New syllabus 2022-23

Chapter 12

Emerging Trends

Informatics Practices

Class XI (As per CBSE Board)

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Emerging Trends

Artificial Intelligence is comprised of two words Artificial and Intelligence, where Artificial means "man-made," and intelligence means "thinking power", hence AI means "a man-made thinking power."

Artificial Intelligence exists there ,where a machine can have human based skills such as learning, reasoning, and solving problems

According to the father of Artificial Intelligence, John McCarthy, it is "The science and engineering of making intelligent machines

Goals of AI

- To Create Expert Systems – The systems which holds intelligent behavior, learn, demonstrate, explain, and advice its users.
- To Implement Human Intelligence in Machines – Creating systems that can understand, think, learn, and behave like humans.

Applications of AI

AI has been dominant in various fields such as –

- **Gaming**
- **Natural Language Processing**
- **Expert Systems**
- **Vision Systems**
- **Speech Recognition**
- **Handwriting Recognition**
- **Intelligent Robots**

Artificial intelligence is a science and technology based on disciplines such as Computer Science, Biology, Psychology, Linguistics, Mathematics, and Engineering.

Emerging Trends

Difference between Normal Programming and AI Programming

	NORMAL/REGULAR PROGRAMMING	AI PROGRAMMING
INPUT	input is a sequence of alphanumeric symbols presented and stored as per some given set of previously stipulated rules and that uses a limited set of communication media such as keyboard, mouse, disc, etc.	input may be a sight, sound, touch, smell or taste. Sight means one dimensional symbols such as typed text, two dimensional objects or three dimensional scenes.
PROCESSING	processing means manipulation of the stored symbols by a set of previously defined algorithms.	processing includes knowledge representation and pattern matching, search, logic, problem solving and learning.
OUTPUT	output is a sequence of alphanumeric symbols, may be in a given set of colors that is placed on such a medium as a CRT screen, paper, or magnetic disk.	output can be in the form of printed language and synthesized speech, manipulation of physical objects or locomotion i.e., movement in space.

Advantages of Artificial Intelligence

- **High Accuracy with less errors**: it takes decisions as per pre-experience or information.
- **High-Speed**
- **High reliability**: can perform the same action multiple times with high accuracy.
- **Useful for risky areas**: helpful in situations such as defusing a bomb, exploring the ocean floor, where to employ a human can be risky.
- **Digital Assistant**: Such as used by various E-commerce websites to show the products as per customer requirement.
- **Useful as a public utility**: such as a self-driving car which can make our journey safer and hassle-free, facial recognition for security purpose, Natural language processing to communicate with the human in human-language, etc.

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Artificial intelligence can be divided into three subfields:

- **Artificial intelligence**
- **Machine learning**
- **Deep learning**

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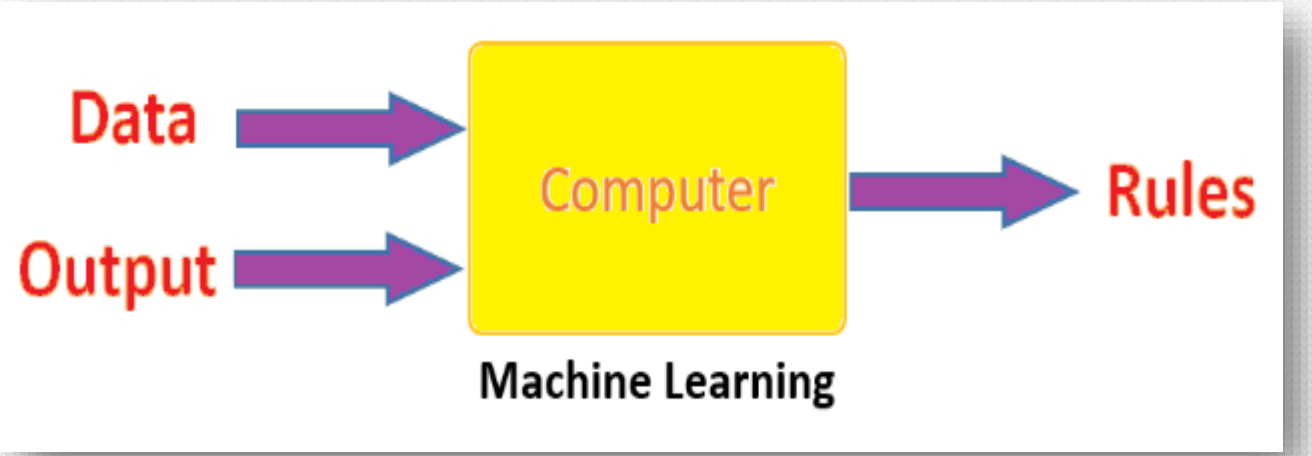
Machine Learning is a system that can learn from example through self-improvement and without being explicitly coded by programmer.

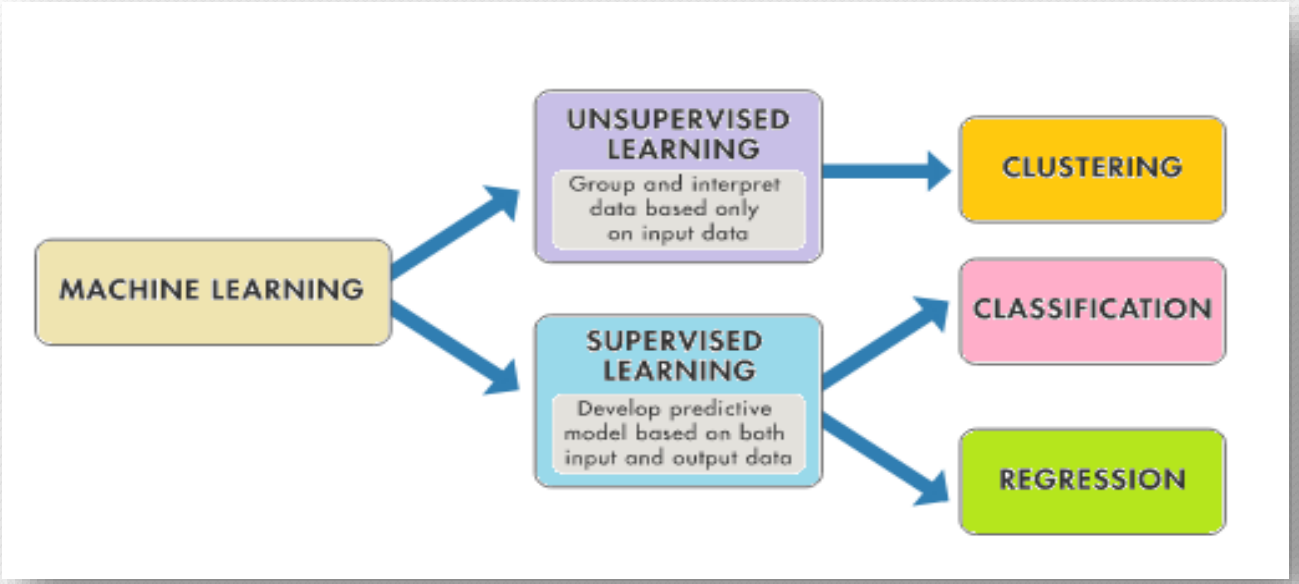
As its name, it gives the computer that makes it more similar to humans: The ability to learn.



Applications of Machine Learning

1. Image Recognition:
2. Speech Recognition
3. Traffic prediction:
4. Product recommendations:
5. Self-driving cars:
6. Email Spam and Malware Filtering:
7. Virtual Personal Assistant:
8. Online Fraud Detection:
9. Stock Market trading:
10. Medical Diagnosis:
11. Automatic Language Translation:

How machine learning works



Clustering is the most common unsupervised learning technique. It is used for exploratory data analysis to find hidden patterns or groupings in data. Applications for cluster analysis include gene sequence analysis, market research, and object recognition.

Classification techniques predict discrete responses—for example, whethera n email is genuine or spam, or whether a tumor is cancerous or benign.

Regression techniques predict continuous responses—for example, changes in temperature or fluctuations in power demand.

Natural Language Processing

NLP is a way of computers to analyze, understand and derive meaning from a human languages such as English, Spanish, Hindi, etc.

It is the technology that is used by machines to understand, analyse, manipulate, and interpret human's languages.

Components of NLP

There are the following two components of NLP -

1. Natural Language Understanding (NLU)
2. Natural Language Generation (NLG)

Advantages of NLP

- NLP helps to get a direct response within seconds.
- NLP offers exact answers to the question
- NLP helps to communicate with humans in their languages.
- It is very time efficient.
- To improve the efficiency of documentation processes, accuracy of documentation, and identify the information from large databases

Applications of NLP

- Question Answering
- Spam Detection
- Sentiment Analysis
- Machine Translation
- Spelling correction
- Speech Recognition
- Chatbot
- Information extraction

Emerging Trends

An "immersive experience" pulls a person into a new or augmented reality, enhancing everyday life via technology. It often use one or more technologies linked together.

The three pillars of immersive experiences are visual quality, sound quality, and intuitive interactions. Full immersion can only be achieved by simultaneously applied all these three.

How does Augmented Reality work

It involves technologies like S.L.A.M. (simultaneous localization and mapping), depth tracking (briefly, a sensor data calculating the distance to the objects), and the following components:

Cameras and sensors. Collecting data about user's interactions and sending it for processing.

Processing. AR devices eventually should act like little computersto be able to measure speed, angle, direction, orientation in space, and so on.

Projection. This refers to a miniature projector on AR headsets, which takes data from sensors and projects digital content

Reflection. Some AR devices have mirrors to assist human eyes to view virtual images.

Applications of AR

- Most popular applications of AR is gaming. New AR games provide much better experiences to players, some even promote a more active outgoing way of life (PokemonGo, Ingress).
- AR in retail may act to bring better customer engagement and retention, as well as brand awareness and more sales. Some features may also help customers make wiser purchases – providing product data with 3D models of any size or color.

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Virtual Reality (VR) is use of computer technology to create a simulated environment. Unlike traditional user interfaces, VR places the user inside an experience. Instead of viewing a screen in front of them, users are immersed and able to interact with 3D worlds/objects.

The Basics of How VR Works:

Every headset is used to perfect their approach to creating an immersive 3D environment. Each VR headset puts up a screen in front of eyes thus, eliminating any interaction with the real world. Two autofocus lenses are generally placed between the screen and the eyes that adjust based on individual eye movement and positioning. The visuals on the screen are rendered either by using a mobile phone or HDMI cable connected to a PC.

A frame rate of minimum 60fps, an equally competent refresh rate and minimum 100-degree field of view (FOV) is required for true VR

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Applications of VR:

- Automotive industry
- Healthcare
- Retail
- Tourism
- Real estate
- Architecture
- Gambling
- Learning and Development

Emerging Trends

Robotics:

Robotics is engineering and operation of machines that can autonomously or semi-autonomously perform physical tasks on behalf of a human being. Typically robots perform tasks that are either highly repetitive or too dangerous for a human to carry out safely.

In recent years, the field of robotics has begun to overlap with machine learning and artificial intelligence.

Big Data

Big Data is also data but with a huge size/volume and yet growing exponentially with time. In short such data is so large and complex that none of the traditional data management tools are able to store it or process it efficiently.

Benefits of Big Data Processing

- Businesses can utilize outside intelligence while taking decisions
- Improved customer service
- Early identification of risk to the product/services, if any
- Better operational efficiency

Characteristics Of Big Data

Volume – The name Big Data itself is related to a size which is enormous

Variety – Variety refers to heterogeneous sources and the nature of data, both structured and unstructured. During earlier days, spreadsheets and databases were the only sources of data considered by most of the applications as structured big data type. Nowadays, data in the form of emails, photos, videos, monitoring devices, PDFs, audio, etc. are also being considered in the analysis applications. This variety of unstructured data poses certain issues for storage, mining and analyzing data.

Velocity – means speed of generation of data. How fast the data is generated and processed to meet the demands, determines real potential in the data.

Variability – This refers to the inconsistency which can be shown by the data at times

Internet of Things-IOT

The IOT concept was initially proposed by a member of the Radio Frequency Identification (RFID) development community in 1999, and now it has become more relevant to the practical world as the use of mobile devices, embedded devices,communication, cloud computing and data analytics has increased.

Internet connects all people means "Internet of People"
IoT connects all things means "Internet of Things"

Interconnection of Things/Objects/Machines, e.g., sensors, mobilephones, electronic devices, home appliances, any existing items and interact with each other via Internet.

Internet of Things technology can include any sensor, electronic devices or software which are connected to the internet and can be utilized remotely and can exchange data. Here devices works themselves without human intervention for the welfare of humans.

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MAJOR CHARACTERISTICS OF IOT

- Very Large Scale
- Heterogeneity
- Pervasivity – Computing and Communication technologies embedded in our environments

How Does the Internet of Things Work?

The Internet of Things is an aggregation of internet enabled sensors, smart devices and software that can be manipulated by scripts, applications and user interfaces across long distances.

Applications of IOT

- **Smart house** - Suppose we are not at home and doubts starts in our mind. Did I turn the coffee maker off? Did I set the security alarm? etc. With a smart home,we can quiet all of these worries with a quick glance at smartphone/tablet. we can connect the devices and appliances in our home so they can communicate with each other and with us and can work with the commands given over smartphone remotely.

- **Smart car** - the driverless car (now a prototype) where taxis work based on AI and take the passengers safely and accurately to the desired destination.

Emerging Trends

Applications of IOT

- **Elderly care-** Patient surveillance can be life-saving; automatically detecting when someone falls down or when they begin to experience a heart attack so that emergency care can be sent immediately.
- **Disaster warning-** Sensors can collect critical information about the environment, allowing for early detection of environmental disasters like earthquakes, tsunamis, etc., thus saving lives.
- **Delivery Drones –** drones being used to deliver item with the help of smart grid/geospatial data.
- **A smart city** is a framework, predominantly composed of Information and Communication Technologies (ICT), to develop, deploy, and promote sustainable development practices to address growing urbanization challenges. A big part of this ICT framework is essentially an intelligent network of connected objects and machines that transmit data using wireless technology and the cloud.

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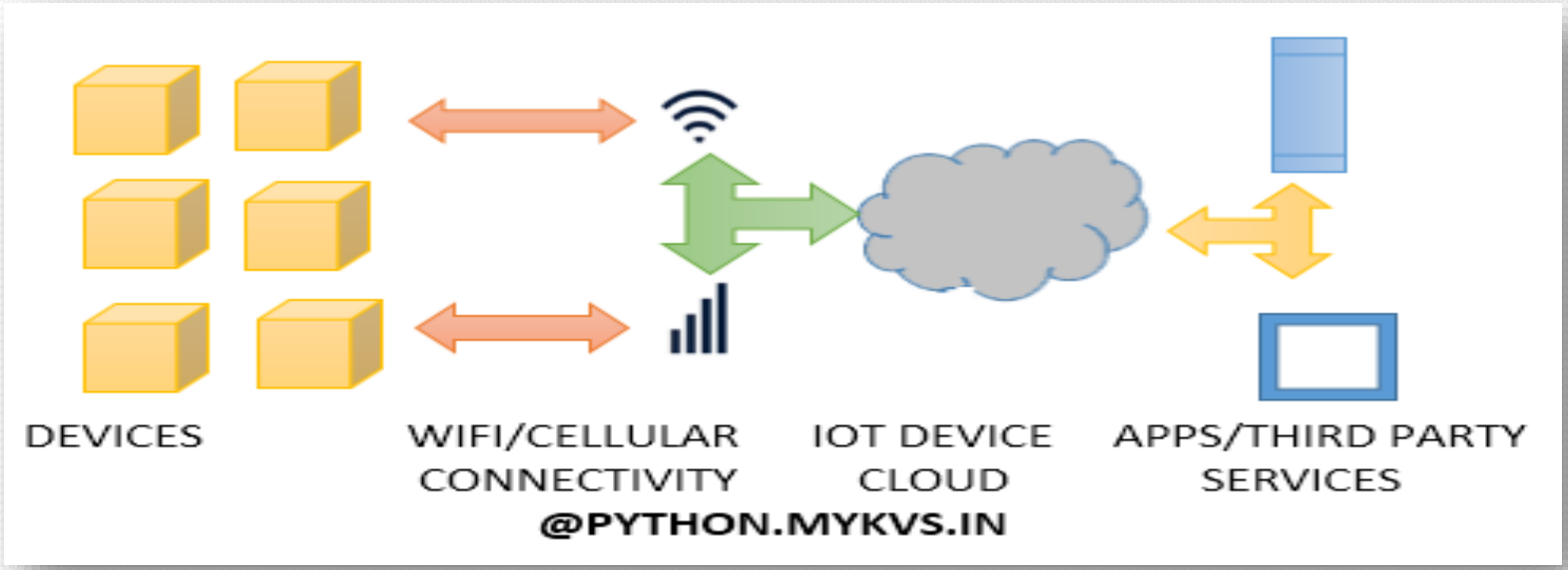
What is an IoT Platform?



It is an integrated service which offers the things to bring physical objects online. It easily allow to configure devices for machine-to-machine communication through millions of devices connects simultaneously .

What is an IoT Platform?

Sensors are useful and very important for the devices in order to fetch the data. The data can be real-time, which includes the current temperature, pressure or humidity.

List of Sensors most commonly used in the IoT devices,

- Temperature Sensor
- Pressure Sensor
- Proximity Sensor
- Accelerometer and Gyroscope Sensor
- IR Sensor
- Optical Sensor
- Gas Sensor
- Smoke Sensor

Emerging Trends

IoT Platform Types

- End-to-end IoT Platforms - provide the hardware, software, connectivity, security, and device management tools to handle connection of millions of concurrent device.
- Connectivity Management Platforms – It offer low power and low cost connectivity management solutions through Wi-Fi and cellular technologies.
- IoT Cloud Platforms – It's aim to get rid of the complexity of building our own complex network
- Data Platform – It deals with data in some way with the tools we need to route device data and manage / visualize data analytics.

Emerging Trends

In Cloud Computing, Cloud refers to a Internet or Network or present at remote location.

Cloud Computing refers to remote access of hardware/software resources for access, configuration, manipulation.Cloud computing offers online data storage, infrastructure, and application. Applications such as customer relationship management (CRM) ,e-mail, web conferencing, execute on cloud. It can work on public and private networks, i.e., WAN, LAN or VPN.

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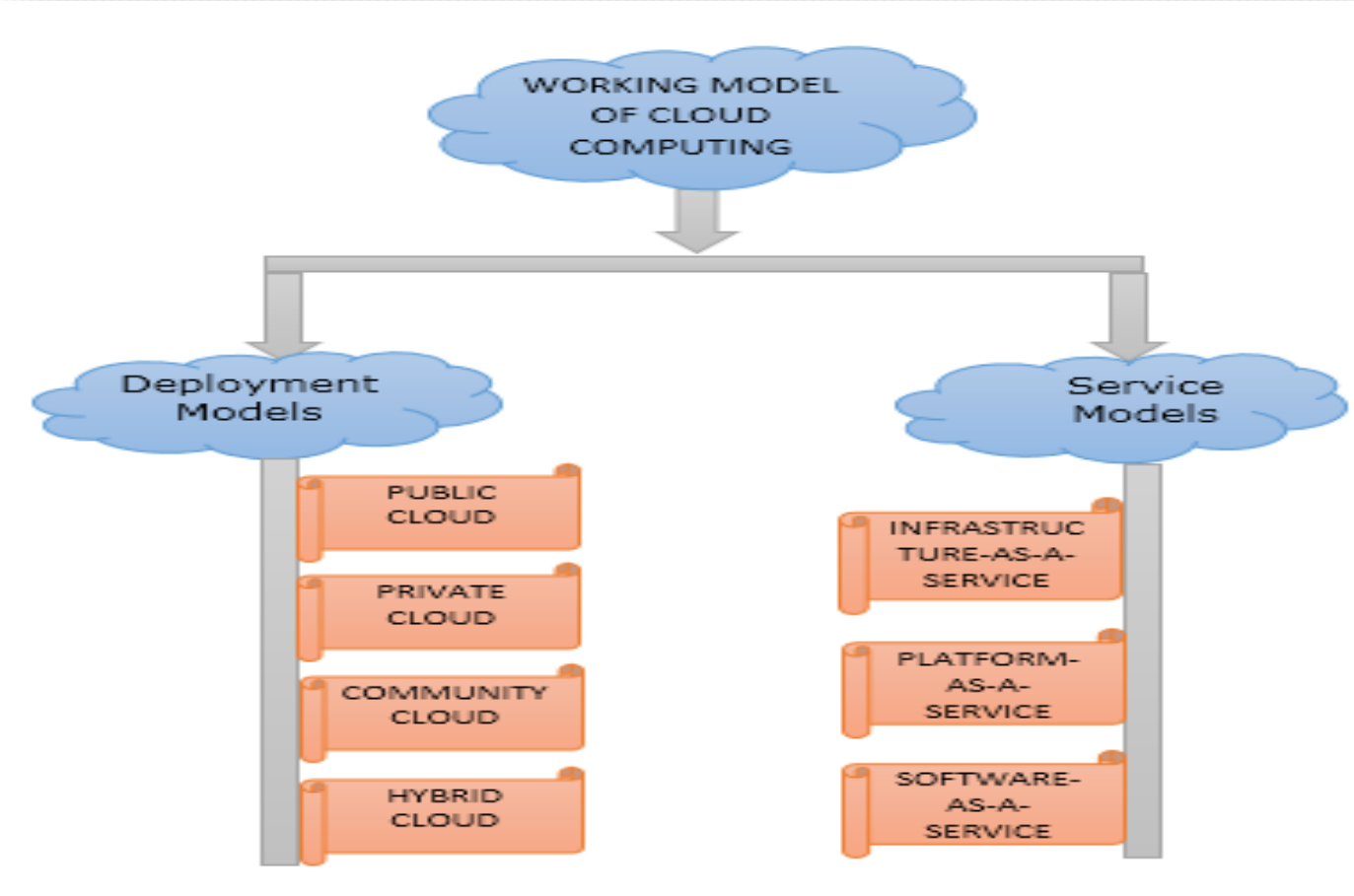
Uses of cloud computing

- Create new apps and services
- Store, back up and recover data
- Host websites and blogs
- Stream audio and video
- Deliver software on demand
- Analyze data for patterns and make predictions

Cloud computing offers platform independency, because software is not required to be installed locally on the PC.Thus applications are being mobile and collaborative.

WORKING MODELS FOR CLOUD COMPUTING



WORKING MODELS FOR CLOUD COMPUTING

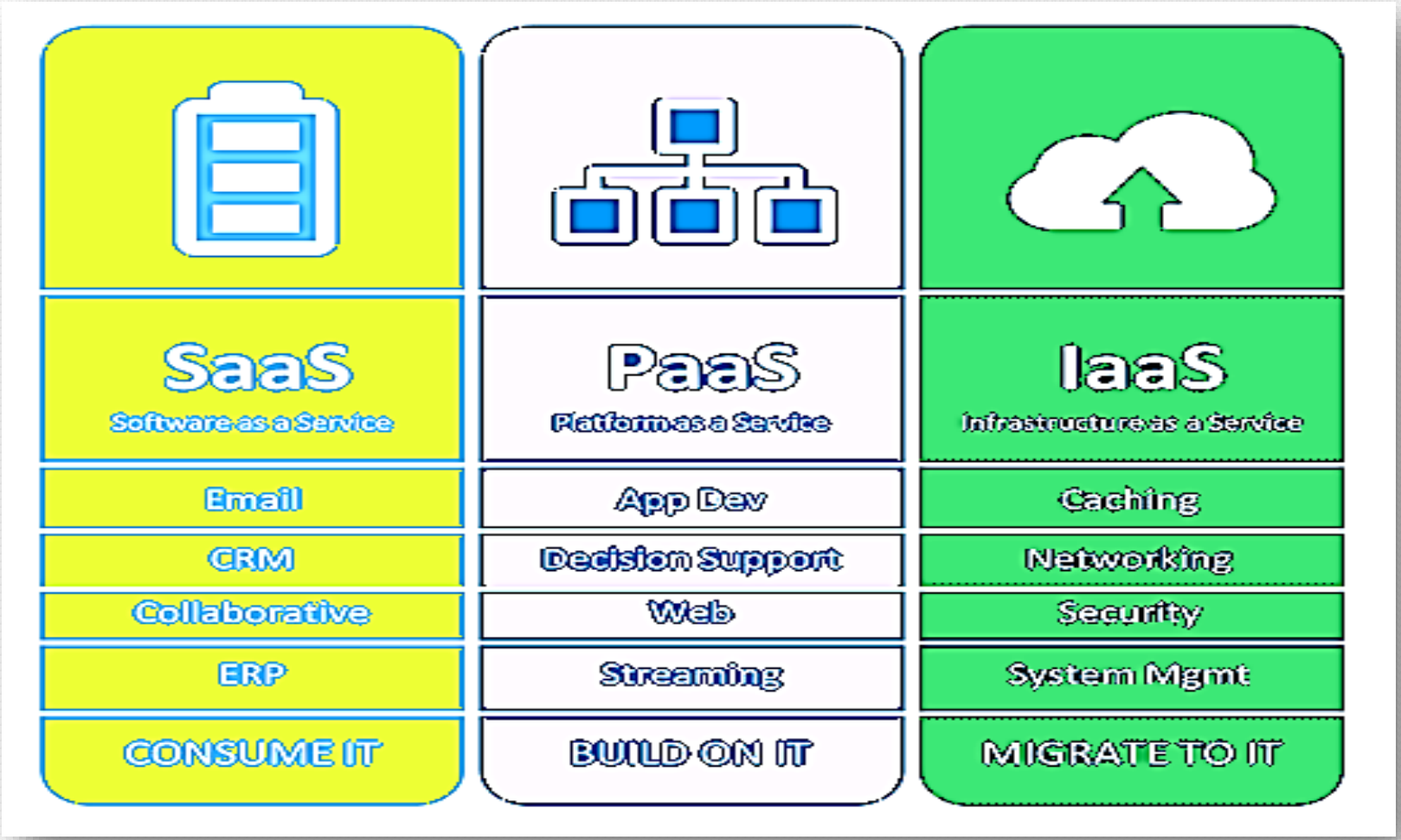
DEPLOYMENT MODEL

- PUBLIC CLOUD –
  For general public.
- PRIVATE CLOUD –
  For an organization only
- COMMUNITY CLOUD -
  For group of organizations.
- HYBRID CLOUD –
  Mixture of public and private cloud

DIFFERENCE BETWEEN PUBLIC AND PRIVATE CLOUD

Public Cloud	Private Cloud
Hosted at service provider site	Hosted at Enterprise or service provider server
Cheaper than private cloud	Costlier than public cloud
Utilizes shared infrastructure	Utilizes own infrastructure
Supports connectivity over internet	Supports connectivity over internet/Private WAN
Require higher level of security	Require medium level of security
Supports multiple customers	Supports one customer
Shared server	Dedicated server
Fixed cost	Variable cost
Multitenant architecture	Dedicated customer architecture
Example - ESDS's eNlight Cloud, Amazon Elastic Compute Cloud (EC2), IBM's Blue Cloud, Sun Cloud, Google AppEngine and Windows Azure Services Platform	Hewlett Packard Enterprise (HPE) -- offers the Helion Cloud Suite software, Helion CloudSystem hardware, Helion Managed Private Cloud and Managed Virtual Private Cloud services

WORKING MODELS FOR CLOUD COMPUTING



Software as a Service (SaaS)

SaaS is a fully-developed software solution ready for purchase and use over the internet on a subscription basis. The SaaS provider manages the infrastructure, operating systems, middleware, and data necessary to deliver the program, ensuring that the software is available whenever and wherever customers need it. Many SaaS applications run directly through web browsers, eliminating the need for downloads or installations. This greatly reduces software management issues for internal IT teams.

Examples of SaaS: Microsoft Office 365, Salesforce, Cisco WebEx, Google Apps.

Platform as a Service (PaaS)

PaaS is extremely helpful for any company that develops software and web-based applications. Many of the tools needed to develop for multiple platforms (computers, mobile devices, browsers, etc) can be quite expensive. By using PaaS, customers can access the development tools they need, when they need them, without having to purchase them outright. Since the platform is accessible over the internet, remote development teams can all access the same assets to speed up product development.
Examples of PaaS: AWS Elastic Beanstalk, Apache Stratos, Google App Engine, Microsoft Azure

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Infrastructure as a Service (IaaS)

it provides a completely virtualized computing infrastructure that is provisioned and managed over the internet. An IaaS provider manages the physical end of the infrastructure (servers, data storage space, etc) in a data center, but allows customers to fully customize those virtualized resources to suit their specific needs. Examples of IaaS: Microsoft Azure, Amazon Web Services (AWS), Cisco Metacloud, Google Compute Engine (GCE)

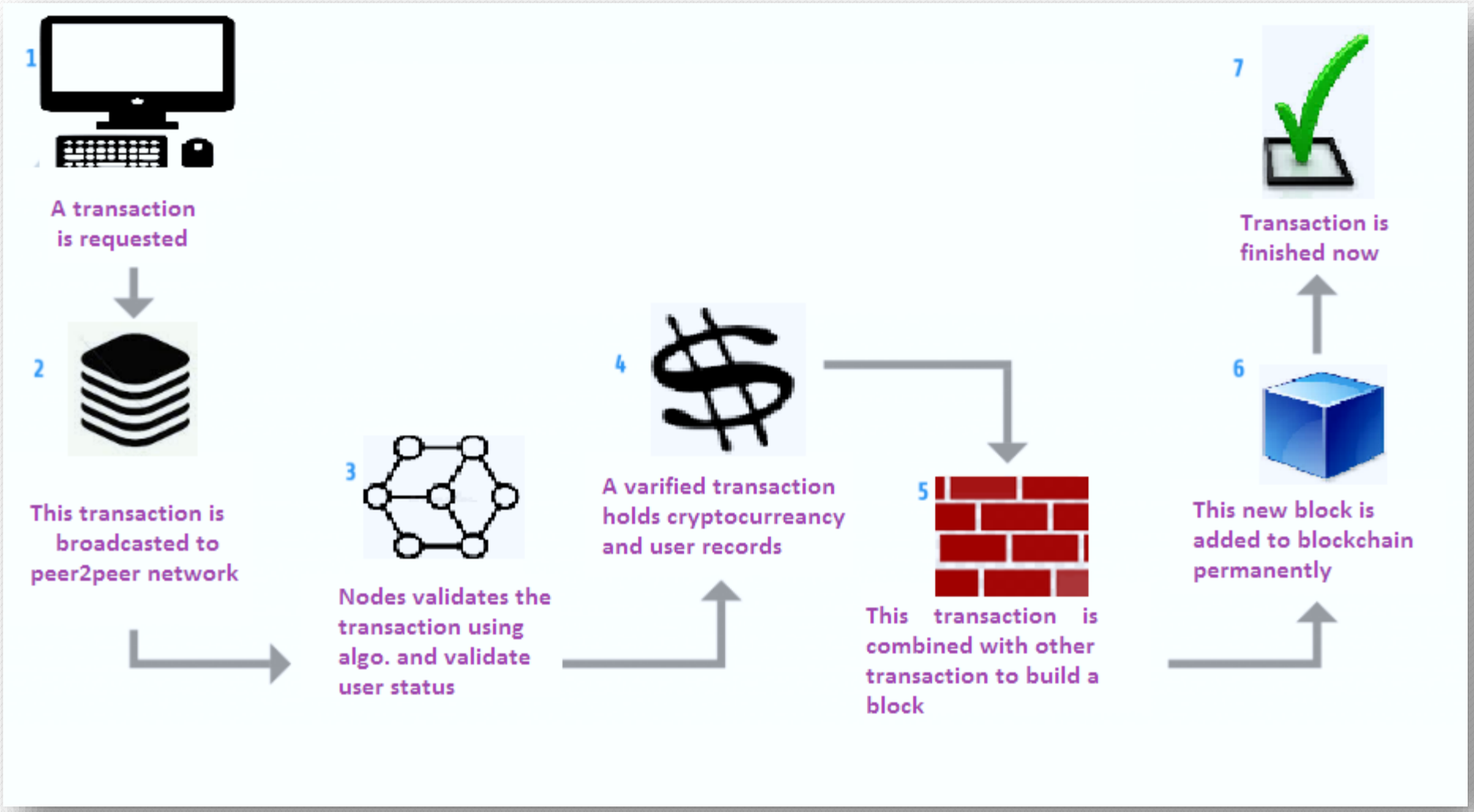
Emerging Trends

Blockchain Technology typically refers to the transparent, trustless, publicly accessible ledger that allows us to securely transfer the ownership of units of value using public key encryption and proof of work methods.

The technology uses decentralized consensus to maintain the network, means not centrally controlled by a bank, corporation, or government. In fact, the larger the network grows and becomes increasingly decentralized, the more secure it becomes.

The potential for blockchain technology is not limited to bitcoin. As such, it has gained a lot of attention in a variety of industries including: financial services, charities and nonprofits, the arts, and e-commerce.

How Blockchain Technology Works



Emerging Trends

Grid computing is a computer network in which each computer's resources are shared with every other computer in the system. Processing power, memory and data storage are all community resources that authorized users can tap into and work/use for specific tasks.