SECURITY AND PRIVACY CONCERNS IN IOT

Session 3

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OBJECTIVES

In this session, you will learn to:

- Explain Radio Frequency Identification (RFID)
- Explain the importance of Networking in IoT
- Explain Network Protocols for IoT
- Explain the Logical Design of IoT
- Describe Computing Devices

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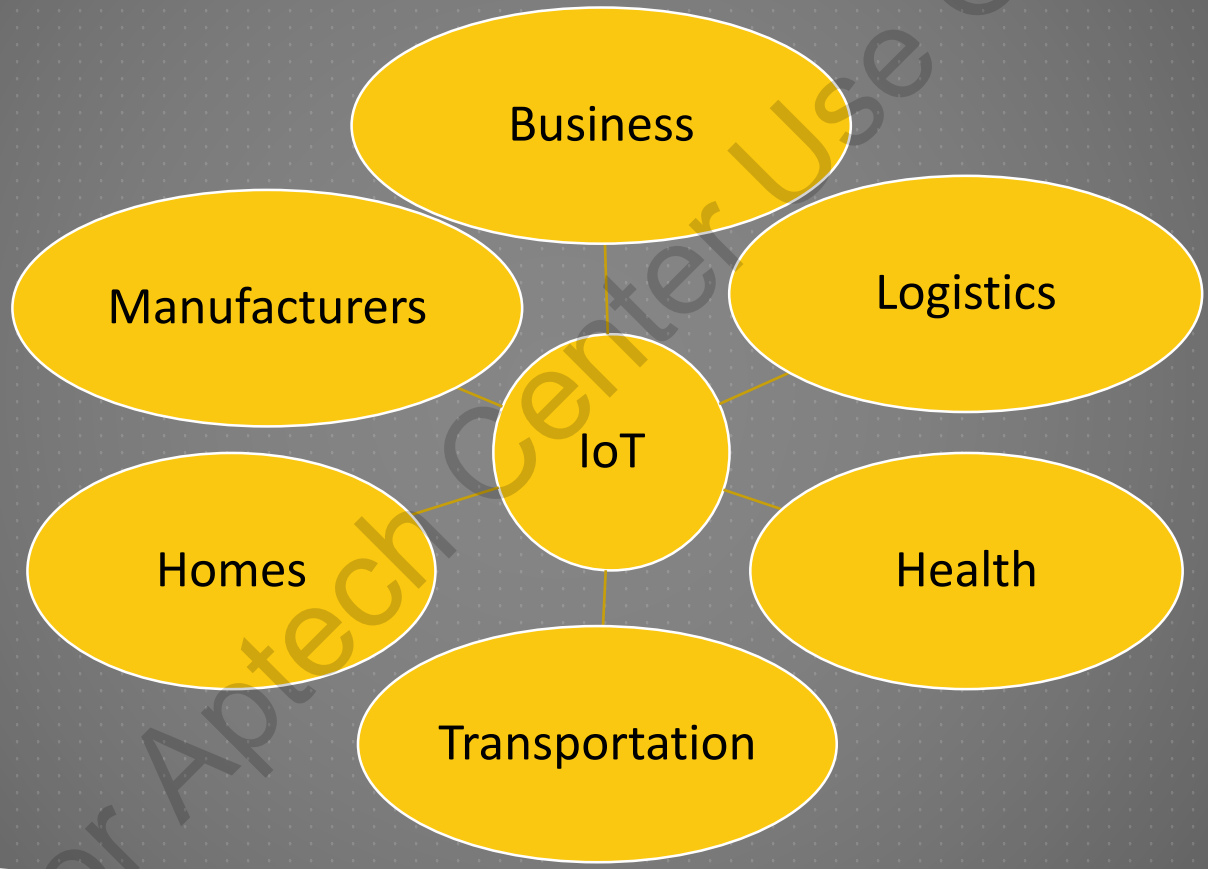
INTRODUCTION 1/6



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INTRODUCTION 2/6

- **Each Domain requires different**

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INTRODUCTION 3/6

- **IOT can perform**

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INTRODUCTION 4/6

- Exchange (collect and send) data
- Several wired and wireless interfaces
- Interface for sensors and audio/video
- Data are collected and analyzed

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INTRODUCTION 5/6

- **Different types of IOT**

Wearables	Sensors	Lightings
Surveillance system	Industrial machines	Automobiles

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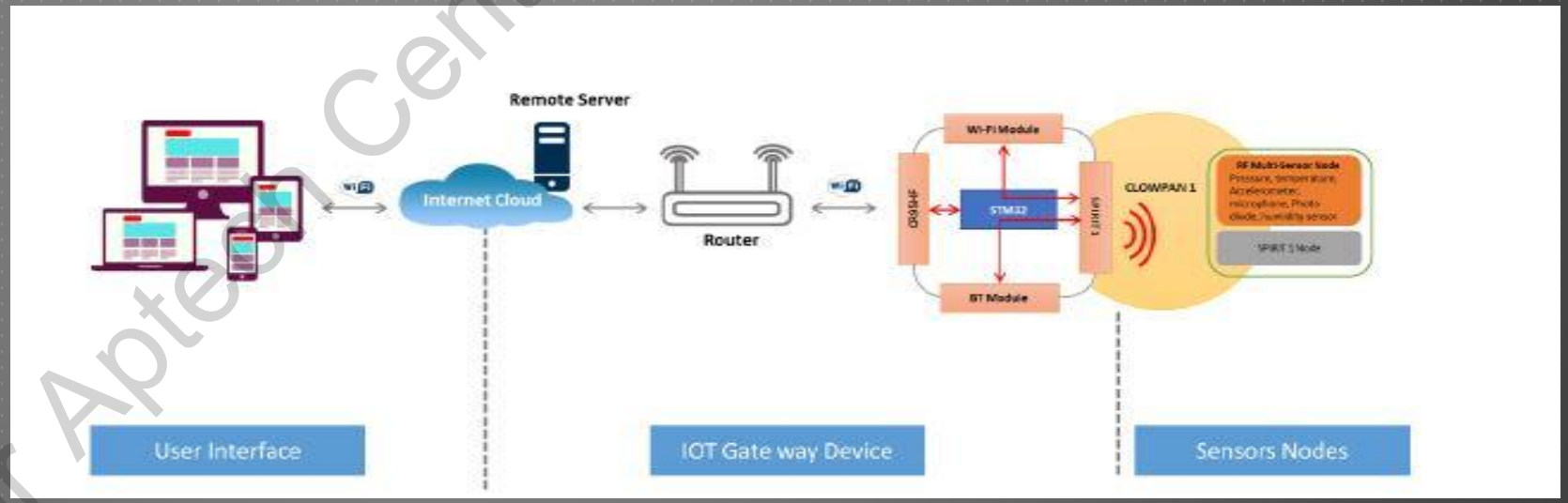
INTRODUCTION 6/6

- **IOT system includes**

Gateway Board	Controls the entire system	Several sensor nodes



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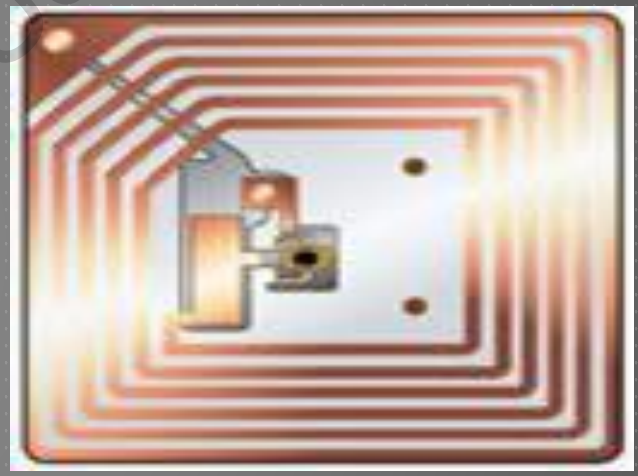
RADIO FREQUENCY IDENTIFICATION (RFID) 1/4

- Uses radio frequency waves or EM fields
- Aerial helps in transmitting and receiving signals
- RFID tags have microprocessor or microchips
- Interrogator or reader



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RADIO FREQUENCY IDENTIFICATION (RFID) 2/4

RFID tags

- Passive
  - Cheaper
  - Uses Radio Signals
- Active
  - Battery
  - Large Memory

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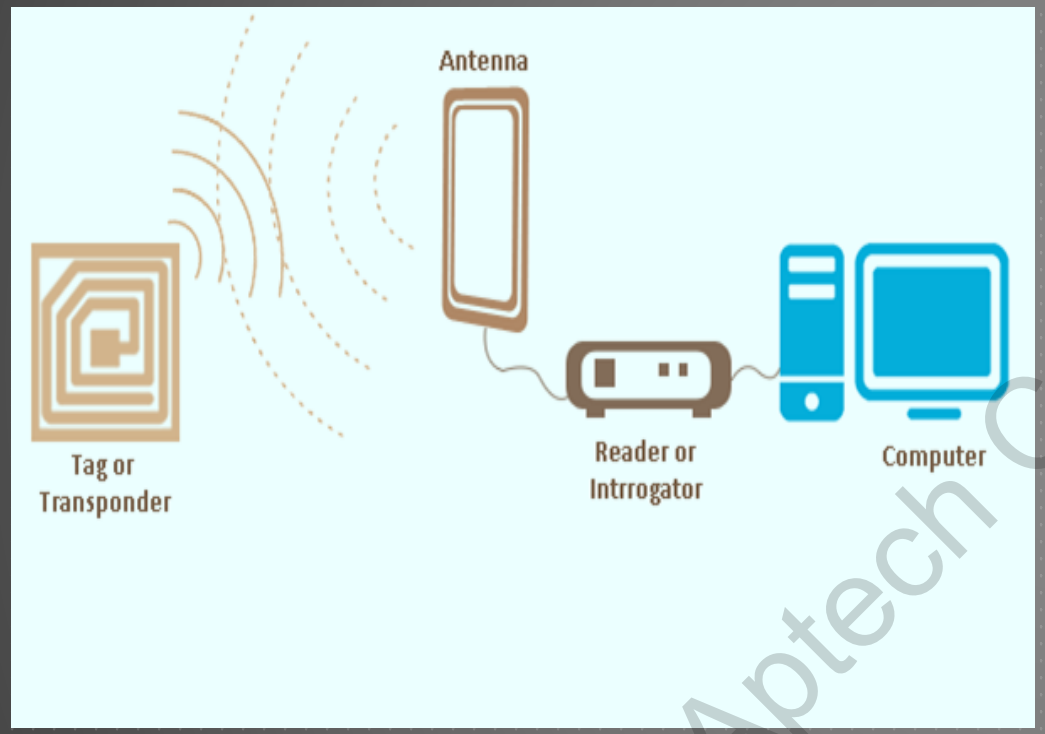
RADIO FREQUENCY IDENTIFICATION (RFID) 3/4



- Electronically stored data
- Read only data
- Non Volatile Memory
- RFID reader diffuses radio waves
- RFID tags respond
- Unique Identification Number

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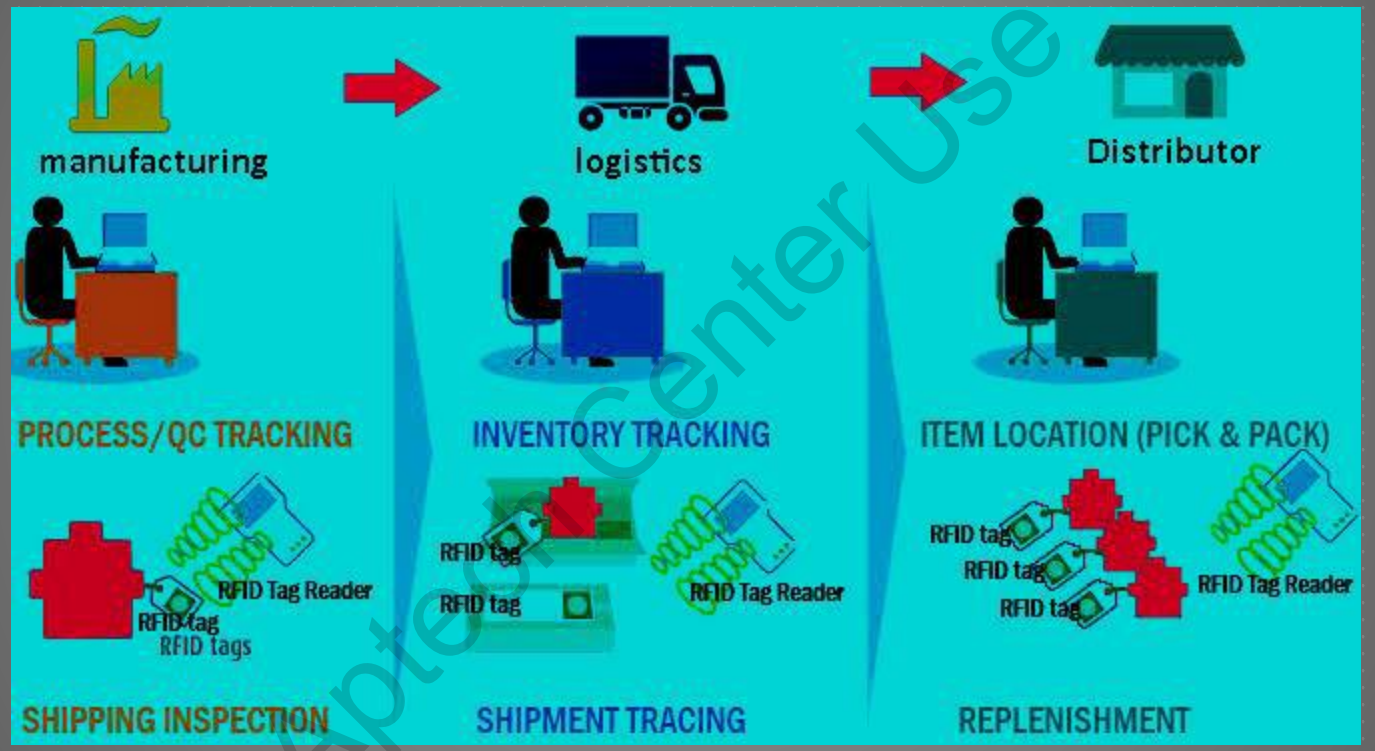
RADIO FREQUENCY IDENTIFICATION (RFID) 4/4



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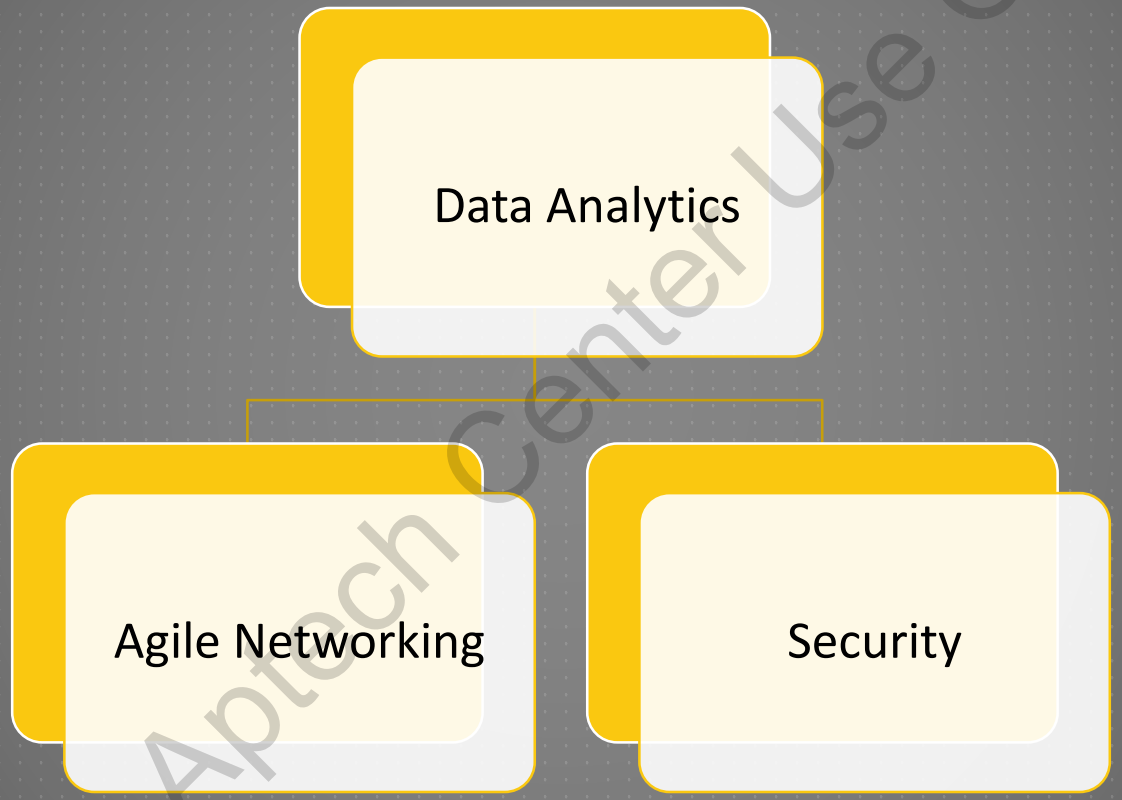
IMPORTANCE OF NETWORKING IN IOT



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ARCHITECTURE OF A NETWORK FOR CONNECTED DEVICES 1/2

- Latency
- Throughput
- Fault Resiliency
- Scalability
- Hops
- Range

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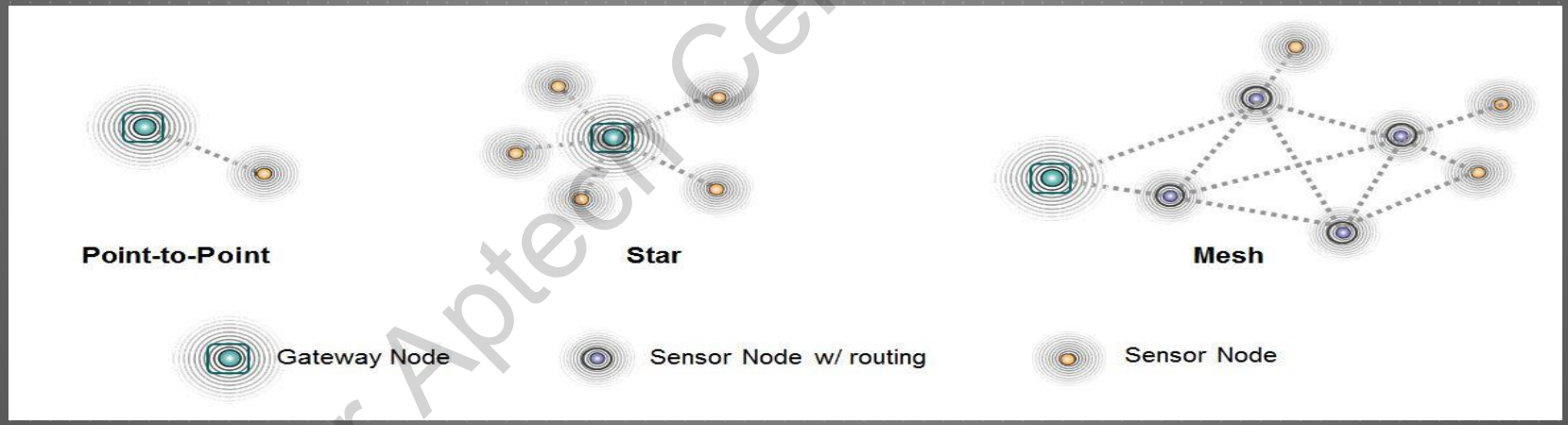
ARCHITECTURE OF A NETWORK FOR CONNECTED DEVICES 2/2

- **Types of Architectures**

Point-to-Point Network → Star Network → Mesh Network



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NETWORK PROTOCOLS 1/3

Several networking features have to be considered when selecting wireless networks which are as follows:

- Set of rules, procedures, and formats for sending and receiving data
- Comprise mechanisms for devices to identify and make connections with each other devices and instruments
- Send and receive messages in the form of packets
- Manage data in a timely and secure manner

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NETWORK PROTOCOLS 2/3

- **Types of Network Protocols**

802.3 Ethernet	802.3 Ethernet	2G/3G/4G	Network/ Internet Layer	IPv4
IPv6	Transport Layer	TCP	UDP	HTTP
	CoAP	WebSocket	AMQP	

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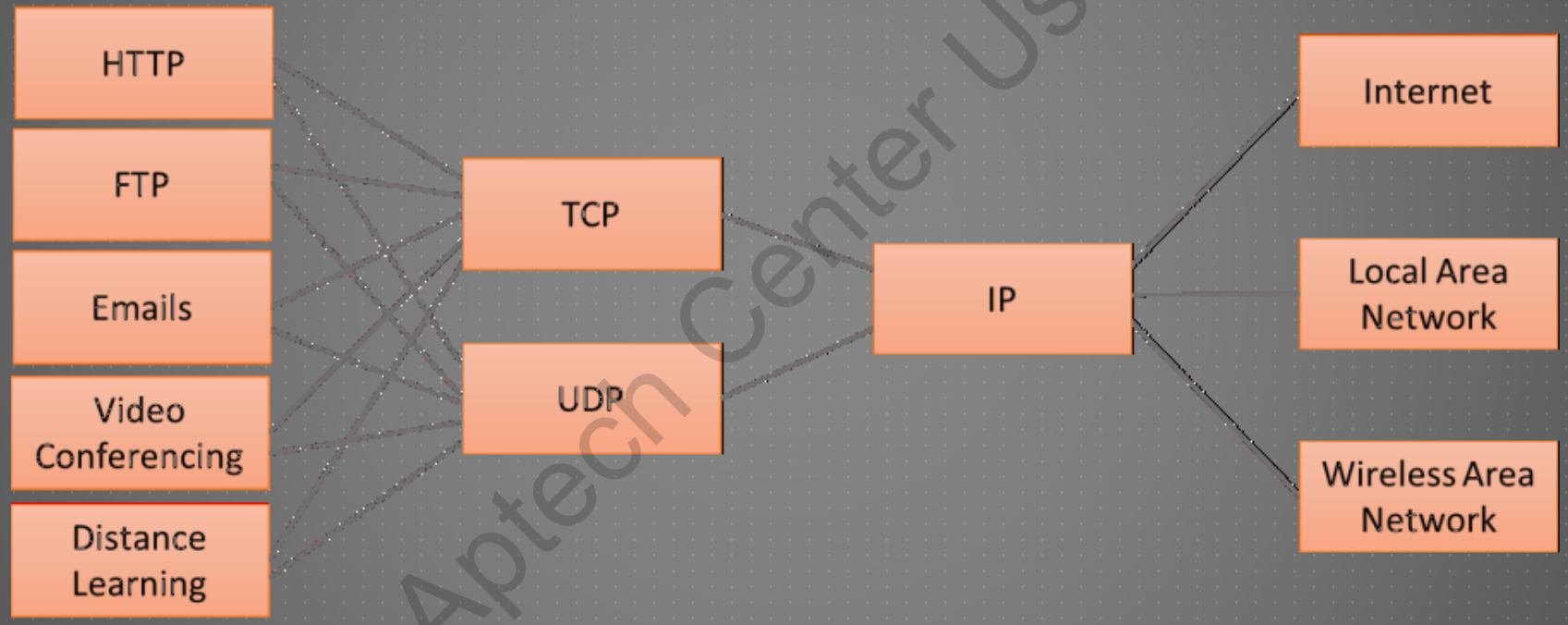
NETWORK PROTOCOLS 3/3



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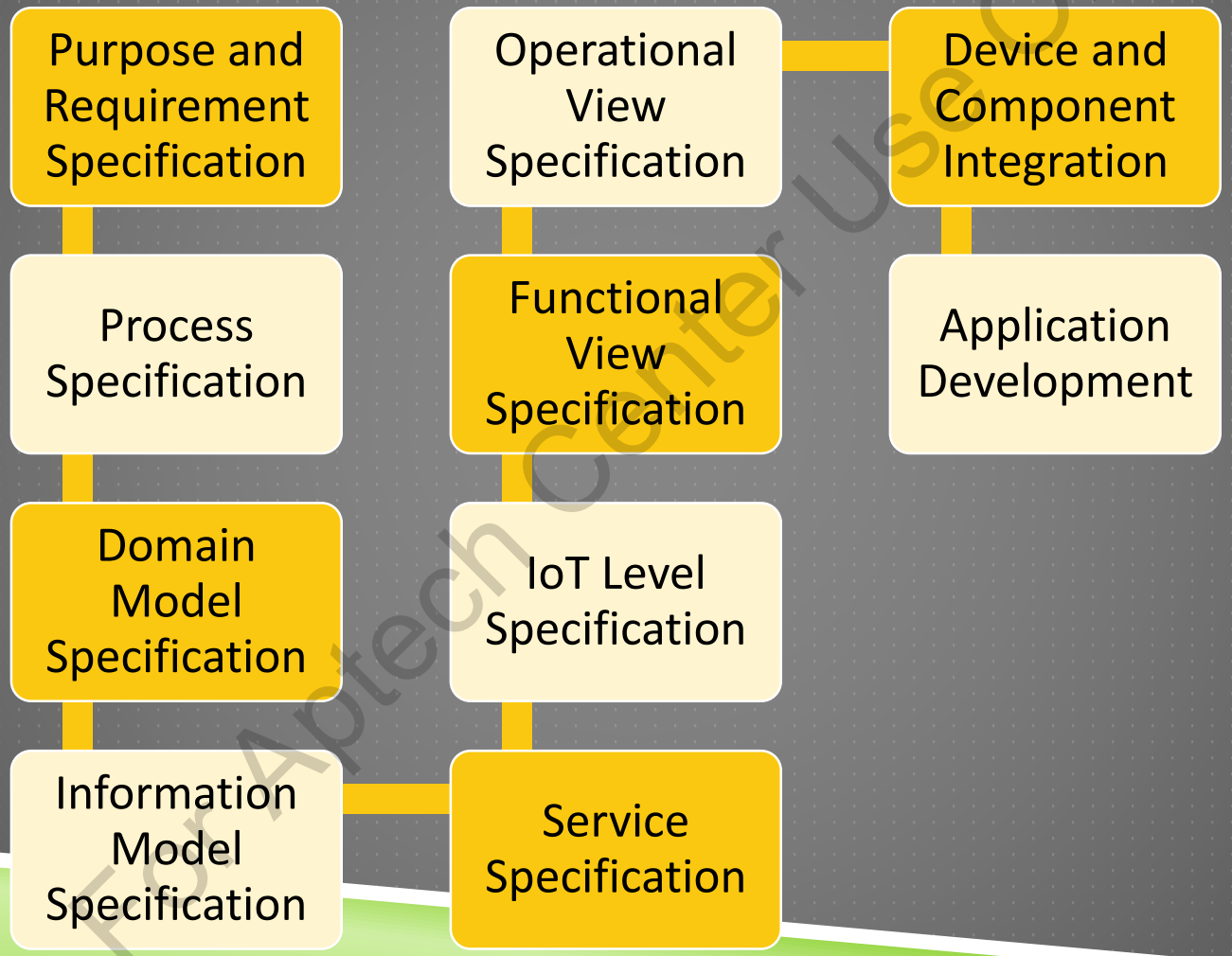
LOGICAL DESIGNS OF IOT 1/8



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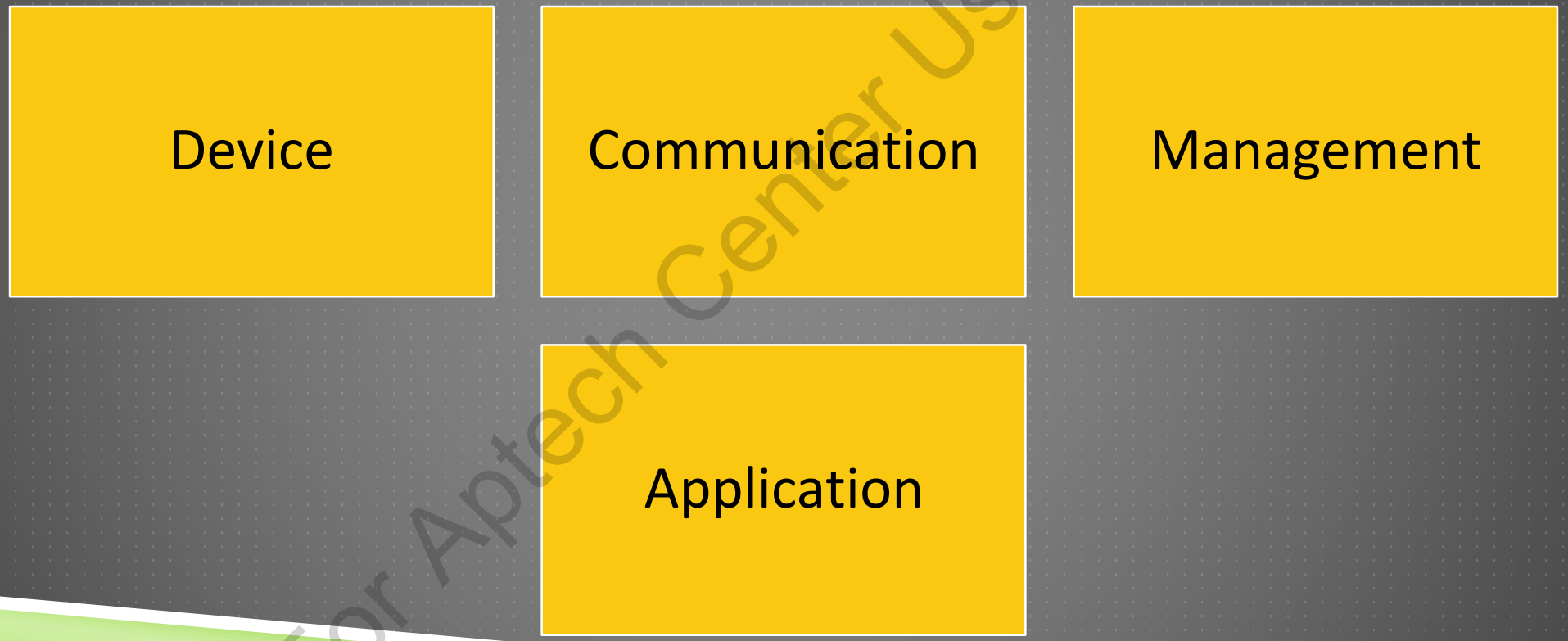
LOGICAL DESIGNS OF IOT 2/8

- **Functional Blocks**



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LOGICAL DESIGNS OF IOT 3/8

- Communication Models

Push-Pull Pattern

Request-Response Model

Subscribe-Notify Model

Publish-Subscribe Model

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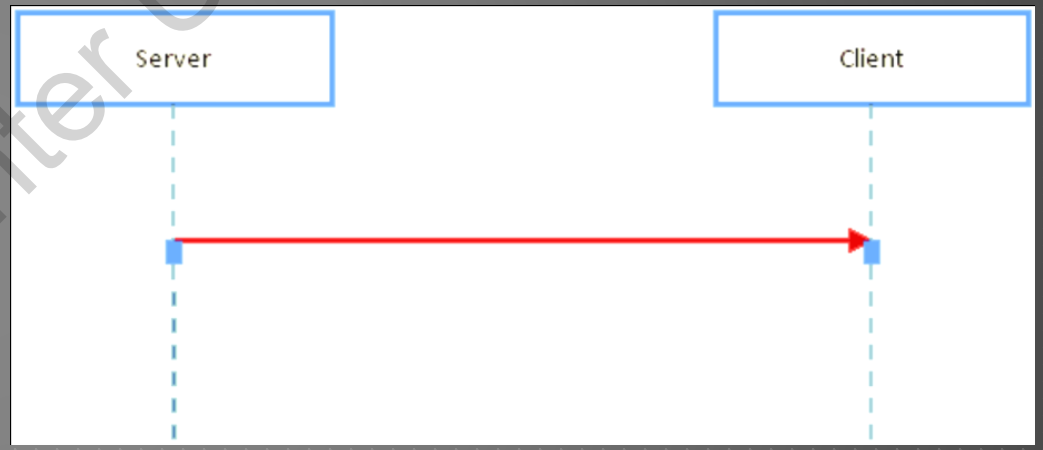
LOGICAL DESIGNS OF IOT 4/8

- Communication Models

  Push Pull Pattern

  - One way communication
  - Server sends data to the client
  - Communication partners do not change frequently



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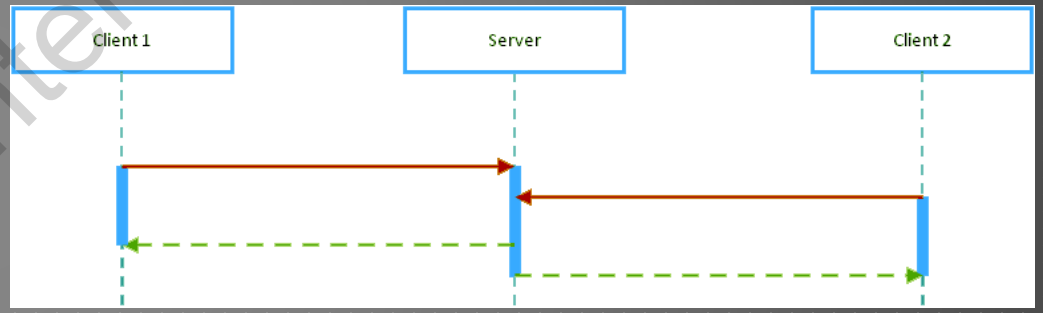
LOGICAL DESIGNS OF IOT 5/8

- Communication Models

  Request-Response Model

  - Client requests server and server responds back
  - Next client will be placed in a queue
  - Unacceptable delays in response



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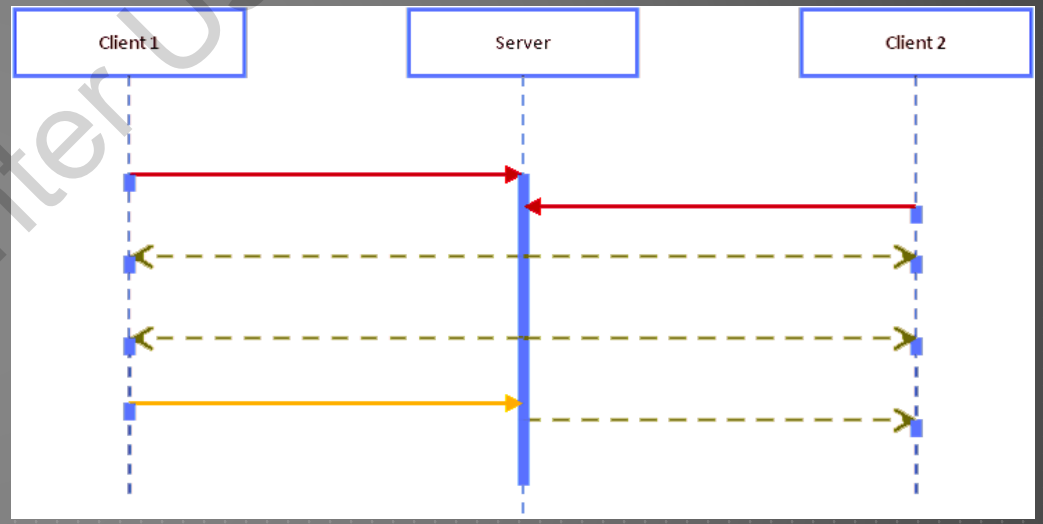
LOGICAL DESIGNS OF IOT 6/8

- **Communication Models**

- **Subscribe - Notify Model**
  - Client subscribes call to the server
  - Sends notification when server is ready
  - Clients will not be placed in queues
  - Can send multiple notifications



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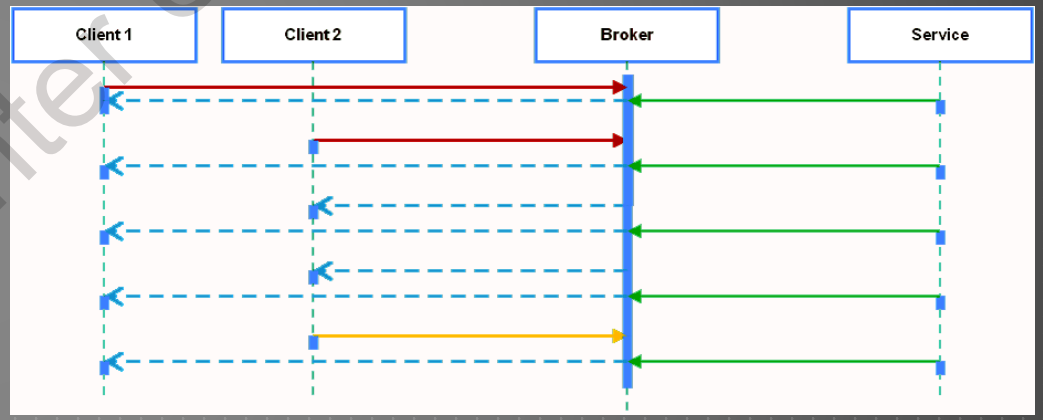
LOGICAL DESIGNS OF IOT 7/8

- **Communication Models**

  Publish-Subscribe Model

  - Service providers' information on a broker module
  - Information flows between the service and client
  - If subscription for the same information, broker sends notification



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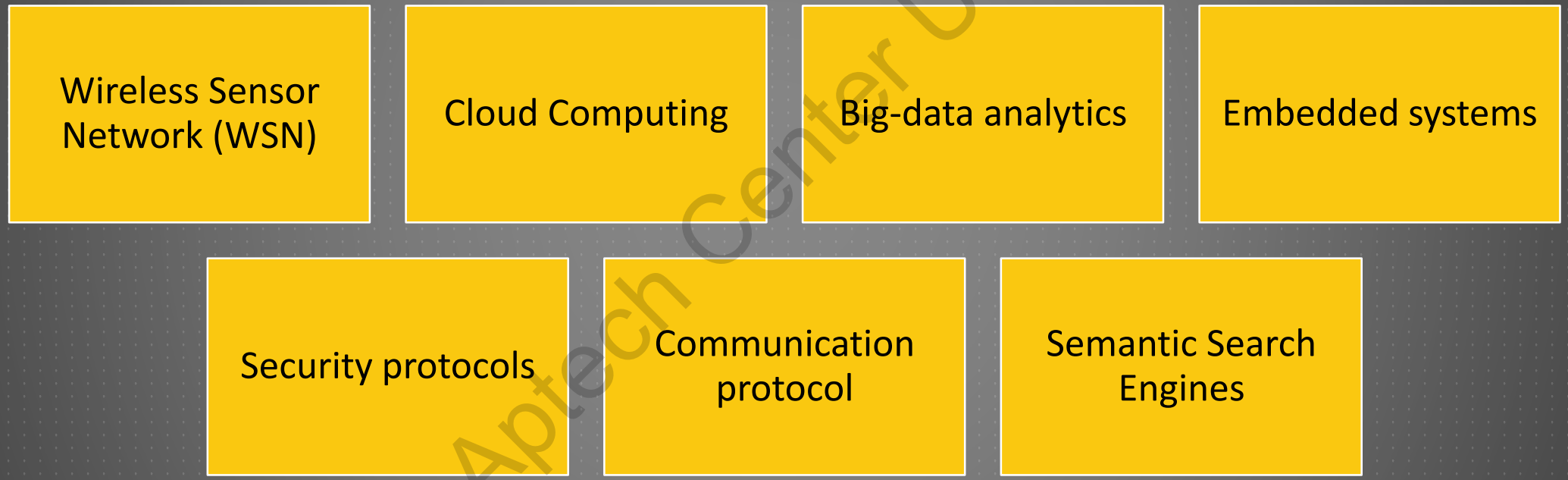
LOGICAL DESIGNS OF IOT 8/8

- **Enabling Devices**



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WIRELESS SENSOR NETWORK (WSN) 1/8

- Wireless network is formed by thousands of sensor nodes
- Monitors physical or environmental conditions
- Equipped with sensing and computing devices, radio transmitter and receiver
- Network architectures
- Easy to deploy, have better flexibility and scalability

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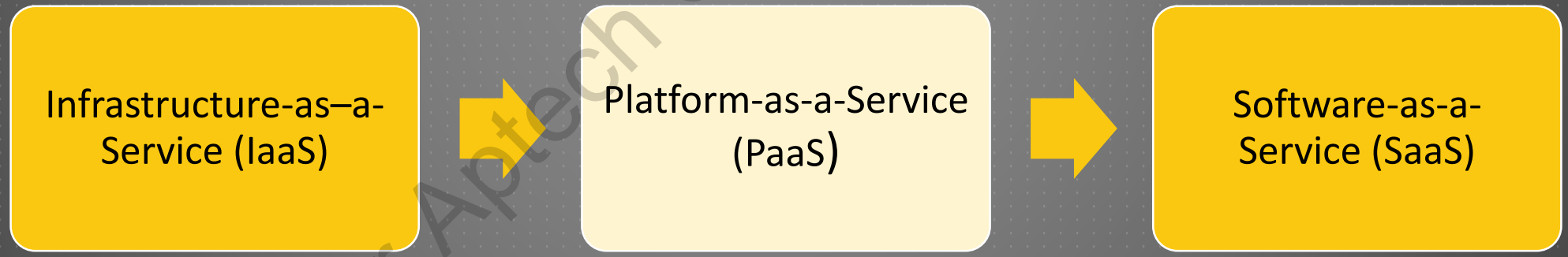
WIRELESS SENSOR NETWORK (WSN) 2/8

- Cloud Computing
- Web-based computing
- Involves provisioning of shared processing resources and data
- Monitors physical or environmental conditions
- Pay-as-you-go (paying for a service before it is used) model



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WIRELESS SENSOR NETWORK (WSN) 3/8

- **Big-data Analytics**

Volume	Variety	Velocity
Variability	Veracity	Complexity

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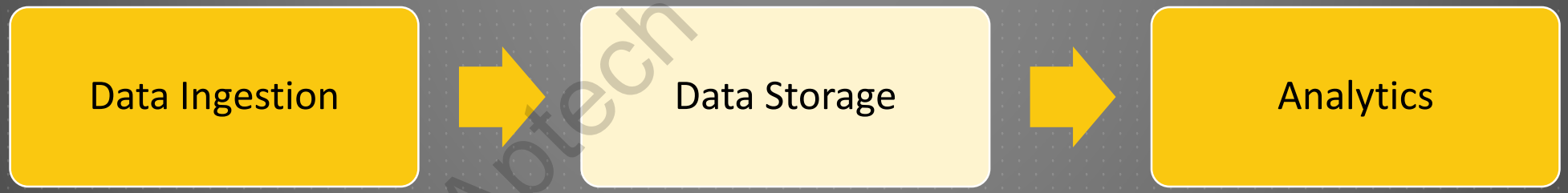
WIRELESS SENSOR NETWORK (WSN) 4/8

- **Big-data Analytics**

  Advantages

  - Precise access to more data
  - Helping the companies to make investments
  - Capacity to make better decisions
  - Considerable cost advantages



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WIRELESS SENSOR NETWORK (WSN) 5/8

- Embedded Systems
- Computer system with software and hardware embedded in the system
- Hardware components connect IoT devices
- The software in the embedded systems interprets data

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WIRELESS SENSOR NETWORK (WSN) 6/8

- **Communication Protocols**

Satellite	Wi-Fi	Radio Frequency (RF)
RFID	Bluetooth	Near-Field Communication (NFC)

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WIRELESS SENSOR NETWORK (WSN) 7/8

- Semantic Search Engines
- Information searching method
- Understand the purpose of the search
- Examples of Semantic search engines are Bing, Google, CMANTIK, iGlue, Kosmix, Twinword Finder, and so on.

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WIRELESS SENSOR NETWORK (WSN) 8/8

- Security Protocols
- Security-related activities
- Cloud interface must be protected
- Data traffic between a device and the cloud
- Devices should be frequently updated

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COMPUTING DEVICES 1/4

- A device with hardware and software
- Capable of operating, executing and providing services, and applications
- It comprises:
  - Processors
  - Random memory
  - Storage
  - Wi-Fi and Base Operating System (OS)

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COMPUTING DEVICES 2/4

- **Following image depicts various computing devices:**

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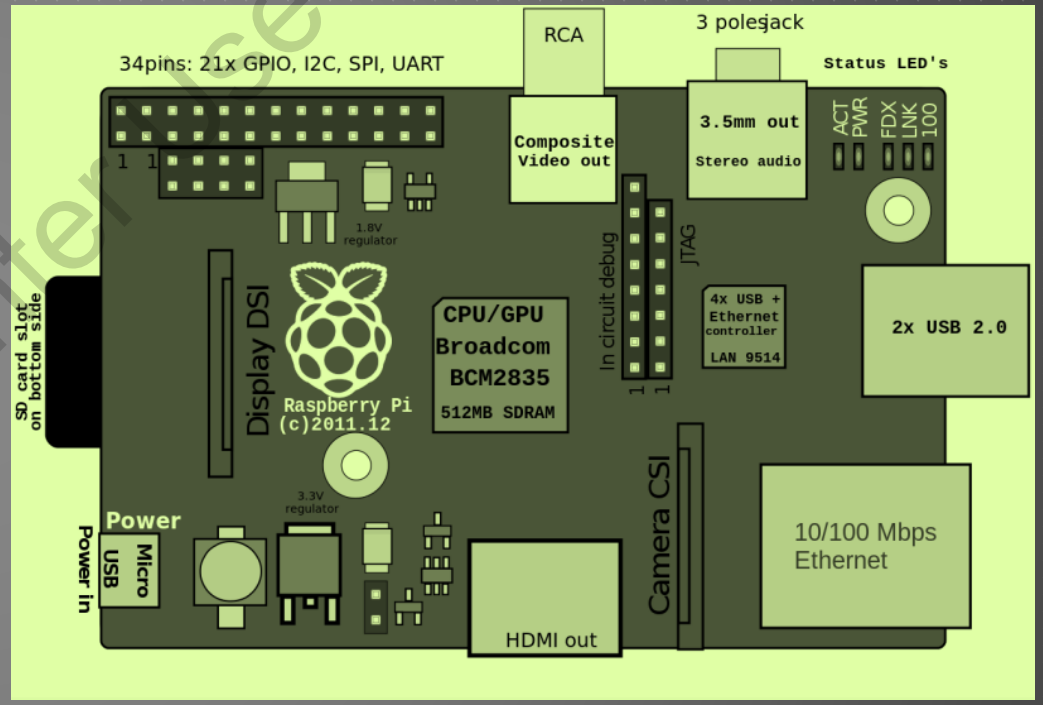
COMPUTING DEVICES 3/4

Raspberry-Pi

- Size of a credit card or an ATM card
- Affordable and enables users to study computing and to write programs
- Used in a varied digital maker projects



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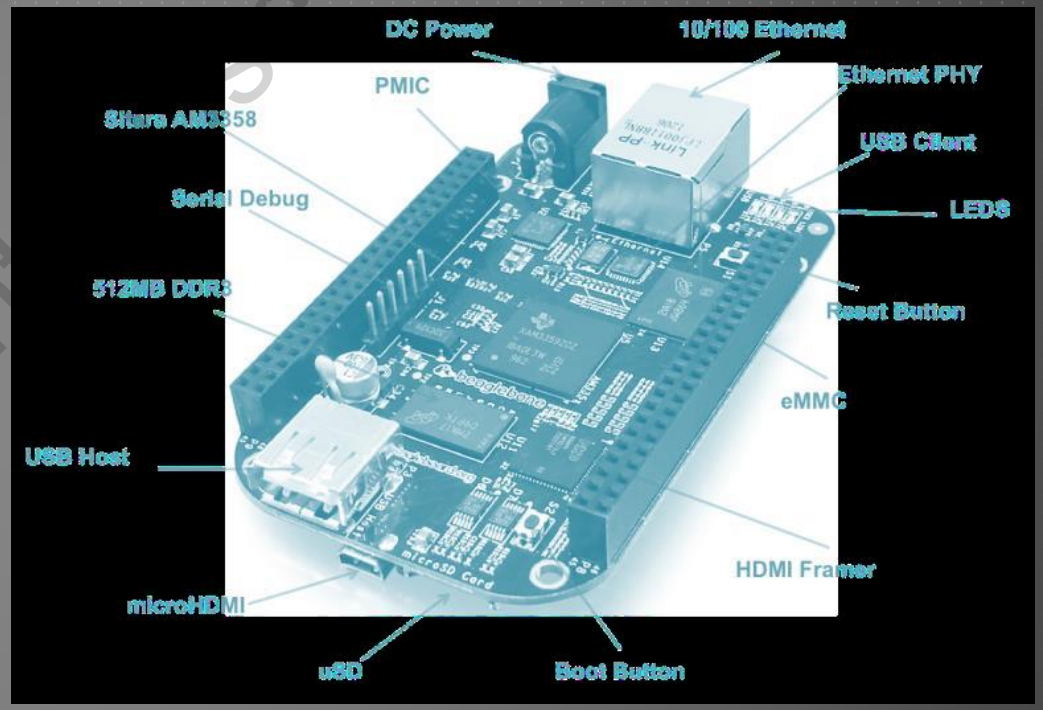
COMPUTING DEVICES 4/4

BeagleBone Black

- To educate students on open-source hardware and software capabilities
- BeagleBone Black is designed with open source software
- It is a low-power open-source hardware single-board computer



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MOBILE PHONES AND TABLETS

- A portable or movable communication device
- Tablet, is a mobile computer with a battery with features such as cameras, microphone, screen pop-up, and virtual keyboards for keying
- Short Service Text Messaging (SMS), Multi Media Message (MMS), E-mail, Internet access are some of the services

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WEARABLES

- Wearables are small electronic devices
- Integrating computer and advanced technologies
- Wearables perform functions of real-world and interweaves with users' everyday life

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IOT PLATFORM 1/2

- The aim is to connect with other IoT devices
- Space between the device sensors and data networks are sealed by an IoT Platform
- Bridge between the hardware devices and various application layers

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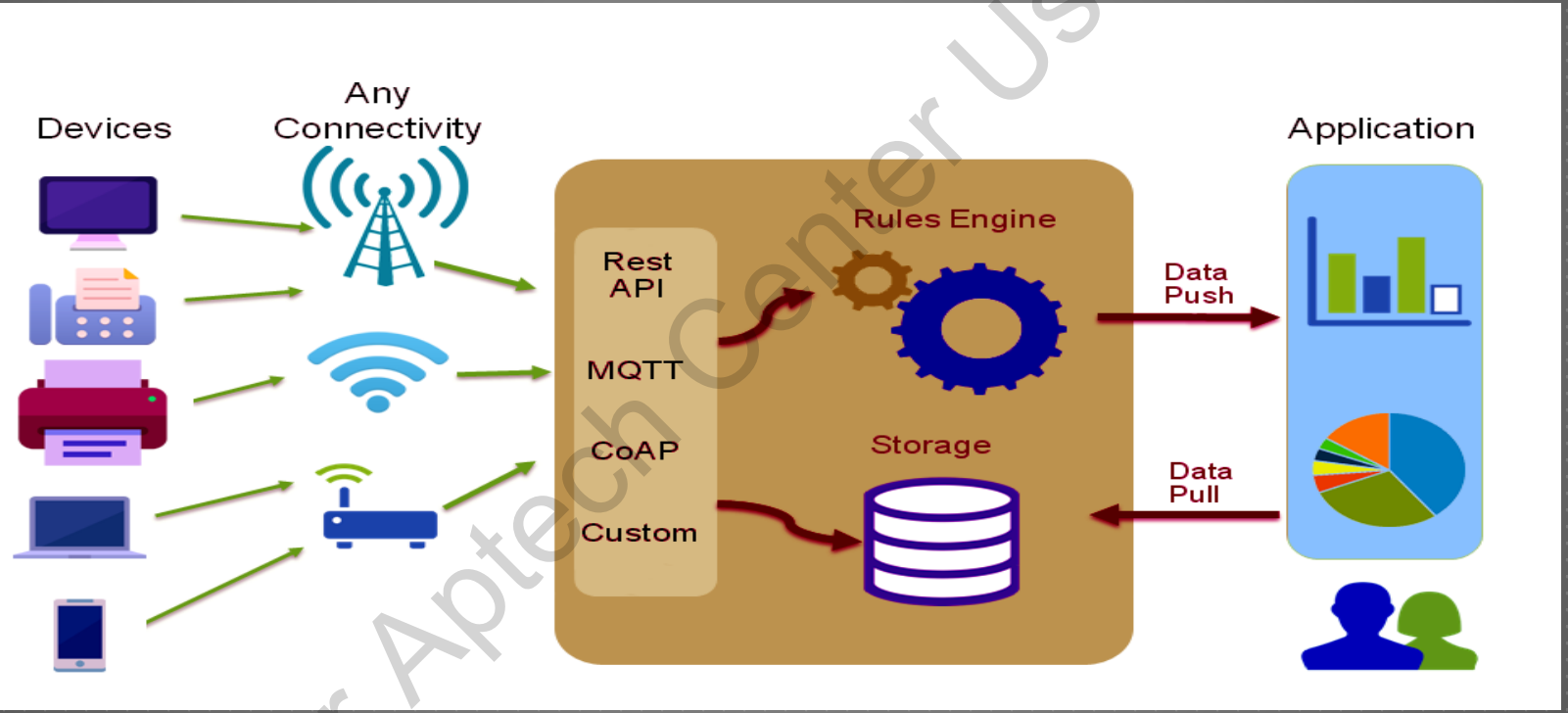
IOT PLATFORM 2/2

- **Following image depicts a model of IoT Platform:**



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SUMMARY 1/2

- IoT devices have unique identities and can perform remote sensing, actuating and monitoring functions. IoT devices can exchange data with other connected devices, applications (directly or indirectly), and collect data from other devices.
- Radio Frequency Identification (RFID) uses a physical field produced by electrically charged objects (electromagnetic fields) to automatically or mechanically identify/recognize and track tags affixed to objects. The tags comprise electronically stored data.
- The IoT will need a network that can manage augmented demand for data analytics, dexterity, and safety. Three areas of the IoT that will influence the network are data analytics, the necessity for network dexterity, and safety. To create the right networking technology for applications, it is important to first comprehend the network architecture that is backed by each technology standard.
- A network protocol outlines rules and principles for transferring data/messages between network devices. Protocols for computer networking commonly use packet swapping methods to transmit and accept messages in the form of packets.
- Logical design of IoT denotes the conceptual or intangible representation of the individuals (entities) and processes without going to the low level details of the implementation. An IoT system comprise number of functional blocks that provide the system abilities for communications, identifications, actuating, sensing and management.
- The four types of IoT communication models are - Push-Pull model, Request-Response model, Publish-Subscribe model, and Subscribe-Notify model.

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SUMMARY 2/2

- IoT is enabled by several technologies including Wireless Sensor Network (WSN), Cloud Computing, Big-data analytics, embedded systems, security protocols and architectures, communication protocol, Web services, Mobile Internet, and Semantic Search Engines.
- Computing device is a device that has a hardware and software capable of operating, executing and providing services and applications. The hardware and software of a computing device comprises processors, random memory and storage, Wi-Fi, and a base Operating System (OS).
- The Raspberry-Pi is a computer that is the size of a credit card or an ATM card that can be plugged into a computer monitor or Television, and uses any standard Universal Serial Bus (USB) computer keyboard and mouse. Raspberry-Pi is very affordable and enables users to study computing and to write programs in software languages.
- The BeagleBone Black is used as an educational board by colleges around the world to educate students on open-source hardware and software capabilities and is a low-power open-source hardware single-board computer.
- An IoT platform is defined as an IoT middleware that acts as a mediator between the hardware and application layers. The IoT platforms are capable of being assimilated with any connected device and meld in with the applications used by the device.

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