just to name a small subset that does use the same frequencies and can

ADVANTAGES OF WNS:

- **Low cost:** WSNs consist of small, low-cost sensors that are easy to deploy, making them a cost-effective solution for many applications.
- **Wireless communication:** WSNs eliminate the need for wired connections, which can be costly and difficult to install. Wireless communication also enables flexible deployment and reconfiguration of the network.
- **Energy efficiency:** WSNs use low-power devices and protocols to conserve energy, enabling long-term operation without the need for frequent battery replacements.
- **Scalability:** WSNs can be scaled up or down easily by adding or removing sensors, making them suitable for a range of applications and environments.
- **Real-time monitoring:** WSNs enable real-time monitoring of physical phenomena in the environment, providing timely information for decision making and control.

DISADVANTAGES OF WNS:

- **Limited range:** The range of wireless communication in WSNs is limited, which can be a challenge for large-scale deployments or in environments with obstacles that obstruct radio signals.
- **Limited processing power:** WSNs use low-power devices, which may have limited processing power and memory, making it difficult to perform complex computations or support advanced applications.
- **Data security:** WSNs are vulnerable to security threats, such as eavesdropping, tampering, and denial of service attacks, which can compromise the confidentiality, integrity, and availability of data.
- **Interference:** Wireless communication in WSNs can be susceptible to interference from other wireless devices or radio signals, which can degrade the quality of data transmission.
- **Deployment challenges:** Deploying WSNs can be challenging due to the need for proper sensor placement, power management, and network configuration, which can require significant time and resources.

TYPES OF WIRELESS NETWORK CONNECTIONS

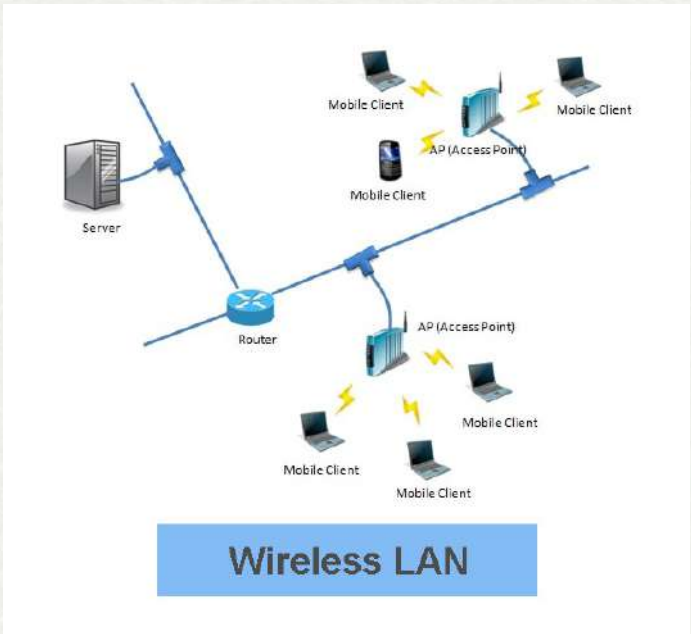
In addition to a LAN, there are a few other types of common wireless networks: personal-area network (PAN), metropolitan-area network (MAN), and wide-area network (WAN).

LAN

A local-area network is a computer network that exists at a single site, such as an office building. It can be used to connect a variety of components, such as computers, printers, and data storage devices. LANs consist of components like switches, access points, routers, firewalls, and Ethernet cables to tie it all together. Wi-Fi is the most commonly known wireless LAN.

PAN

A personal-area network consists of a network centralized around the devices of a single person in a single location. A PAN could have computers, phones, video game consoles, or other peripheral devices. They are common inside homes and small office buildings. Bluetooth is the most commonly known wireless PAN.



MAN

A metropolitan-area network is a computer network that spans across a city, small geographical area, or business or college campus. One feature that differentiates a MAN from a LAN is its size. A LAN usually consists of a solitary building or area. A MAN can cover several square miles, depending on the needs of the organization.

Large companies, for example, may use a MAN if they have a spacious campus and need to manage key components, such as HVAC and electrical systems.

WAN

A wide-area network covers a very large area, like an entire city, state, or country. In fact, the internet is a WAN. Like the internet, a WAN can contain smaller networks, including LANs or MANs. Cellular services are the most commonly known wireless WANs.

CONCLUSION

In conclusion, wireless network systems have transformed the way we live and work, and their potential for innovation and growth is limitless. As technology continues to advance, wireless networks will continue to play a critical role in powering the future of connectivity, enabling new applications, and shaping the way we interact with the digital world. It is imperative to invest in research, development, and standards to further enhance the capabilities of wireless networks and unlock their full potential for the benefit of society at large.

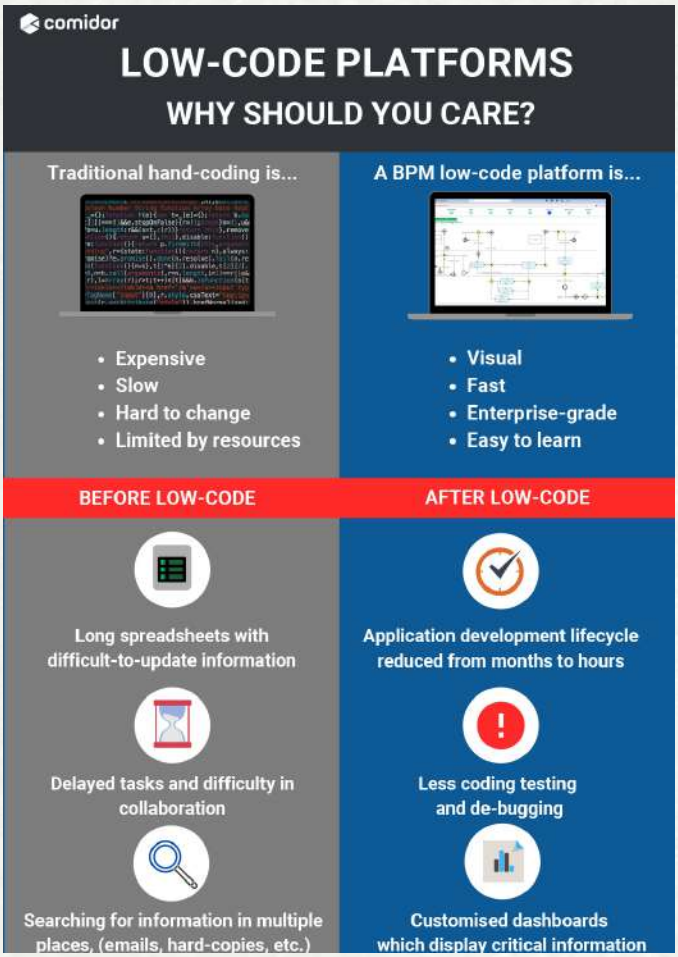
Author:
1.Harshad Shelke
2.Siddhi Khandarkar
3.Gargi Wawre
4.Pritam Aher

THE RISE OF LOW-CODE DEVELOPMENT PLATFORMS: HOW THEY ARE CHANGING THE SOFTWARE DEVELOPMENT LANDSCAPE

INTRODUCTION

The article discusses the rise of low-code development platforms and how they are changing the software development landscape. These platforms offer a visual interface that enables developers to build applications at a faster pace, with fewer resources, and at a lower cost, compared to traditional software development methods. Low-code development platforms democratize software development and improve collaboration between business stakeholders and developers, resulting in better-designed applications that meet business needs more effectively However, there are also some challenges that organizations need to be aware of, such as limited customization, vendor lock-in, and security concerns. Overall, low-code development platforms offer significant benefits to organizations looking to build applications at a faster pace and at a lower cost.

In recent years, the software development landscape has undergone a significant transformation, thanks to the emergence of low-code development platforms. These platforms have enabled developers to build applications at a faster pace, with fewer resources, and at a lower cost, compared to traditional software development methods.Low-code development platforms offer a visual interface that enables developers to drag-and-drop pre-built components and integrate them into the application. This approach to development is often referred to as model-driven development..



WHAT IS LOW-CODE?

A software development approach that requires minimal hand-coding i.e, it uses the GUI with little coding for software development.

There are several platforms that provide users with low-level coding like –

Quickbase, ZohoCreator, Oracle APEX, Mendix ,Salesforce lightning,Airtable, Kissflow Low Code, Appian, OutSystems etc.

BENEFITS OF LOW-CODE DEVELOPMENT PLATFORMS

Low-code development platforms offer several benefits to organizations looking to build applications.

Here are some of the most significant advantages:

1. Faster Time to Market: Low-code development platforms allow developers to build applications at a much faster pace compared to traditional software development methods. The visual interface and pre-built components eliminate the need for developers to write code from scratch, which significantly reduces the development time.
2. Lower Costs: Building applications using low-code development platforms requires fewer resources, which means lower development costs. By reducing the need for manual coding, companies can lower the number of developers required to build an application, leading to a significant reduction in development costs.
3. Increased Collaboration: Low-code development platforms enable business stakeholders to work together more effectively. The visual interface and pre-built components make it easy for stakeholders to provide feedback, resulting in more effective collaboration between developers and business stakeholders.
4. Better Agility: Low-code development platforms enable developers to quickly make changes to the application as per changing business needs. This agility is critical in today's fast-paced business environment.

IMPACT OF LOW-CODE DEVELOPMENT PLATFORMS

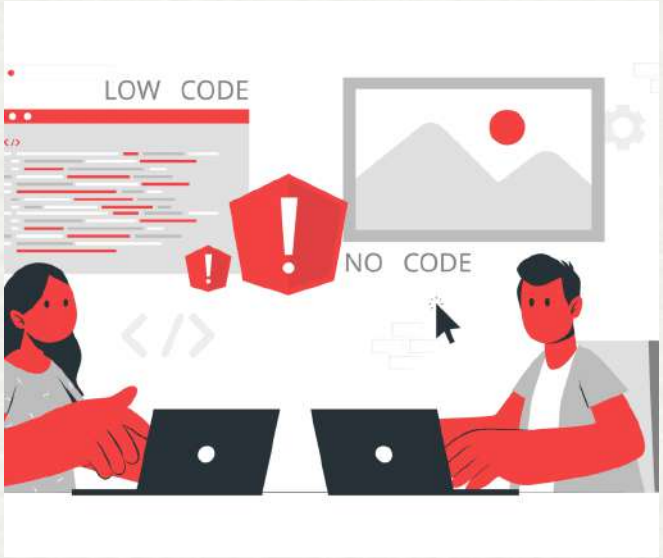
Low-code development platforms are changing the software development landscape in several ways. :

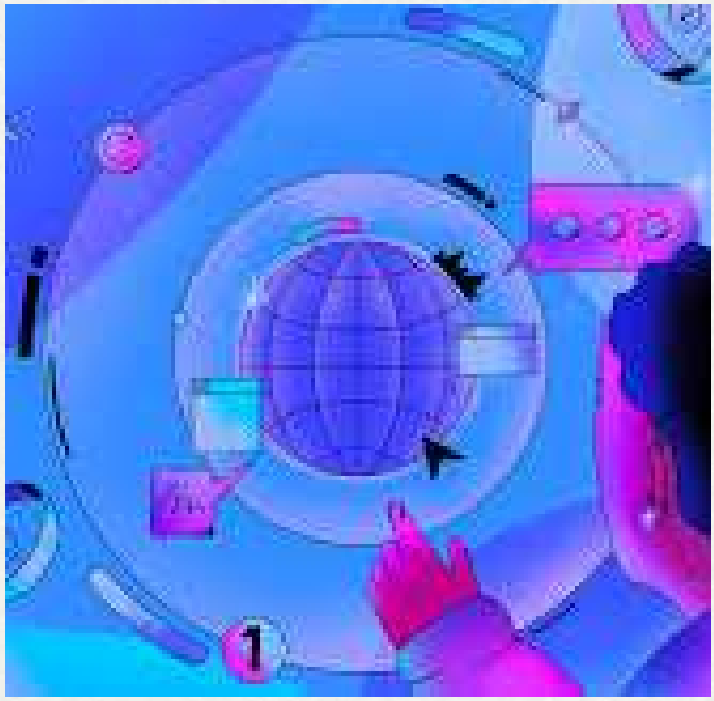
1. Democratization of Software Development: Low-code development platforms are making it possible for non-technical stakeholders to build applications. This democratization is reducing the reliance on developers, resulting in more innovative solutions as individuals from different business functions bring their perspectives to the application development process.
2. Improved Collaboration: Low-code development platforms are empowering business stakeholders to become more involved in the development process, resulting in more efficient and effective collaboration. This approach is leading to better-designed applications that meet business needs more effectively.
3. Increased Speed of Innovation: Low-code development platforms enable developers to build applications at a faster pace, resulting in a quicker time to market. This speed of innovation is giving companies a competitive edge in the marketplace.

CHALLENGES OF LOW-CODE DEVELOPMENT PLATFORMS

While low-code development platforms offer several benefits, there are also some challenges that organizations need to be aware of. Here are some of the most significant challenges:

1. Limited Customization: Low-code development platforms are best suited for building applications that require standard functionality. For applications that require extensive customization, developers may still need to write custom code.
2. Vendor Lock-in: Organizations that use low-code development platforms are often dependent on the vendor for ongoing support and maintenance. This dependence may make it challenging for organizations to switch to a different platform in the future.
3. Security Concerns: Low-code development platforms often require developers to share access to the platform, which may raise security concerns. Organizations need to ensure that adequate security measures are in place to protect their data and applications.





CONCLUSION

Low-code development platforms are transforming the software development landscape by offering a more efficient, cost-effective, and collaborative approach to building applications. Organizations that use low-code development platforms can benefit from a faster time to market, reduced development costs, improved collaboration, and better agility. While there are challenges that organizations need to be aware of, low-code development platforms are likely

Author:
1.Aaditya Dhondkar
2.Gaurang Khanderay
3.Yogesh Palode

ROBOTICS

ROBOTICS:

Robotics is a branch of engineering that involves the conception, design, manufacture and operation of robots. The objective of the robotics field is to create intelligent machines that can assist humans in a variety of ways.

Robotics can take on a number of forms. A robot may resemble a human, or it may be in the form of a robotic application, such as robotic process automation (RPA), which simulates how humans engage with software to perform repetitive, rules-based tasks.

While the field of robotics and exploration of the potential uses and functionality of robots have grown substantially in the 20th century, the idea is certainly not a new one.

HISTORY OF ROBOTICS

The term robotics is an extension of the word robot.One of its first use came from Czech writer Karel Čapek, who used the word in his play,Rossum's Universal Robots, in 1920.

Perhaps about the year 2020 the process will have produced the first broadly competent “universal robots” with lizardlike minds that can be programmed for almost any routine chore.

By 2030 second-generation robots with trainable mouselike minds may become possible. . Besides application programs, these robots may host a suite of software “conditioning modules” that generate positive- and negativereinforcement signals in predefined i crcumstances.

By 2040 computing power should make third-generation robots withmonkeylike minds possible. Such robots would learn from mental rehearsalsin simulations that would model physical, cultural, and psychologicalfactors.

Robots have a wide range of uses and applications across different industries and fields including:

Manufacturing and production: Robots are widely used in the manufacturing sector for tasks such as assembly, inspection, and packaging. They can work in hazardous or repetitive environments, reducing the risk of injury to human workers and increasing productivity.

Healthcare: Robots are used in the healthcare for various purposes, such as assisting in surgery, rehabilitation, and elderly care. For example, surgical robots can perform precise movements and reduce the risk of human error during operations.

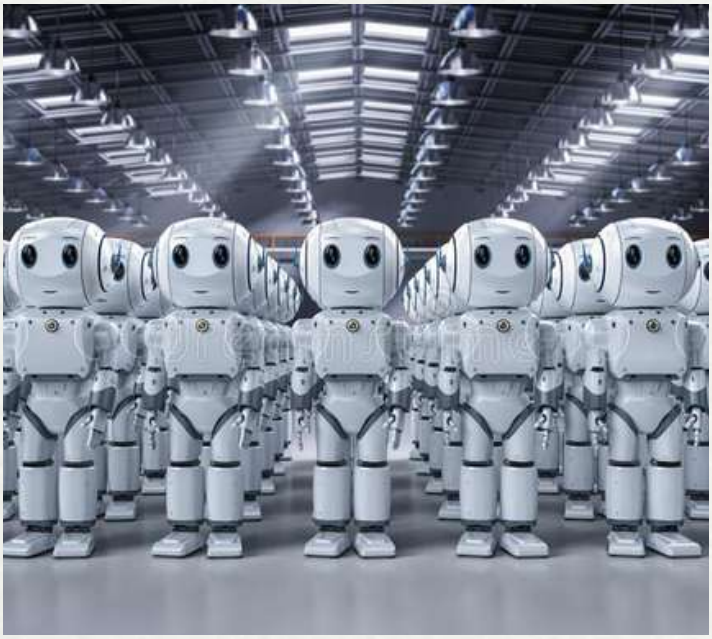
Agriculture: Agricultural robots are used for tasks such as planting, harvesting, and monitoring crops. They can help increase efficiency and reduce the need for manual labor in agriculture.

Retail and logistics: Retail and logistics robots are used for tasks such as inventory management, order fulfillment, and customer service. They can help increase efficiency and reduce costs in these industries.

Space exploration: Robots are used for space exploration, including missions to Mars and other planets. They can perform tasks such as collecting and analyzing data, drilling for samples, and mapping the terrain.

Search and rescue: Robots are used in search and rescue operations, where they can access dangerous or difficultto-reach areas to search for survivors or provide assistance

Military: Robots are used in military operations for tasks such as reconnaissance, surveillance, and bomb disposal.



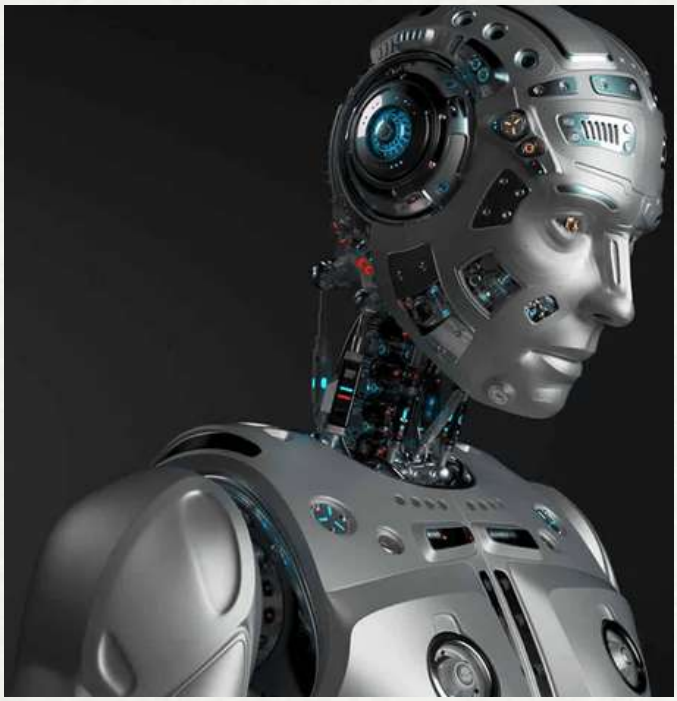
A D V A N T A G E

There are several advantages of robotics, some of which are:

1. **Precision:** Robots can perform tasks with high precision, accuracy, and repeatability that is difficult for humans to achieve. They can carry out tasks with consistent quality and precision without getting tired or making mistakes.
2. **Efficiency:** Robots can work continuously without taking breaks or getting tired, leading to increased productivity and efficiency. They can also perform tasks that are too dangerous or tedious for humans to undertake.
3. **Cost Savings:** Robots can help organizations reduce labor costs by automating various tasks. They can also help reduce production costs by minimizing scrap and rework.
4. **Flexibility:** Robots can be programmed to perform a wide range of tasks, making them highly adaptable to changing production needs. They can also perform tasks in hazardous or difficult-toreach areas.

DISADVANTAGES:

1. **High Cost:** One of the major disadvantages of robotics is the high cost of design, manufacturing, and implementation. The advanced robotics technology is expensive in every aspect, from purchasing to maintenance, and requires a significant financial investment.
2. **Lack of Flexibility:** Robots are designed to perform specific tasks, and are not easily adaptable when it comes to new, non-standard jobs. They need to be reprogrammed or redesigned to make changes within their function, unlike human workers who can easily adapt to new challenges.
3. **Job Loss:** The rise of robotic technology has led to a decrease in job opportunities for human workers, particularly in industries such as manufacturing, where robots can perform tasks more efficiently and for longer hours without fatigue.
4. **Technical Issues:** Robotics systems are complex and require a high level of technical expertise to design, develop, and repair.



CONCLUSION

Today we find most robots working for people in industries, factories, warehouses, and laboratories. Robots are useful in many ways. For instance, it boosts economy because businesses need to be efficient to keep up with the industry competition. Therefore, having robots helps business owners to be competitive, because robots can do jobs better and faster than humans can, e.g. robot can built, assemble a car. Yet robots cannot perform every job; today robots roles include assisting research and industry. Finally, as the technology improves, there will be new ways to use robots which will bring new hopes and new potentials.

Author:
1.Arya Dandnaik
2.Shivani Khanderay

CLOUD COMPUTING

CLOUD COMPUTING

Cloud computing is a relatively new approach in the field of information technologies. It involves storing and accessing data and applications over the internet, rather than through a physical server or computer. As one of its core implementations, cloud technology has gained a lot of attention in recent years. It represents the very core of modern IT infrastructure and development. This article is meant to provide a brief introduction to the fundamental concepts of cloud computing, including its key components and benefits.

INTRODUCTION

Cloud computing and its associated technologies have begun to shape and define new aspects in the computer science and information technology fields. The need for flexible and scalable computing resources has been growing rapidly, and in the past decade, cloud computing has emerged as a viable solution.

While there are still debates about the best ways to use cloud technology and its potential risks, one thing is certain: it has brought something revolutionary to the world, and it is up to the users to decide how to leverage it.

Some will take advantage of cloud computing to develop their own applications for solving various problems in society, while others will invest in cloud-based solutions or simply use cloud services to improve their business operations.

ESSENTIALS -

Cloud computing is a digital technology designed to work as a flexible and scalable computing infrastructure that allows for the exchange of data and applications over a network that is not reliant on any central authority, such as a government or bank, to uphold or maintain it.

It is a decentralized system for processing and storing data, eliminating the need for traditional intermediaries, such as physical servers, when resources are being used between two entities. Individual data ownership records are stored in a digital ledger, which is a computerized database using strong cryptography to secure transaction records, control the creation of additional data, and verify the transfer of data.

Despite its name, cloud computing is not considered to be computing in the traditional sense, and while varying treatments have been applied to it, including classification as a service, platform, and infrastructure, cloud computing is generally viewed as a distinct technology class in practice. Some cloud schemes use validators to maintain the infrastructure. In a pay-as-you-go model, users pay for the computing resources they use on a per-use basis. Generally, these users get additional computing resources over time via network upgrades, software updates, or other such reward mechanisms. Cloud computing does not exist in physical form (like a computer or server) and is typically not controlled by a central authority. Cloud computing typically uses decentralized control as opposed to a centralized server model. When a cloud infrastructure is set up, it can be considered centralized if managed by a single provider. When implemented with decentralized control, each cloud infrastructure works through distributed technology, typically a network of interconnected servers, that serves as a public computing resource database. Traditional computing models, as well as technological factors, have modest exposures to cloud computing returns. The first mainstream cloud provider was Amazon Web Services, which was first released as a public service in 2006. As of March 2022, there were more than 100 cloud providers in the marketplace, of which more than 10 had a market share exceeding $1 billion.

CLOUD COMPUTING TECHNOLOGY

Cloud computing is a type of computing model that relies on a network of remote servers hosted on the internet to store, manage, and process data. It eliminates the need for local servers and physical storage devices. Cloud computing offers several advantages, including cost savings, scalability, and flexibility.

There are three main types of cloud computing: public, private, and hybrid. Public clouds are owned and operated by third-party providers, while private clouds are managed by the organization that uses them. Hybrid clouds combine elements of both public and private clouds. The key components of cloud computing are virtualization, software-defined networking, and automation. Virtualization enables multiple operating systems to run on a single physical machine, while software-defined networking allows for more flexible and efficient network management. Automation streamlines processes and reduces manual labor, making it easier to manage large-scale cloud infrastructure.

"There is no cloud it is just someone else's computer."

SECURITY CONSIDERATIONS

As more organizations migrate their data and applications to the cloud, ensuring the security of these resources has become a top priority. While cloud providers typically have robust security measures in place, customers still need to take steps to ensure the security of their data and applications. One of the key considerations for securing data and applications in the cloud is implementing strong access controls, which includes limiting access to only those who need it, using strong passwords or two-factor authentication, and regularly reviewing access logs to identify potential security risks. Another important step is encrypting sensitive data both in transit and at rest, which can help protect data from interception or theft, even if it falls into the wrong hands. In addition to access controls and encryption, organizations should also monitor for potential security breaches, including regularly reviewing logs and network traffic to identify potential threats.

CONCLUSION

Moving on to cloud computing, it is a model of providing on-demand access to shared computing resources over the internet. It enables users to access data, applications, and services from anywhere in the world, without the need for physical hardware. There are several benefits of cloud computing such as scalability, cost-effectiveness, flexibility, and increased efficiency. Cloud computing can be categorized into three main service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

Cloud computing is widely used in businesses of all sizes, from startups to large enterprises, due to its ability to offer cost-effective solutions for data storage, processing, and management. With the increasing adoption of cloud computing, it is expected that it will continue to revolutionize the way businesses operate and deliver services to their customers.

Authors :

1. Piyush Holkar
2. Shubham Jadhav
3. Ishan Chipate
4. Mayur Pandit

REFRENCES

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3798877

https://www.redhat.com/en/topics/devops

https://www.altexsoft.com/blog/engineering/devops-principles-practices-and-devops-engineer-role/

https://www.twi-global.com/technical-knowledge/faqs/what-is-digital-twin

https://ieeexplore.ieee.org/document/8345547

https://www.investopedia.com/metaverse-definition-5206578

https://www.fortinet.com/cn/resources/cyberglossary/wireless-network

https://azumo.com/insights/the-rise-of-low-code-and-no-code-development-platforms-how-they-are-revolutionizing-the-software-development

https://www.techtarget.com/whatis/definition/robotics#:~:text=Robotics%20is%20a%20branch%20of,on%20a%20number%20of%20forms.

https://www.investopedia.com/terms/c/cryptocurrency.asp

https://www.simplilearn.com/tutorials/blockchain-tutorial/what-is-cryptocurrency

https://www.zdnet.com/article/what-is-cloud-computing-everything-you-need-to-know-about-the-cloud/r

https://www.twi-global.com/technical-knowledge/faqs/simulation-vs-digital-twin

https://www.altexsoft.com/blog/digital-twins/

https://www.fisdom.com/what-is-metaverse-all-you-need-to-know-about-metaverse/

https://www.mendix.com/low-code-guide/

https://www.futurelearn.com/info/courses/begin-robotics/0/steps/2845

Bits & Bytes

TECHNICAL MAGAZINE

2022 - 2023 ISSUE - 1

Bits & Bytes

Presented by

Computer Department