21ES614 – Internet of Things

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Syllabus

Unit 1

Introduction to IoT - Definitions, frameworks and key technologies. Functional blocks of IoT systems: hardware and software elements- devices, communications, services, management, security, and application. Challenges to solve in IoT

Unit 2

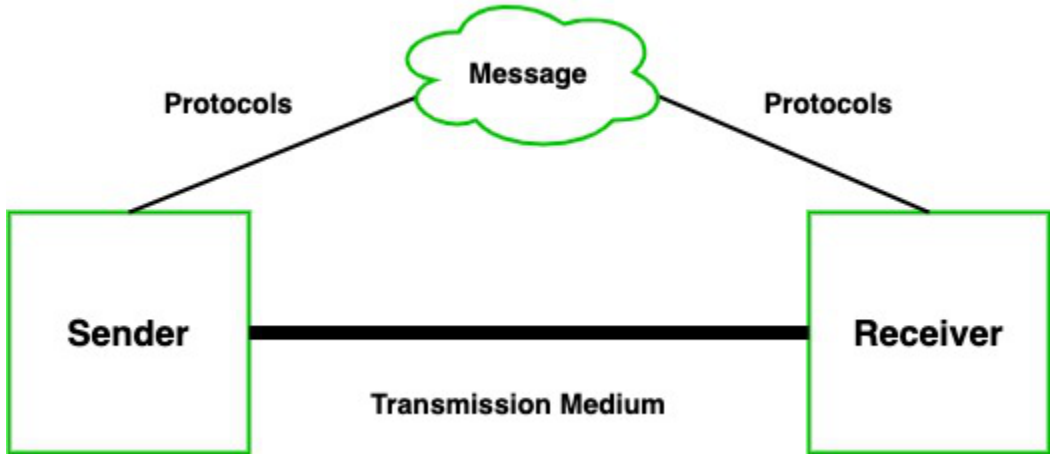
Basics of Networking & Sensor Networks - Applications, challenges - ISO/OSI Model, TCP/IP Model, Sensor network architecture and design principles, IoT technology stack, Communication models. Communication Protocols - Overview of protocols in each layer, Application protocols for the transfer of sensor data, Infrastructure for IoT: LoRa-Wan, 6LoWPAN, 5G and Sigfox.

Unit 3

Introduction to Cloud, Fog and Edge Computing. Modern trends in IoT – Industrial IoT, Wearable. Applications of IoT - Smart Homes/Buildings, Smart Cities, Smart Industry, and Smart Medical care, Smart Automation etc.

Components of Data Communication System

- Messages
- Sender
- Receiver
- Transmission Medium / Communication Channel
- Protocols (Set of rules / guidelines)



Ref: https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/

Types of Data Communication

- Simplex
- Half – Duplex
- Full – Duplex

- Unicast (Point-to-Point)
- Broadcast (Point-to-Multipoint)
- Multicast (Point-to-Multipoint)
- Multipoint-to-point

Ref: https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/
https://www.geeksforgeeks.org/difference-between-unicast-broadcast-and-multicast-in-computer-network/

Medium

- Guided – Wired
  - Twisted Pair Copper
  - Coaxial Cable
  - Power Line
  - Optical Fiber
- Unguided – Wireless
  - Electromagnetic Waves
  - Radio waves, Microwaves, Infrared, Visible

Ref: https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/
https://ncert.nic.in/textbook/pdf/lecs111.pdf

Networking

- Telephone Network
- Computer Network
- Cellular Network
- Internet
- Embedded Network
- Sensor Network
- …

network

/ˈnɛtwəːk/

See definitions in:

All | Transportation | Broadcasting | Technology

noun

- a number of interconnected computers, machines, or operations.
  "a computer network"
- a system of connected electrical conductors.

verb

- link (computers or other machines) to operate interactively.
  "more and more PCs are networked together"

Definitions from Oxford Languages

Types of Network

- Personal Area Network - PAN
- Local Area Network - LAN
- Metropolitan Area Network - MAN
- Wide Area Network - WAN
- Wireless LAN - WLAN
- Virtual Private Network - VPN

Ref: https://www.educba.com/types-of-network/

Network Devices

- Transceiver
- Modem
- Network Interface Card
- Hub
- Repeater
- Bridge
- Switch
- Router
- Gateway
- Access Point

Ref: https://www.geeksforgeeks.org/network-devices-hub-repeater-bridge-switch-router-gateways/
https://blog.netwrix.com/2019/01/08/network-devices-explained/

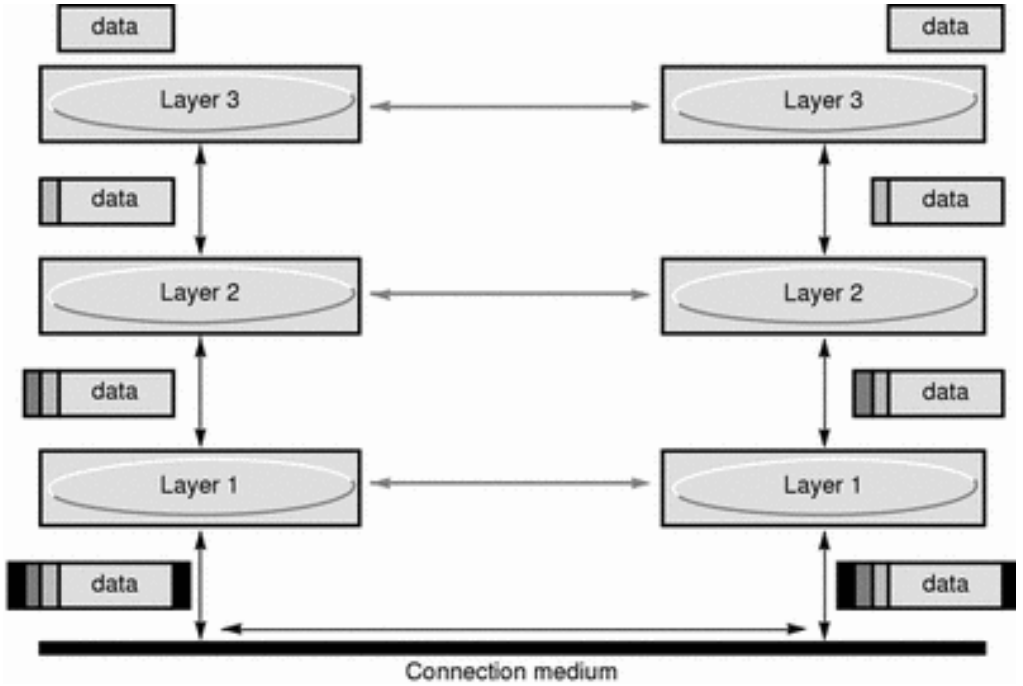
Protocol - Need

- Protocol – Sets of rules and regulations
- Syntax, Semantics, Timing, etc.
- Data Sequencing/Formatting/Packaging
- Security and Logging
- Flow and Error Control
- Routing and Medium Access
- Connection establishment and termination
- Signal generation and processing

Ref: https://www.cdw.com/content/cdw/en/articles/networking/types-of-network-protocols.html
http://www2.cs.uidaho.edu/~krings/CptS-555/Notes-F13/420-13-02.pdf
https://ecomputernotes.com/computernetworkingnotes/communication-networks/what-is-data-communication
https://ncert.nic.in/textbook/pdf/lecs111.pdf

Protocol Layering

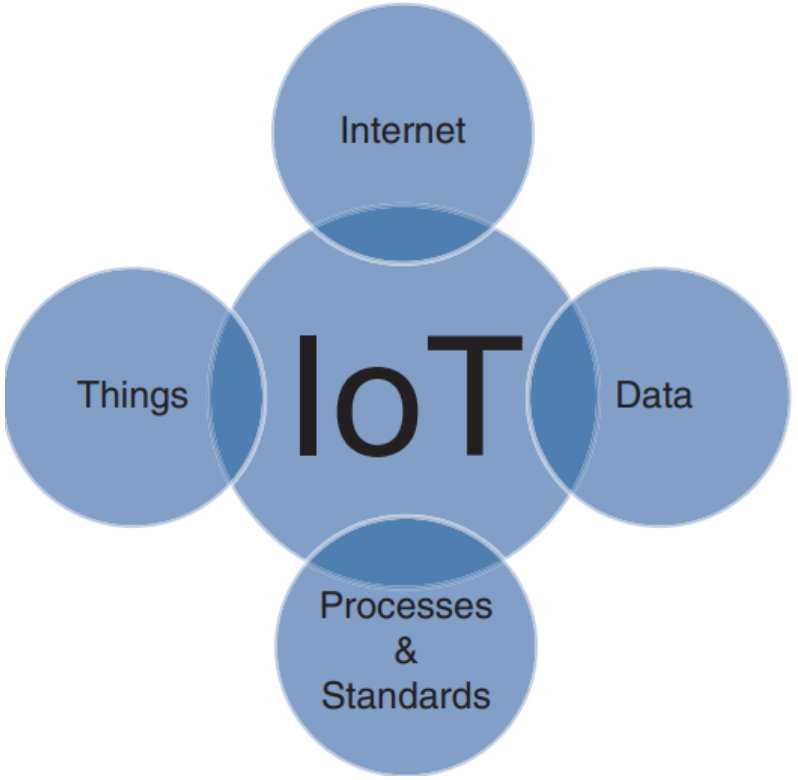
- Services & Interfaces
- Reusability & Modularity
- Interoperability
- Abstraction
- Overhead



Ref: https://docs.oracle.com/cd/E19620-01/805-4041/6j3r8iu2e/index.html
https://www.cl.cam.ac.uk/teaching/1011/PrincComm/slides/layering-11.pdf
https://erg.abdn.ac.uk/users/gorry/course/intro-pages/layer.html
https://www.tutorialspoint.com/what-is-protocol-layering

Internet of Things - Definition

- IoT is the network of things, with clear element identification, embedded with software intelligence, sensors, and ubiquitous connectivity to the Internet.
- IoT enables things or objects to exchange information with the manufacturer, operator, and/or other connected devices utilizing the telecommunications infrastructure of the Internet.
- Each thing is uniquely identifiable through its embedded computing system and is able to interoperate within the existing Internet infrastructure.



Courtesy: Rayes, Ammar, Salam, Samer "Internet of Things from Hype to Reality" 2nd edition, Springer, 2018.

IoT Reference Framework

- IoT devices (things)
- IoT network (infrastructure transporting the data)
- IoT Services Platform (software connecting the things with applications and providing overall management)
- IoT applications (specialized business-based applications such as customer relation management (CRM), Accounting and Billing, and Business Intelligence (BI) applications)

Courtesy: Rayes, Ammar, Salam, Samer “Internet of Things from Hype to Reality” 2nd edition, Springer, 2018.

IoT Reference Framework

- IoT Device Level includes all IoT sensors and actuators (i.e., the Things in IoT).
- IoT Network Level includes all IoT network components including IoT gateways, routers, switches, etc. (i.e., the Internet in IoT) will be
- IoT Application Services Platform Level includes the key management software functions to enable the overall management of IoT devices and network. It also includes main functions connecting the device and network levels with the application layer.
- IoT Application Level includes all applications operating in the IoT network.

Courtesy: Rayes, Ammar, Salam, Samer "Internet of Things from Hype to Reality" 2nd edition, Springer, 2018.

IoT Reference Framework

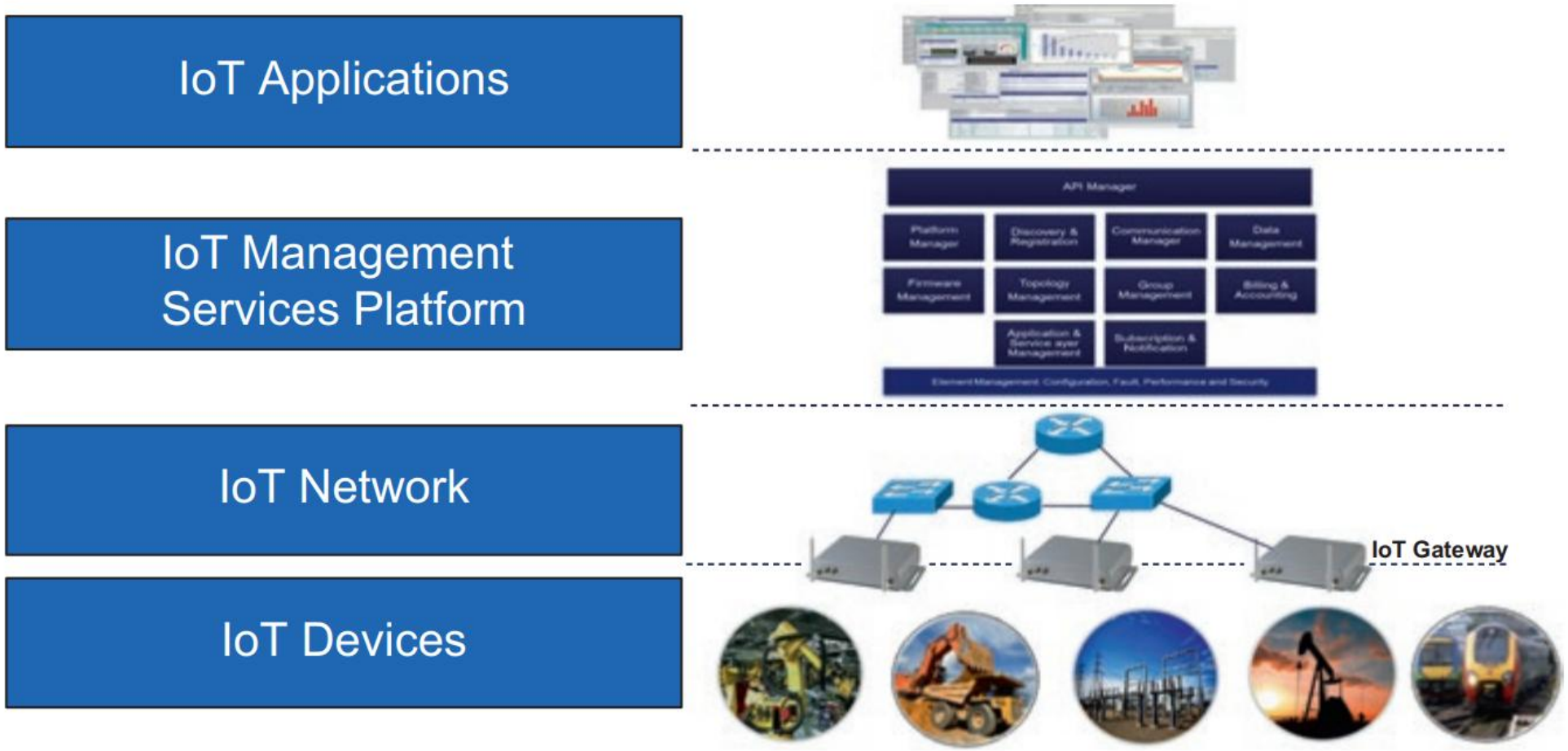


Image Courtesy: Rayes, Ammar, Salam, Samer “Internet of Things from Hype to Reality” 2nd edition, Springer, 2018.

Internet of Everything (IoE) – Key Components

- People: Connecting people in more relevant ways.
- Data: Converting data into intelligence to make better decisions.
- Process: Delivering the right information to the right person or machine at the right time.
- Things: Physical devices and objects connected to the Internet and each other for intelligent decision-making, often called IoT.

Courtesy: Rayes, Ammar, Salam, Samer “Internet of Things from Hype to Reality” 2nd edition, Springer, 2018.

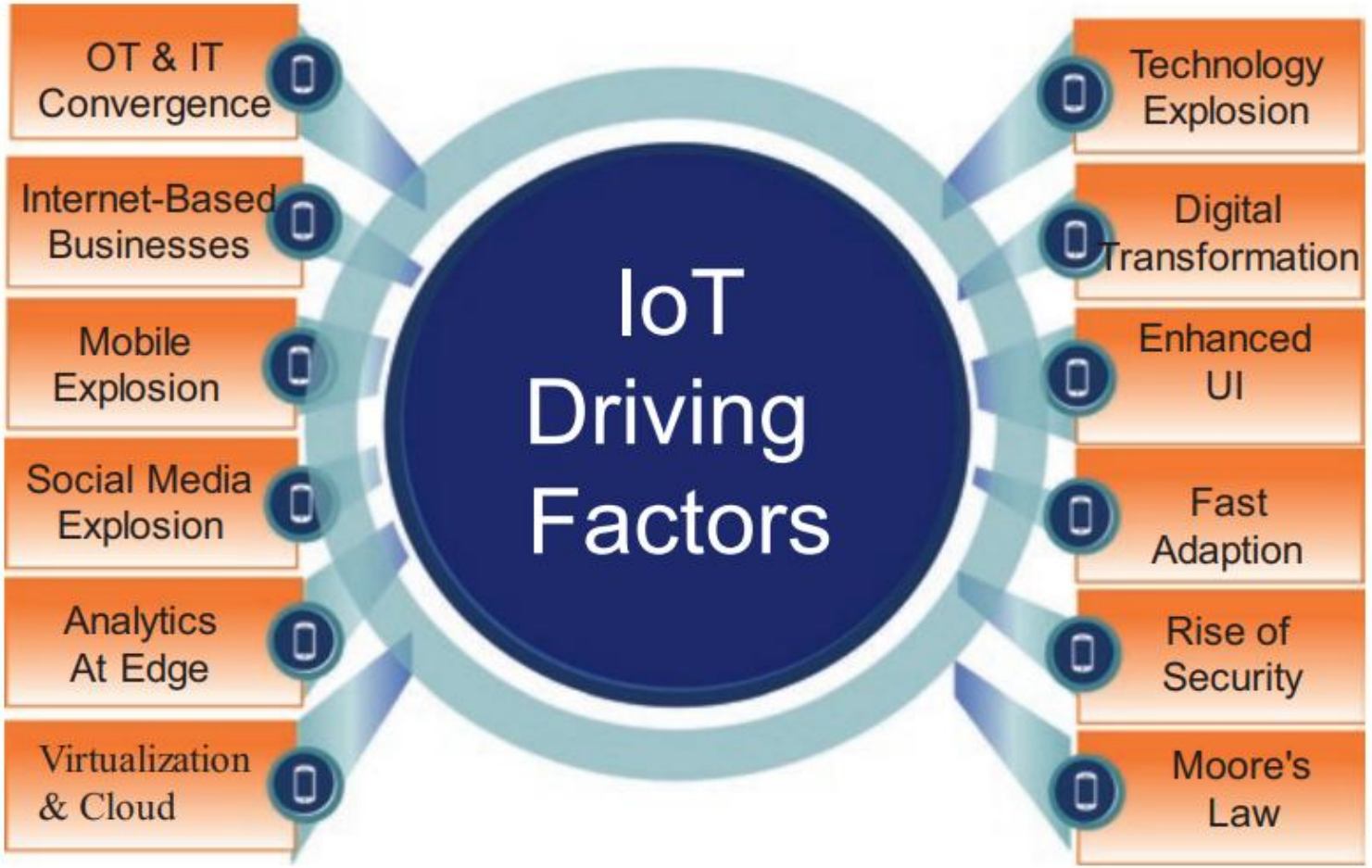
IoT vs IoE

- Internet of People
- Internet of Things
- Internet of Everything = Internet of People + Internet of Things

- IoT is the network of things, with device identification, embedded intelligence, and sensing and acting capabilities, connecting people and things over the Internet

Courtesy: Rayes, Ammar, Salam, Samer “Internet of Things from Hype to Reality” 2nd edition, Springer, 2018.

IoT – Driving Factors



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Thank You…