

Overview of Internet of Things (IoT)

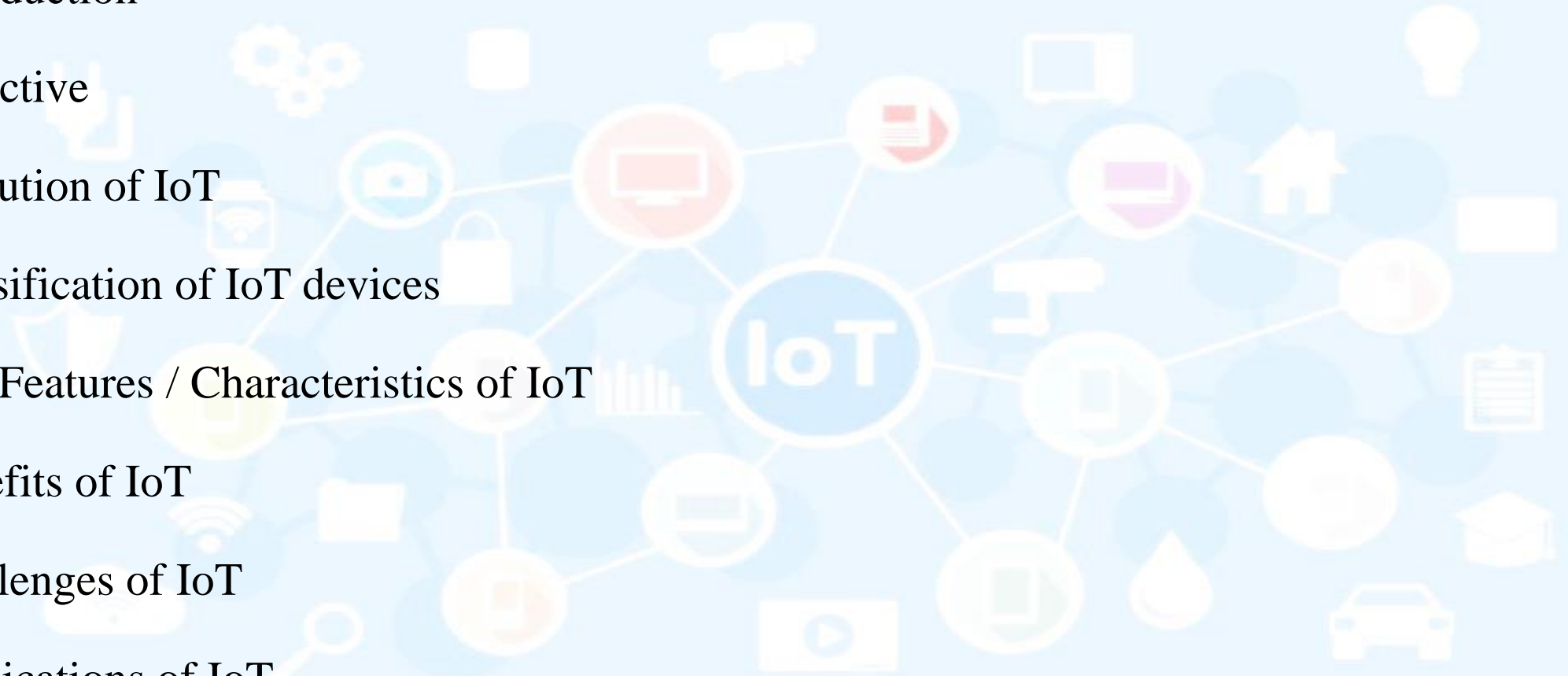
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Contents

1. Introduction
2. Objective
3. Evolution of IoT
4. Classification of IoT devices
5. Key Features / Characteristics of IoT
6. Benefits of IoT
7. Challenges of IoT
8. Applications of IoT
9. Security Issues of IoT



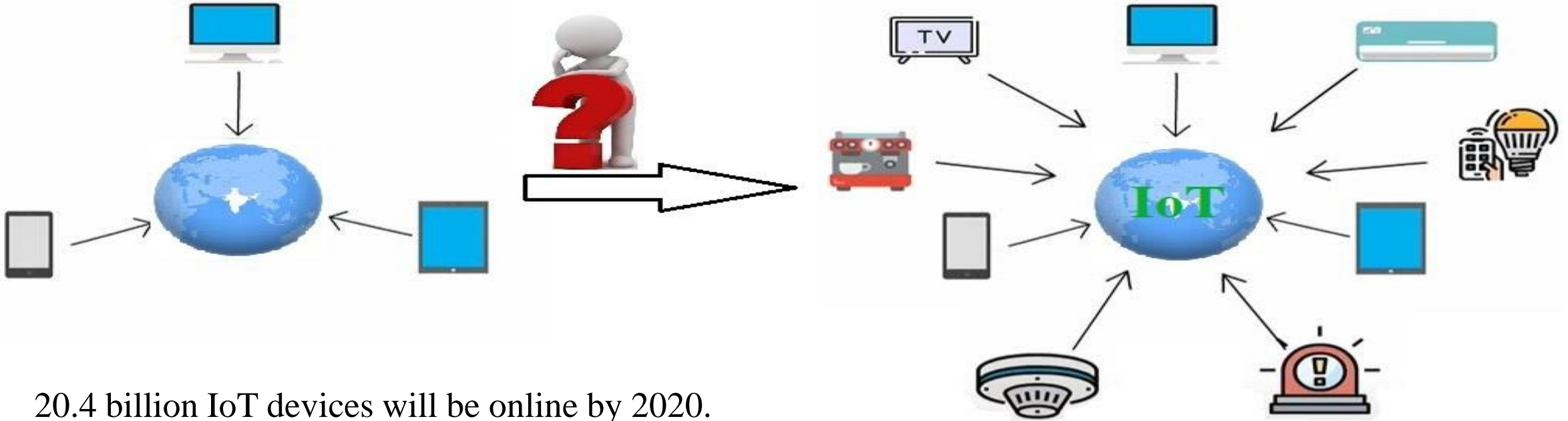
Introduction

- **Internet of Things (IoT)** is a network of devices / physical objects that are capable of communicating with each other over the Internet. Allowing these devices to generate, exchange and consume data with minimal human intervention.
- IoT was a primitive concept in the early 2010s.
- It is now a potential research area owing to its application in diverse fields. Research in IoT emerged at the convergence of different areas such as embedded systems, artificial intelligence, and computer networking.
- IoT extends the reach of the internet to a wide range of computing devices, beyond laptops and mobile phones.

Motive of IoT

- The main purpose of IoT is to create an ecosystem that connects everything. An ecosystem where everything is connected to each other is known as the Internet of Everything.
- The IoT Eco-system enables the entities to connect and control the IoT devices present in the network by-
- In case of an IoT Eco-system, the entity can use a remote (tablets, smartphones) for sending a command or request for information over an IoT device
- The device then performs the command or can even send the information back over the network which has to be analyzed
- This storing and analyzing of data can be carried out in multiple locations which include-cloud, local database or sometimes the data himself

Evolution of IoT

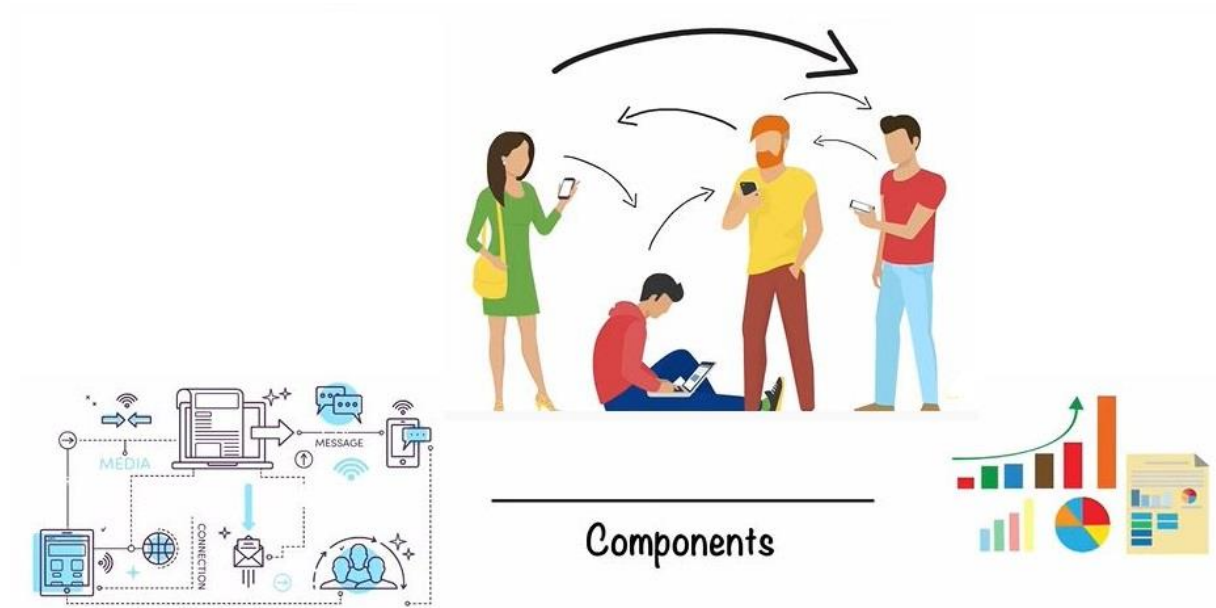


- 20.4 billion IoT devices will be online by 2020.
- Gartner IoT research claims that there will be 25 billion devices by the end of 2021.
- By 2025, the number is expected to rise to 75 billion devices.

IoT is shaping the way we live our lives

Internet to IoT

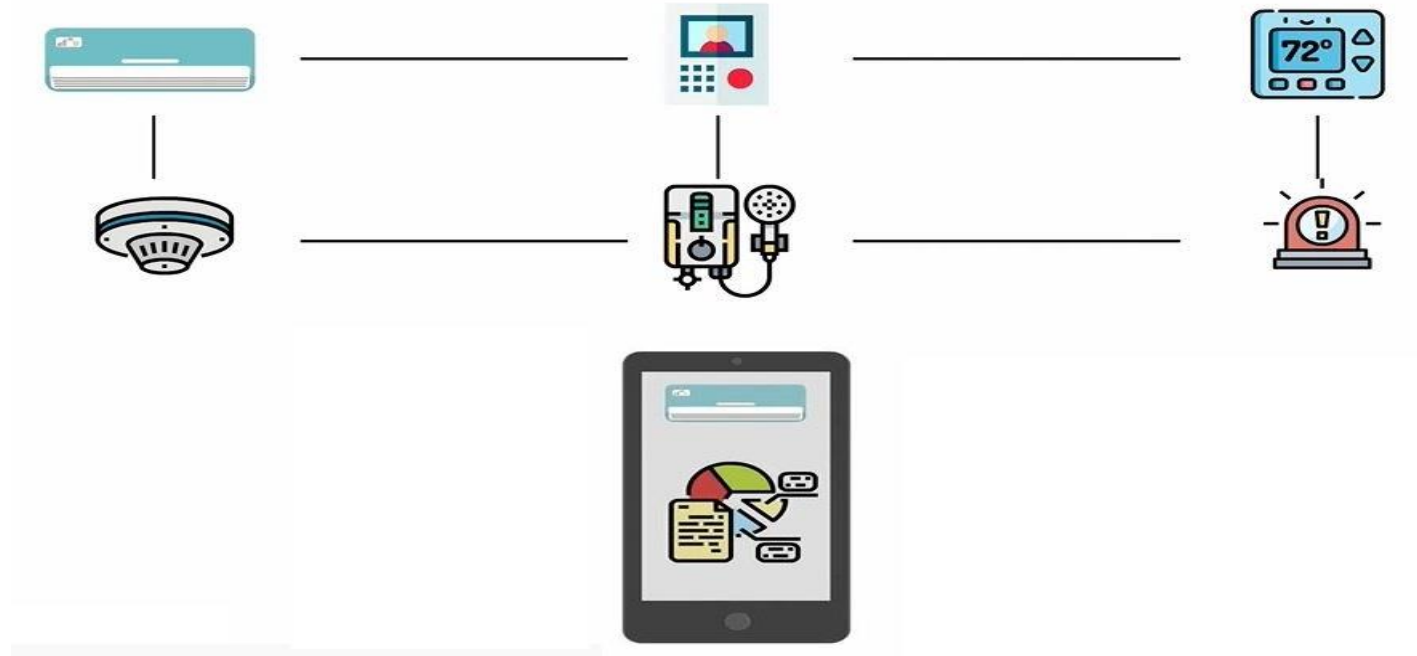
- We already know, the internet help people to connect and interact to each other,
but
- Now, IoT help to connect physical objects and can share data to each other.



- For that a lot of components are involved for providing an efficient data exchange.
- Each IoT component has a Unique Identifier (UID) that makes it recognizable.

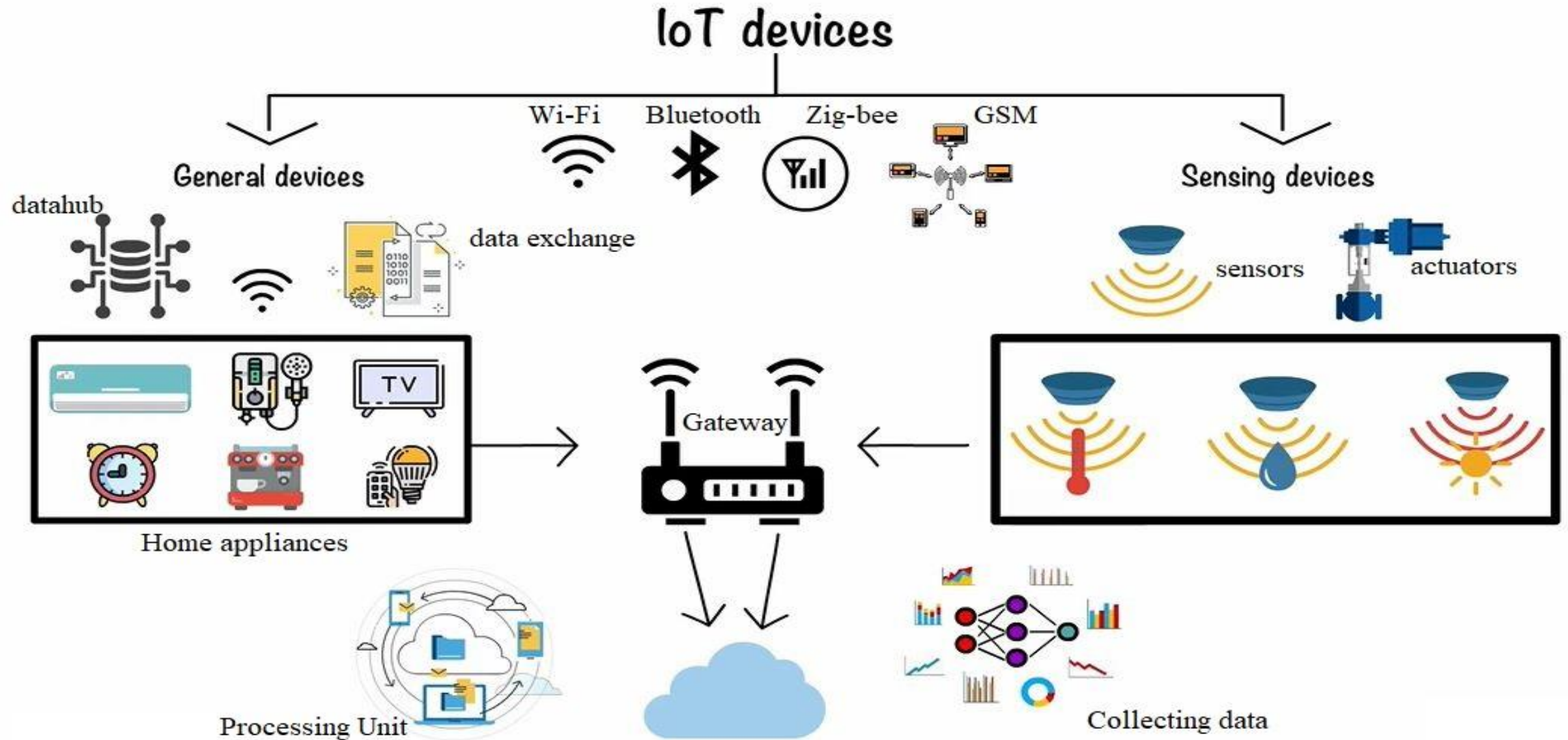
The Best Example for IoT – Smart House

- The home appliances are interconnected to share the data with user over a mobile application.



- The user can get a detailed information of the devices and also can get the working condition for those devices
- E.g. IoT system can operate, many applications such as, in the morning alarm can goes off, turn-on coffee boiler and water heater, etc.,

Types of IoT devices



Key Features / Characteristics of IoT

1. **Connectivity** – This doesn't need too much further explanation. With everything going on in IoT devices and hardware, with sensors and other electronics and connected hardware and control systems there needs to be a connection between various levels.
2. **Things** – Anything that can be tagged or connected as such as its designed to be connected. From sensors and household appliances to tagged livestock. Devices can contain sensors or sensing materials can be attached to devices and items.
3. **Data** – Data is the glue of the Internet of Things, the first step towards action and intelligence.
4. **Communication** – Devices get connected so they can communicate data and this data can be analyzed. Communication can occur over short distances or over long range to very long range.

Key Features / Characteristics of IoT

5. **Intelligence** – The aspect of intelligence as in the sensing capabilities in IoT devices and the intelligence gathered from big data analytics (also artificial intelligence).
6. **Action** – The consequence of intelligence. This can be manual action, action based upon debates regarding phenomena (for instance in smart factory decisions) and automation, often the most important piece.
7. **Ecosystem** – The place of Internet of Things from a perspective of other technologies, communities, goals and the picture in which the Internet of Things fits. The Internet of Everything dimension, the platform dimension and the need for solid partnerships.

Benefits / Advantages of IoT

1. **Connectivity** – IoT permits devices to stay connected to a central terminal and helps us check the connected devices from our phone.
2. **Efficiency** – It also allows instant access to information, which in turn frees up time and resources which can be dedicated to more important engagements.
3. **Ease** – IoT connected devices are basically computers sending data in real-time, i.e. our fridge can keep an eye on its contents and send us an alert if we're out of provisions.
4. **Adapting to New Standards** – Though IoT is ever-changing, its alterations are minimal compared to the rest of the high tech world. Without IoT, it would be hard for us to keep track of all the latest updates.
5. **Better Time Management** – Overall, the IoT is an incredible time-saving tool. We can search for the latest news on our phones during our daily commute, or visit a blog about our favorite pastime, purchase an item in an online shop, you name it. Eventually, we end up with much more time on our hands.

Disadvantages of IoT

- **Data Breach** - Having easy access to data is wonderful. Unfortunately, our own private data is more exposed than ever too. 2.7 million Americans were victims of identity theft. Data breaches are extremely stressful. Companies also fear them and can lose the trust of their clients for good if the cyber attack came via their website pages.

Example – The riskiest devices are said to be: smart toys for kids, off-brand IoT gadgets, second-hand smart devices, and the latest, suspicious apps (about the newest unusual devices).

- **Dependence** – The IoT, obviously, is dependent on the internet connection. When there is none, it can't be used. On the other hand, we have become increasingly dependent on the IoT's everyday usage. Not only in business, but in our private lives.
- **Complexity** – Though IoT seems to be completing tasks with ease, a lot of complex operations are behind it. Consequently, if the software makes a wrong calculation, this will affect the rest of the process.

Challenges of IoT

1. Compatibility and Interoperability of Different IoT systems
2. Identification and Authentication of Technologies
3. Enterprises need to integrate various IoT connected products with right IoT platforms.
4. Connectivity – the Internet is still not available everywhere at the same speed.
5. Handling Unstructured Data – to determine which data is valuable from the gathered info
6. Data Capturing Capabilities
7. Intelligent Analytics
8. Data Security and Privacy Issues – by 2020, 25% of cyber attacks will target IoT devices.
9. Consumer Awareness – Many people are not aware of IoT, but they depend on smart apps
10. Delivering Value – Quality of IoT technology

Applications of IoT

There are currently five types of IoT applications:

1. **Consumer IoT**—such as light fixtures, home appliances, and voice assistance for the elderly.
2. **Commercial IoT**—applications of IoT in the healthcare and transport industries, such as smart pacemakers, monitoring systems, and vehicle to vehicle communication (V2V).
3. **Industrial Internet of Things (IIoT)**—includes digital control systems, statistical evaluation, smart agriculture, and industrial big data.
4. **Infrastructure IoT**—enables the connectivity of smart cities through the use of infrastructure sensors, management systems, and user-friendly user apps.
5. **Military Things (IoMT)**—application of IoT technologies in the military field, such as robots for surveillance and human-wearable biometrics for combat.

Security and Privacy of IoT

- **Lack of Compliance on the part of IoT manufacturers** - The primary source of most IoT security issues is that manufacturers do not spend enough time and resources on security.
- **Lack of User Knowledge & Awareness** – One of the biggest IoT security risks and challenges is the user's ignorance and lack of awareness of the IoT functionality. As a result, everybody is put at risk.
- **IoT Security Problems in device update management** - If the connection is unencrypted and the update files are unprotected, a hacker could steal sensitive information.
- **Lack of Physical Hardening** – Users are also responsible for keeping IoT devices physically secured. A smart motion sensor or a video camera that sits outside a house could be tampered with if not adequately protected.
- **Botnet Attacks** – To perform a botnet attack, a hacker creates an army of bots by infecting them with malware and directs them to send thousands of requests per second to bring down the target.

Security and Privacy of IoT

- Industrial Espionage & Eavesdropping – Spying and intruding through IoT devices is a real problem, as a lot of different sensitive data may be compromised and used against its owner.
- High jacking your IoT Devices
- Data Integrity Risks of IoT security in healthcare
- One of the most significant IoT security risks and challenges is being able to manage all our devices and close the perimeter.
- Crypto mining with IoT bots. This type of attack involves infected botnets aimed at IoT devices, with the goal not to create damage, but mine cryptocurrency.
- Still many risks and security challenges of IoT now — and more will inevitably emerge in the coming years.

References

- Borgia, E. (2014). The Internet of Things vision: Key features, applications and open issues. *Computer Communications*, 54, 1-31.
- Rose, K., Eldridge, S., & Chapin, L. (2015). The internet of things: An overview. The internet society (ISOC), 80, 1-50.

The background is a light blue gradient. It features a network of white lines and nodes. In the top left, there are several parallel white lines. Scattered throughout are various white icons: a plug, a gear, a camera, a smartphone, a lightbulb, a shield, a shopping bag, a bar chart, a document, a house, and a speech bubble. A central node is a blue circle with the text 'IoT' in white. To the right of the 'Thank you' text, there is a large, faint white triangle.

Thank you