IoT Enabling Technology

Internet of Things, Lecture : 7

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- Coordinator also acts as a gateway that connects the WSN to the Internet.
- The power of WSNs lies in their ability to deploy large number of low-cost and low-power sensing nodes for continuous monitoring of environmental and physical conditions.
- WSNs are self-organizing networks. Since WSNs have large number of nodes, manual configuration for each node is not possible. The self-organizing capability of WSN makes the network robust.

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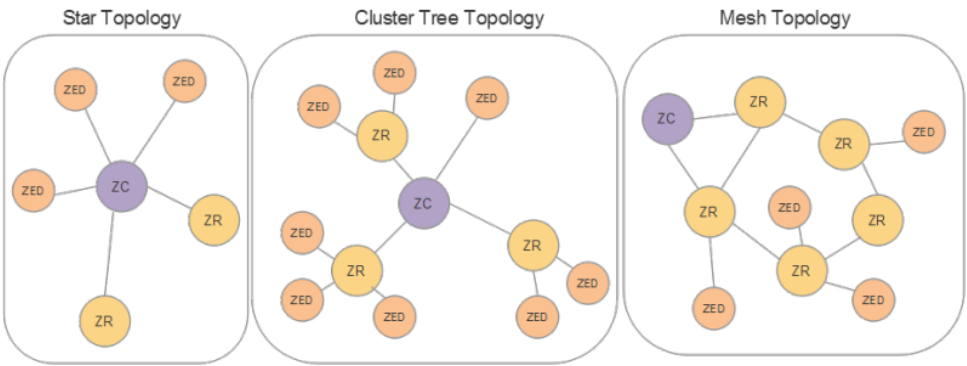

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- Structural health monitoring systems use WSNs to monitor the health of structures (buildings, bridges) by collecting vibration data from sensor nodes deployed at various points in the structure.

Embedded Systems

An Embedded System is a computer system that has computer hardware and software embedded to perform specific tasks. In contrast to general purpose computers or personal computers (PCs) which can perform various types of tasks, embedded systems are designed to perform a specific set of tasks.

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- Embedded systems run embedded operating systems such as real-time operating systems (RTOS).
- Embedded systems range from low-cost miniaturized devices such as digital watches to devices such as digital cameras, point of sale terminals, vending machines, appliances (such as washing machines), etc.

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- Communication protocols allow devices to exchange data over the network.
- These protocols define the data exchange formats, data encoding, addressing schemes for devices and routing of packets from source to destination.
- Other functions of the protocols include sequence control (that helps in ordering packets determining lost packets), flow control (that helps in controlling the rate at which the sender is sending the data so that the receiver or the network is not overwhelmed) and retransmission of lost packets.

Cloud Computing

Cloud computing is a transformative computing paradigm that involves delivering applications and services over the Internet. Cloud computing involves provisioning of computing, networking and storage resources on demand and providing these resources as metered services to the users, in a "pay as you go" model.

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- Users are assigned virtual resources that run on top of the physical resources.

Cloud computing services are offered to users in different forms:

- **Infrastructure-as-a-Service (IaaS):** IaaS provides the users the ability to provision computing and storage resources. These resources are provided to the users as virtual machine instances and virtual storage. Users can start, stop, configure and manage the virtual machine instances and virtual storage. Users can deploy operating systems and applications of their choice on the virtual resources provisioned in the cloud. The cloud service provider manages the underlying infrastructure.

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- **Software-as-a-Service (SaaS):** SaaS provides the users a complete software application or the user interface to the application itself. The cloud service provider manages the underlying cloud infrastructure including servers, network, operating systems, storage and application software, and the user is unaware of the underlying architecture of the cloud.

Big Data Analytics

Big data is defined as collections of data sets whose volume, velocity (in terms of its temporal variation), or variety, is so large that it is difficult to store, manage, process and analyze the data using traditional databases and data processing tools. Big data analytics involves several steps starting from data cleansing, data munging (or wrangling), data processing and visualization. Some examples of big data generated by IoT systems are described as follows:

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- Data generated by retail inventory monitoring systems.

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- Volume: Though there is no fixed threshold for the volume of data to be considered as big data, however, typically, the term big data is used for massive scale data that is difficult to store, manage and process using traditional databases and data processing architectures. The volumes of data generated by modern IT, industrial, and health-care systems, for example, is growing exponentially driven by the lowering costs of data storage and processing architectures and the need to extract valuable insights from the data to improve bi processes, efficiency and service to consumers.

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- Variety: Variety refers to the forms of the data. Big data comes such as structured or unstructured data. including text data. image. audio. video and sensor data.