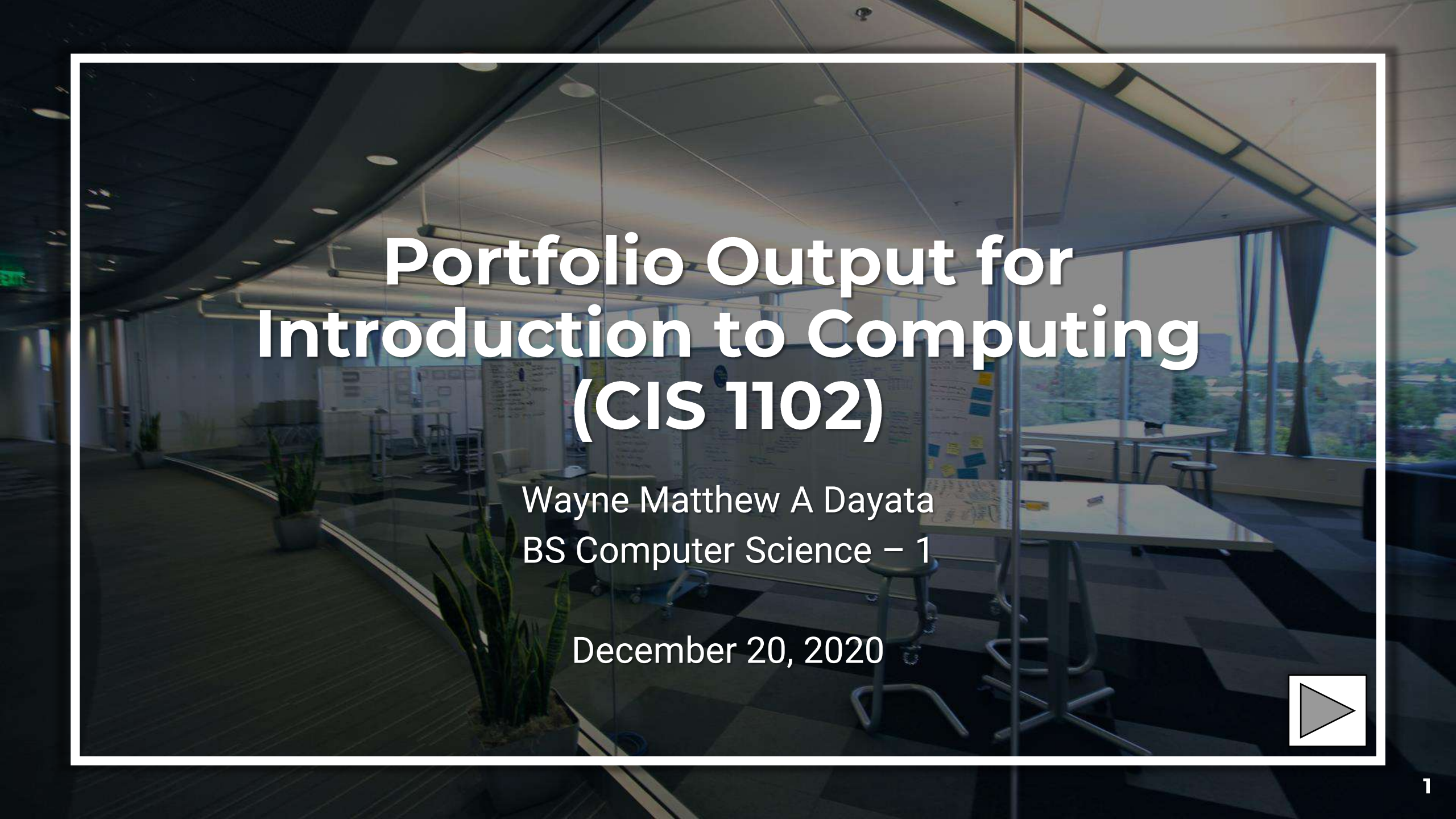


Portfolio Output for Introduction to Computing (CIS 1102)

Wayne Matthew A Dayata
BS Computer Science – 1

December 20, 2020

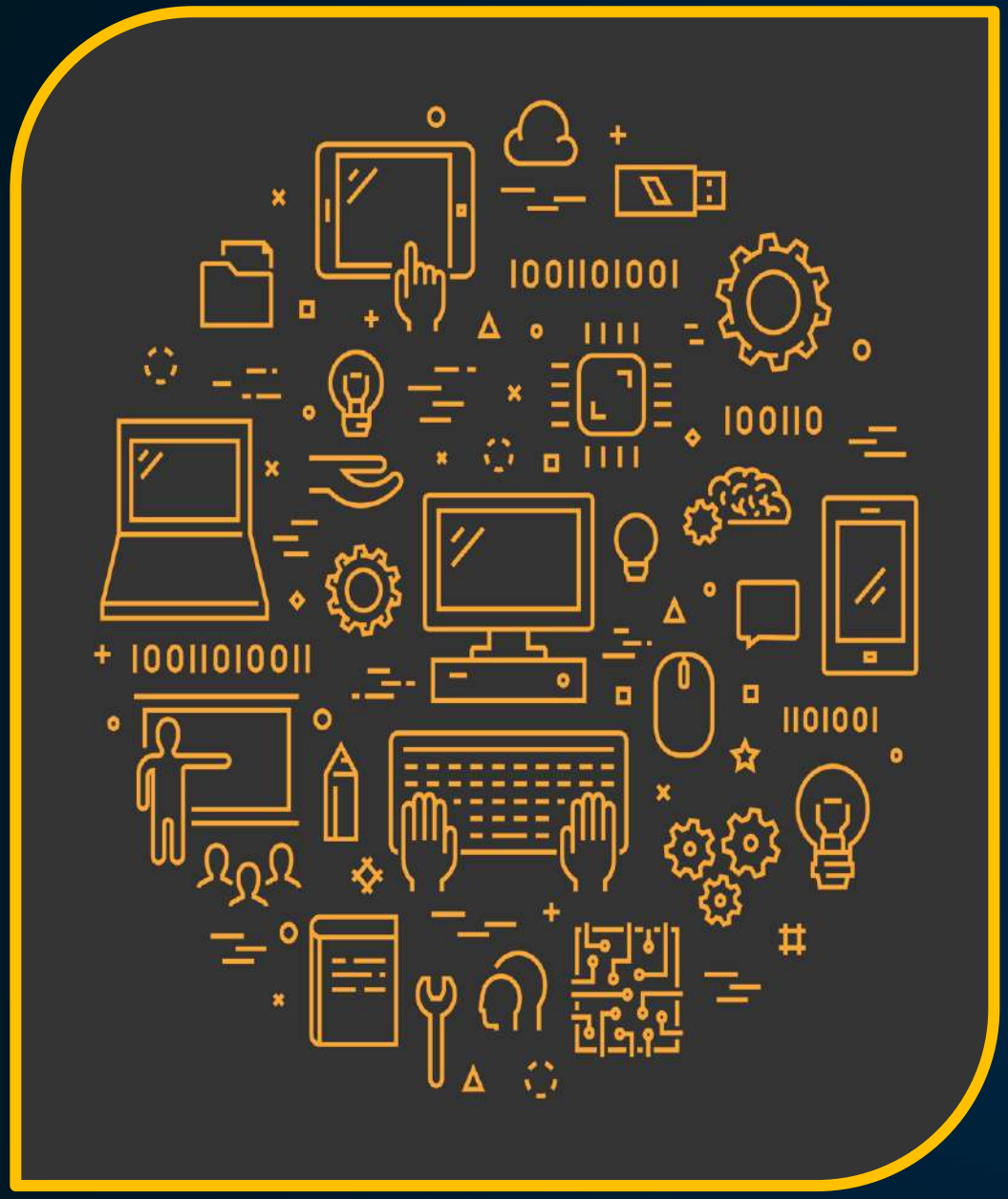
TOPIC COVERAGE

(Click on the topic to advance to that section)

01

COMPUTER SCIENCE OVERVIEW AND ITS SCOPE

Pages 3-21



WHAT COMPUTER SCIENCE IS

Computer science is the study of the theoretical foundations of information and computation and their implementation and application in computer systems. It is also concerned with the design, development, and analysis of software and hardware.

The field of computer science is broad, covering the concepts of design, logical reasoning, and problem solving — all valuable well beyond the computer science classroom. The ability to create and adapt new technologies distinguishes Computer Science from computer literacy, which focuses more on using existing technologies.

Computers are becoming a part of everything we do; and thus knowledge about computers is an essential requirement.

MORE ABOUT COMPUTER SCIENCE

Computer science is considered as part of a family of five separate yet interrelated disciplines:

> Computer engineering, computer science, information systems, information technology, and software engineering.

Computer science draws some of its foundations from mathematics and engineering and therefore incorporates techniques from areas such as

> Queueing theory, probability and statistics, and electronic circuit design.

Computer science also makes heavy use of hypothesis testing and experimentation during the conceptualization, design, measurement, and refinement of new algorithms, information structures, and computer architectures.

DEVELOPMENT OF COMPUTER SCIENCE

Computer science emerged as an independent discipline in the early 1960s, although the electronic digital computer that is the object of its study was invented some two decades earlier.

Mathematics is the source of two key concepts in the development of the computer — the idea that all information can be represented as sequences of zeros and ones and the abstract notion of a “stored program.”

- The relative ease with which two states (e.g., high and low voltage) can be realized in electrical and electronic devices led naturally to the binary digit, or bit, becoming the basic unit of data storage and transmission in a computer system – originating the Binary Number System.

DEVELOPMENT OF COMPUTER SCIENCE

Electrical engineering provides the basics of circuit design, the idea that electrical impulses input to a circuit can be combined using Boolean algebra to produce arbitrary outputs.

- The advances in this field resulted in the **invention of the transistor and circuits miniaturization, along with the invention of electronic, magnetic, and optical media for information storage and transmission**.

Data processing systems provided early ideas from which various concepts such as sorting, searching, databases, information retrieval, and graphical user interfaces (GUI) evolved.

- Large corporations housed computers that stored information that was central to the activities of running a business—**payroll, accounting, inventory management, production control, shipping, and receiving**.

SIGNIFICANT BREAKTHROUGHS IN COMPUTING

1936
Alan Turing's invention of the world's first programmable computer

Early 1950s
Development of assembly language computers

Late 1950s
Introduction of computerized graphical devices (CRT technology)

1960s
Development of operating systems involving automatic I/O handling and program execution; magnetic disk storage

1970s
Development of Wide-area computer networks (WAN)

Early 1980s
Emergence of visual computing: Bitmap technology and high-resolution display screens; the internet

Late 1980s and 1990s
Emergence of graphical user interfaces (GUI) seen in operating systems (Windows, Xerox (currently Apple))

Currently developing fields
Platform-based development, parallel and distributed computing, information assurance and security

BRANCHES OF COMPUTER SCIENCE

The following outline is provided as an overview of and introduction to computer science:

MATHEMATICAL FOUNDATION

COMPUTATIONAL SCIENCE

DATA STRUCTURES AND ALGORITHMS

PROGRAMMING FUNDAMENTALS

PARALLEL AND DISTRIBUTED COMPUTING

SOFTWARE ENGINEERING

COMPUTER ARCHITECTURE

COMMUNICATIONS AND SECURITY

INFORMATION MANAGEMENT

ARTIFICIAL INTELLIGENCE

COMPUTER GRAPHICS

SCIENTIFIC COMPUTING

MATHEMATICAL FOUNDATIONS

Involves the fundamental mathematical concepts required to create programs, software, and other computing devices. Majority of them revolve around the concepts of logic, complex analysis and arrangement of data, and proving mathematical relationships that may be useful and applicable in the other sub-disciplines in computer science.

1 **MATHEMATICAL LOGIC**

Boolean logic and other ways of modeling logical queries; the uses and limitations of formal proof methods

2 **NUMBER THEORY**

Theory of proofs and heuristics for finding proofs in the simple domain of integers. Used in cryptography as well as a test domain in artificial intelligence.

3 **GRAPH THEORY**

Foundations for data structures and searching algorithms.

4 **GAME THEORY**

Useful in artificial intelligence and cybernetics.

COMPUTATIONAL SCIENCE

Computational science applies computer simulation, scientific visualization, mathematical modeling, algorithms, data structures, networking, database design, symbolic computation, and high-performance computing to help advance the goals of various disciplines.

1 **AUTOMATA THEORY**

Different logical structures for solving problems.

2 **COMPUTABILITY THEORY**

What is calculable with the current models of computers. Proofs developed by Turing and others provide insight into the possibilities of what may and may not be computed.

3 **COMPUTATIONAL COMPLEXITY THEORY**

Fundamental bounds (especially time and storage space) on classes of computations.

4 **QUANTUM COMPUTING THEORY**

Explores computational models involving quantum superposition of bits.

DATA STRUCTURES AND ALGORITHMS

An algorithm is a specific procedure for solving a well-defined computational problem. The development and analysis of algorithms is fundamental to all aspects of computer science: artificial intelligence, databases, graphics, networking, operating systems, security, and so on.

1 **ALGORITHMS**

Sequential and parallel computational procedures for solving a wide range of problems. Also considers and compares the complexity of each algorithm presented to maximize the efficiency of programs created.

2 **DATA STRUCTURES**

What is calculable with the current models of computers. Proofs developed by Turing and others provide insight into the possibilities of what may and may not be computed.

PROGRAMMING FUNDAMENTALS

Programming languages are the languages with which a programmer implements a piece of software to run on a computer. The earliest programming languages were assembly languages, not far removed from the binary-encoded instructions directly executed by the computer. By the mid-1950s, programmers began to use higher-level languages.

1 **COMPILER THEORY**

Theory of compiler design, based on Automata theory.

2 **PROGRAMMING LANGUAGE PRAGMATICS**

Taxonomy of programming languages, their strength and weaknesses. Various programming paradigms, such as object-oriented programming.

3 **TYPE THEORY**

Formal analysis of the types of data, and the use of these types to understand properties of programs — especially program safety.

4 **FORMAL SEMANTICS**

Rigorous mathematical study of the meaning of programs.

PARALLEL AND DISTRIBUTED COMPUTING

The simultaneous growth in availability of big data and in the number of simultaneous users on the Internet places particular pressure on the need to carry out computing tasks “in parallel,” or simultaneously.

Parallel and distributed computing occurs across many different topic areas in computer science, including algorithms, computer architecture, networks, operating systems, and software engineering.

1 **CONCURRENCY**

The theory and practice of simultaneous computation; data safety in any multitasking or multithreaded environment.

2 **PARALLEL COMPUTING**

Computing using multiple concurrent threads of execution, devising algorithms for solving problems on multiple processors to achieve maximal speed-up compared to sequential execution.

3 **DISTRIBUTED COMPUTING**

Computing using multiple computing devices over a network to accomplish a common objective or task and there by reducing the latency involved in single processor contributions for any task.

SOFTWARE ENGINEERING

Software engineering is the discipline concerned with the application of theory, knowledge, and practice to building reliable software systems that satisfy the computing requirements of customers and users. It is applicable to small-, medium-, and large-scale computing systems and organizations. It uses engineering methods, processes, techniques, and measurements.

1 **FORMAL METHODS**

Mathematical approaches for describing and reasoning about software designs.

2 **REVERSE ENGINEERING**

The application of the scientific method to the understanding of arbitrary existing software.

3 **ALGORITHM DESIGN**

Using ideas from algorithm theory to creatively design solutions to real tasks.

4 **COMPUTER PROGRAMMING**

The practice of using a programming language to implement algorithms.

COMPUTER ARCHITECTURE

Computer architecture deals with the design of computers, data storage devices, and networking components that store and run programs, transmit data, and drive interactions between computers, across networks, and with users.

Computer architects use parallelism and various strategies for memory organization to design computing systems with very high performance.

1 **COMPUTER ARCHITECTURE**

The design, organization, optimization and verification of a computer system, mostly about CPUs and Memory subsystem (and the bus connecting them).

2 **OPERATING SYSTEMS**

Systems for managing computer programs and providing the basis of a usable system.

COMMUNICATIONS AND SECURITY

Security and information assurance refers to policy and technical elements that protect information systems by ensuring their availability, integrity, authentication, and appropriate levels of confidentiality.

Information security concepts occur in many areas of computer science, including operating systems, computer networks, databases, and software.

1 **NETWORKING**

Algorithms and protocols for reliably communicating data across different shared or dedicated media, often including error correction.

2 **COMPUTER SECURITY**

Practical aspects of securing computer systems and computer networks.

3 **CRYPTOGRAPHY**

Applies results from complexity, probability and number theory to invent and break codes, and analyze the security of cryptographic protocols.

INFORMATION MANAGEMENT

Involves the fundamental mathematical concepts required to create programs, software, and other computing devices. Majority of them revolve around the concepts of logic, complex analysis and arrangement of data, and proving mathematical relationships that may be useful and applicable in the other sub-disciplines in computer science.

1 **RELATIONAL DATABASES**

The set of theoretic and algorithmic foundation of databases.

2 **DATA MINING**

Study of algorithms for searching and processing information in documents and databases; closely related to information retrieval.

ARTIFICIAL INTELLIGENCE

Refers to the implementation and study of systems that exhibit an autonomous intelligence or behavior of their own.

The idea of building a machine that can perform tasks perceived as requiring human intelligence is an attractive one.

The tasks that have been studied from this point of view include game playing, language translation, natural language understanding, fault diagnosis, robotics, and supplying expert advice.

1 **AUTOMATED REASONING**

Solving engines, such as used in Prolog, which produce steps to a result given a query on a fact and rule database, and automated theorem provers that aim to prove mathematical theorems with some assistance from a programmer.

2 **ROBOTICS**

Algorithms for controlling the behavior of robots.

3 **COMPUTER VISION**

Algorithms for identifying three dimensional objects from a two dimensional picture.

4 **MACHINE LEARNING**

Automated creation of a set of rules and axioms based on input.

COMPUTER GRAPHICS

Graphics and visual computing is the field that deals with the display and control of images on a computer screen, including rendering, modeling, animation, and visualization. They incorporate principles of linear algebra, computational geometry, numerical integration, file formats, special-purpose hardware, and graphical user interfaces (GUIs) to accomplish these complex tasks.

Applications of graphics include CAD, fine arts, medical imaging, scientific data visualization, and video games.

1 **COMPUTER GRAOHICS**

Algorithms both for generating visual images synthetically, and for integrating or altering visual and spatial information sampled from the real world.

2 **IMAGE PROCESSING**

Determining information from an image through computation.

3 **HUMAN-COMPUTER INTERACTION**

The study and design of computer and user interfaces that people use for any types of software and operating system. Includes the study of design principles and paradigms.

SCIENTIFIC COMPUTING

1 **NUMERICAL ANALYSIS**

Approximate numerical solution of mathematical problems such as root-finding, integration, the solution of ordinary differential equations; the approximation of special functions.

2 **SYMBOLIC COMPUTATION**

Manipulation and solution of expressions in symbolic form (Computer algebra).

3 **COMPUTATIONAL PHYSICS**

Numerical simulations of large non-analytic systems.

4 **COMPUTATIONAL CHEMISTRY**

Computational modelling of theoretical chemistry in order to determine chemical structures and properties

5 **BIOINFORMATICS**

The use of computer science to maintain, analyze, store biological data and to assist in solving biological problems such as Protein folding, function prediction and Phylogeny.

6 **COMPUTATIONAL NEUROSCIENCE**

Computational modelling of neurophysiology.

02

COMPUTER SCIENCE APPLICATIONS AND CAREERS

Pages 22-41

COMPUTER SCIENCE IN OUR DAILY LIVES

Computer science is a field of study that can be implemented in everything we do and below are few examples of the applications of computer science in daily life.

INTERNET BROWSING

When a person is searching for information and types something on the search engine, how does the system provides you the relevant results within a matter of second?

The answer is through various search algorithms and parallel computing.

VIDEO GAMES

Ever thought about how the games you play in your laptops or computer looks so real?

It is possible because of the constantly improving computer graphics and visualizations.

COMPUTER SCIENCE IN OUR DAILY LIVES

Computer science is a field of study that can be implemented in everything we do and below are few examples of the applications of computer science in daily life.

ONLINE SHOPPING

When you purchase something online, have you ever wondered how nobody else can steal your credit or debit card information, or how does the website always predicts precisely what you might want to purchase?

This is because of network security and artificial intelligence.

SMARTPHONE FUNCTIONALITIES

The smart phones you use are able to do so much more than just make some calls and text. They are lately becoming more handy as they can perform most of the functionalities seen in PCs.

This is possible because of programming and wireless networking.

THE RISING DEMAND OF COMPUTER SCIENCE

Computer science is not merely about sitting behind a computer to code programs and develop various software. Rather, it also considers the ability to integrate knowledge acquired from the different CS fields to solve real-world context problems and ease issues in the society.

It is also a field that is ideal for problem solvers, for those who are constantly looking to learn new things, and for those who want to become changemakers in a rapidly evolving, technology-focused world.

The impact brought by the COVID-19 global pandemic has further magnified the level of demand for computer science jobs and professions as several companies and industries are starting to utilize better technology to maintain their activities and interaction within the society.

HOW COMPUTER SCIENCE BENEFITS SOCIETY

Computer science is indeed an incredible career choice for someone who wants to change the world as long as the technologies are used under ethical circumstances. Computer science benefits society by:

DIRECTLY MEETING NEEDS

Computer scientists can easily get into direct applications that address societal issues like poverty, unemployment, climate change and more.

There are online resources for them who want to put their skills to work for global issues. These platforms allow a wide array of tech professionals to create, support and execute projects that change lives.

ACCELERATING HEALTHCARE PROGESS

Genomics and personalized medicine are an excellent example of how computer science-driven technologies are accelerating healthcare progress.

The genome sequencing process that powers this frontier of medicine used to cost tens of millions of dollars to complete, but machine-learning (AI) techniques and improved computing power have dropped its costs substantially.

SOCIETAL REBALANCING

Computer science can help level the playing field with regards to inexpensive solutions. It could be a tool for societal rebalance regarding gender identity, ethnicity, background and more.

In the computer and IT industry, what truly matters are the codes, programs, applications being developed; no background unrelated to CS involved.

It is a positive step for society that computers are blind to everything but the code.

HOW COMPUTER SCIENCE BENEFITS SOCIETY

Computer science is indeed an incredible career choice for someone who wants to change the world as long as the technologies are used under ethical circumstances. Computer science benefits society by:

FURTHERING EDUCATION

Computer science pros have helped make the act of taking a class online, researching for a paper or sharing work via the cloud all possible nowadays.

E-learning platforms and applications give students new tools to problem-solve and study, which has changed and benefited the academic world, as it creates access to education for students whose locations, abilities or finances were a barrier.

EXPANDING COMMUNICATION

One of the biggest contribution computer science has made is in the field of communication, making the whole world a very small place—available at our fingertips now.

Social media, video calling and chatting apps — even the applications that allow you to share documents and photos with someone else long-distance are now possible, completely revolutionizing the workforce.

PREDICTING AND AVOIDING CATASTROPHIES

With the emerging technologies, we can predict everything from an incoming tsunami to the outbreak pattern of a pathogen.

In that way, some of the most life-saving works that happen in our world relies on computer scientists.

Computer science is even in action when predicting the trajectory of dangerous comets near our planet.

CAREER OPPORTUNIES

Computing is involved in all industries (e.g., the arts, film, finance, health care, manufacturing, music, security, government, and more), thereby widening the options of the computer scientists. Below are the additional facts:

58%

of all new jobs in STEM are centered in computing.

3.5 M

Computing related jobs available by 2026.

40%

Higher earnings in the CS field than the average earnings from all fields.

4.1 M

Median annual salary for computer and IT occupations in 2018, in PHP

COMPUTER SCIENCE CAREERS (1/3)

Below is a list of the popular roles one can work on in the CS industry and their brief descriptions.

1. **BIG DATA ENGINEER**

Communicating with business users and data scientists with the goal of translating business objectives into workable data-processing workflows.

2. **GROWTH HACKER**

Using technology to help startup businesses grow rapidly by identifying overall business goals, driving traffic to their digital platforms, and working toward automating the growth processes.

3. **APPLICATIONS ARCHITECT**

Designing major aspects of the architecture of an application, providing technical leadership to the development team, performing design reviews, and ensuring enterprise-wide application standards are met.

4. **WEB DEVELOPER**

Responsible for the building and maintenance of a website; must be able to understand business needs and build sites that accommodate them.

5. **DATABASE ADMINISTRATOR**

Using specialized software to securely store, modify, merge, and organize data, also ensuring that sensitive data is both available to appropriate users and secure from unauthorized access.

6. **COMPUTER HARDWARE ENGINEER**

Designing, developing and supervising the production and installment of computer hardware, which includes keyboards, modems, printers, computer systems, chips and circuit boards, and blueprints of new equipment.

COMPUTER SCIENCE CAREERS (2/3)

Below is a list of the popular roles one can work on in the CS industry and their brief descriptions.

7 COMPUTER SOFTWARE ENGINEER

Designing and developing software used to control computers by utilizing the principles of computer science and mathematical analysis.

8 INFO. SYSTEMS SECURITY MANAGER

Reviewing, implementing, and updating information security policies and procedures within an organization, ensuring that legal and contractual security and privacy mandates are adhered to.

9 DATA SECURITY ANALYST

Performing security audits and risk assessments and make recommendations for enhancing security on their organizations, researching and rectify attempted data security breaches, and formulating security policies and procedures.

10 MATHEMATICIAN

Utilizing existing mathematical theories and developing new ones to connect previously unknown relationships between concepts.

11 HEALTH INFO. TECHNOLOGY CAREERS

Specialized subset of IT professionals who work for medical facilities and other healthcare organizations to increase the efficiency and quality of clinical care and records through technology.

12 STATISTICIAN

Conducting surveys, opinion polls to collect, analyze and present data. They determine how to best collect information, what groups to test, what questions to ask and how to interpret and publish their findings.

COMPUTER SCIENCE CAREERS (3/3)

Below is a list of the popular roles one can work on in the CS industry and their brief descriptions.

13 **COMP. AND INFO. RESEARCH SCIENTIST**

Inventing and designing new approaches to computing technology while also discovering innovative uses for technology that already exist.

14 **NETWORK ARCHITECT**

Planning, designing, upgrading, and trouble-shooting network installation projects and architecture, and maintaining backup, version-control and defense systems.

15 **BUSINESS INTELLIGENCE ANALYST**

Designing and developing data analysis and reporting solutions, communicating analysis results while making recommendations to senior management teams and developing data cleansing regulations for their organizations.

16 **COMPUTER SUPPORT SPECIALIST**

Provide help and advice to computer users and organizations by offering technical assistance directly to computer users.

17 **SYSTEMS ENGINEER**

Developing, maintaining and supporting technical infrastructure, hardware and system software components, while also providing user support across multiple infrastructure platforms.

18 **MOBILE APPLICATION DEVELOPER**

Specialize in coding, testing, debugging and monitoring mobile apps and contribute to the development of ongoing projects, recommending changes and enhancements to software applications as needed.

WHAT FIELDS AND INDUSTRIES CAN COMPUTER SCIENCE BE APPLIED ON?

HEALTH AND MEDICINE

Computers have become an important part in hospitals, labs, and dispensaries. They are being used in hospitals to keep the record of patients and medicines as well as to scan for or diagnose different diseases.

1. **DIAGNOSTIC SYSTEM**

   Computers are used to collect data and identify the cause of illness. Can also determine laboratory test results.

2. **HUMAN GENOME RESEARCH**

   Computers can aid in the study, mapping, and understanding of the behavior of the human genes.

3. **PATIENT MONITORING SYSTEM**

   These are used to check the patient's signs for abnormality such as in Cardiac Arrest, ECG, etc.

4. **PHARMA INFORMATION SYSTEM**

   Computers are used to check drug labels, expiry dates, harmful side effects, etc.

5. **SURGERIES AND THERAPIES**

   Computers are also used in performing surgery and therapies.

COMMERCE AND BUSINESS

Computers have high speed of calculation, diligence, accuracy, reliability, or versatility which has made it an integrated part in all business organizations.

1 **CORE BUSINESS PROCESSES**

Payroll calculations, budgeting, sales analysis, financial forecasting, managing employee database, maintenance of stocks, etc.

2 **BANKING**

Automated Teller Machines (ATM); online accounting facility, which includes checking current balance, making deposits and overdrafts, checking interest charges, shares, and trustee records.

3 **INSURANCE**

Database maintenance - Procedure to continue with policies, starting date of the policies, next due installment of a policy, maturity date, interests due, survival benefits, bonus.

4 **MARKETING**

Advertising – creation via graphics and promotion; home or mobile shopping via computerized catalogs.

COMMUNICATION

Communication is a way to convey a message, an idea, a picture, or speech that is received and understood clearly and correctly by the person for whom it is meant.

1 **TELECOMMUNICATIONS**

Telephone switching, wired computer networks power by ethernet cables

2 **INTERNET USAGE**

E-mail, social media platforms for chatting and blogging, file transfer protocol (FTP), video conferencing

3 **PHONE USAGE**

Cellphone tracking, voice compression, data transfer, text messaging

4 **OTHER BROADCAST MEDIA**

Digital broadcasting, radio, television

MANUFACTURING INDUSTRY

Several processes involved in the manufacturing of products are aided by computers and various technologies, saving unnecessary manpower, reducing the overall time, and increasing production efficiency, accuracy, and reliability.

1 **QUALITY CONTROL**

Process monitoring and optimization, quality assurance testing and defect detection

2 **DESIGN**

CAD, CAM, circuit layout, simulations, etc.

3 **PROCESS ASSISTANCE**

Robotic manufacturing, welding, painting, other automated processes; GPS location systems for construction sites, agriculture and forestry

4 **EMBEDDED SYSTEMS**

Used in cars, copiers, and other products involving electronic systems.

GOVERNMENT

Computers play an important role in government services. They help automate several essential processes in government agencies to keep their data up-to-date and all the services running well.

1. **FINANCE**

   Budget allocation, sales tax and income tax department

2. **STATISTICS AND CENSUS**

   Computation of male/female ratio and other useful demographics, computerization of voters' lists and poll tracking; voting system security enhancement

3. **INDIVIDUAL INFORMATION**

   Identification cards, passports, certificates for various purposes

4. **OTHER SERVICES**

   Weather forecasting, tropical cyclone prediction and path tracking

ENGINEERING AND DESIGN

Computers are widely used for Engineering purpose. One of the major areas is CAD (Computer Aided Design) that provides creation and modification of images.

1 **STRUCTURAL ENGINEERING**

Requires stress and strain analysis for design of ships, buildings, budgets, airplanes, etc.

2 **INDUSTRIAL ENGINEERING**

Computers deal with design, implementation, and improvement of integrated systems of people, materials, and equipment.

3 **ARCHITECTURAL ENGINEERING**

Computers help in planning towns, designing buildings, determining a range of buildings on a site using both 2D and 3D drawings.

MILITARY

Computers are largely used in state defense such as modern tanks, missiles, and weapons. Military also employs computerized control systems to ensure that they are prepared with the right set of information.

1 **THEORETICAL COMPONENTS**

Guidance systems, planning assistance, weather forecasting, and simulations

2 **APPLIED COMPONENTS**

Missile control, military operations, military communications, and smart weapon creation and analysis

3 **DATABASES**

Personal - Inventory, personnel, payroll

Environmental - historical databases of world environments, land, sea, air, and space

ARTS AND ENTERTAINMENT

Computer science is also applicable in the art and entertainment industry as it helps magnify the beauty and clarity of the works and uncover the hidden meanings of old artworks and compositions.

1. **VIDEO AND GRAPHICS**

   Video games and film – animation, filming and photography, editing and add-on effects

2. **AUDIO**

   Instruments, mixing, recording, audio editing and noise filtering and reduction, creation of backup music, sound searching

3. **SPORTS**

   Screen effects in Live sports broadcasts (display of moving lane markers), competition aids (in racing)

4. **ART**

   Rediscovering the texture and paintings of ancient artworks, recreating statues and sculptures, examining stress of objects

OTHER NOTABLE CS ADVANCEMENTS

Below is a list of some other excellent and helpful advancements in CS towards other disciplines.

1 GEOLOGY AND ASTRONOMY

OneGeology Team, Jul 31, 2008
- Producer of the first global digital geological map, with locations of the rocks underground.

Microsoft's World Wide Telescope, May 13, 2008
- Allows users to explore detailed, high-res and animated 3D astronomical images via a Website.

2 BIOLOGY

Stanford University, May 3, 2008
- Developed tools that helped facilitate a new type of cancer gene map, yielding a new explanation of how breast tumors spread into bone.

Carnegie Mellon University, May 12, 2008
- Developed software that will help characterize protein patterns in human tissues that could help with cancer diagnosis and therapy.

3 ENVIRONMENTAL SCIENCE

University of Oklahoma, Feb 23, 2009
- Simulated tornados with remarkable accuracy, to learn the tornado's microphysical processes.

Georgia Institute of Technology, May 27, 2008
- Developed robots designed to travel on volatile ice sheets to collect data that will help understand why the ice shelves are melting.

4 HUMAN ASSISTANCE

Federal Institute of Technology, Sep 13, 2010
- Developed brain computer interfaces to control PCs, wheelchairs and a robotic arm by thought.

Washington University of Medicine, Nov 9, 2007
- Used robots to help autistic children learn social skills by having the robots observe and react to their emotions.

03

NEW TECHNOLOGY TRENDS

Pages 42-54

INTRODUCTION

Technology is an ever-changing playing field, and those wanting to remain at the helm of innovation have to adapt to the latest trends.

The consumer journey is charting a new course and customers and companies alike are embracing emerging technologies.

As the IT industry trends such as cloud and edge computing become more pervasive, the world will look to brands who can deliver with accuracy and real-time efficiency.

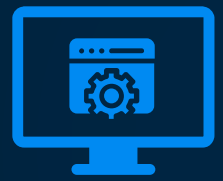
INTRODUCTION

To help meet the demands of a technology-enabled consumer base, businesses and solution providers must also turn toward the latest trends and possibilities provided by the emerging innovations to realize their full potential.

It is not only technology trends and top technologies that are evolving, a lot more has changed this year due to the outbreak of COVID-19, making IT professionals realize that their role will not stay the same in the contactless world tomorrow.

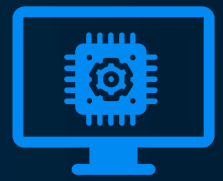
WHAT ARE THE NOTABLE NEW TECHNOLOGY TRENDS?

ARTIFICIAL INTELLIGENCE



INTERNET OF THINGS (IoT)

EDGE COMPUTING



QUANTUM COMPUTING

ROBOTIC PROCESS AUTOMATION (RPA)

EXTENDED REALITY

BLOCKCHAIN CYBERSECURITY

5G DATA NETWORKS

COMPUTER VISION

ARTIFICIAL INTELLIGENCE

AI is about machines with human attributes - speaking, reading, seeing and even recognizing emotion - completing tasks while also "learning" from repeated interactions. Using algorithms that adapt to location, speech or user-history machines can perform tasks that are dangerous or tedious, more accurately or much faster than humans.

AI is already known for its superiority in image and speech recognition, navigation apps, smartphone personal assistants, ride-sharing apps, automating tasks such as traffic, scheduling trains, making business predictions and designing driverless cars.

As is often seen with social media, AI, combined with machine learning, can be a powerful combination. Businesses can use AI to achieve cost-saving benefits, streamline workflows, enable more efficient communications, improve customer satisfaction, and provide insight into purchasing behavior.

INTERNET OF THINGS (IoT)

Many “things” are now being built with WiFi connectivity, meaning they can be connected to the Internet—and to each other. Hence, the Internet of Things, or IoT. The Internet of Things is the future, and has already enabled devices, home appliances, cars and much more to be connected to and exchange data over the Internet.

Unlike traditional data collection methods of the past, IoT not only enables the connection between different devices but also their remote access. For example, we lock doors of our car remotely, and preheat our ovens and geysers. IoT chips embedded on machines help businesses to assess the performance of those machines and assist in their maintenance.

Forecasts suggest that by 2030 around 50 billion of these IoT devices will be in use around the world, creating a massive web of interconnected devices spanning everything from smartphones to kitchen appliances.

EDGE COMPUTING

Edge computing is a decentralized model which places computing nodes closer to the source of interaction, becoming the most efficient path for localized interactions, replacing the current cloud computing technology.

Edge computing is designed to help solve some of those problems as a way to bypass the latency caused by cloud computing and getting data to a datacenter for processing and reduce bandwidth in the process. It can exist “on the edge,” closer to where computing needs to happen.

For this reason, edge computing can be used to process time-sensitive data in remote locations with limited or no connectivity to a centralized location. In those situations, edge computing can act like mini datacenters.

The technology will make cloud computing and IoT devices faster. It is estimated that by 2022, the edge computing market will be worth $7 billion. And it will be popular in areas such as healthcare, retail, and manufacturing.

QUANTUM COMPUTING

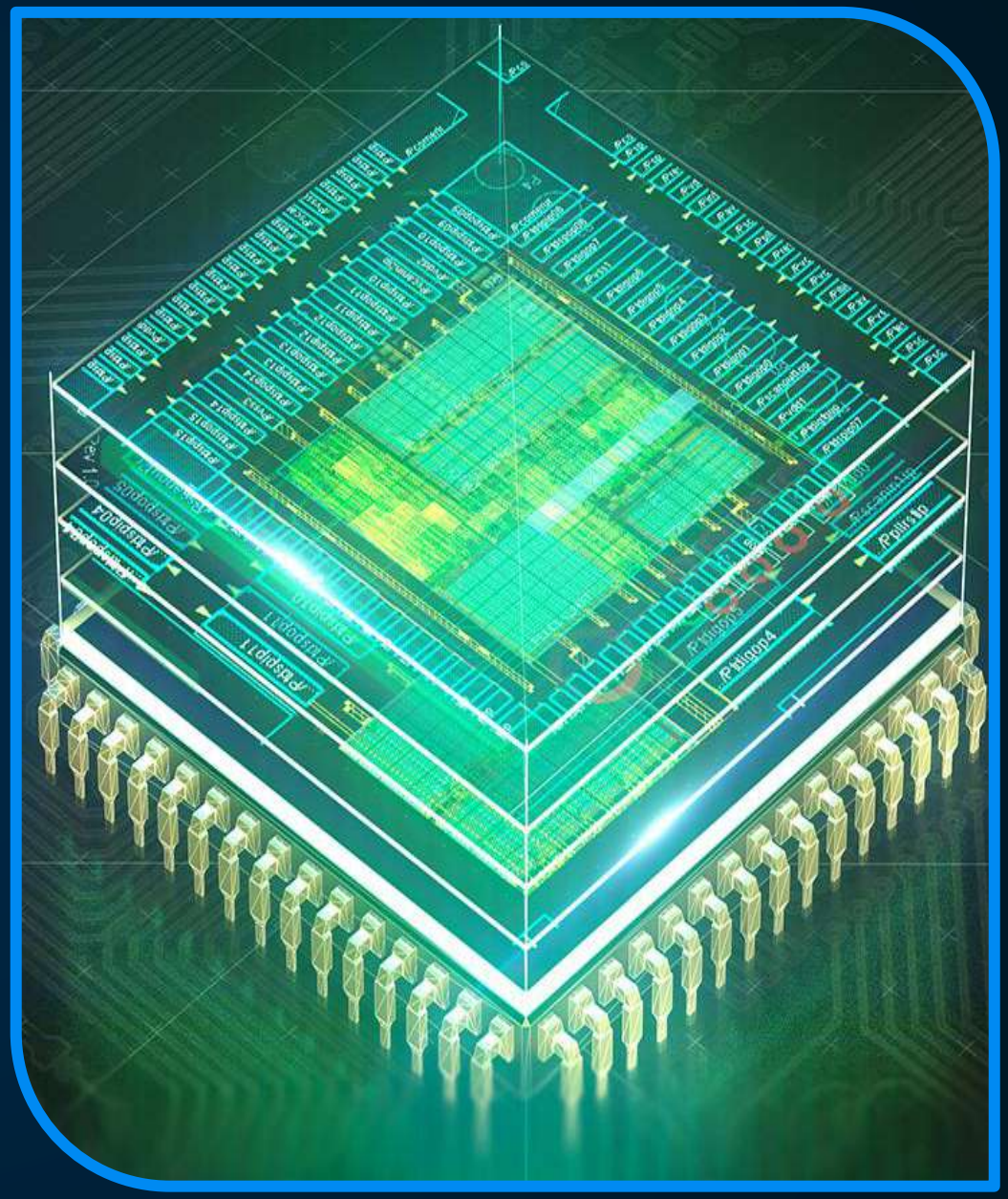
Quantum computing is a form of computing that takes advantage of quantum phenomena like superposition and quantum entanglement. This amazing technology trend is also involved in preventing the spread of COVID-19, and to develop potential vaccines, thanks to its ability to easily query, monitor, analyze and act on data, regardless of the source.

Another field where quantum computing is finding applications is banking and finance, to manage credit risk for high frequency trading and fraud detection.

While Google came on the scene in 2017 with a promise of the largest quantum computer, IBM has actually made it possible for businesses to leverage this technology.

As we encounter new problems, quantum computing will help predict viable solutions, though it may not be on the radar for many solution providers or channel partners just yet.

Requirements: Quantum mechanics, linear algebra, probability, information theory, and machine learning.



ROBOTIC PROCESS AUTOMATION (RPA)

Like AI and Machine Learning, Robotic Process Automation, or RPA, is another technology that is automating jobs. RPA is the use of software to automate business processes such as interpreting applications, processing transactions, dealing with data, and even replying to emails. RPA automates repetitive tasks that people used to do.

Robots in manufacturing go back to the 1960s. Now it's the scale and breadth of the transformation that automated systems make possible, as a result of other advances in machine learning and connectivity, for example, that puts automation firmly at the forefront of technology trends.

From convenient devices at home to industrial applications on a massive scale, automation will be a key focus of technological change, with potentially far-reaching economic and social consequences.

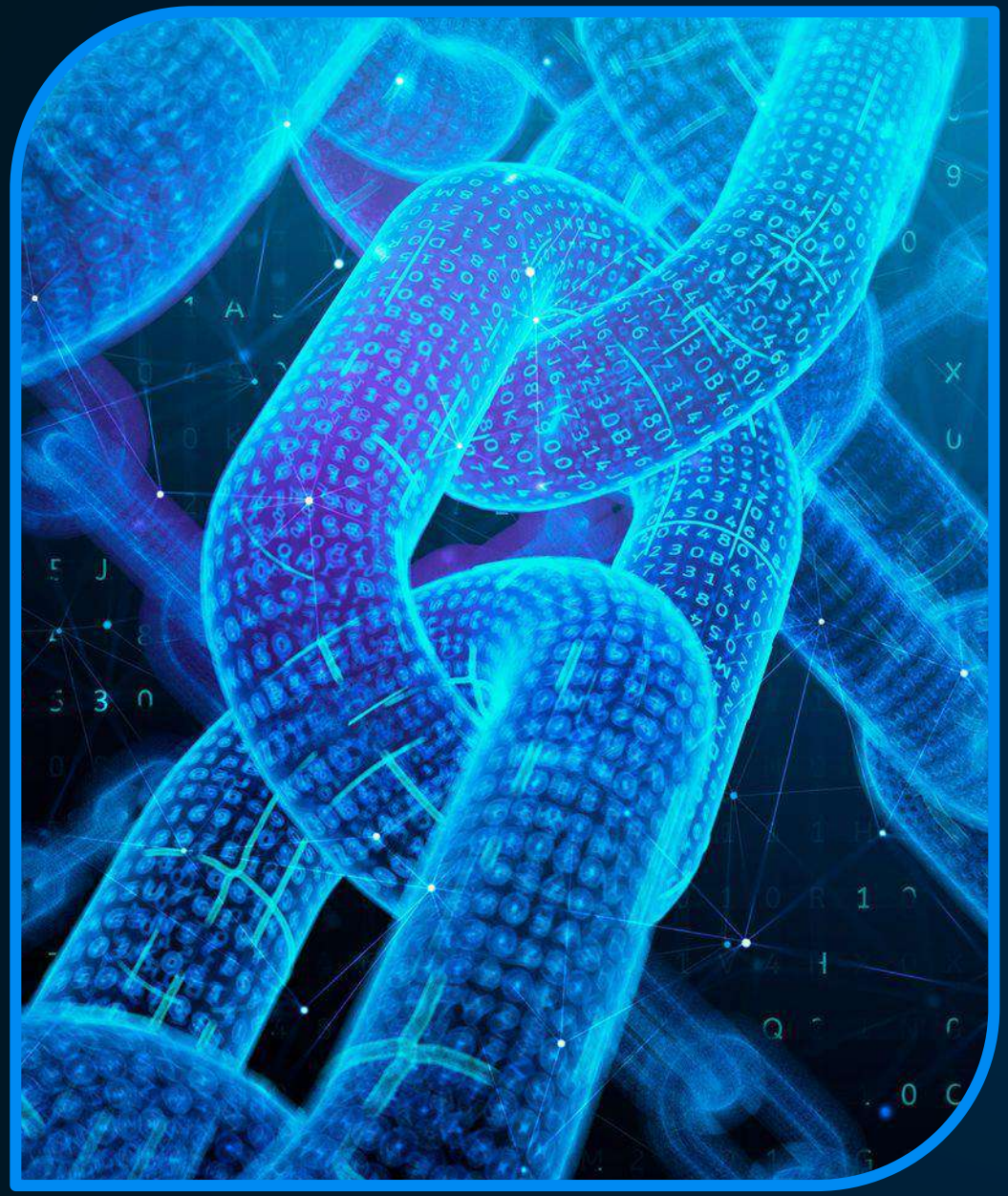
EXTENDED REALITY

Extended Reality (XR) is a catch-all term that covers several new and emerging technologies being used to create more immersive digital experiences. It is the use of computer technology for creating a simulated environment.

Virtual Reality (VR) immerses the user in an environment while Augmented Reality (AR) enhances their environment. Mixed reality (MR) is an extension of AR, that means users can interact with digital objects placed in the real world.

Organizations are increasingly applying this technology across a wide spectrum of human activity from art and entertainment to commerce, education, and the military.

For instance, XR used by the U.S. Navy and Coast Guard for training staff. They use a VR game called VirtualShip. XR is used by doctors while performing surgery. Visitors in an amusement park or a museum can also use the technology to enhance their experience.



BLOCKCHAIN TECHNOLOGY

The blockchain is an information system that holds promise for supply chain management, enabling transparency into the origin and journey of materials from origin to product. Blockchain technology will also allow for better record management, providing a snapshot of any record from its origination. This could be used to verify orders, purchases, returns, receipt of products, and the like.

Not being able to change the previous blocks is what makes it so secure. In addition, blockchains are consensus-driven, so no one entity can take control of the data. With blockchain, we don't need a trusted third-party to oversee or validate transactions.

Past discussions of blockchain are often hinged on cryptocurrency, but the real power lies in the immutability and transparency of a blockchain. Due to the fixed and highly visible nature of blockchains, this trend has been widely accepted to have financial applications, and often informs discussions of bitcoin.

5G DATA NETWORKS

Where 3G and 4G technologies have enabled us to browse the internet, use data driven services, increased bandwidths for streaming on Spotify or YouTube and so much more, the 5th generation of mobile internet connectivity is going to revolutionize our lives by providing super-fast download and upload speeds as well as more stable connections.

Super-fast data networks will not only give us the ability to stream movies and music at higher quality when we're on the move. The greatly increased speeds mean that mobile networks will become more usable even than the wired networks running into our homes and businesses.

Companies must consider the business implications of having super-fast and stable internet access anywhere. The increased bandwidth will enable machines, robots, and autonomous vehicles to collect and transfer more data than ever, leading to advances in the area of the Internet of Things (IoT) and smart machinery.

COMPUTER VISION

In computer terms, “vision” involves systems that are able to identify items, places, objects or people from visual images – those collected by a camera or sensor. It is this technology that allows our smartphone camera to recognize which part of the capturing image is a face especially during phone unlocking, and powers technology such as Google Image Search for more relevant results.

Computer vision, as it is becoming popular this year, equipped tools and technology rolled out for an ever-increasing number of uses. It is fundamental to the way autonomous vehicles will “see” and navigate their way around danger as this is incorporated in the development of the autonomous driving technology for cars and trucks.

Production lines will employ computer vision cameras to watch for defective products or equipment failures, and security cameras will be able to alert us to anything out of the ordinary, without requiring 24/7 monitoring.

04

TYPES OF OPERATING SYSTEMS

Pages 55-70

INTRODUCTION

An Operating system (OS) is a software which acts as an interface between the end user and computer hardware. Every computer must have at least one OS to run other programs. An application like Chrome, MS Word, Games, etc. needs some environment in which it will run and perform its task. The OS helps you to communicate with the computer without knowing how to speak the computer's language. It is not possible for the user to use any computer or mobile device without having an operating system.

Our computer's operating system (OS) manages all of the software and hardware on the computer. Most of the time, there are several different computer programs running at the same time, and they all need to access our computer's central processing unit (CPU), memory, and storage. The operating system coordinates all of this to make sure each program gets what it needs.

DEVELOPMENT OF OPERATING SYSTEMS

1950s
First appearance of single-stream batch-operating systems (IBM 701)

1960s
Emergence of the multiprogramming concept, making batch processing more efficient

1969
Unix OS Release – the foundation of some current OS (Linux, macOS)

1973
Xerox Alto – The first OS with a mouse and a fully graphical user interface (GUI)

1978
Apple Disk Operating System (DOS) – first to integrate in PCs

1985
Introduction of the Windows operating system

1991 Linux initial Release

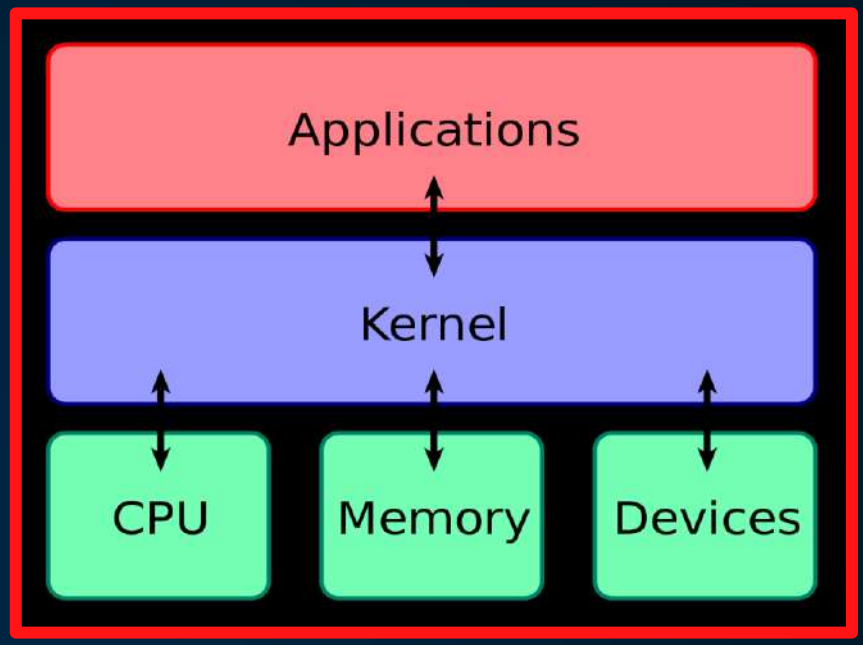
1992 First operating system supporting the internet (Windows 3.1)

2003
Android initial release

2007
iOS initial release

WHAT IS A KERNEL?

It is the central component of a computer operating systems. The only job performed by the kernel is to the manage the communication between the software and the hardware. A Kernel is at the nucleus of a computer. It makes the communication between the hardware and software possible. While the Kernel is the innermost part of an operating system, a shell is the outermost one.



FEATURES

1. Low-level scheduling of processes
2. Inter-process communication
3. Process synchronization
4. Context switching

MAIN TYPES

1. MONOLITHIC - provides all the required services offered by the operating system. It is a simplistic design which creates a distinct communication layer between the hardware and software.
2. MICROKERNELS - services are implemented in different address space. The user services are stored in user address space, and kernel services are stored under kernel address space, reducing overall storage sizes.

FUNCTIONS OF OPERATING SYSTEMS

Operating systems do not just perform one function, but they are being used for performing various functions.

1. PROCESS MANAGEMENT

Helps OS to create and delete processes. Also provides mechanisms for synchronization and communication among processes.

2. MEMORY MANAGEMENT

Memory management module performs the task of allocation and de-allocation of memory space to programs in need of this resources.

3. FILE MANAGEMENT

Manages all the file-related activities such as organization storage, retrieval, naming, sharing, and protection of files.

4. DEVICE MANAGEMENT

Keeps tracks of all devices; also responsible for this task is known as the I/O controller. Performs the task of allocation and de-allocation of the devices.

5. I/O SYSTEM MANAGEMENT

One of the main objects of any OS is to hide the peculiarities of that hardware devices from the user.

6. SECURITY

Protects the data and information of a computer system against malware threat and authorized access.

FUNCTIONS OF OPERATING SYSTEMS

Operating systems do not just perform one function, but they are being used for performing various functions.

7. COMMAND INTERPRETATION

Interprets commands given by the and acting system resources to process that commands.

8. NETWORKING

A distributed system is a group of processors which do not share memory, hardware devices, or a clock. The processors communicate with one another through the network.

9. JOB ACCOUNTING

Keeping track of time & resource used by various job and users.

10. COMMUNICATION MANAGEMENT

Coordination and assignment of compilers, interpreters, and another software resource of the various users of the computer systems.

11. SECONDARY STORAGE MANAGEMENT

Systems have several levels of storage which includes primary storage, secondary storage, and cache storage.

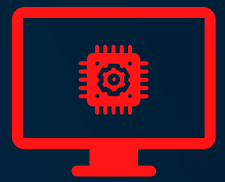
Instructions and data must be stored in primary storage or cache so that a running program can reference it.

TYPES OF OPERATING SYSTEMS

The following outline is provided as an overview of and introduction to computer science:

BATCH PROCESSING SYSTEMS

TIME-SHARING OPERATING SYSTEMS



DISTRIBUTED OPERATING SYSTEMS

NETWORK OPERATING SYSTEMS

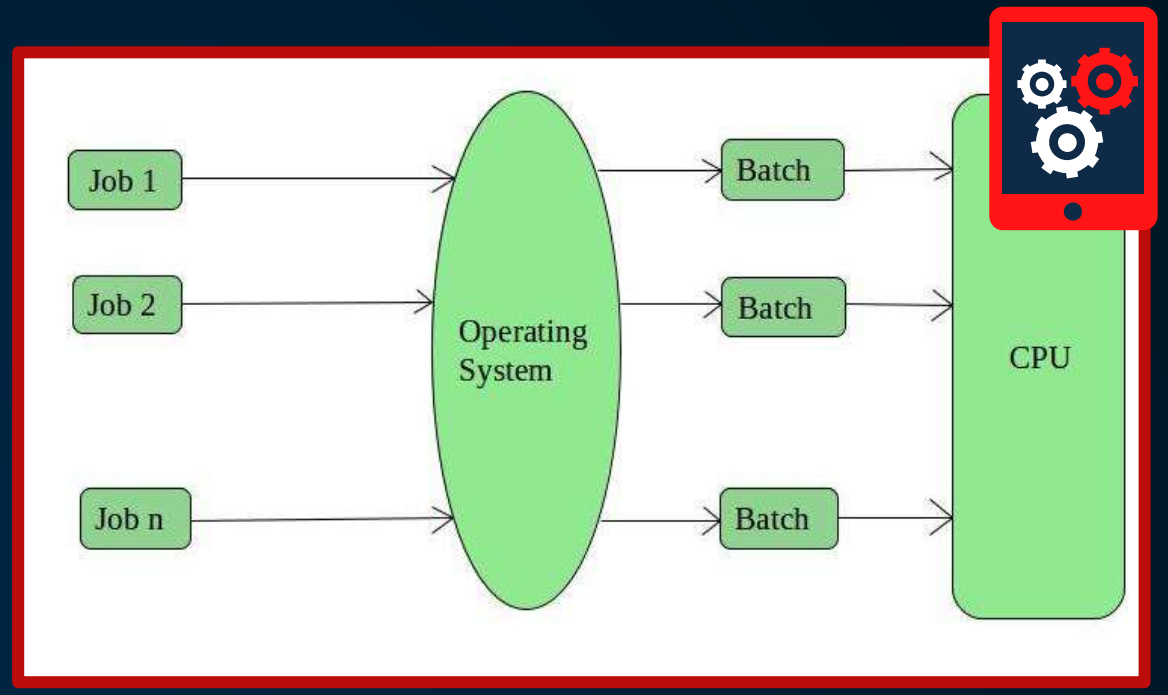
REAL-TIME OPERATING SYSTEMS

MOBILE APPLICATION SYSTEMS

BATCH PROCESSING SYSTEMS

This type of operating system does not interact with the computer directly. There is an operator which takes similar jobs having same requirement and group them into batches. It is the responsibility of operator to sort the jobs with similar needs.

The programmers leave their programs with the operator, and the operator then sorts the programs with similar requirements into batches.



ADVANTAGES / BENEFITS

- It is very difficult to guess or know the time required by any job to complete. Processors of the batch systems know how long the job would be when it is in queue.
- Multiple users can share the batch systems.
- The idle time for batch system is very less.
- It is easy to manage large work repeatedly in batch systems.

DISADVANTAGES / ISSUES

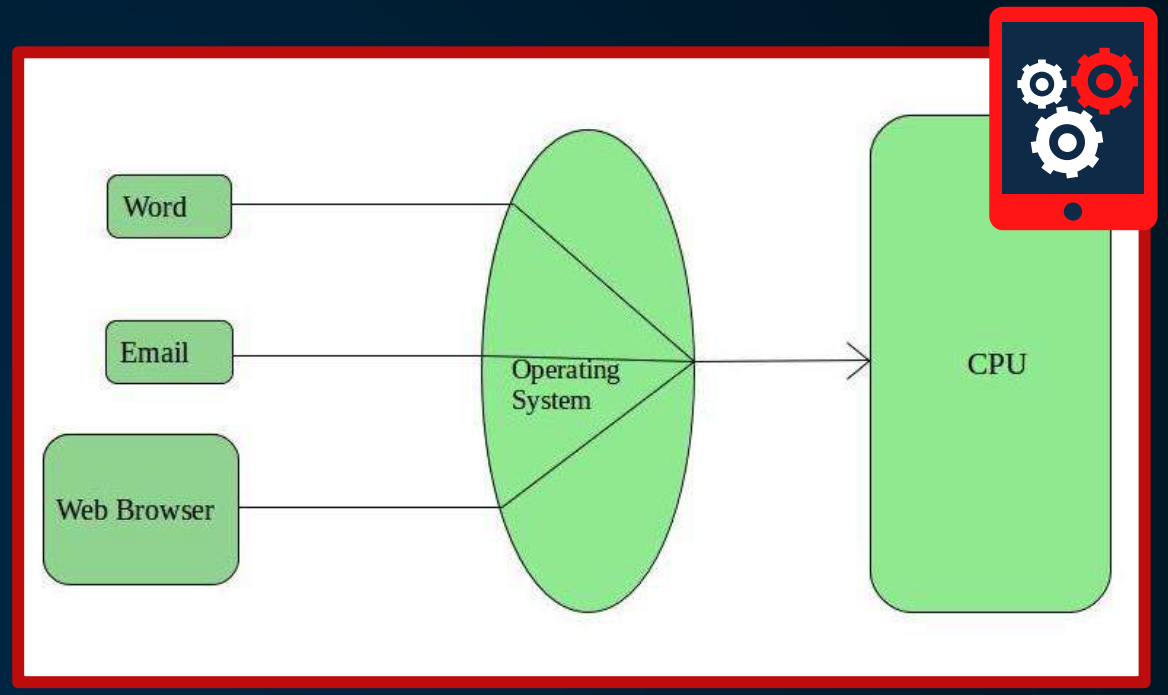
- Lack of interaction between the user and the job.
- CPU is often idle, because the speed of the mechanical I/O devices is slower than the CPU.
- Difficult to provide the desired priority.
- The other jobs will have to wait for an unknown time if any job fails.

EXAMPLES INCLUDE: Payroll System, Bank Statements

TIME-SHARING OS

Time-sharing is a technique which enables many people, located at various terminals, to use a particular computer system at the same time. Time-sharing or multitasking is a logical extension of multiprogramming.

Processor's time which is shared among multiple users simultaneously is termed as time-sharing. Its objective is to minimize response time (instead of processor use in batch processing systems).



ADVANTAGES / BENEFITS

- Provides the advantage of quick response.
- Avoids duplication of software.
- Reduces CPU idle time.

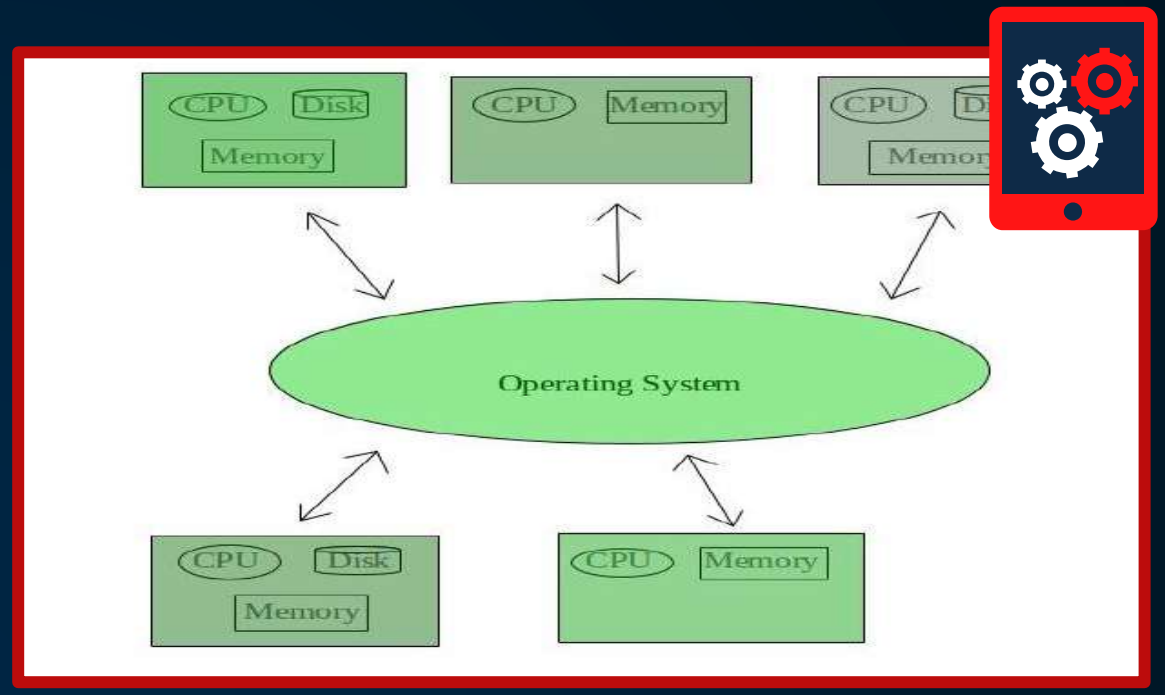
DISADVANTAGES / ISSUES

- Problem of reliability.
- Question of security and integrity of user programs and data.
- Problem of data communication.

EXAMPLES INCLUDE: Multics, Unix

DISTRIBUTED OS

Distributed systems use multiple central processors to serve multiple real-time applications and multiple users. Data processing jobs are distributed among the processors accordingly. The processors communicate with one another through various communication lines (such as high-speed buses or telephone lines). These are referred as loosely coupled systems or distributed systems. Processors in a distributed system may vary in size and function. These processors are referred as sites, nodes, computers, and so on.



ADVANTAGES / BENEFITS

- Electronic mail increases the data exchange speed
- Computation is highly fast and durable
- Load on host computer reduces
- Delay in data processing reduces
- These systems are easily scalable as many systems can be easily added to the network.

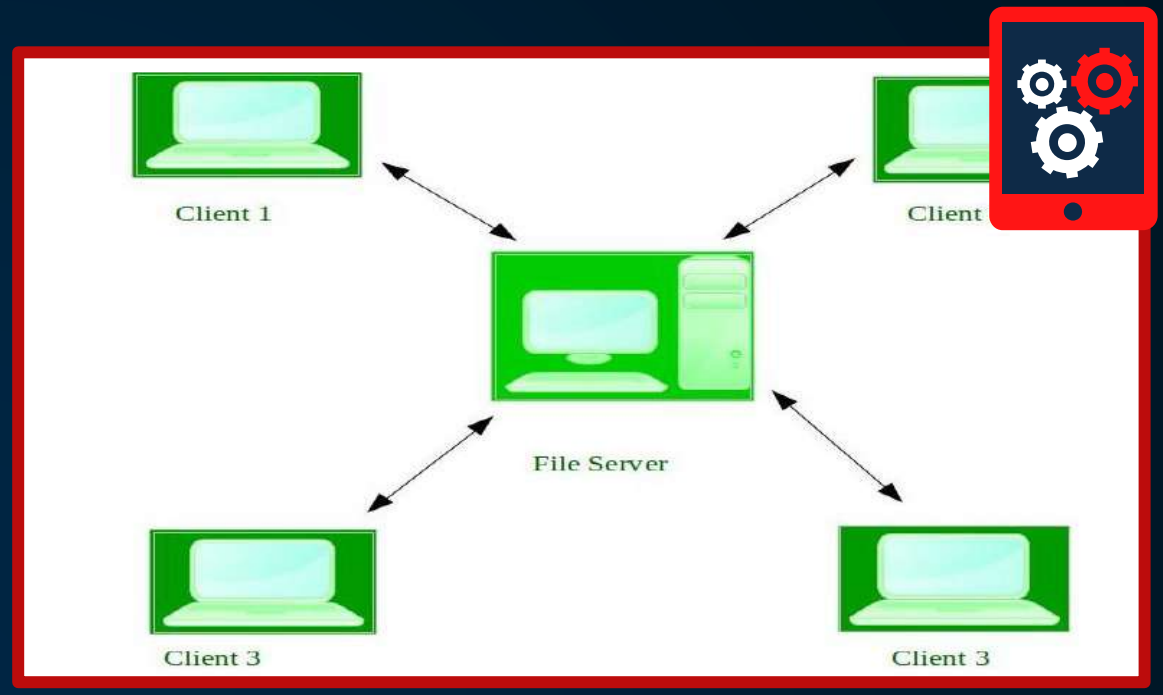
DISADVANTAGES / ISSUES

- Failure of the main network will stop the entire communication.
- To establish distributed systems the language which are used are not well defined yet.
- These types of systems are not readily available as they are very expensive. Not only that the underlying software is highly complex and not understood well yet.

EXAMPLES INCLUDE: LOCUS, IRIX

NETWORK OS

These systems run on a server and provide the capability to manage data, users, groups, security, applications, and other networking functions. They allow shared access of files, printers, security, applications, and other networking functions over a small private network. All the users are well aware of the underlying configuration, of all other users within the network, their individual connections, making these computers popularly known as tightly coupled systems.



ADVANTAGES / BENEFITS

- Highly stable centralized servers.
- Security concerns are handled through servers.
- New technologies and hardware up-gradation are easily integrated to the system.
- Server access are possible remotely from different locations and types of systems.

DISADVANTAGES / ISSUES

- Servers are costly.
- User has to depend on central location for most operations.
- Maintenance and updates are required regularly.

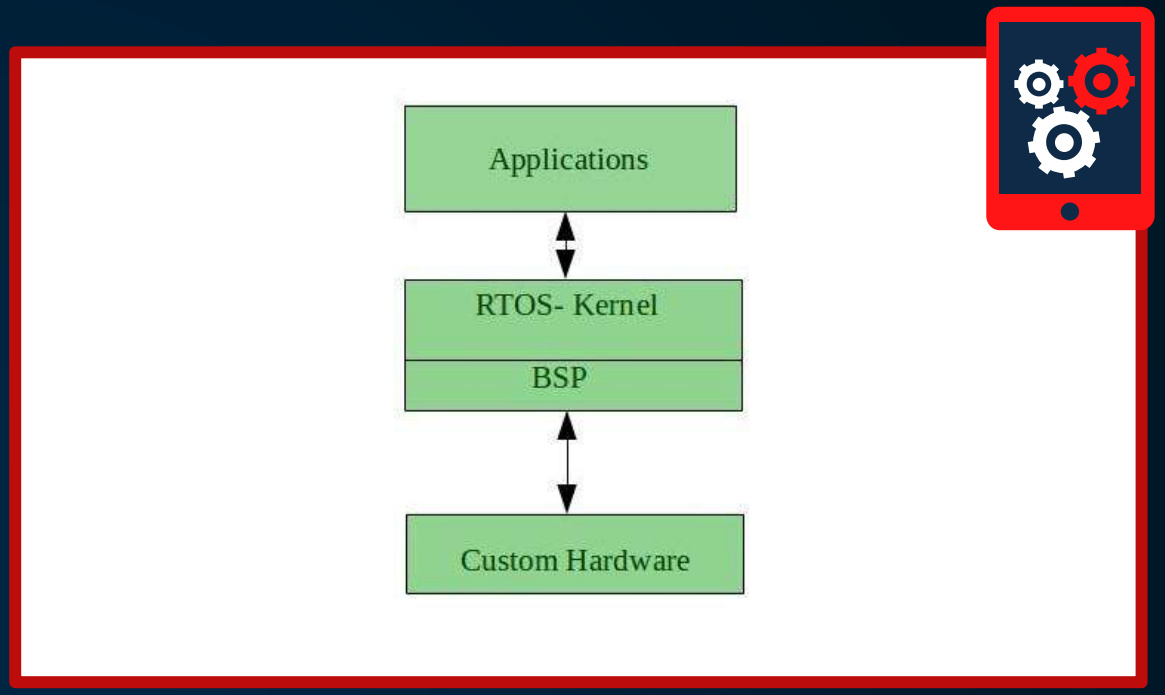
EXAMPLES INCLUDE: Microsoft Windows Server 2003/2008, UNIX, Linux, Mac OS X, Novell NetWare, and BSD

REAL-TIME OS

A real-time system is defined as a data processing system in which the time interval required to process and respond to inputs (response time) is so small that it controls the environment.

Hard real-time systems guarantee that critical tasks complete on time. In hard real-time systems, secondary storage is limited or missing and the data is stored in ROM.

Soft real-time systems, otherwise, are less restrictive.



ADVANTAGES / BENEFITS

- Maximum utilization of devices and system.
- Focus on running applications and less importance to applications which are in queue.
- These types of systems are error free.
- Memory allocation is best managed in these type of systems.

DISADVANTAGES / ISSUES

- Complex and difficult-to-construct algorithms.
- Very few tasks run at the same time and their concentration is very less on few applications to avoid errors.
- It is not good to set thread priority as these systems are very less prone to switching tasks.

EXAMPLES INCLUDE:

Scientific experiments, medical imaging systems, industrial control systems, weapon systems, robots, air traffic control systems

MOBILE OS

Mobile devices such as phones, tablet computers, and MP3 players are different from desktop and laptop computers, so they run operating systems that are designed specifically for mobile devices.

Operating systems for mobile devices generally aren't as fully featured as those made for desktop and laptop computers, and they aren't able to run all of the same software. However, we can still do a lot of things with them, like watch movies, browse the Web, manage our calendar, and play games.

ADVANTAGES / BENEFITS

- Easy navigation between applications.
- Has several functionalities although being compact in size, making it convenient to bring around and use.

DISADVANTAGES / ISSUES

- Several background running applications causing devices to slow down.
- Not all applications from PCs or from different mobile OS are compatible.

EXAMPLES INCLUDE: Apple iOS, Google Android, Blackberry, Web, watchOS

COMMON OPERATING SYSTEMS IN PCs

WINDOWS OS

Microsoft created the Windows operating system in the mid-1980s.

There have been many different versions of Windows, but the most recent ones are Windows 10 (released in 2015), Windows 8 (2012), Windows 7 (2009), and Windows Vista (2007).

Windows comes pre-loaded on most new PCs, which helps to make it the most popular operating system in the world.

MAC OS

macOS (previously called OS X) is a line of operating systems created by Apple. It comes preloaded on all Macintosh computers, or Macs.

Some of the specific versions include Mojave (released in 2018), High Sierra (2017), and Sierra (2016).

Although being more expensive than other operating systems, many people do prefer the look and feel of macOS over Windows.

LINUX OS

Linux has been around since the mid-1990s and has since reached a user-base that spans the globe.

Linux is actually everywhere: It is in our phones (Android), our cars, our thermostats, our refrigerators, and televisions.

Linux OS also runs most of the Internet, all of the world's top 500 supercomputers, and the world's stock exchanges.

FIRMWARE vs. OPERATING SYSTEM (COMPARISON)

FIRMWARE	OPERATING SYSTEM
Firmware is one kind of programming that is embedded on a chip in the device which controls that specific device.	OS provides functionality over and above that which is provided by the firmware.
Firmware is programs that been encoded by the manufacture of the IC or something and cannot be changed.	OS is a program that can be installed by the user and can be changed.
Firmware is stored on non-volatile memory.	OS is stored on the hard drive.

32-BIT vs. 64 BIT OPERATING SYSTEMS (COMPARISON)

	32-BIT OS	64-BIT OS
ARCHITECTURE AND SOFTWARE	Allow 32 bit of data processing simultaneously	Allow 64 bit of data processing simultaneously
COMPATIBILITY	32-bit applications require 32-bit OS and CPUs.	64-bit applications require a 64-bit OS and CPU.
SYSTEMS AVAILABLE	All versions of Windows 8, Windows 7, Windows Vista, and Windows XP, Linux, etc.	Windows XP Professional, Vista, 7, Mac OS X and Linux.
MEMORY LIMITS	32-bit systems are limited to 3.2 GB of RAM.	64-bit systems allow a maximum 17 Billion GB of RAM.

05

TYPES OF PROGRAMMING LANGUAGES

Pages 71-86

INTRODUCTION

A program is a set of instructions given to a computer to perform a specific operation, written using programming languages.

A programming language is a notation designed to connect instructions to a machine or a computer. It controls the performance of a machine or to express algorithms.

Programming languages, like human languages (English, etc.) are made of different elements and follow grammar rules called syntax. Most of the time, they need to be stated in either in an imperative form or a declarative form.

At present, thousands of programming languages have been implemented already. However, for a computer programmer to choose the correct or best language to be used, he or she needs to consider and analyze the many differences between programming languages, which will be expounded in this section.

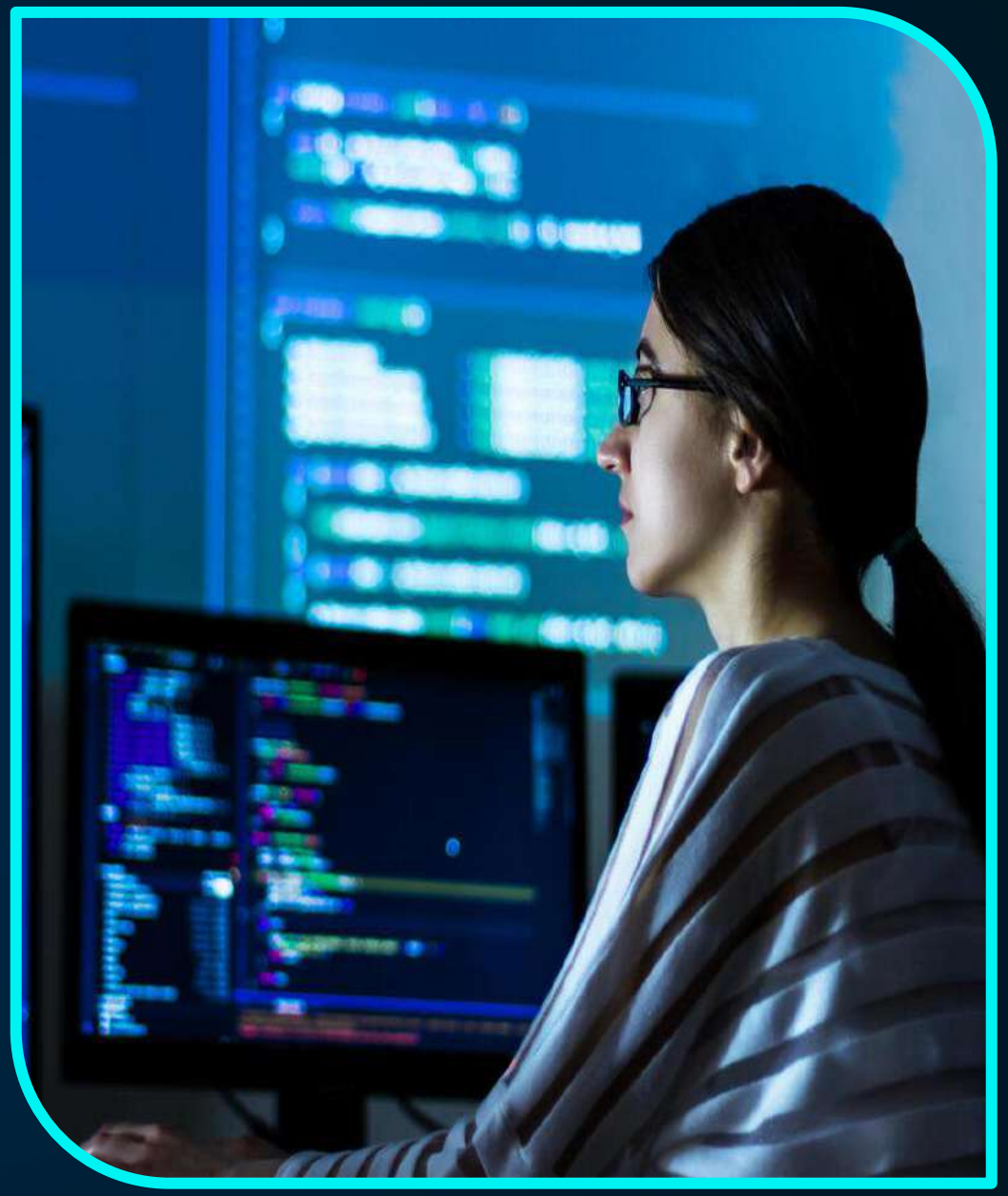
MORE CONCEPTS

The most important basic elements for programming languages are:

1. Programming Environment
2. Data Types
3. Variables
4. Keywords
5. Logical and Arithmetic Operators
6. If else conditions
7. Loops
8. Arrays and Structures
9. Functions
10. Input and Output Operations

The following are the things to consider when choosing a programming language to work on:

1. System response time
2. No. of simultaneous users
3. Web compatibility
4. Mobile compatibility
5. Security
6. Field of application
7. Design paradigm
8. Target platform



DEVELOPMENT OF PROGRAMMING LANGUAGES

1843
Ada Lovelace's machine algorithm, the foundation of all programming languages

1945
First "real programming language (Plankalkül) by Konrad Zuse – allowed for procedure creation

1949
Emergence of assembly language and High Level Language (Shortcode by John McCauley)

1952
Autocode by Alick Glennie – first ever compiled language to be implemented (translation to machine code)

1957
FORTRAN (FORmula TRANslation) by John Backus – Oldest programming language in-use today

1958
ALGOL (Algorithmic Language) – Starting point for the development of Pascal, C, C++, Java, etc.

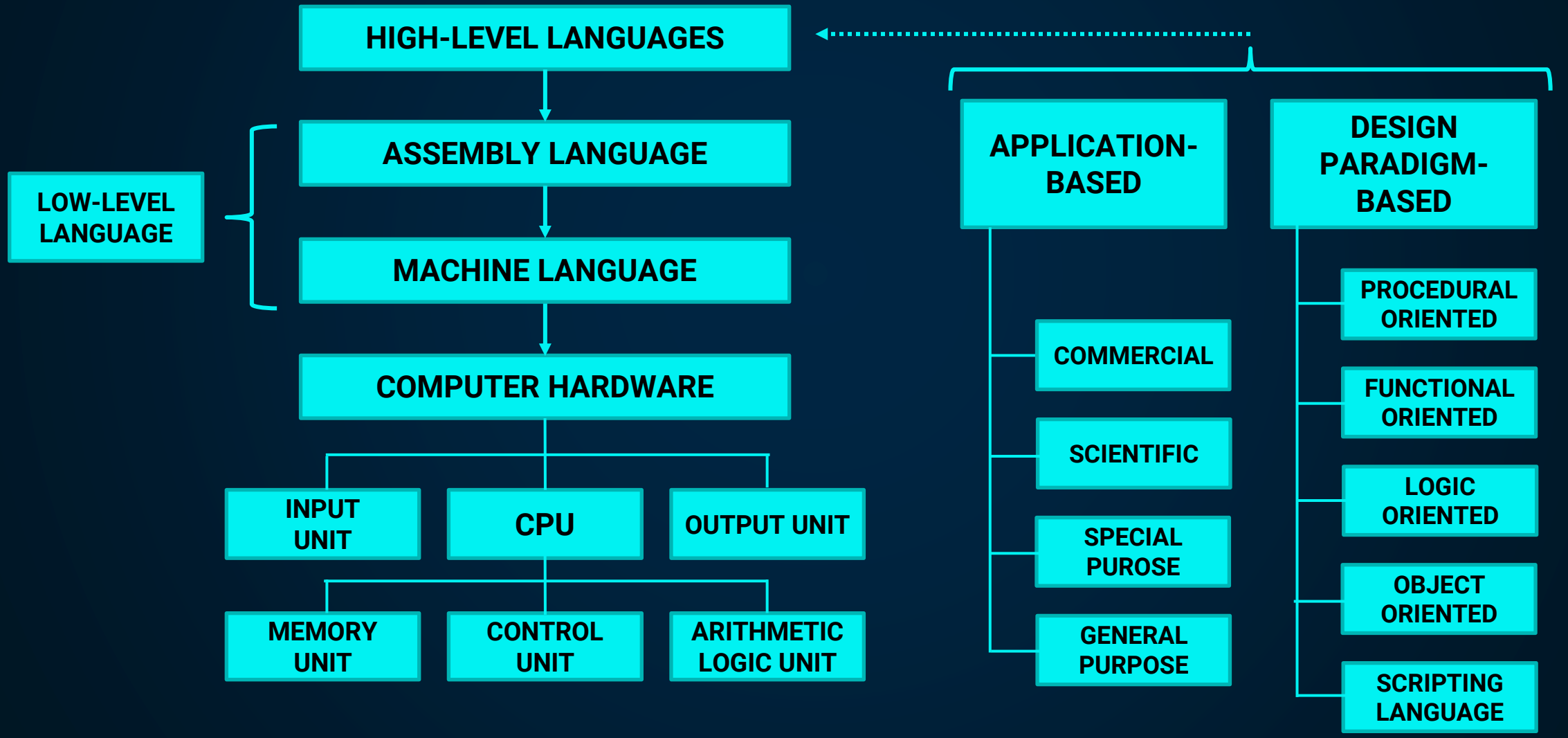
1959
COBOL - used in credit card processors, ATMs, phone calls, hospital and traffic signals systems

1964
BASIC (Beginners All-Purpose Symbolic Instruction Code) by Bill Gates – built for students with no programming background

CHARACTERICSTICS OF PROGRAMMING LANGUAGES

1. Simple, easy to learn and use.
2. Has the ability to define the complex structure of the language (abstraction).
3. Well structured and documented to make it suitable for application development.
4. Good readability and recognizability.
5. High-efficiency, minimal memory consumption
6. Ease of program verification
7. Portability; easy to transfer to other computers
8. Necessary tools for development, debugging, testing, program maintenance must be provided.
9. Provide single environment known as Integrated Development Environment (IDE).
10. Consistent in syntax and semantics.

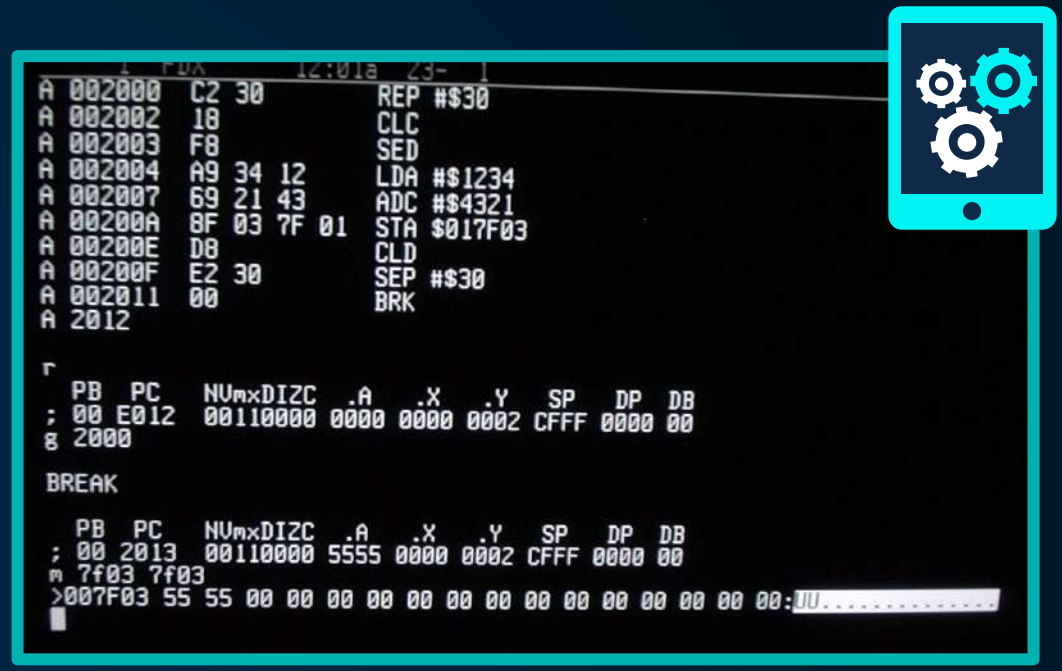
HIERARCHY OF PROGRAMMING LANGUAGES



MACHINE LANGUAGE

The instructions are written in binary form, which can be directly understood by the computer (CPU) without translating them, is called a machine language or machine code.

Machine language is also known as first generation of programming language. Machine language is the fundamental language of the computer and the program instructions in this language is in the binary form (that is 0's and 1's).



ADVANTAGES

- The only advantage of machine language is that the program of machine language runs very fast because no translation program is required for the CPU.
- It is the language being understood most by machines.

DISADVANTAGES

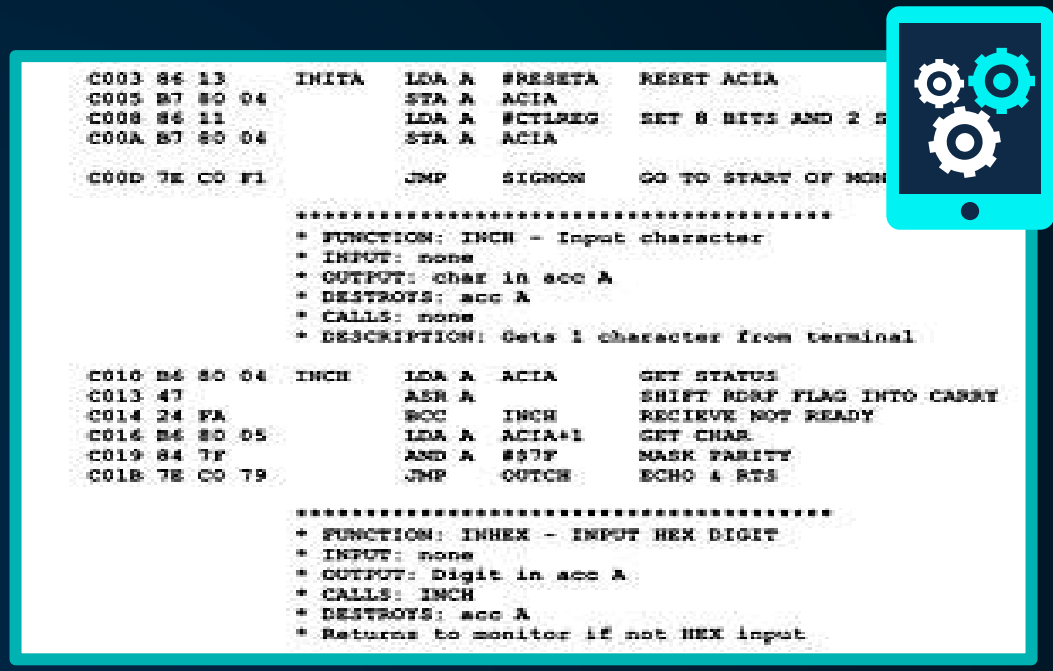
- The internal design of every computer is different from every other type of computer, making the machine language also differ from one computer to another.
- Difficult to create and modify programs under this language.
- Storage locations are to be remembered.

ASSEMBLY LANGUAGE

It is another low-level programming language because the program instructions written in this language are close to machine language.

Assembly language is also known as second generation of programming language. With assembly language, a programmer writes instructions using symbolic instruction code (mnemonic code) instead of binary codes.

Assembly language provides facilities for controlling the hardware.



```
C003 86 13      INITA   LDA A   #RESETA     RESET ACIA
C005 B7 80 04           STA A   ACIA
C008 86 11              LDA A   #CTLREG     SET 8 BITS AND 2 S
C00A B7 80 04           STA A   ACIA

C00D 7E C0 F1           JMP     SIGNON      GO TO START OF MON

                ****************************************
                * FUNCTION: INCH - Input character
                * INPUT: none
                * OUTPUT: char in acc A
                * DESTROYS: acc A
                * CALLS: none
                * DESCRIPTION: Gets 1 character from terminal

C010 B6 80 04   INCH    LDA A   ACIA        GET STATUS
C013 47                 ASR A               SHIFT RDRF FLAG INTO CARRY
C014 24 FA              BCC     INCH        RECIEVE NOT READY
C016 B6 80 05           LDA A   ACIA+1      GET CHAR
C019 84 7F              AND A   #$7F        MASK PARITY
C01B 7E C0 79           JMP     OUTCH       ECHO & RTS

                ****************************************
                * FUNCTION: INHEX - INPUT HEX DIGIT
                * INPUT: none
                * OUTPUT: Digit in acc A
                * CALLS: INCH
                * DESTROYS: acc A
                * Returns to monitor if not HEX input
```

ADVANTAGES

- Much easier to understand and use in contrast with machine language.
- Programmers need not to keep track of storage location of the data and instruction especially when locating errors.
- Easier to locate, correct and modify instruction in it.

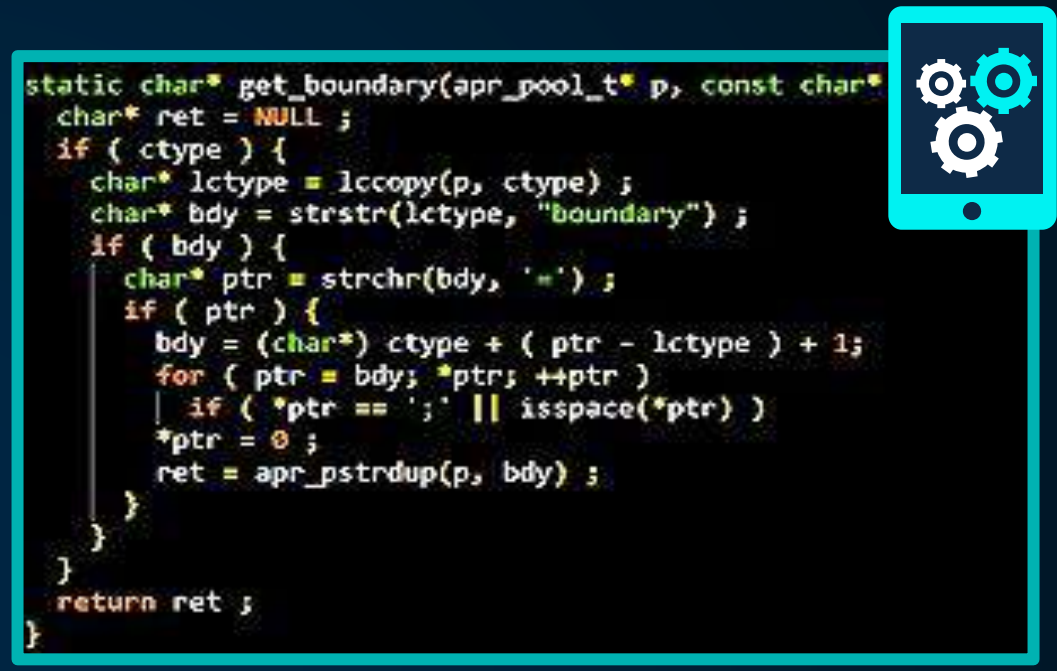
DISADVANTAGES

- Each instruction of assembly language program is translated into exactly one machine language instruction.
- Machine dependent, programmers must have solid knowledge on the computer hardware.
- Time-consuming and difficult to write codes.

HIGH-LEVEL LANGUAGE

The high level languages are similar to English language. The program instructions are written using English words, for example print, input etc. But each high level language has its own rule and grammar for writing program instructions – syntax of the language.

The high-level programming languages are designed for use in a number of areas. Each high-level language is designed by keeping its target application area in mind. Some of the high-level languages are best suited for business domains, while others are apt in the scientific domain only.



```
static char* get_boundary(apr_pool_t* p, const char*
  char* ret = NULL ;
  if ( ctype ) {
    char* lctype = lccopy(p, ctype) ;
    char* bdy = strstr(lctype, "boundary") ;
    if ( bdy ) {
      char* ptr = strchr(bdy, '=') ;
      if ( ptr ) {
        bdy = (char*) ctype + ( ptr - lctype ) + 1;
        for ( ptr = bdy; *ptr; ++ptr )
          if ( *ptr == ';' || isspace(*ptr) )
        *ptr = 0 ;
        ret = apr_pstrdup(p, bdy) ;
      }
    }
  }
  return ret ;
}
```

ADVANTAGES

- Easy to learn and understand, making programmers easy to coordinate with one another when developing.
- Machine-independent – can be worked across computers.
- A new program can easily be written in a very short time. The larger and complicated software can be developed in few days or months.
- Built in library functions that save programmers' time.

DISADVANTAGES

- May require more memory space, since a program written in high level languages has lower efficiency than one written in a machine/assembly language to do the same job.
- Less flexible than assembly languages because they do not normally have instructions or mechanism to control a computer's CPU, memory and register.

HIGH-LEVEL LANGUAGE: APPLICATION BASED CATEGORIZATION

COMMERCIAL LANGUAGES

These programming languages are dedicated to the commercial domain and are specially designed for solving business-related problems.

These languages can be used in organization for processing handling the data related to payroll, accounts payable and tax building applications.

EXAMPLES

COBOL – business domains

SCIENTIFIC LANGUAGES

These programming languages are dedicated to the scientific domain and are specially designed for solving different scientific and mathematical problems.

These languages can be used to develop programs for performing complex calculation during scientific research.

EXAMPLES

FORTRAN

HIGH-LEVEL LANGUAGE: APPLICATION BASED CATEGORIZATION

SPECIAL-PURPOSE LANGUAGES

These programming languages have precise semantics that are specially designed for performing some dedicated functions.

Such a language cannot be used to solve a problem that does not fall within its domain, since they do not have the properties that are suited for such problems.

Special-purpose languages are very specific and offer the necessary abstractions and notations.

EXAMPLES

SQL – Database Manipulation

LISP, Prolog – Artificial Intelligence

GENERAL-PURPOSE LANGUAGES

These programming languages are used for developing different types of software application regardless of their application area, covering a wide range of problems.

Sometimes, general-purpose programming languages are referred to as text-based programming, because programmers need to type texts, numbers, and symbols when coding. These languages also use a formal syntax.

EXAMPLES

BASIC, C, C++, Java

Markup Languages: HTML, XHTML

HIGH-LEVEL LANGUAGE: DESIGN PARADIGM BASED CATEGORIZATION

PROCEDURAL-ORIENTED LANGUAGES

Used to execute a sequence of statements which lead to a result. Typically, this type of programming language uses multiple variables, heavy loops and other elements, which separates them from functional programming languages.

Functions of procedural language may control variables, other than function's value returns. For example, printing out information.

EXAMPLES

FORTRAN, ALGOL, C, BASIC, and ADA

FUNCTIONAL-ORIENTED LANGUAGES

Functional programming language typically uses stored data, frequently avoiding loops in favor of recursive functions.

The functional programing's primary focus is on the return values of functions, and side effects and different suggests that storing state are powerfully discouraged.

EXAMPLES

Kotlin, Python, Wolfram Language

HIGH-LEVEL LANGUAGE: DESIGN PARADIGM BASED CATEGORIZATION

LOGIC-ORIENTED LANGUAGES

These languages use logic programming paradigms as the design approach for solving various computational problems. Predicate logic is used to describe the nature of a problem by defining the relationship between rules and facts.

In a sense, this language doesn't tell the computer how to do something, but employing restrictions on what it must consider doing.

EXAMPLES

Prolog, Mercury, Oz

OBJECT-ORIENTED LANGUAGES

This programming language views the world as a group of objects that have internal data and external accessing parts of that data. One of its main principles is encapsulation that everything an object will need must be inside of the object.

This language also emphasizes reusability through inheritance and the capacity to spread current implementations without having to change a great deal of code via polymorphism.

EXAMPLES

C++, C#, Java

HIGH-LEVEL LANGUAGE: DESIGN PARADIGM BASED CATEGORIZATION

SCRIPTING PROGRAMMING LANGUAGES

These programming languages are often procedural and may comprise object-oriented language elements, but they fall into their own category as they are normally not full-fledged programming languages with support for development of large systems.

For example, they may not have compile-time type checking. Usually, these languages require tiny syntax to get started.

EXAMPLES

JavaScript, PHP, Ruby, Bash

COMMONLY USED PROGRAMMING LANGUAGES

1	**C++**	Game Development, Advance Computations, and Graphics Compilers
2	**Java**	Android application development, web apps, and Big data.
3	**R**	Data Science projects, Statistical computing, Machine learning
4	**JavaScript**	Web/mobile app development, game development, and desktop app development.
5	**Python**	Web and Internet Development, Scientific and Numeric applications, Desktop GUIs, Business applications. It is widely used in AI and Machine Learning space.

COMMONLY USED PROGRAMMING LANGUAGES

6	**C#**	Enterprise Cross-Applications Development, Web Applications
7	**PHP**	Web Development, Content Management Systems, eCommerce Applications
8	**Go**	Console utilities, GUI applications, and web applications
9	**SQL**	Manipulation of any database
10	**Swift**	Works with Apple's Cocoa and Cocoa Touch frameworks to create all types of iOS apps.

06

TYPES OF NETWORKING DEVICES

Pages 87-103

INTRODUCTION

Network devices, or networking hardware, are physical devices that are required for communication and interaction between hardware on a computer network.

In a computer network, network devices are mainly used for transmitting and receiving the data quickly and securely in between computers, fax machines, printers, etc. These devices may be intra network or internetwork. Also, each network device plays a key role based on their functionality, and also works for different purposes at different segments.

There are some devices are installed on the device such as RJ45 connector otherwise NIC card, whereas some devices are part of the network namely switch, router, etc.

These network devices are specific devices that handle digital or electrical connections to perform their exclusive roles very efficiently.

IMPORTANT TERMINOLOGIES

1	**Server**	Computers that hold accessible shared programs, files, and the network resources.
2	**Client**	Computers which access and uses the network as well as shares network resources.
3	**Shared data**	Data between the clients such as data files, printer access programs, and email.
4	**Network Interface Card (NIC)**	Sends, receives data, and controls data flow between the computer and the network.
5	**Protocol**	Set of defined rules that allows two entities to communicate across the network.
6	**IP Address**	Unique identifier for each device on the Internet. 32 bits for IPv4 and 64 bits for IPv6.
7	**DNS Server**	Server which translates URL or web addresses into their corresponding IP addresses.
8	**MAC address**	Physical address uniquely identifying each host and is associated with the NIC. Has 48 bits.
9	**Port**	Logical channel which allows network users to send or receive data to an application.

COMMON NETWORKING DEVICES

REPEATER

HUB

SWITCH

BRIDGE

ROUTER

GATEWAY

MODEM

ACCESS POINT

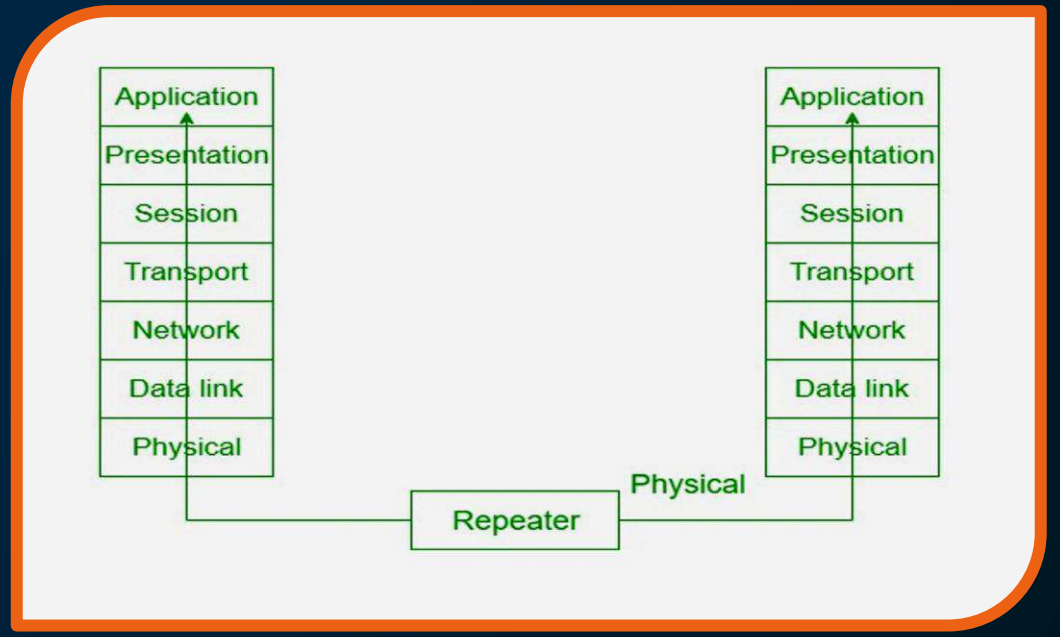
BROUTER

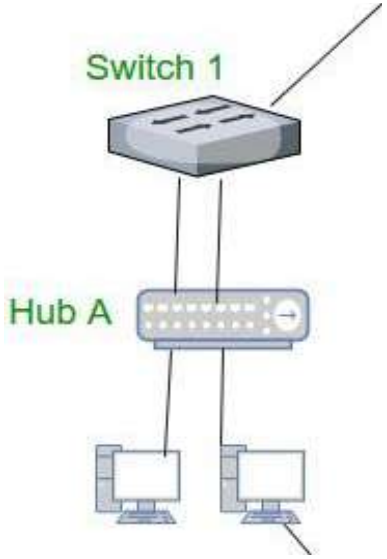
REPEATER

Operating at the physical layer, the repeater's job is to regenerate the signal over the same network before the signal becomes too weak or corrupted so as to extend the length to which the signal can be transmitted over the same network, covering up to more than 100 meters for standard LAN cables.

Repeaters do not amplify the signals. Rather, when the signal becomes weak, they copy the signal bit by bit and regenerate it at the original strength.

A repeater is a two port device. The functionality of the network remains unchanged by the use of repeater.





HUB

A hub is basically a multiport repeater. A hub connects multiple wires coming from different branches, for example, the connector in star topology which connects different stations.

Hubs cannot filter data, so data packets are sent to all connected devices. In other words, collision domain of all hosts connected through Hub remains one. Also, they do not have the intelligence to find out best path for data packets which leads to inefficiencies and wastage.

A hub provides the half duplex mode of transmission, transmits data in electric signals or bits, and is generally used in LANs. It usually has a maximum of four ports.

TYPES OF HUBS

ACTIVE HUB

These are the hubs which have their own power supply and can clean, boost, and relay the signal along with the network.

It serves both as a repeater as well as wiring center. These are used to extend the maximum distance between nodes.

PASSIVE HUB

These are the hubs which collect wiring from nodes and power supply from active hub.

These hubs relay signals onto the network without cleaning and boosting them and can't be used to extend the distance between nodes.

INTELLIGENT HUB

These work like active hubs and include remote management capabilities. They also provide flexible data rates to network devices.

It also enables an administrator to monitor the traffic passing through the hub and to configure each port in the hub.

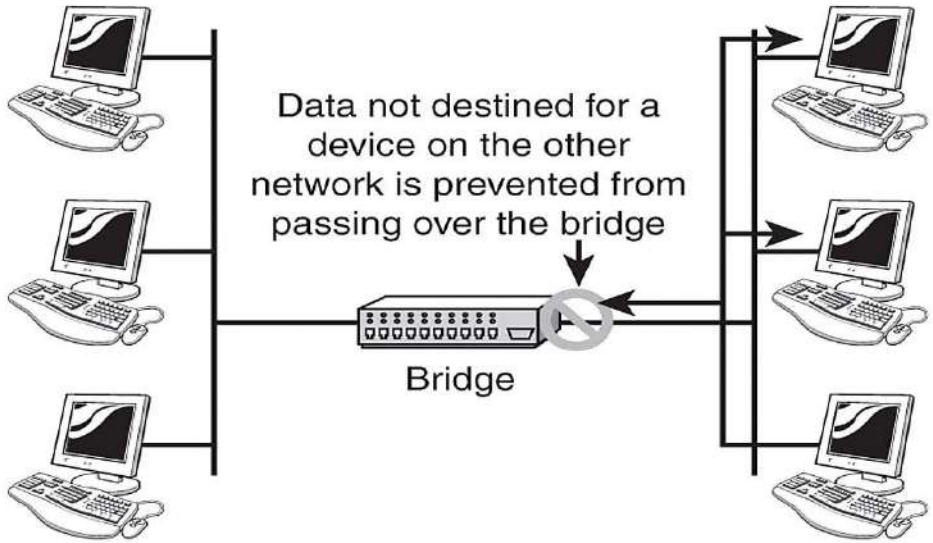
BRIDGE

Bridges are networking devices that connect networks. Sometimes it is necessary to divide networks into subnets to reduce the amount of traffic on each larger subnet or for security reasons. Once divided, the bridge connects the two subnets and manages the traffic flow between them.

A bridge functions like a repeater but also controls the blocking and forwarding of data, based on the destination MAC address written into each frame of data.

If the bridge believes the destination address is on a network other than that from which the data was received, it can forward the data to the other networks to which it is connected. If the address is not on the other side of the bridge, the data is blocked from passing.

Bridges "learn" the MAC addresses of devices on connected networks by "listening" to network traffic and recording the network from which the traffic originates.



TYPES OF BRIDGES

TRANSPARENT BRIDGE

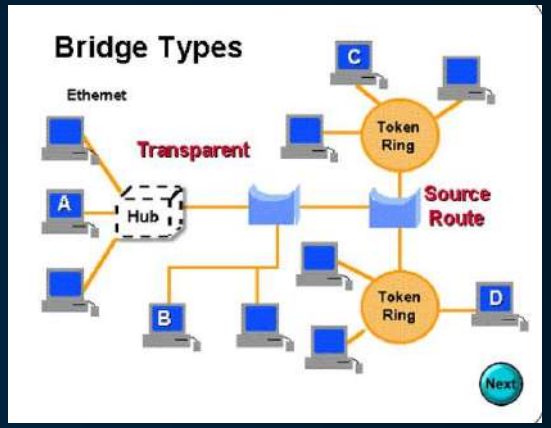
Invisible to the other devices on the network. They perform only the function of blocking or forwarding data based on the MAC address.

The devices on the network are oblivious to these bridges' existence.

TRANSLATIONAL BRIDGE

Can convert from one networking system to another, translating the data it receives.

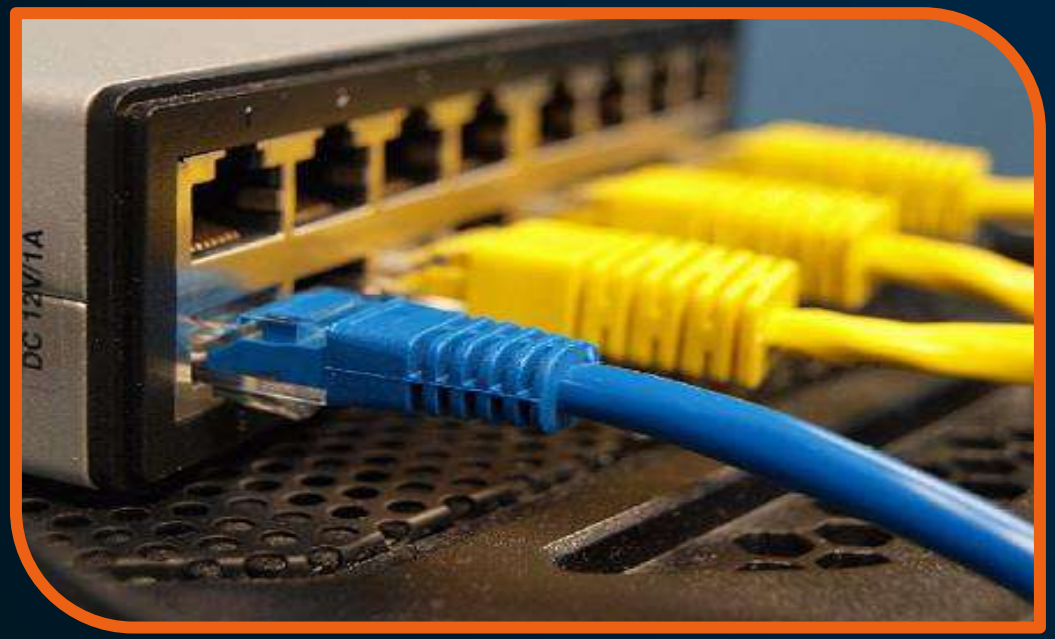
Useful for connecting two different networks, such as Ethernet and Token Ring networks. Depending on the direction of travel, a translational bridge can add or remove information and fields from the frame as needed.



SOURCE-ROUTE BRIDGE

Designed by IBM for use on Token Ring networks.

The entire route of the frame is embedded within the frame. This allows the bridge to make specific decisions about how the frame should be forwarded through the network.



SWITCH

A switch is a multiport bridge with a buffer and a design that can boost its efficiency (a large number of ports imply less traffic) and performance. A switch is a data link layer device.

The switch can perform error checking before forwarding data, that makes it very efficient as it does not forward packets that have errors and forward good packets selectively to correct port only. In other words, switch divides collision domain of hosts, but broadcast domain remains same.

A switch is more intelligent than a hub. It improves the capacity of the network and keeps limited information on routing nodes in the internal network and provides links to systems such as hubs or routers.

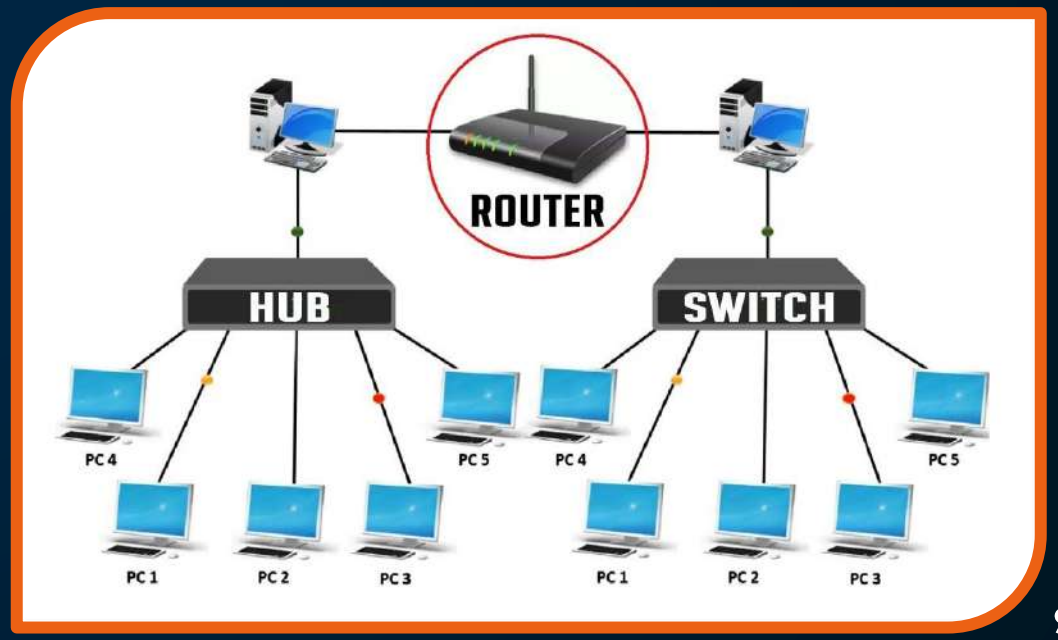
It improves the effectiveness of the Network over hubs or routers because of the flexibility of the digital circuit, improving overall network protection.

ROUTERS

A router is a device like a switch that routes data packets based on their IP addresses. Router is mainly a Network Layer device.

Routers normally connect LANs and WANs together and have a dynamically updating routing table based on which they make decisions on routing the data packets. A router also divides broadcast domains of hosts connected through it.

Routers allow packets to be transmitted to their destinations by monitoring the sea of networking devices interconnected with different network topologies. Routers are smart devices and store data on the networks to which they are connected. Most routers can be adjusted as a firewall for packet filters and can use ACLs.



TYPES OF ROUTERS

WIRED ROUTER

One connection port of the wired router used to connect modem for receiving internet data packs, while another set of ports allows a wired router to connect to computers for distributing internet data packets.

Uses (SPI) firewalls while providing communication between computers within a network for the security purpose.

WIRELESS ROUTER

Distributes data packets using one or more antennae.

It carries binary code data packets or series of 1s and 0s which converted into radio signals and the antennae broadcast wirelessly.

Engaged Media access control (MAC) address filtering and Wi-Fi Protected Access (WPA) security.

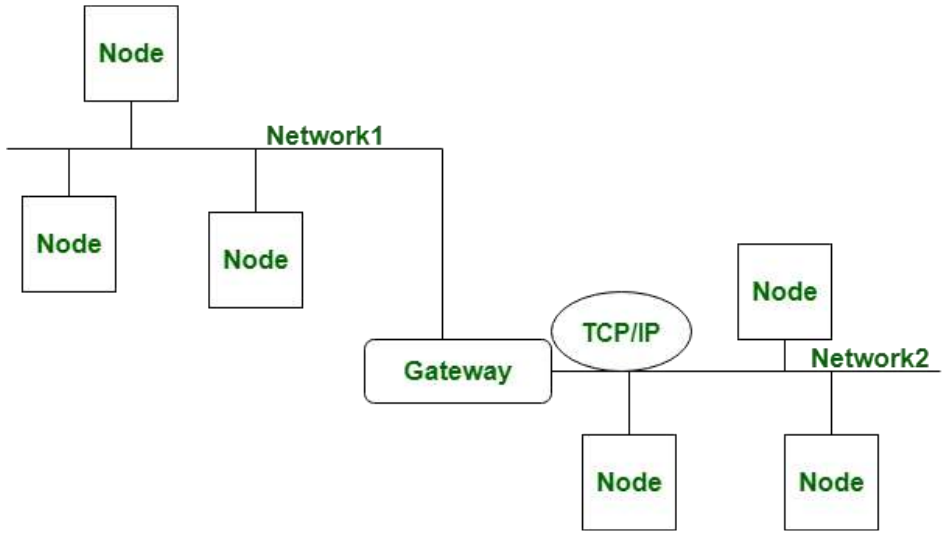
CORE / EDGE ROUTER

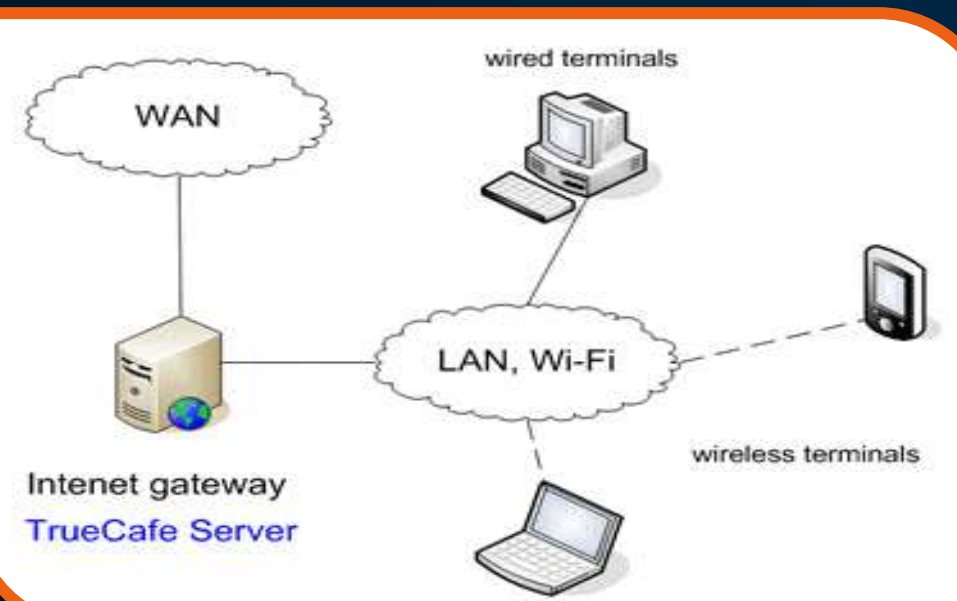
Core router

- wired or wireless router that distributes internet data packets within a network.

Edge router

- wired or wireless router which distributes Internet data packets between one or more networks but does not distribute data packets within a network





GATEWAY

A gateway is a passage to connect two networks together that may work upon different networking models. They basically work as the messenger agents that take data from one system, interpret it, and transfer it to another system. Gateways are also called protocol converters and can operate at any network layer. Gateways are generally more complex than switch or router.

It is where the transportation and session layers of the OSI model usually work in. Gateways link, thus, two or more self-contained networks with their own algorithms, protocols, topology, domain name system and policy, and network administration.

All routing functions and more are handled by gateways.

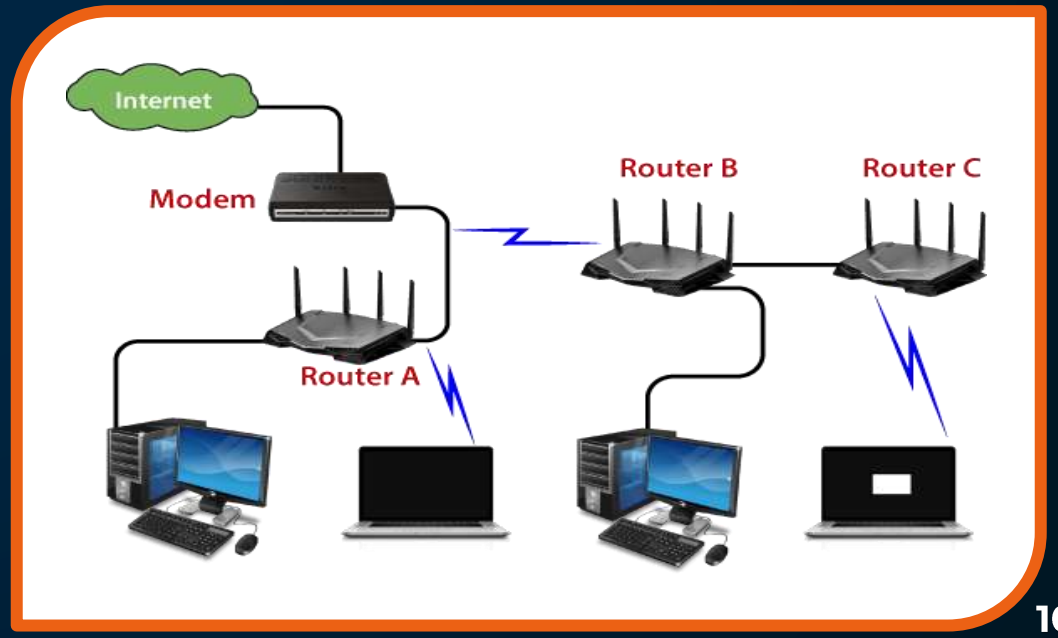
MODEM

Digital signals are transmitted through analog phone lines using modems (modulator-demodulators). The modem converts digital signals into analog signals of various frequencies and transmits them to a modem at the receiver location.

The receiving modem turns the other way and provides a digital output to a device, normally a computer, connected to a modem.

The digital data is usually transferred to or from the modem over a serial line through an industry standard interface, RS-232. Many telephone companies offer DSL services, and many cable operators use modems as end terminals for identification and recognition of home and personal users.

All physical and data link layers are operating on modems.



TYPES OF MODEMS

EXTERNAL MODEM

Standalone modem that does not contain a router. It can, but is rarely, attached directly to a computer via USB, Ethernet or sometimes Wi-Fi.

Usually attached to a separate router so to share connection with multiple network nodes around the home or office.

ROUTER/MODEM COMBO

Modem that is contained within a router, which allows multiple computers or devices to connect within one network.

It is a fairly common technology nowadays as it means networks don't need a separate modem and router.

INTEGRATED MODEM

Modem that is contained within a computer (usually by USB or as a PCI card).

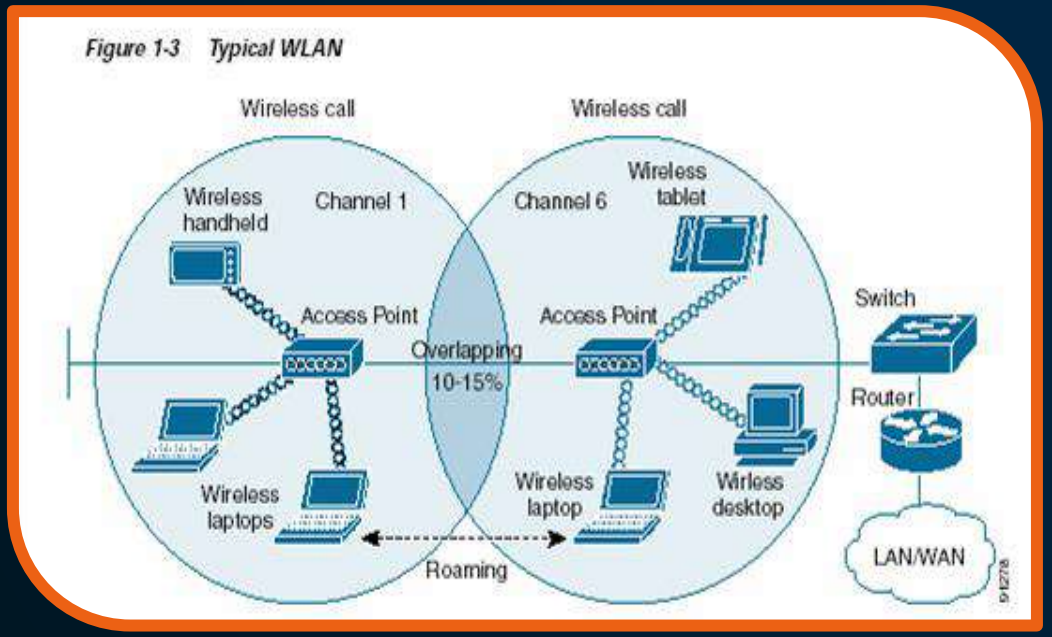
As most people have a range of computers and devices they want to connect to the internet, this type of modem is not really used anymore as it only allows the one computer to connect to the internet.

ACCESS POINT

While a wired or wireless link is technological in an AP, it usually means a wireless device. An AP operates on the second OSI layer, the data link layer, and can either act as a bridge that connects a standard wireless network to wireless devices or as a router that transmits data to another access point. Access points are usually networked separate machines with an integrated antenna, transmitter, and adapter.

In order to provide a link between WLAN and wired Ethernet Lan, APs are using wireless infrastructure network mode. They have several ports, which allow us to extend the network to support other customers.

One or more APs may need to have full coverage, depending on the size of the network. APs may also provide multiple ports that can be used to increase the size of the network, the capabilities of firewalls and the DHCP. So this becomes switch-based APs, DHCP servers, firewall, and router.



BROUTER

It is also known as bridging router is a device which combines features of both bridge and router. It can work either at the data link layer or at the network layer.

Working as router, it is capable of routing packets across networks.

Working as bridge, it is capable of filtering local area network traffic.

Having a solid understanding of the types of network devices available can help design and build a network that is secure and serves our organization well.

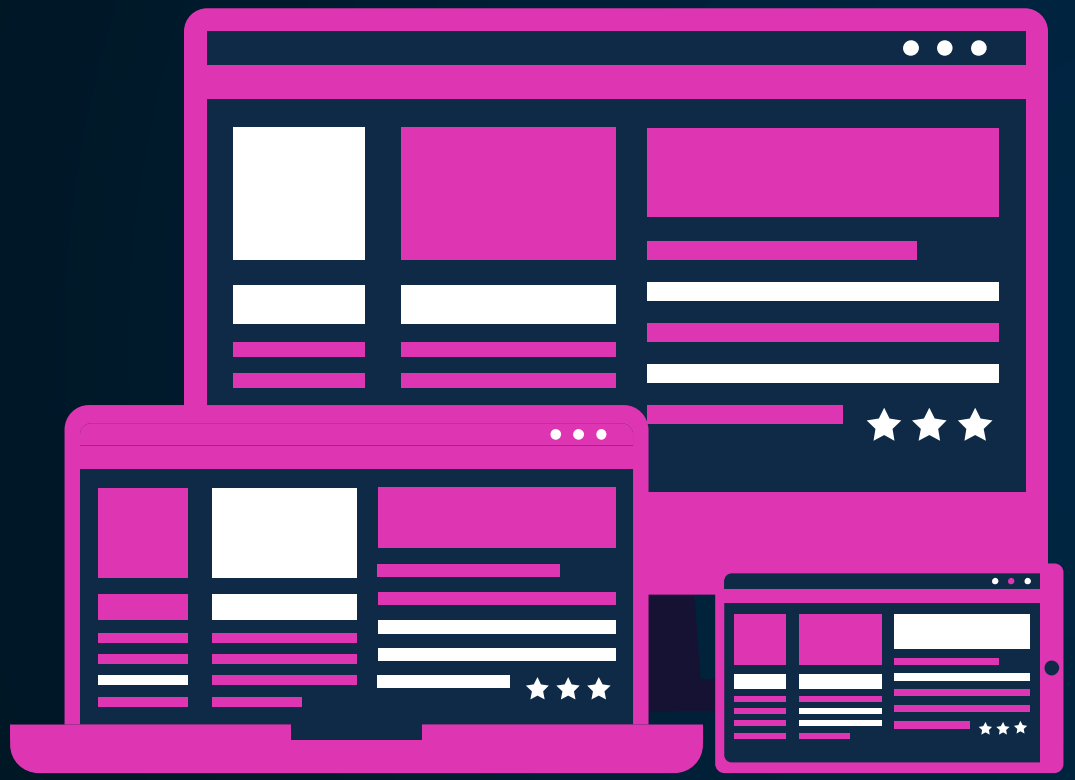
However, to ensure the ongoing security and availability of the network, we should carefully monitor our network devices and activity around them, so we can quickly spot hardware issues, configuration issues and attacks.

07

TYPES OF WEBSITES

Pages 104-123

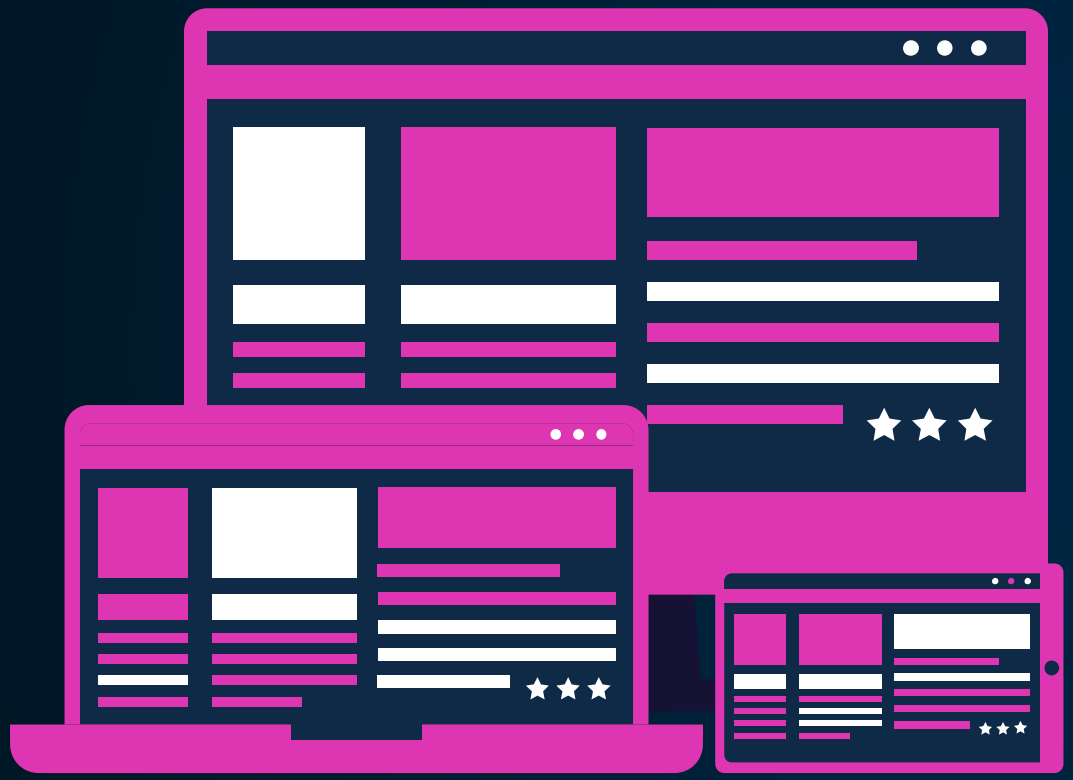
INTRODUCTION



The World Wide Web (WWW) was created back in 1990 by the British CERN physicist Tim Berners-Lee. On 30 April 1993, CERN announced that the World Wide Web would be free to use for anyone.

Different websites started to pop up since then. And currently, instead of only text and images, current web browsers are now supporting multimedia and all other forms of interactive content, making web pages appear better and more attractive than they used to be before.

Nowadays, websites primarily act as a bridge between one who wants to share information and those who want to consume it. If a person is running a business, then it is almost imperative for him or her to have a website to broadcast his or her offerings and reach out to potential clients at a global stage. The same also applies to those with other agendas such as blogging and creating music so that they can be able to showcase what they have to the billions of people browsing the internet.



DESIGNING QUALITY WEBSITES

It is important to design quality websites since it is the main basis for attracting viewers and clients as well as to increase their time being spent on the websites created.

A quality website should be…

- clean and decent, well-organized, easy to navigate
- clear and modern in appearance and layout
- functional, branded, and motivating
- looking good in all browsers and platforms (responsive)
- consistent, concise, and coherent in terms of content
- easy-to-find essential information (hours of operation, contact info, location, etc.)
- attractive in design with the right use of colors, spaces, fonts, and other website attributes

Your website is a tool. Make that tool quality from the start. Then use it and take good care of it.

STATIC vs. DYNAMIC WEBSITES

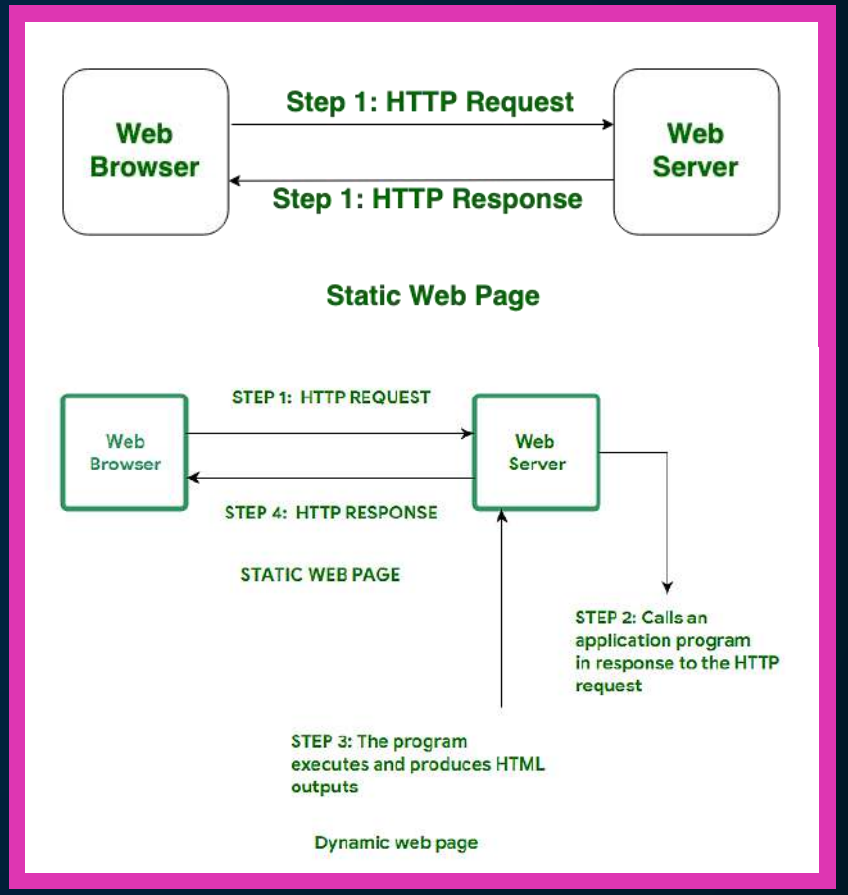
- Internet communication involves a server and a web browser.
- To establish a connection between the two, a set of rules called Hypertext Transfer Protocol (HTTP) is used. Simply put, the web browser transmits an HTTP request to the server, and the server then replies with an HTTP response along with the requested webpage in HTML.

STATIC WEBSITES

Static websites usually come with a fixed number of pages that have a specific layout. When the page runs on a browser, the content is literally static and doesn't change in response to user actions. A static website is usually created with HTML and CSS in simple text editors like Notepad.

DYNAMIC WEBSITES

Dynamic websites are more functional than static websites. It allows users to interact with the information that is listed on the page. They include aspects that are characterized by interactivity and functionality, making them more complex in terms of building and design, but they are also more versatile. That requires utilizing HTML and CSS plus both client-side and server-side scripting languages such as JavaScript, PHP, or ASP.



STATIC vs. DYNAMIC WEB PAGES (CONT.)

STATIC WEB PAGES	DYNAMIC WEB PAGES
Pages will remain same until someone changes it manually.	Content of pages are different for different visitors.
Simple in terms of complexity.	Complicated compared to static web pages.
Information are changed rarely.	Information are changed frequently.
Takes less time for loading.	Takes more time for loading.
Database is not used.	Database is used.
Written in languages such as: HTML, JavaScript, CSS, etc.	Written in languages such as: CGI, AJAX, ASP, ASP.NET, etc.
Does not contain any application program.	Contains application programs for different services.
Require less work and cost in designing them.	Require comparatively more work and cost in designing them.

WEB APPLICATION vs. WEBSITE

WEB APPLICATION

A piece of software that can be accessed by the browser (an application that is used to browse the internet).

Web application needs authentication. The web application uses a combination of server-side scripts and client-side scripts to present information. It requires a server to manage requests from the users.

EXAMPLES

Facebook, Google Apps, Amazon

WEBSITE

A collection of related web pages that contains images, text, audio, video, etc. It can consist of any number of webpages which are identified by a common domain name and published on at least one web server.

A website provides visual and text content that users can view and read.

EXAMPLES

Archive websites, Blogs, Community websites

WEB APPLICATION vs. WEBSITE (CONT.)

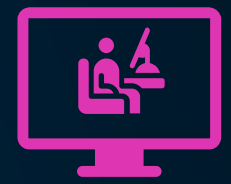
WEB APPLICATION	WEBSITE
Designed for interaction with end users.	Basically contains static content.
The user can read the content of web application and also manipulate the data.	The user can only read the content of website but not manipulate.
Should be precompiled before deployment.	Does not need to be precompiled.
Functions are quite complex.	Functions are simple.
Interactive for users.	Not interactive for users.
Integration is complex for web application because of its complex functionality.	Integration is simpler for web site.
Mostly requires authentication.	Authentication is not necessary.

COMMON WEBSITE CATEGORIES

BLOG

PORTFOLIO

E-COMMERCE



ENTERTAINMENT

BROCHURE

NONPROFIT

MEDIA

PERSONAL

WEB PORTAL

EDUCATIONAL

INFOPRENEUR

COMMUNITY FORUM

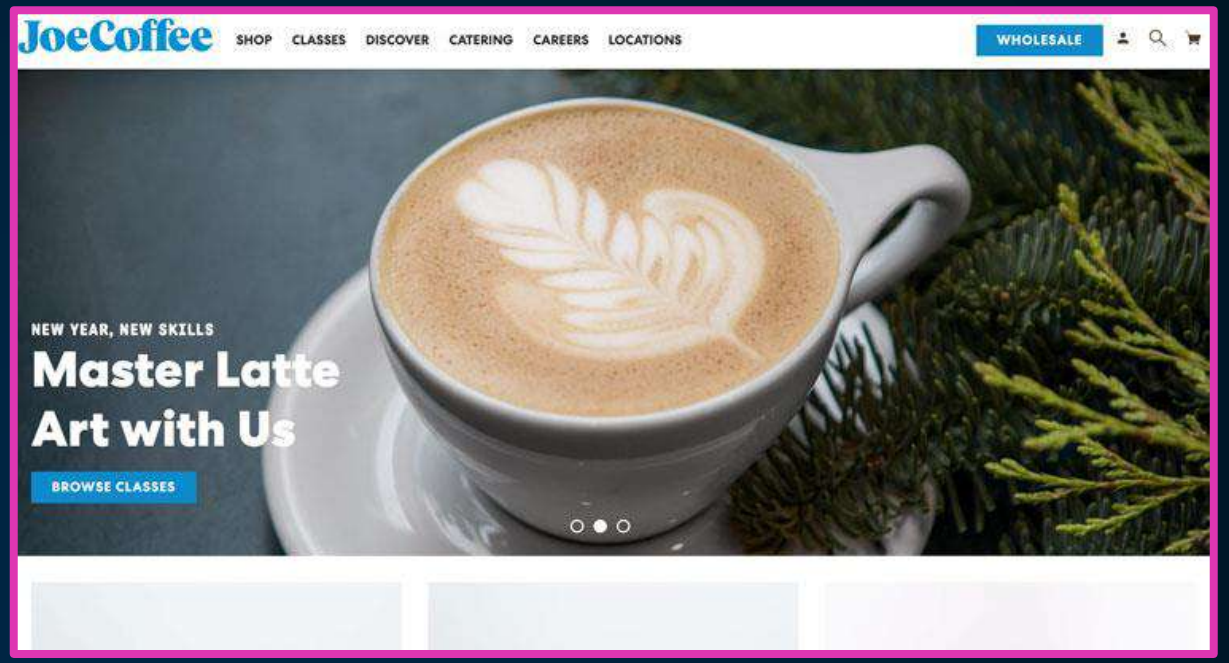
1 BLOG WEBSITE

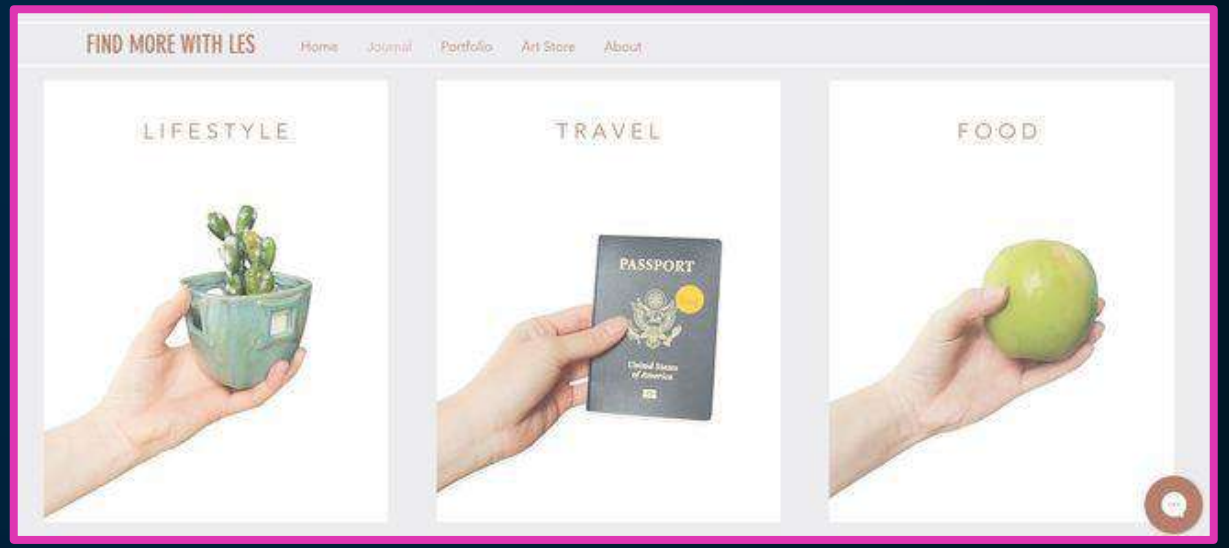
The word “blog” is the short form for “weblog.” It is a digital journal. It started as a trend for individuals, but it grew as businesses started using them to update customers as well as offer valuable and informative content.

The difference between a blog and a regular website is that a blog is a website to create if you only want to publish blog articles. The typical website has other features and components like the other types of websites in this list.

They’re the type of website to create if you want to quickly share life updates to friends and family.

A blog can cover any topic – whether it’s travel tips, financial advice, or doughnut reviews. While they’re often written in an informal or conversational style, professional blogging has gone on to become an extremely popular method of making money online.





2 PORTFOLIO WEBSITE

Portfolio websites are extremely helpful for showcasing examples of your work, all in one place. They are popular for any creator, whether that be an artist, photographer, journalist, or graphic designer.

Having examples of one's work in one place is a great way to show prospective new clients what he or she is capable of. It can be notable that a prospective client will choose to work with someone with an online portfolio that they can peruse versus someone who doesn't have one.

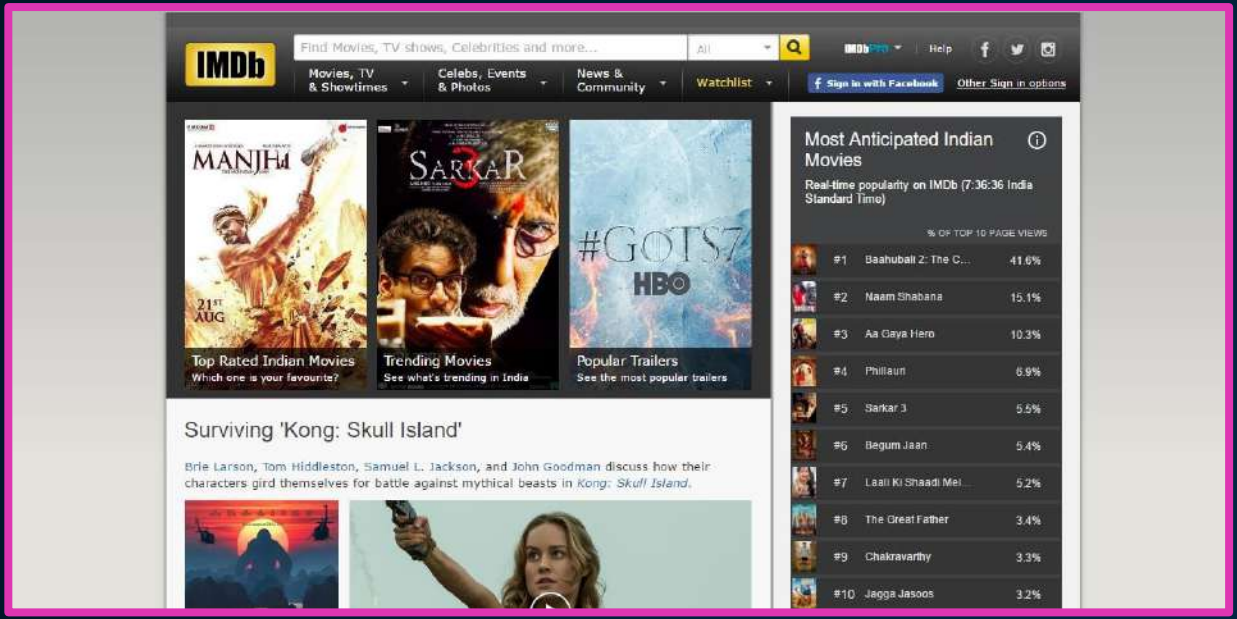
These websites are also used by those in the creative industry, a portfolio website can be used like a CV, demonstrating one's skills in order to impress clients, customers, or future employers. This is also common for creative professionals and freelancers that are hired based on demonstrated skill and can be a more efficient alternative to a business website that serves a similar focus

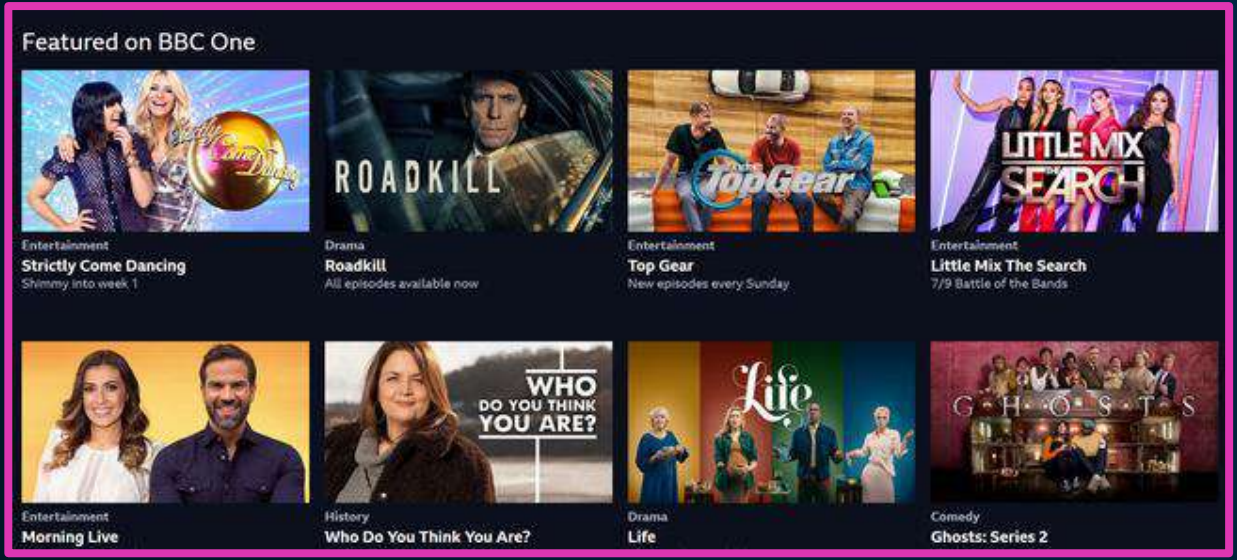
3 E-COMMERCE WEBSITE

An ecommerce site, otherwise known as an online store, allows one to take online payments for products or services. Stores can function as standalone websites, or be combined with a blog or corporate website. They're the type of websites to build if you want to earn money on the side, or you want to start a business.

These types of websites contain components like product pages with buttons that either leads directly to the checkout page to process the payment, or items can be placed in a virtual shopping cart. Items are collected there until the shopper is ready to checkout and place their order.

Some important steps include investing in eCommerce software and getting an SSL certificate to ensure that your customers can pay securely.





4 ENTERTAINMENT WEBSITE

An entertainment website exists purely for entertainment purposes. Successful entertainment websites are extremely popular and receive hundreds of thousands of hits every day. Entertainment websites are about boosting the mood of the viewer and having a little fun.

Entertainment websites are important as they are an online platform for the entertainment that reaches users. It is more effective as it blends entertaining content and functionality with video chat communications, live video streaming, music and videos streaming, multi-player gaming, and more.

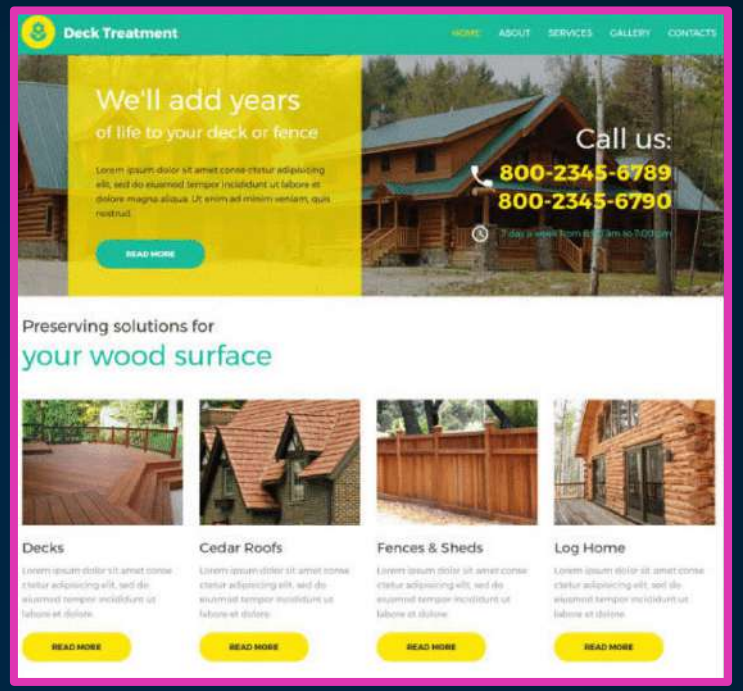
Entertainment websites should be well-designed so that it could be easy for the users to navigate and get the frequent updates so that they keep coming back for the same.

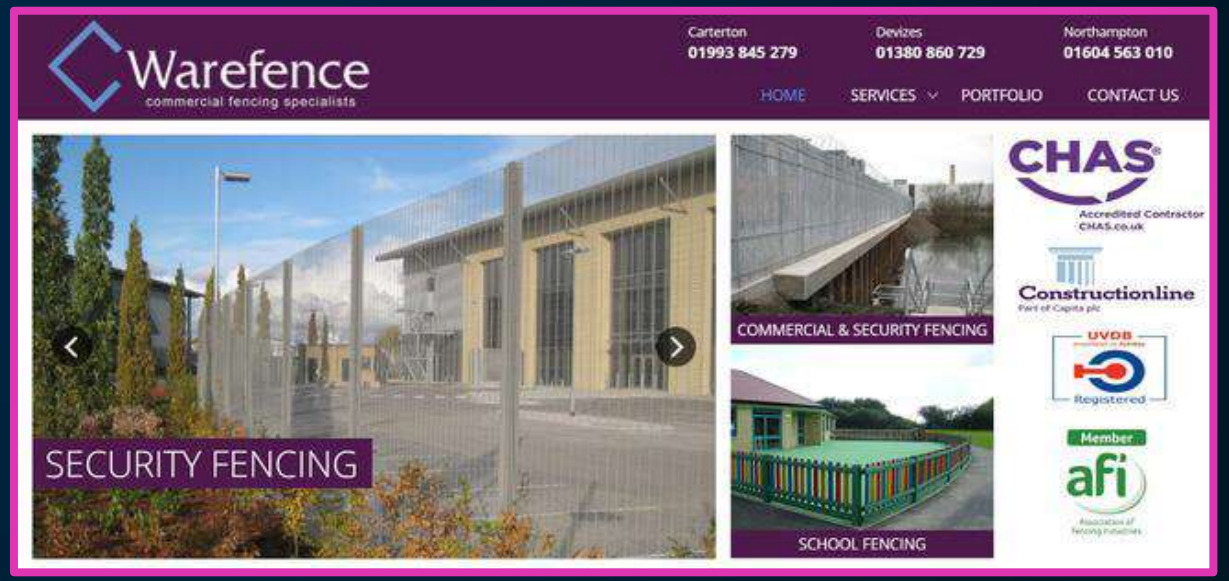
5 BROCHURE WEBSITE

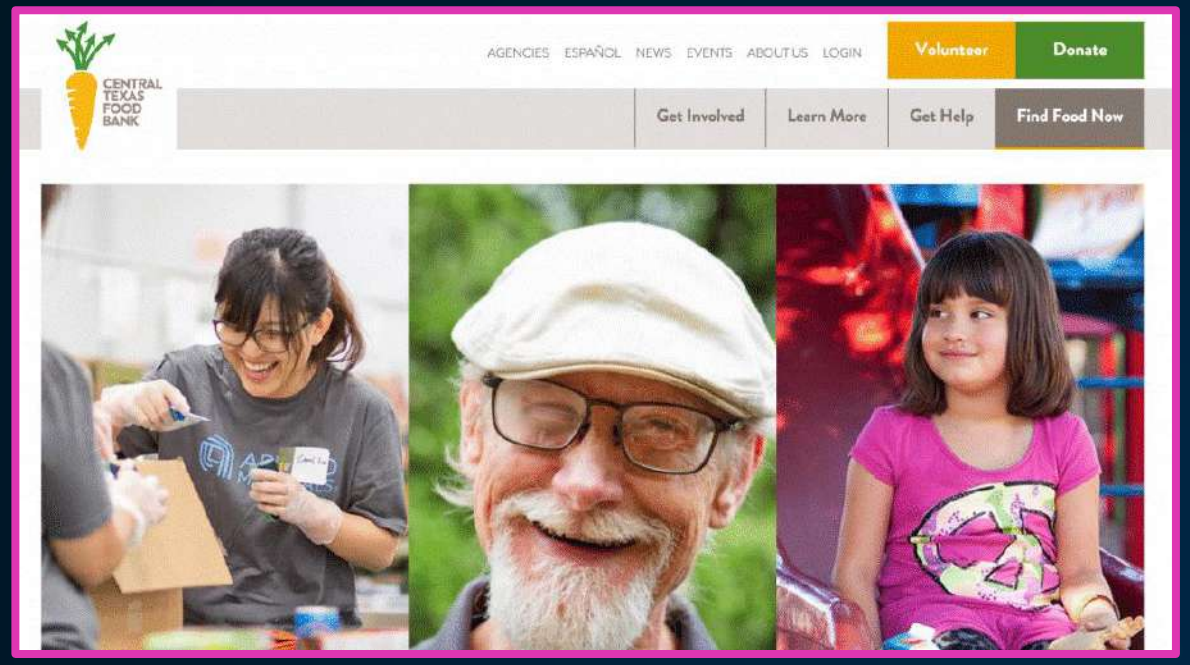
Brochure websites are like digital business cards. Mainly used by small businesses, these types of websites are used to advertise services, and to display contact information, with just a few pages. Brochure websites are a type of business website but are much, much simpler.

For businesses that know they need an online presence, but don't want to invest a lot into it (maybe you're confident you'll continue to get most of your business from other sources), a simple brochure site that includes just a few pages that lay out the basics of what you do and provide contact information may be enough for you..

This may be enough for your business, especially if you don't plan on selling your products or services online.







6 NONPROFIT WEBSITE

In the same way that businesses need websites to be their online presence, nonprofits do as well. A nonprofit website is the easiest way for many potential donors to make donations and will be the first place many people look to learn more about a nonprofit and determine if they want to support it.

Nonprofit websites are important for any charity. It's an integral part of putting your cause out there for the public to find and donate to. Having a nonprofit website is your chance to explain what your charity's all about and what your cause of action is while letting someone decide for themselves if they want to support it.

It's a perfect way to reach as many people as possible while developing legitimacy as a charity.

7 MEDIA WEBSITE

Media websites collect news stories or other reporting. There's some overlap here with entertainment websites, but media websites are more likely to include reported pieces in addition to or instead of content meant purely for entertainment. The primary aim of media websites is to inform the public about current news and events to keep the audience updated of the current ongoing affairs in the society.

Sites like these are getting popular nowadays amidst the public as companies doing print media before are shifting to an online platform, thus creating websites. These are important as well as they contain factual and verified information compared to unfiltered contents revolving In social media.

Media websites generally make money through either advertisements that show up on the site, subscription models, or a combination of the two.

8 PERSONAL WEBSITE

This is a type of website to create if you want to feature a person as a brand. The defining characteristic of a personal website is the title, which is the person the site is about.

Other than that, there are no conventions for what these types of websites can include. Generally speaking, the subject matter that's covered is a topic that's expressed genuinely and in the personality's tone, style, and point of view.

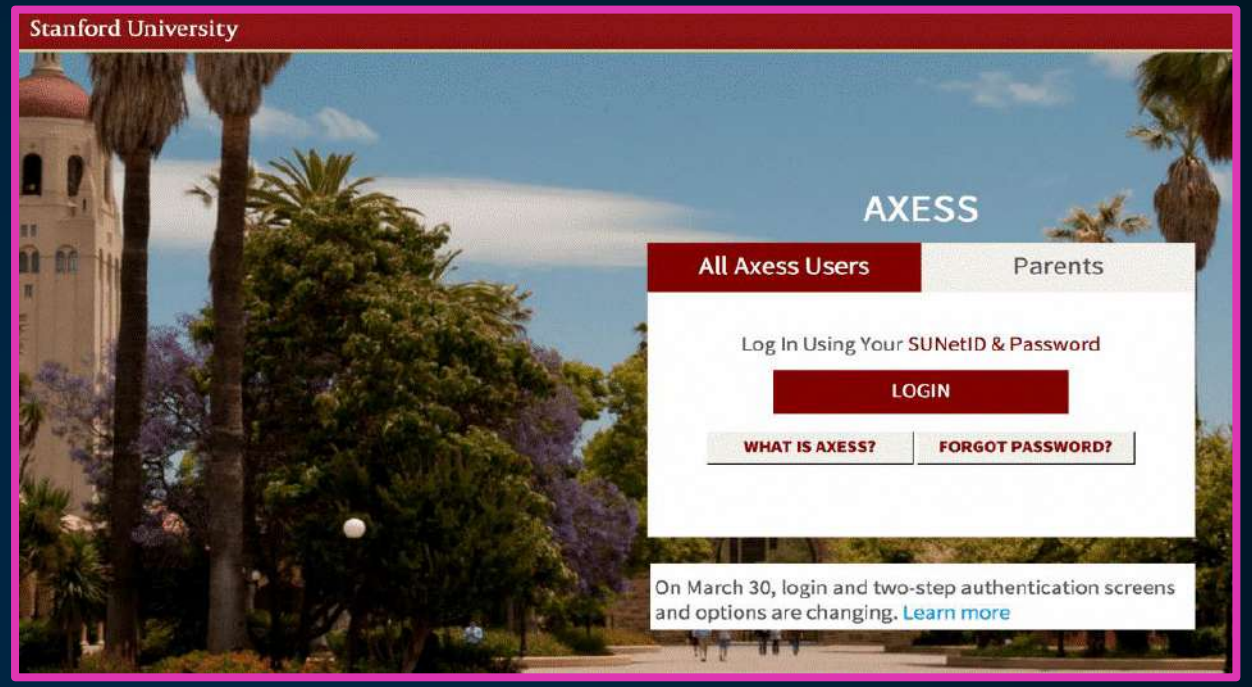
A personal website does not necessarily exist to make money, though it can. It could just be about getting your ideas, thoughts, and general content out into the world. However, this can eventually be a rewarding project and is a great way to represent yourself in the wide world of the internet.

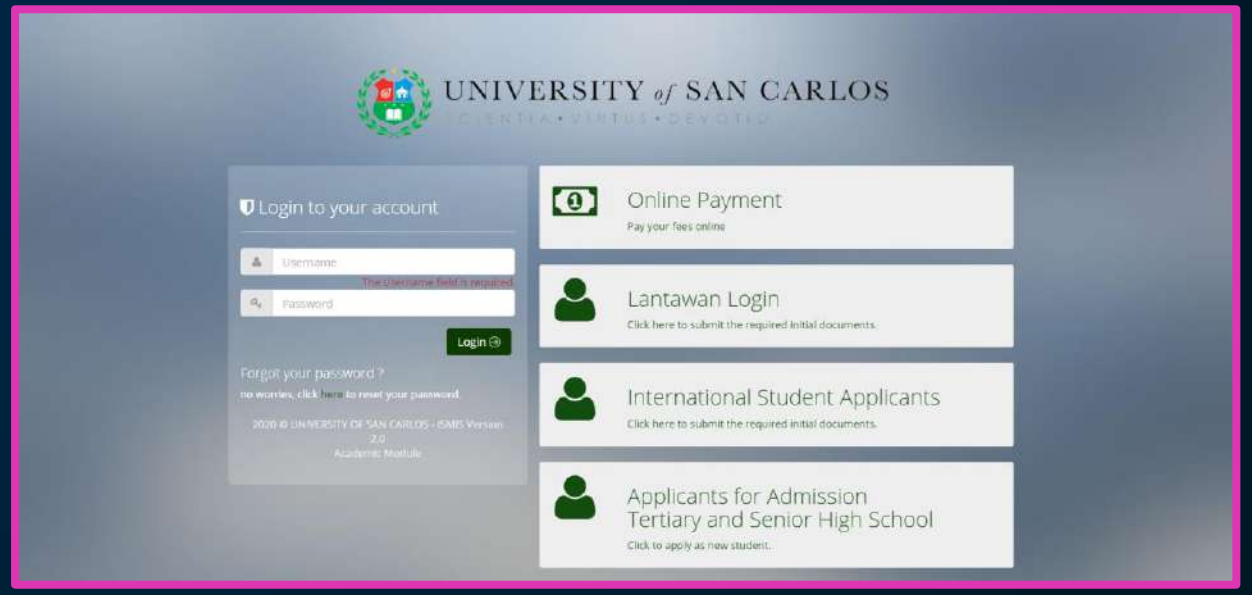
9 WEB PORTAL

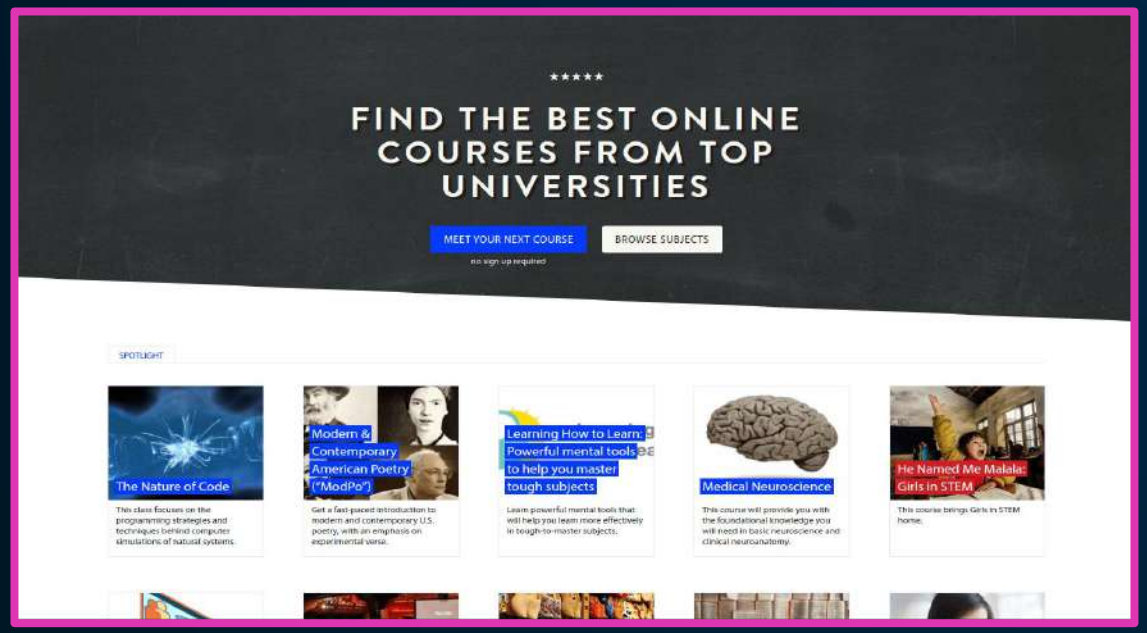
Web portals are often websites designed for internal purposes at a business, organization, or institution. They collect and organize information in different formats from different sources into one place to make all relevant information accessible to the people who need to see it.

These websites often involve a login process, allowing students to access the school website, or granting employees access to their emails, alerts, and files all in one place.

Compared to other websites, web portals will generally involve more complicated programming and design, leaving room for skilled developers to analyze and craft one for their respective institutions.







10 EDUCATIONAL WEBSITE

Educational websites can include websites that have games, videos or topic related resources that act as tools to enhance learning and supplement classroom teaching. These websites help make the process of learning entertaining and attractive to the student, especially in today's age.

While there are many advantages of such websites, we also need to be aware of the negatives. Students need to be guided properly. Otherwise, they may find resources and content that are not reliable or do not align with the direction of the teaching in class.

This is usually the case for online classes with vaguely defined scopes since some educational sites offer a huge variety of content that students have a hard time searching for the content they need. This is why it is important for educational sites to have a clear statement of their field of focus and its scope and target audience.

11 INFOPRENEUR WEBSITE

Infopreneur sites are often multiple types of websites rolled into one. They're part business website, part personal website, part e-commerce store, part blog, and part education. Infopreneurs may create and sell information products. That could be in the form of courses, tutorials, videos or ebooks.

Whatever form it takes, infopreneurs need their website to do the hard work of building up a knowledge brand – convincing visitors that they know enough to make their educational products worth buying.

They normally create a mix of valuable free content and premium content they charge for. The infopreneur's website serves as the central location for both things – the free content which serves as a marketing tool to get people onto the site, and the paid products that account for their profits. Building a good website is therefore crucial for this type of business model.

12 WIKI/ COMMUNITY FORUM WEBSITES

A wiki website allows people to collaborate online and write content together. The most popular example is Wikipedia itself, which allows anyone to amend, add to, and assess the content of each article. These can be simple to create, and user-generated content is the primary source for information.

Community forums can be developed for any topic or field. There are wikis for fan communities, for business resources, technology resources, and for collecting valuable information sources.

Visitors can interact together with one another by either asking questions or through publishing new documentations or editing existing ones to have the questions answered. In this manner, this helps reduce the cost of customer support services as well as the overall number of support tickets that users submit.

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BACKGROUND IMAGES:

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SLIDE TEMPLATE:

Original design by slidesgo.com. Modified by Wayne Dayata

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