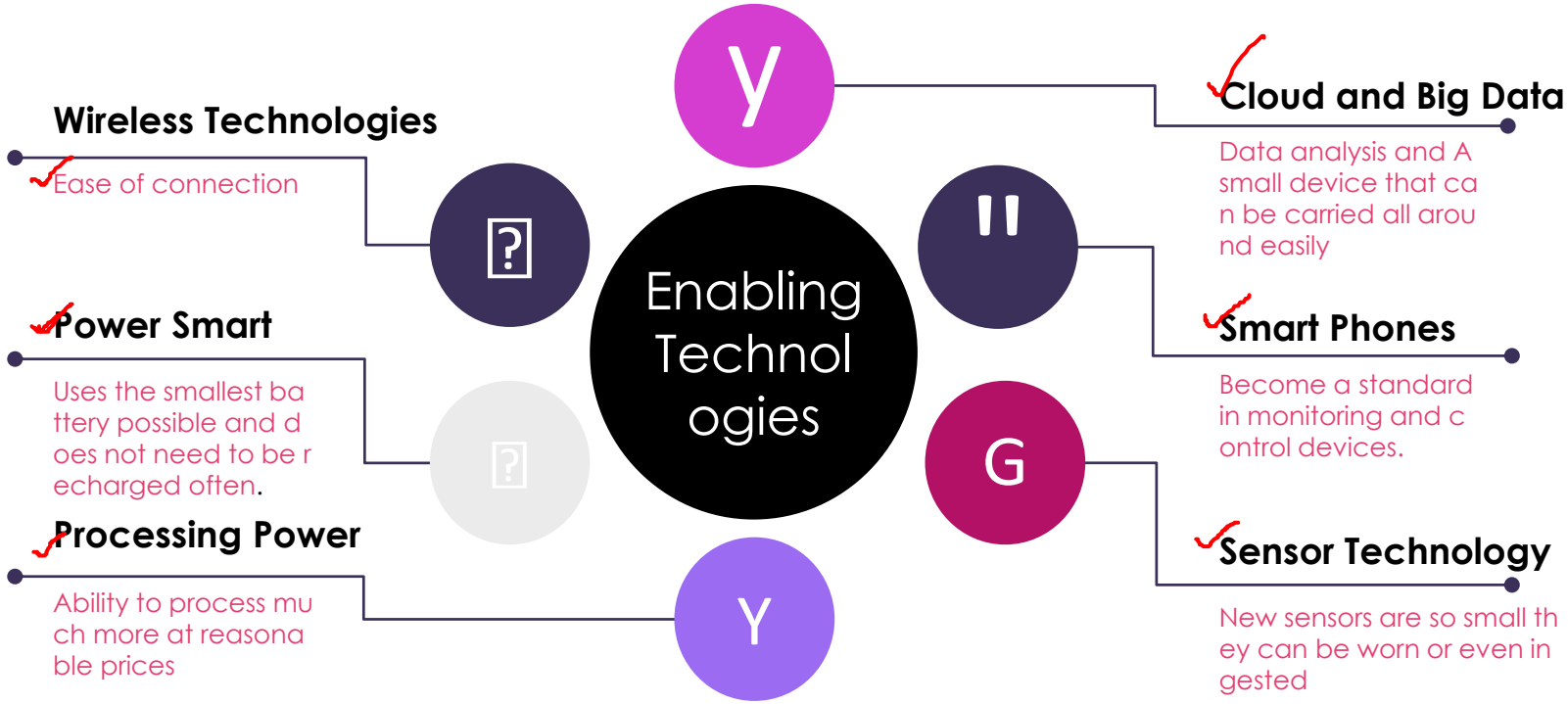
IoT Enabling Technologies

IoT – Enabling Technologies

What are the important technology devices that enable IoT?

IoT devices include wireless sensors, software, actuators, and computer devices. They are attached to a particular object that operates through the internet, enabling the transfer of data among objects or people automatically without human intervention.

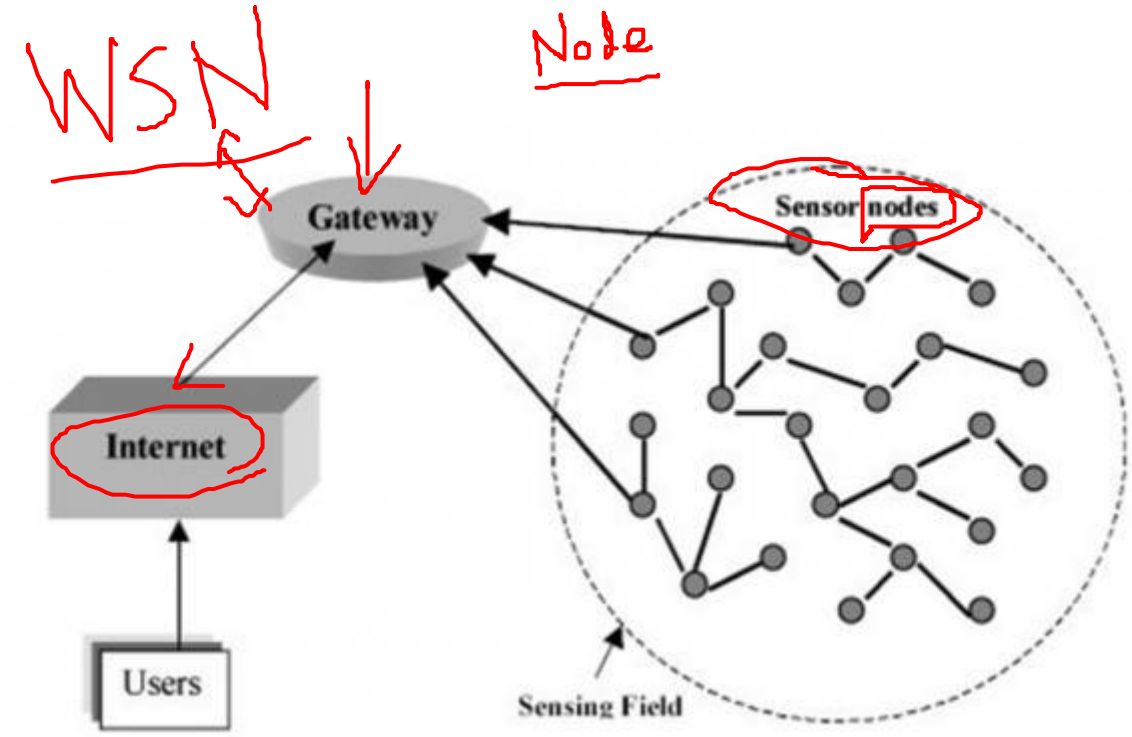


IoT – Enabling Technologies

- Wireless Sensor Network
- Cloud Computing
- Big Data Analytics
- Communications Protocols
- Embedded System

Wireless Sensor Network

- A **WSN** comprises distributed devices with sensors which are used to monitor the environmental and physical conditions. A **wireless sensor network** consists of end nodes, routers and coordinators. End nodes have several sensors attached to them where the data is passed to a coordinator with the help of routers. The coordinator also acts as the gateway that connects WSN to the internet.

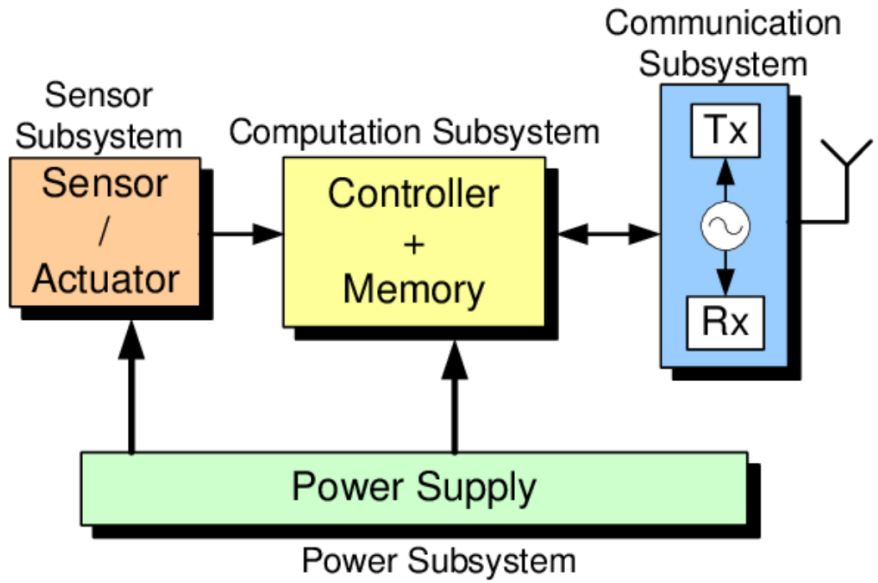


Wireless Sensor Network

WSN is a collection of nodes organized into a cooperative network.

Each node consists of

1. **Processing capability**
2. **Multiple types of memory**
3. **RF transceiver**
4. **Power source (e.g., batteries and solar cells)**
5. **Various sensors.**



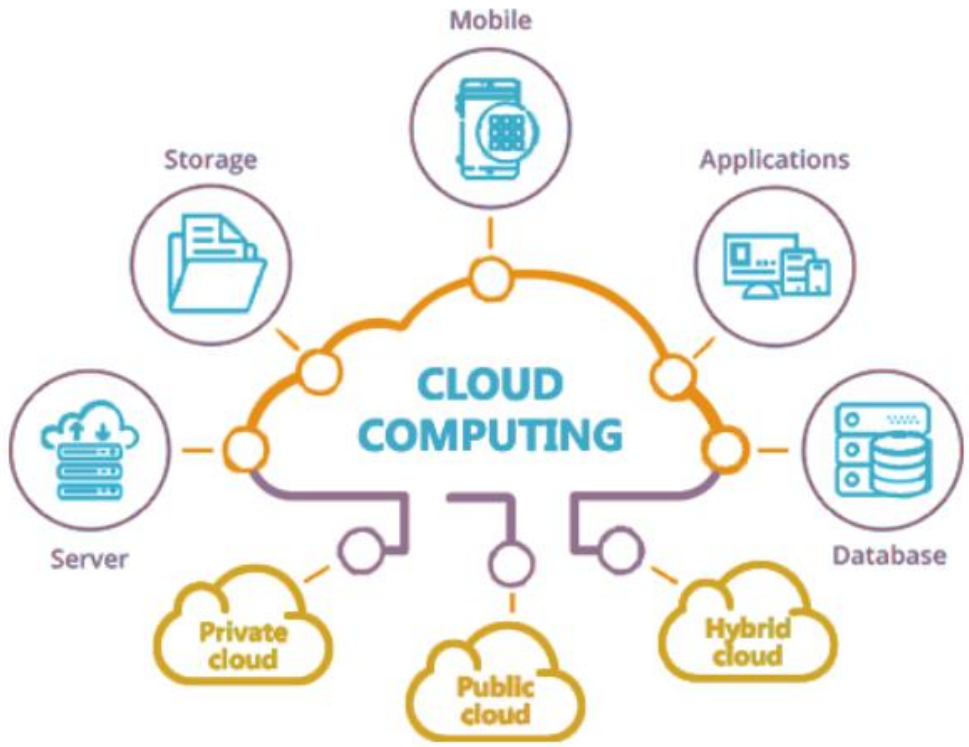
Wireless Sensor Network - Examples

- Weather monitoring system
- Indoor air quality monitoring system
- Soil moisture monitoring system
- Surveillance system
- Health monitoring system

Cloud Computing

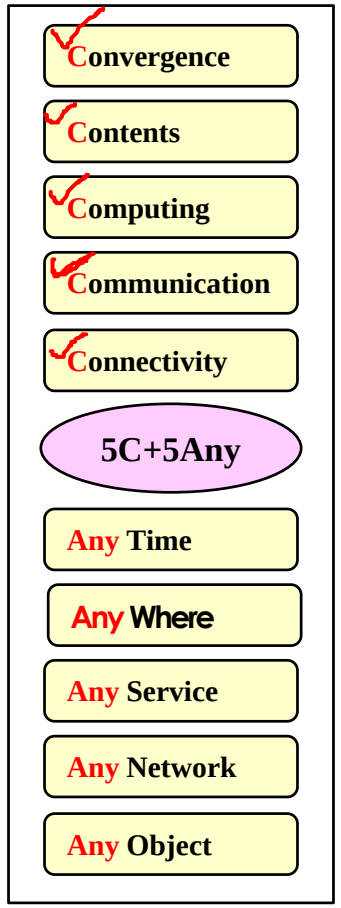
- It provides us the means by which we can access applications as utilities over the internet. Cloud means something which is present in remote locations.

- With Cloud computing, users can access any resources from anywhere like databases, webservers, storage, any device, and any software over the internet.



Cloud Computing - Characteristics

- Broad network access
- On demand self-services
- Rapid scalability
- Measured service
- Pay-per-use



Cloud Computing - Services

- **IaaS (**Infrastructure as a service**)**
  Provides users the ability to provision computing and storage resources. Resources in the form of Virtual machine instances and Virtual storage. Major IaaS providers are Google Compute Engine, Amazon Web Services and Microsoft Azure etc.
  Ex : Web Hosting, Virtual Machine etc.
- **PaaS (**Platform as a service**)**
  Provides users the ability to Develop and deploy applications in the cloud using development tools, APIs, software libraries and services provided by the cloud. Basically, it provides a platform to develop applications.
  Ex : App Cloud, Google app engine
- **SaaS (**Software as a service**)**
  Provides users a complete software application or the user interface to the application itself. SaaS Applications are sometimes called web-based software on demand software or hosted software.
  Ex : Google Docs, Gmail, office etc.

Big Data Analytics

- It refers to the method of studying massive volumes of data or big data. Collection of data whose volume, velocity or variety is simply too massive and tough to store, control, process and examine the data using traditional databases.

- Big data is gathered from a variety of sources including social network videos, digital images, sensors and sales transaction records.

Big Data - Steps

Collection	Ingestion	Discovery & Cleaning	Integration	Analysis	Delivery
Structured, unstructured and semi-structured data from multiple sources	Loading vast amounts of data onto a single data store	Understanding format and content; clean up and formatting	linking, entity extraction, entity resolution, indexing and data fusion	Intelligence, statistics, predictive and text analytics, machine learning	querying, visualization, real time delivery on enterprise-class availability

Big Data Characteristics – 3Vs

Variety Includes different types of data

Structured
Unstructured
Semi-Structured
All of above
-text, audio , video

Volume refers to the amount of data

Terabyte
Records
Transactions
Files
Tables

Velocity Refers to speed at which data is processed

Batch
Real-time
Streams

Big data Considerations

Data Sources

- Sensors
- Applications
- Software agents
- Individuals
- Organizations
- Hardware resources

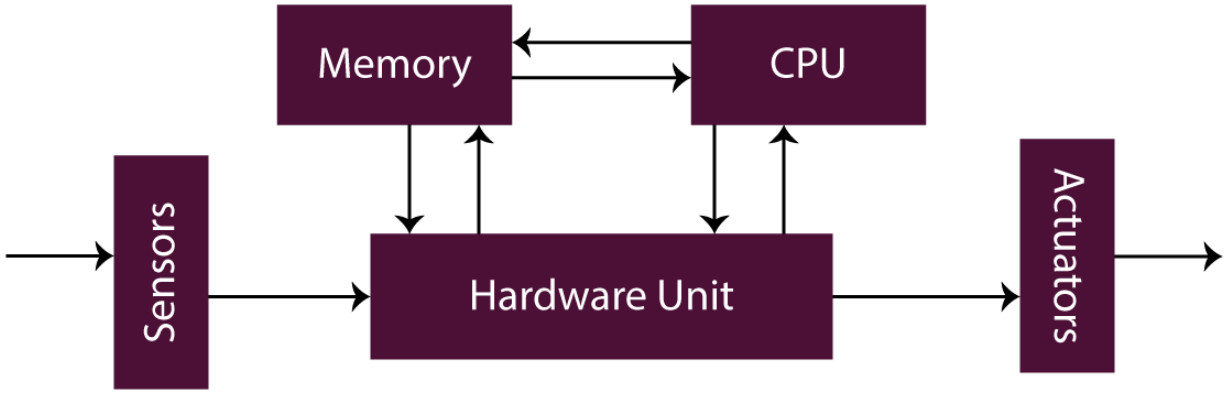
- Anytime
- Anything
- Any Device
- Any Context
- Any Place
- Anywhere
- Any one

Communication Protocols

- They are the backbone of IoT systems and enable network connectivity and linking to applications.
- Communication protocols allow devices to exchange data over the network.
- Multiple protocols often describe different aspects of a single communication.
- A group of protocols designed to work together is known as a protocol suite; when implemented in software they are a protocol stack.
- Various application layer protocols define
  - Data exchange formats
  - Data encoding
  - Addressing mechanisms
  - Data rate / flow control
  - Security features

Embedded Systems

- A system that has computer hardware and software embedded to perform specific tasks
- Key components of an embedded system are
  - Microcontroller
  - Memory (RAM / ROM / Cache)
  - Networking units (Ethernet / WiFi adapters)
  - Input Output (I/O) units (Keyboard, display etc)
  - Storage (Flash / cloud connectivity)
  - Specialized processors like digital signal processors(DSP), graphic processors, other specialized processors.
  - Operating systems (RTOS)



EMBEDDED SYSTEM

Embedded Systems

- It collects the data and sends it to the internet.
  Embedded systems used in
  Examples –
  - Digital camera
  - DVD player, music player
  - Industrial robots
  - Wireless Routers etc.

Thank you!