Sejarah dan Perkembangan Internet of Things

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Foreword

- Internet of Things (IoT) is an important part of the new generation of information technologies and an important development phase in the information era.
- IoT is widely used in network convergence using communications and sensing technologies, such as intelligent sensing, identification, and pervasive computing. Therefore, IoT is called the third wave of global information industry development after computers and the Internet.

Evolusi Transformasi Digital

- Today there are more smart devices than there are people:
  - Many people are connected to the Internet 24 hours a day.
  - By 2020 each consumer will have 6.58 smart devices.
- Modern digital networks make all of this possible
- Digital transformation is the application of digital technology to provide the stage for business and industry to innovate.

How Connected Are You?

Cisco Networking Academy® Mind Wide Open™

Lab – Survey: How many "connected" hours per day? (Instructor Version)

Instructor Note: Red font color or gray highlights indicate text that appears in the instructor copy only.

Objectives

Survey 3 or 4 people: family, colleagues, and friends. Determine how many hours they are "connected" via any device during each day.

Background / Scenario

It is important to understand that most people born in the 1990s, will have grown up in a primarily digital world. Computers, the Internet, mobile phones, texting, social networking are all second nature to members of this group. This survey will help you to recognize how much of the day is actually spent "connected". This will help us to see the impact this generation will have on business and the economy.

Required Resources

- 3 or 4 people (friends, family, colleagues)

Step 1: Create a spreadsheet similar to the one below.

a. Add extra rows for more information if needed.

	A	B	C	D	E	F
1	How Many Hours are You Connected during the Day?					
2						
3	Person 1	Age	Gender	Device	Task	Time in hours
4		43	M	Smartphone	Facebook	4
5					Talking	2
6					Texting	10
7					Twitter	3
8				Fitbit	Tracking exercise	14
9				Tablet	On-line banking	0.5
10						
11					Total	33.5
12	Person 2	Age	Gender	Device	Task	Time
13						
14						

The Impact of Digital Transformation on Business

Click the arrow keys at the bottom of the screen to move between slides.

Digital Technology has enabled business to innovate their approach to interacting with society. People from all generations are more comfortable with digital technology and are using smart devices to their advantage throughout their busy days.

Can Smart Devices Think?

- If programmed appropriately, smart devices are able to evaluate data that is provided to them and modify processes or settings “on the fly”.
- If provided with sufficient data, they can “learn” and modify their own code based on the new parameters.
- Smart Cities use sensors to control many of their infrastructure systems such as traffic flow, parking, water utilization, and hydro.
- Self-driving cars are equipped with many ultrasound sensors, cameras, precision GPSs, and computers.

Networking is the Foundation

- Fifty billion things provide trillions of gigabytes of data
- Networks provide the foundation for the Internet and the digitized world.
- Networks can range from simple networks consisting of two computers to networks connecting millions of devices.
- Networks can provide products and services to customers through their connection to the Internet.
- The Internet is the largest network in existence and effectively provides the “electronic skin” that surrounds the planet.

How are IoT Devices Connected to the Network?

- A sensor needs to be connected to a network so that the gathered data can be stored and shared.
- Controllers are responsible for collecting data from sensors and providing network or Internet connectivity.
  - Controllers may have the ability to make immediate decisions, or they may send data to a more powerful computer for analysis.
- Sensors often work together with a device called an actuator.
- Actuators take electrical input and transform the input into physical action.

IoT Overview

- The concept of IoT was first proposed by MIT in 1999. The early IoT was a network based on RFID technology and devices. It combined objects with the Internet using the agreed communication protocols to implement intelligent identification and management of objects and realize interconnection and information sharing.
- IoT serves as a network that enables information sensing devices, such as QR code scanners, RFID, infrared sensors, global positioning systems, and laser scanners, to **connect any item with the Internet** for information exchange and communications based on agreed protocols. As such, IoT can facilitate intelligent identification, location, tracking, monitoring, and management (ITU).
- IoT is an Internet **where all things are interconnected**. This sentence has two meanings. First, the core and foundation of the IoT is still the Internet. IoT is an extended network based on the Internet. Second, the IoT connects any thing at the user end for information exchange and communication (Baidu Baike).

What is the IoT?

- The Internet of Things (IoT) is the connection of millions of smart devices and sensors connected to the Internet.
- Previously inanimate objects such as doorknobs or light bulbs can now be equipped with an intelligent sensor that can collect and transfer data to a network.
- An estimated 3 million new devices are connected to the Internet each month.
- In the next four years, there are going to be over 50 billion connected devices worldwide.
- Two-thirds will be “things”: sensors, actuators, and newly invented intelligent devices that monitor, control, analyze, and optimize our world.

IoT: From Internet of People to Internet of Things

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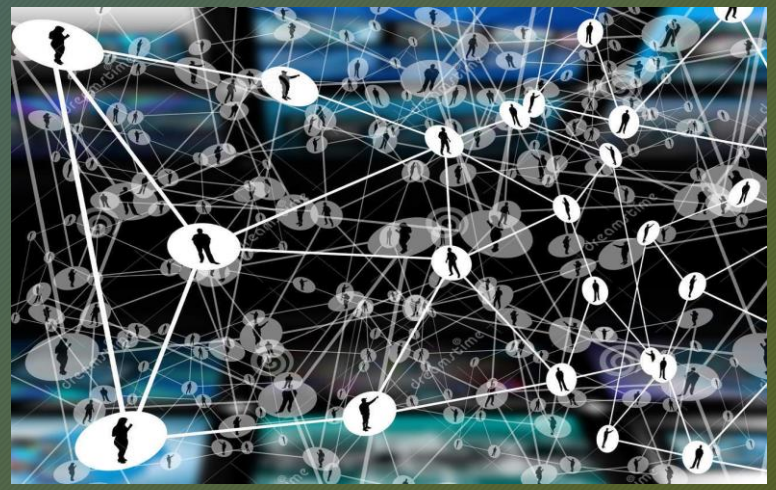
Internet of People



Internet of Things

Layers of the IoT

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Application — Data presentation and customer interaction

Smart home

IoV

Transportation

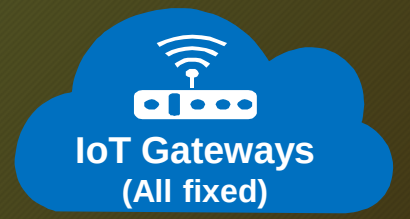
...

Petroleum and electricity

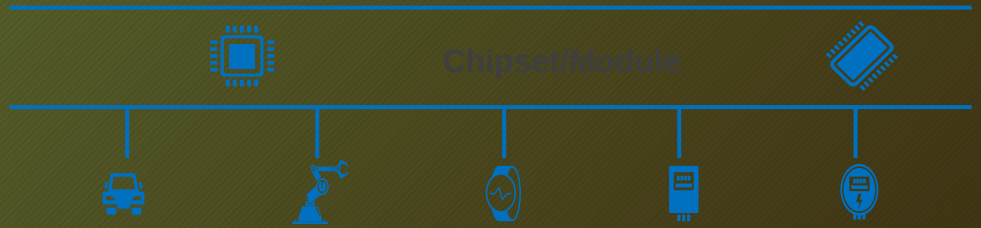
Platform — Storage, retrieval, use, service planning, security, maintenance, and expenses of data

- Cloud data center
- Device management
- Operations platform
- Security maintenance

Network — Access and transmission network

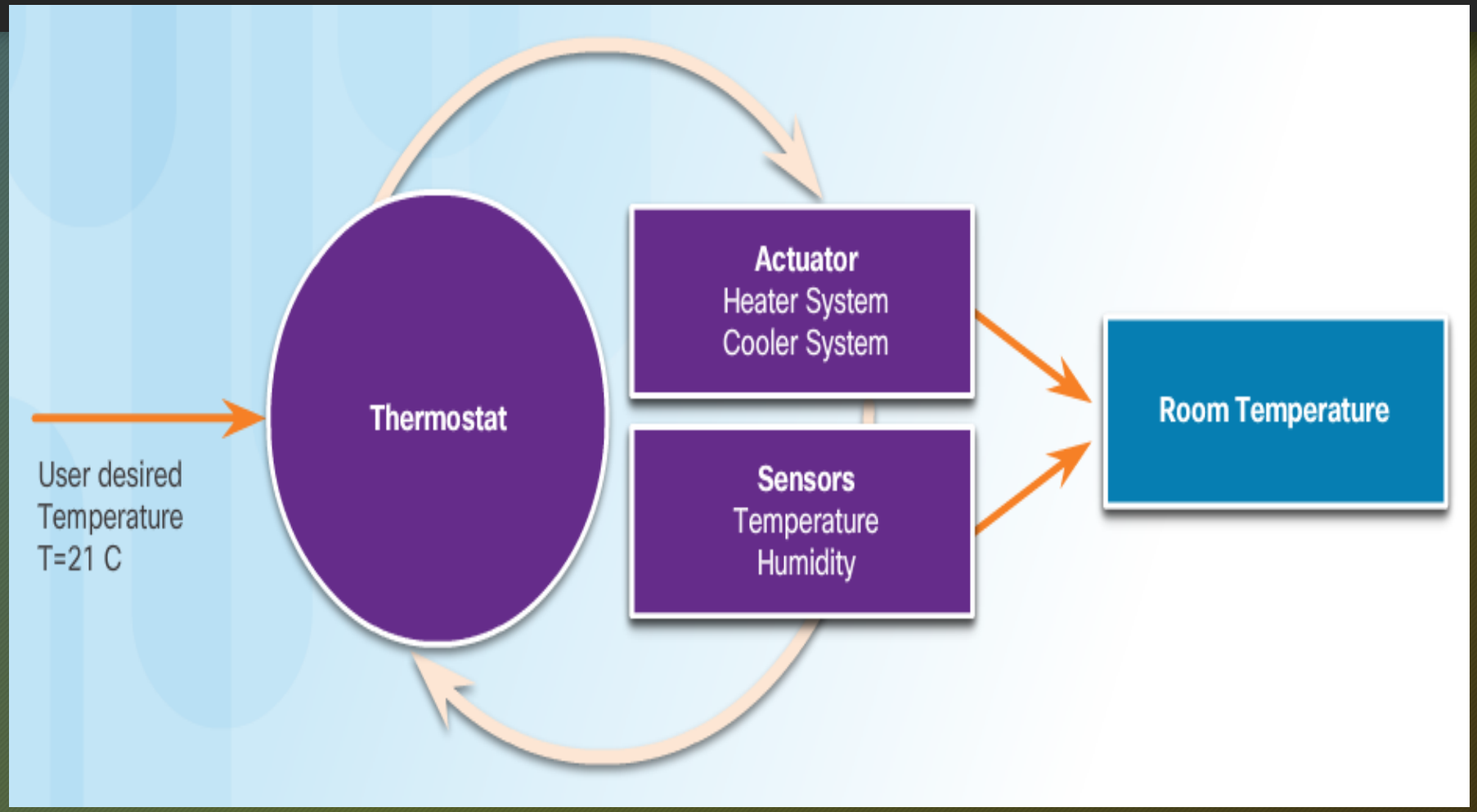


Sensing — Information collection and signal processing



What are Things?

Building Blocks (1)



Building Blocks (2)

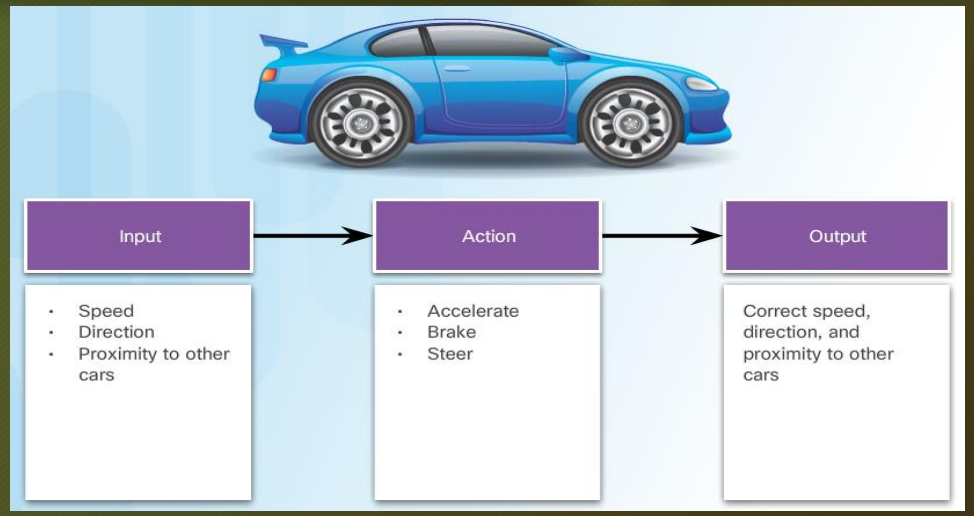
- Overview of a Controlled System
  - Feedback loops are used to provide real-time information to its controller based on current behavior.
  - In a closed loop, feedback is continuously being received by the controller from its sensors.
  - The controller continuously analyzes and processes information, and use actuators to modify conditions.
- Sensors
  - A sensor is a device that can be used to measure a physical property by detecting some type of information from the physical world.
  - A sensor may be connected to a controller either directly or remotely.

Building Blocks (3)

- Actuators
  - An actuator is a basic motor that can be used to control a system.
  - Can be hydraulic, electric or pneumatic.
  - can be responsible for transforming an electrical signal into physical output.
- Controllers
  - Responsible for collecting data from sensors and providing network connectivity.
  - Controllers may have the ability to make immediate decisions.
  - May also send data to remote and more powerful computer for analysis.
- IoT Process Flow
  - A simple IoT system include sensors connecting, through a wireless or wired connection, to actuators or controllers.
  - Some devices can have more than one function.

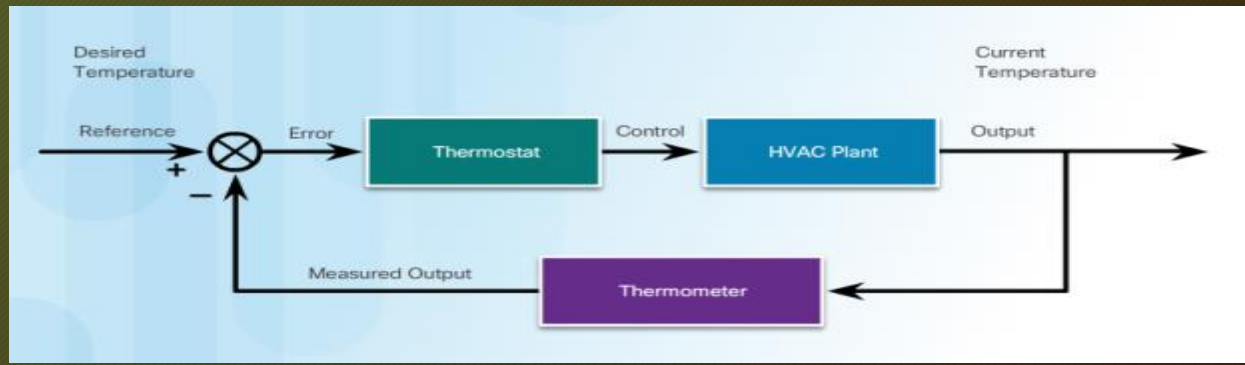
Processes in Controlled Systems (1)

- Processes
  - A process is a series of steps or actions taken to achieve a desired result by the consumer of the process.
- Feedback
  - Feedback is when the output of a process affects the input.
  - Feedback is often referred to as a feedback loop.
  - Feedback loops can be positive or negative.
- Control Systems
  - Includes a controller that uses inputs and outputs to manage and regulate the behavior of the system in an attempt to achieve a desired state.
  - The controlled portion of the system is often called the plant.
  - Choosing the adjustments to apply to a plant to achieve a desired output is called control theory.
  - Control theory is applied to many systems, including driving a car.



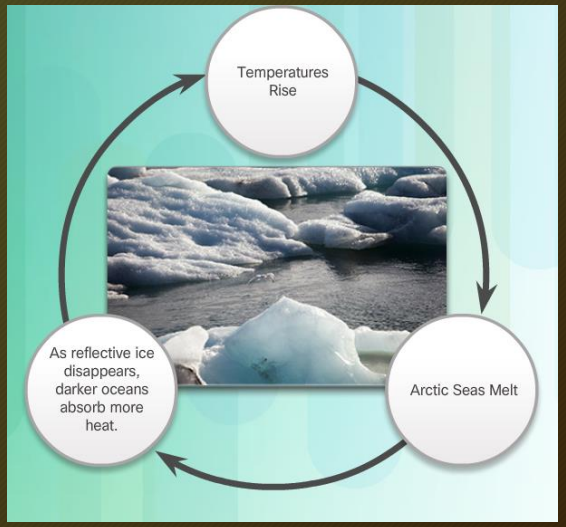
Processes in Controlled Systems (2)

- Open-Loop Control Systems
  - Open-loop control systems do not use feedback.
  - The plant performs a predetermined action without any verification of the desired results.
  - Open-loop control systems are often used for simple processes.
- Closed-Loop Control Systems
  - A closed-loop control system uses feedback to determine whether the collected output is the desired output.
  - The result is then fed back into a controller to adjust the plant for the next iteration of output, and the process repeats.



Processes in Controlled Systems (3)

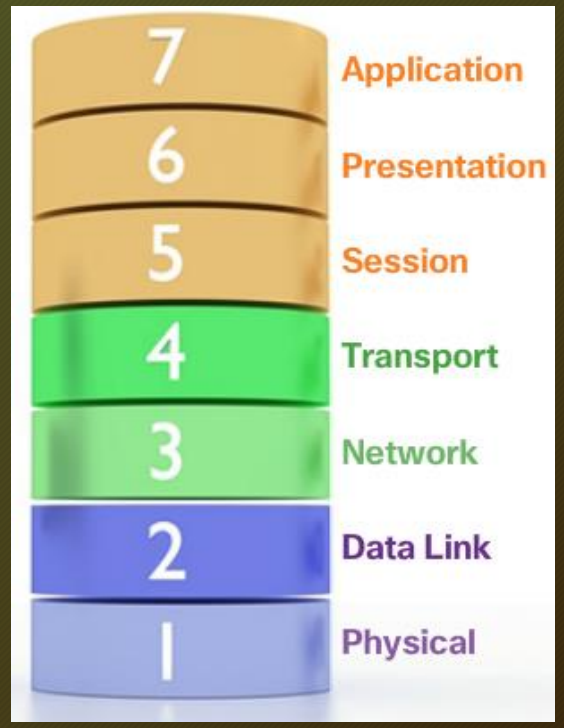
- Closed-Loop Controllers
  - There are many types of closed-loop controllers:
    - Proportional controllers (P): based on the difference between the measured output and the desired output.
    - Integral controllers (PI): use historical data to measure how long the system has deviated from the desired output.
    - Proportional, Integral and Derivative controllers (PID): include data about how quickly the system is approaching the desired output.
    - PID controller is an efficient way to implement feedback control.
    - The Arduino and Raspberry Pi devices can be used to implement PID controllers.
- Interdependent Systems
  - Most systems have many interdependent pieces contributing to and affecting the output.



What are Connections?

Models of Communication

- Layered networking models are used to illustrate how a network operates. Benefits include:
  - Assists in protocol design.
  - Fosters competition.
  - Promotes technology or capability independence.
  - Provides a common language to describe networking functions and capabilities.

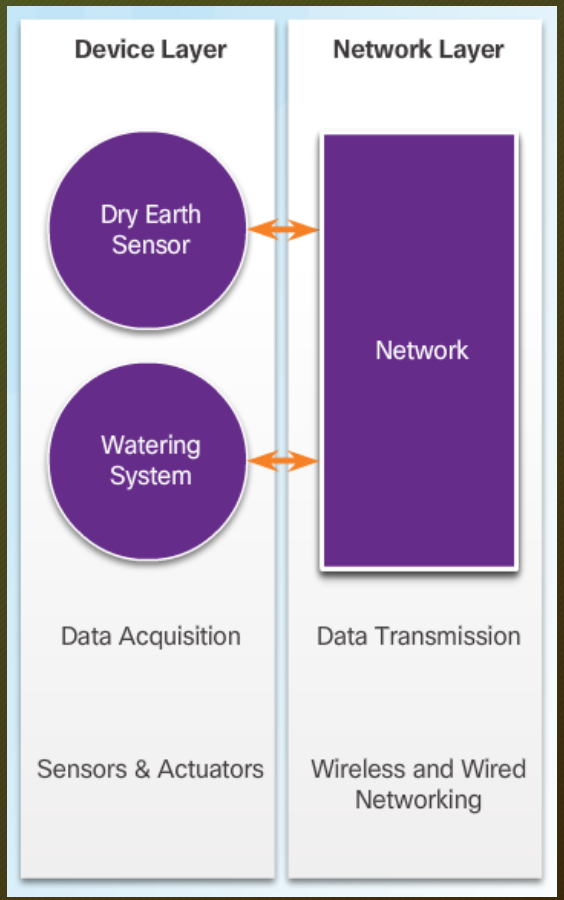


Standardization

- TCP and OSI Models
  - Both OSI and TCP/IP models are used to describe network connections and often used interchangeably.
  - The TCP/IP model is commonly referred to as the Internet model.
  - The OSI model provides an extensive list of functions and services that can occur at each layer.
- IoT World Forum Reference Model
  - Developed as a common framework to guide and to help accelerate IoT deployments.
  - It’s intent is to provide common terminology and help clarify how information flows and is processed for a unified IoT industry.

Simplified IoT Architecture

- Several architectures exist to help facilitate the design and creation of IoT systems.
- The OSI model, TCP/IP model, and the IoT World Forum Reference model have been presented as examples.
- A simpler approach is based on connection levels. The levels are:
  - Device-to-Device
  - Device-to-Cloud
  - Device-to-Gateway-to-Cloud
  - Device-to-Gateway-to-Cloud-to-Application



Layers of Connections (1)

- Connections Within Networks
  - Connections can have different contexts.
  - Power connections, circuit connections or network connections.
- Physical Connections
  - Relate to the media and cable type.
  - Common media types include copper, fiber optics and wireless.

Layers of Connections (2)

- Data Link and Network Connections
  - Network communication requires protocols to establish the rules of communications. Data Link protocols:
    - Allow the upper layers to access the media
    - Prepare network data for the physical network
    - Control how data is placed and received on the media
    - Exchange frames between nodes over a physical network media, such as copper or fiber-optic
    - Receive and directing packets to an upper layer protocol
    - Perform error detection
  - The most popular data link layer connection used in wired networks is Ethernet.
  - Other data link protocols include wireless standards such as IEEE 802.11 (Wi-Fi), IEEE 802.15 (Bluetooth), and cellular 3G or 4G networks.
  - LoRaWAN and NB-IoT are examples of emerging IoT supporting technologies.

Application Connections

- Application Connections
  - The IoT supports many types of connections.
  - Devices must use the same application layer protocols to connect.
  - The application will vary depending on the devices and type of connection involved.
  - MQTT and REST are newer application protocols, created to support IoT devices that connect in the myriad of different types of remote configurations.
  - MQTT is a lightweight messaging protocol with minimal overhead that provides high data integrity and security for remote environments.
  - REST or RESTful web services is a type of API designed to make it easier for programs to interact over the Internet.

Quiz

1. (T or F) IoT is an Internet where all things are interconnected. This sentence has three meanings.
2. (Multiple-choice) Which of the following belong to the hierarchical architecture of IoT?
   A. Sensing Layer
   B. Network Layer
   C. Platform Layer
   D. Application Layer

Reference

- Introduction to IoT (netacad.com)
- HCIA-IoT V2.5 Training Material (e.huawei.com)

Thank You