INTRODUCTION TO INTERNET OF THINGS

Session I

OBJECTIVES

In this session, you will learn to:

- Explain IoT
- Enumerate the history of IoT
- List the objects in IoT
- Describe the role of cloud computing in IoT
- Describe the role of big-data in IoT

INTRODUCTION TO IOT 1/3

- A proposed development of the Internet in which everyday objects have network connectivity, enabling sending and receiving data.

- How does it work?

  With unique identifiers (IDs) and without human intervention.

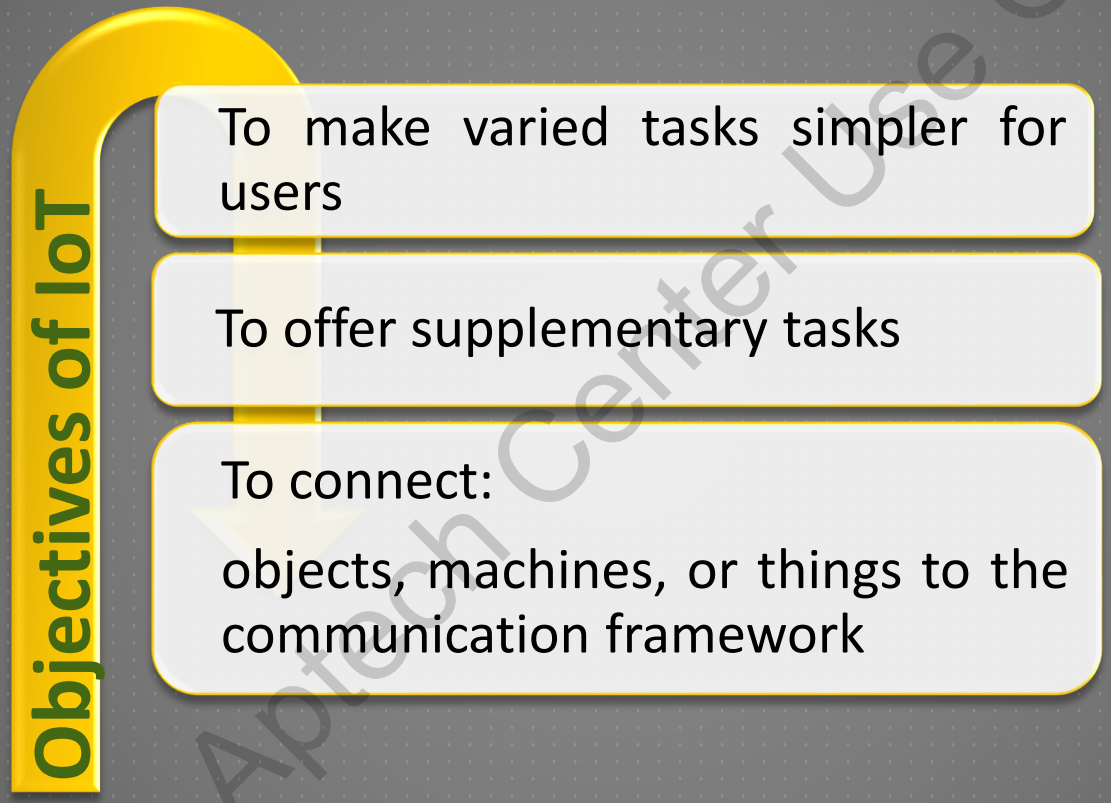
INTRODUCTION TO IOT 2/3

- What does it do?

  IoT makes daily life objects smarter

- A SMART clip gives alerts with an automated message to the user's smartphone.

INTRODUCTION TO IOT 3/3



WIRED AND WIRELESS TECHNOLOGIES

Wired and wireless technologies provide communication abilities and connections in IoT

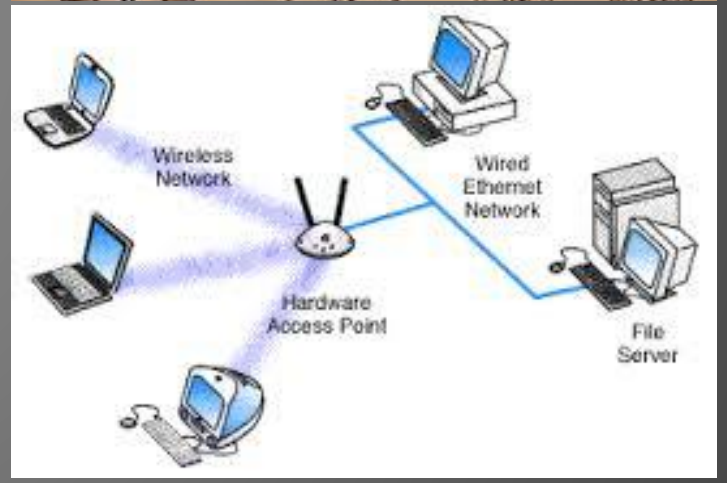
It offers a wide range of services based on:

- Individual-to-individual
- Individual-to-machine
- Machine-to-individual
- Machine-to-machine interactions

SMART TECHNOLOGY 1/2

- IoT makes objects smarter as most of devices now-a-days are electrified.

- Electrification is defined as the process of powering by electricity. The electrified world and the extensive usage of embedded processing make objects smarter.

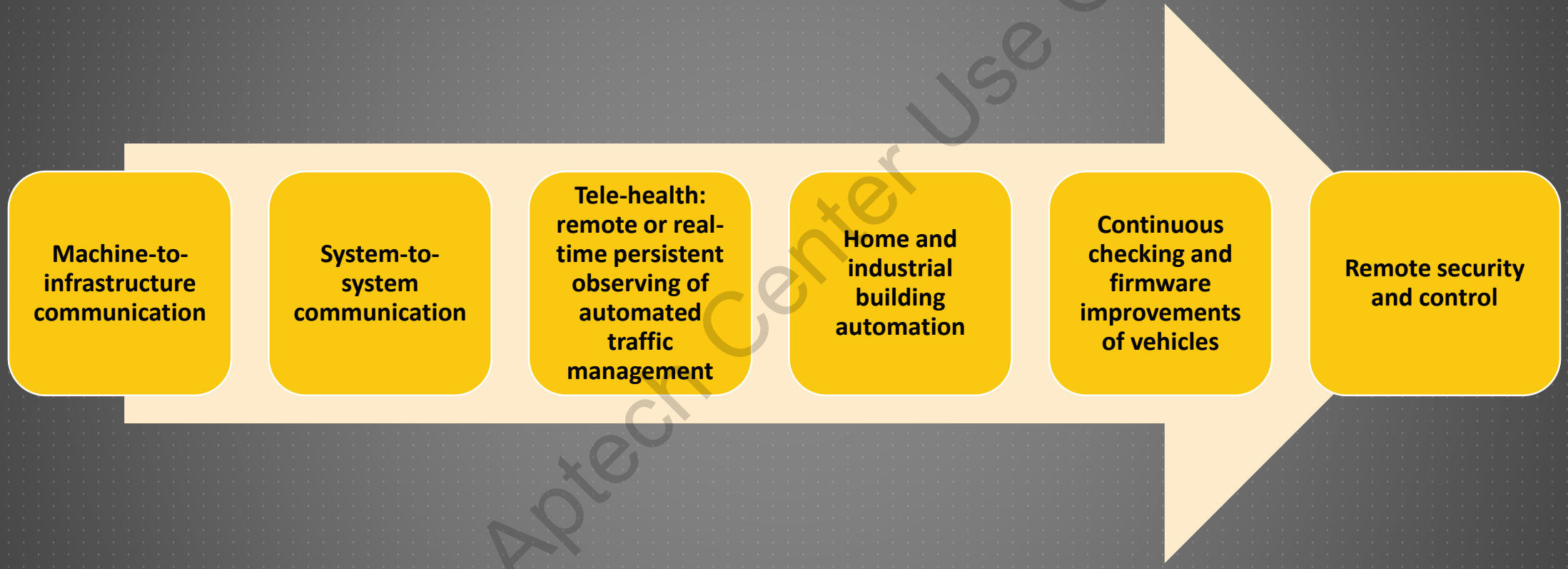


SMART TECHNOLOGY 2/2

Micro Controller Unit (MCU)

- Helps to remotely access the devices from a distant location
- Controls the working of the instrument automatically

USE OF IOT IN REAL-LIFE TECHNOLOGY 1/2



USE OF IOT IN REAL-LIFE TECHNOLOGY 2/2

Asset tracking of goods on the move

Smart applications of IoT include - agriculture, grid, ater, meters, buildings, broadband, cities, cars, appliances, tags, animal farming, and the environment

Environmental monitoring and control

IOT AND QUALITY LIFE OF USERS

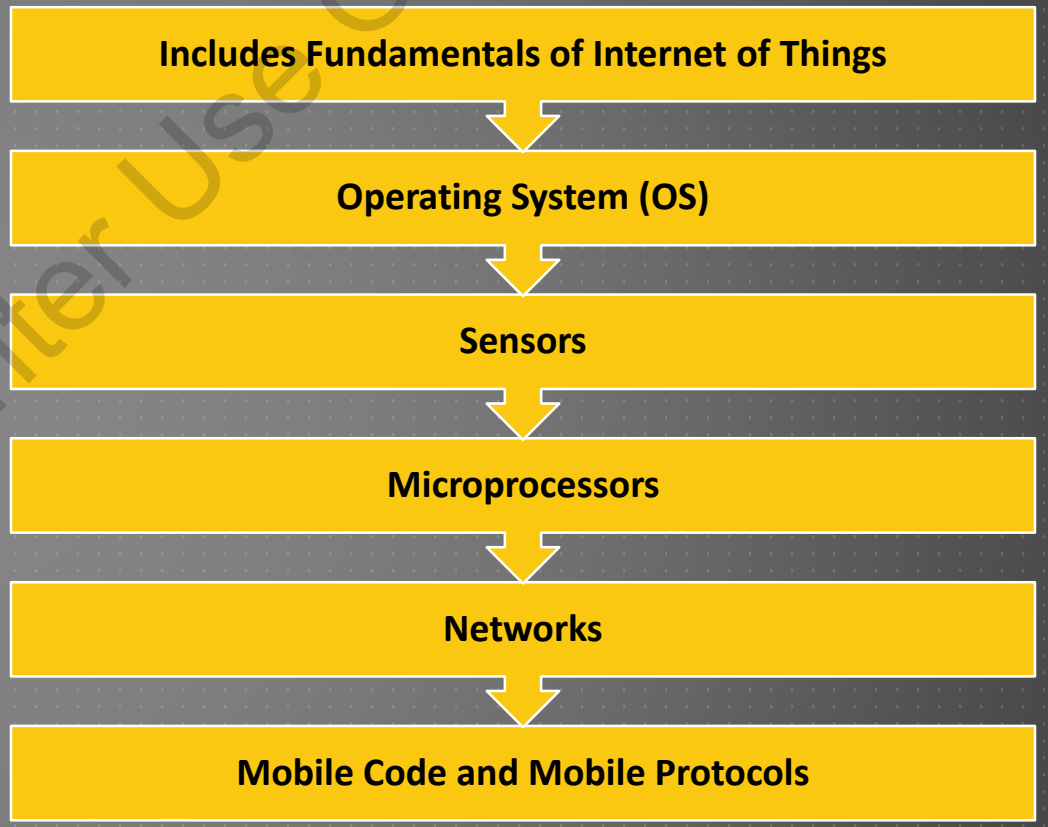
Banking or shopping

Home intruder sensor triggers the surveillance and security cameras around the house and residential area

Reduces paperwork and improves quality of life

MOVING TOWARDS UBIQUITOUS OR PERVASIVE COMPUTING

- The primary tools that supports ubiquitous or pervasive computing:



FUNDAMENTAL COMPONENTS OF IOT 1/4

- **Hardware** - Makes physical objects approachable and enables data recovery, and it reacts to instructions.
- **Software** - Facilitates data collection, storage, manipulating, instructing, and processing.
- **Communication Infrastructure** - Most vital of all, it is a communication infrastructure which includes protocols and technologies to support two physical objects to exchange data.

FUNDAMENTAL COMPONENTS OF IOT 2/4

Significant architectural building blocks:

- Connectivity and Normalization for carrying various protocols and data formats.
- Device Management for updating software and other applications running on the device or edge gateways.
- Database a mountable storage of device data generating the necessities for hybrid cloud-based databases.

FUNDAMENTAL COMPONENTS OF IOT 3/4

- Processing and Action Management for giving life to data with rule-based event action triggers.
- Analytics for performing an array of compound analysis and excavate the maximum value out of the IoT data stream.
- Visualization for facilitating humans to perceive patterns and witness trends depicted through stacked, line, or pie charts as well as 2D or 3D models.

FUNDAMENTAL COMPONENTS OF IOT 4/4

- Additional Tools for supporting IoT developers' prototype.
- External Interfaces for communicating with third-party systems and rest of the IT-ecosystem through Software Development Kits (SDK), built-in Application Programming Interfaces (API), and gateways.

HISTORY OF IOT 1/12

- The term IoT was coined by Kevin Ashton in 1999.
- Ashton is the Executive Director of the Auto-ID Centre at the Massachusetts Institute of Technology (MIT), Cambridge, USA.
- The Internet links software across the world includes:
  - Wearables
  - Machine-to-Machine (M2M)
  - Ubiquitous Computing
  - Radio Frequency Identification (RFID)
  - Context-aware computing and the Web of Things

HISTORY OF IOT 2/12

1926	• Tesla had prophesied that the present day smartphones would be the size of a shirt pocket that would be easy to carry and simple to handle
1946	• The two-way wrist-radio, which was worn by fictional characters such as Dick Tracy and his colleagues, made its appearance first and became most identifiable icons
1949	• Barcode was conceived
1955	• Tiny automatic device were invented
1960	• Telesphere Mask, the first instance of a Head-Mounted Display (HMD) was invented

HISTORY OF IOT 3/12

1966	• Learnmatrix, an 'Associative-Memory-like Architecture,' was developed and an initial implementation of Artificial Neural Networks (ANN) happened
1967	• An 'analogue wearable computer' was created
1969	• The first message from ARPANET was transmitted
1973	• Received the first patent for a passive, read-write RFID tag to mechanically categorize and detect tags attached to objects
1974	• For the first time, UPC label was used to ring up purchases at a supermarket

HISTORY OF IOT 4/12

1977	• A five-pound wearable PC, which had a camera that could be fitted on the head was invented
1981	• Mann developed a backpack-mounted ‘wearable personal computer-imaging system and lighting kit
1989	• Sir Timothy John Berners-Lee designed the 'world wide web (www)'
1990	• An 'Active Badge' system, using electromagnetic signals was developed
1990	• An internet toaster was invented and connected the toaster to the internet with TCP/IP networking

HISTORY OF IOT 5/12

1993	• Started using a specially rigged computer and heads-up display as a wearable device
1994	• Exhibit the 'Forget-Me-Not', a wearable device that communicates via wireless transmitters and records communications
1994	• Coined the term 'context-aware' for the first time in a network article
1995	• Sets up a department to develop and launch a Global System for Mobile Communication (GSM)
1995	• Invented the first wearable wireless Webcam, the first example of life logging

HISTORY OF IOT 6/12

1997	• It was predicted that in the near-term technology expansions in sensors will help prepare people for the ensuing effect of nanotechnology
1998	• Constructed a water fountain outside his office whose flow and height calculated the volume
1999	• Procter and Gamble's Kevin Ashton first mentioned IoT-denoting to the link between supply chain and Internet
2000	• Launched the world's first internet refrigerator, 'Internet Digital DIOS'

HISTORY OF IOT 7/12

2002	• Showed that the Dow Jones 'personal finance and weather information' was centered on Internet data and changes its color based on the active structures
2003	• A waste management company announced that it aims to transform its trash cans to double the wireless hotspots throughout New York City
2003	• Projects such as, Cool Town, Internet are implemented. RFID is installed on an enormous scale by the US Department of Defense. ICT and Internet of Things were introduced.
2005	• Created 'Arduino', an inexpensive and simple-to-use 'single-board microcontroller

HISTORY OF IOT 8/12

2005	• IoT reached new heights, when the UN's International Telecommunications Union, ITU, published its first report
2005	• Nabaztag, a Wireless Fidelity (WiFi) device, which is rabbit-shaped, collected information from the Internet
2006	• Recognition by the European Union (EU), and the first European IoT conference was held
2008	• The IPSO alliance presently has over 50 member companies, including corporate giants such as Bosch, Cisco, Ericsson, and others.

HISTORY OF IOT 9/12

2008	• The Internet of Things was born
2008	• The U.S .National Intelligence Council warned that the IoT would be an interruptive technology by 2025
2008	• An array of IoT platforms (Pachube, Thingspeak standards (6LoWPAN, Dash7) hardware and software (Contiki, TinyOS) was developed
2010	• The concept of IoT became popular

HISTORY OF IOT 10/12

2010	• In May 2010, Zigbee Alliance and Internet Protocol version 6, (Ipv6) Forum form strategic partnership with IPSO for speedy implementation of IP networked smart objects
2011	• Gartner, the market research company that designed the well-known 'hype-cycle for developing technologies' included 'The Internet of Things'
2011	• In February 2011, the wireless firm envisaged that there would a whopping 50 billion IoT devices by 2020
2011	• Introduced its 'Nest Learning Thermostat', which uses sensor algorithms, machine learning, and cloud computing

HISTORY OF IOT 11/12

2012	• Begins testing its Google Glass prototype which is a pair of glasses with an optical HMD that exhibits information gathered wirelessly
2012	• On June 6,2012, World IPv6 Launch Day was organized
2012	• In July 2012, US gets Food and Drug Administration (FDA) clearance for its ingestible medical device that wirelessly transmits information to the patient's vital signs
2012	• Internet of Things grows rapidly on social networks such as LinkedIn

HISTORY OF IOT 12/12

2013	• US published a report stating that the Internet of Things would be an $8.9 trillion market in 2020. Do It Yourself Consumers (DIY'ers) will take interest in the topic
2014	• In April 2014, Google Glass goes on sale to the general public for a hefty $1500
2015	• Microsoft, Apple, Oracle, HP, Google, GE, and many others have some sort of IoT platform established. By 2020, Internet is expected to have 7.6 billion users

OBJECTS OR THINGS IN IOT

- **Various sectors that use IoT smart devices:**

- Business and Manufacturing
- Healthcare
- Retail
- Security

SMART OBJECTS 1/2

- A thing or object in the context of IoT is an entity or physical object that has:
  - A unique identifier
  - An embedded system
  - The ability to transfer data over a network

SMART OBJECTS 2/2

- Examples of the objects or things of IoT are:

THE INTERNET EVOLUTION

- **By 2020**:
  - Human intelligence and machine intelligence will merge
  - Users will use their brain waves for communicating through smart objects
- **Networked Robots**:
  - Will absorb from each other and work in teams to increase the productivity and solve scientific problems

ADVENT OF INTERNET ERA

- Used for global communication
- Internet technology made objects or things smarter
- It includes:
  - Smart-TVs
  - Smartphones
  - Smart bulbs
  - Smart homes

IOT IN CLOUD COMPUTING

Cloud computing is a type of Web-based computing

It provides applications and services to users on demand

It involves provisioning of shared processing resources and data to users on request

Cloud computing resources do not require interactions with the cloud service providers

Cloud computing and storage solutions offer individual users and organizations benefits to

- Store
- Monitor
- Process and control their data from external data centers

IOT IN BIG DATA 1/2

- Datasets that are so large or complex that traditional data processing applications are inadequate
- Big-data is the key product of device interconnectivity and enables precise targeting
- New era of economic growth and competitiveness

IOT IN BIG DATA 2/2

- **Usefulness of Big-data:**
  - Less downtime
  - Predictive health monitoring
  - Improved quality
  - Higher quantity
  - Lower reject rates
  - More efficient use of labor
  - Improved safety and enable mass customization of manufacturing

- **Examples of Big-data:**
  - Extensive E-commerce
  - Internet script
  - Google
  - Call detail records
  - Astronomy
  - Atmospheric science
  - Genomics

SUMMARY 1/2

- Internet of Things (IoT), is the way to a smart-world with ubiquitous computing and networking.
- IoT-based services concentrate on offering more automation of many tasks around people and allied objects so as to build a smart world not only in manufacturing units, also in office, at home and across the world.
- Quality of our life is improving in numerous ways with smart IoT devices; whether it is banking or shopping it can be done fairly with a single click.
- Internet of Things (IoT) is not a technology, however, a system that permits for modifications with a certain degree of flexibility.

SUMMARY 2/2

- IoT includes wide range of connected objects computers smaller than a grain of sand can be sprayed or injected almost all over to measure chemicals in the soil or to sense problems in the human body.
- Combination of IoT along with cloud computing, support sensing services and commanding process of sensing data stream.
- Big-data functions vary for each single IoT device it is connected, on the other hand chiefly it captures and stores all the incoming data. This information will be examined in one point center to improve the performance and process.