

# 1. Introduction to IoT

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# Chapter 1 - Sections & Objectives

- 1.1 Digital Transformation
  - Explain how digital transformation affects business, industry, and our daily lives.
    - Explain how digital transformation enables innovation.
    - Explain how networks provide the platform for Digital Business and society.
- 1.2 Devices that Connect to the IoT
  - Configure an IoT device to connect to the network.
    - Describe the exponential growth of connected IoT devices
    - Configure devices to communicate in the IoT.

# 1.1 Digital Transformation

# The Evolution of Digital Transformation

- 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.



# Digitization Transforms Business

## Lab - 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.

- 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						
15						

# Lab - Determine Your Digital Generation

A baby with blue eyes is pointing its right index finger at a digital interface. The interface has a dark background with four red square icons in a row: a hand with a finger pointing, a smartphone, a computer mouse, and an open book. The baby's finger is touching the book icon, which is highlighted with a blue circular ripple effect. Above the icons, the text "What Digital Generation Are You?" is written in a white, serif font. Below the icons, the text "Find out with our Digital Generation Tool" is written, with "Digital Generation Tool" in a red, bold, italicized font. Further down, a paragraph of text asks the user to compare their digital behavior with typical people. At the bottom left, there is a red button with the text "start tool >". At the bottom right, the logos for "pwc" and "strategy&" are displayed.

**What Digital Generation Are You?**

Find out with our  
***Digital Generation Tool***

Compare your digital behavior with that of typical people. Do you behave like a member of "Generation Connected" even though you're 85 years old? Or are you 25 but have fewer Facebook friends than your grandmother?

**start tool >**

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**pwc** **strategy&**

# 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.





# Globally Connected Through Networks

## 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.





# Globally Connected Through Networks

## Network Types



- **Personal Area Network (PAN)** - Connecting your smartphone to your car using Bluetooth is an example of a PAN.

- **Local Area Network (LAN)** - Networks in a small geographic area, such as a home or small business.
- **Wide Area Networks (WANs)** - A collection of LANs that provides inter-LAN and Internet connectivity.
- **Internet** - A multi-layer global network system that connects hundreds of millions of computers.
- **Wireless Networks** - Use electromagnetic waves to carry signals over the network.
- **The Cloud** - Data centers or groups of connected servers used to store and analyze data, provide access to on-line applications, and provide backup services.
- **The Edge** - The physical “edge” of a corporate network.
- **Fog Computing** - The data from IoT devices can be pre-processed for immediate use in the fog located at the edge of the network.

# Globally Connected Through Networks

## Network Terms

Use the arrow keys at the bottom of the screen or click the next slide circle to move to the next question.

What type of computing allows local data to be pre-processed at the edge of the network?

☐ fog

☐ cloud

☐ sensor

☐ wireless

☒ Check



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# 1.2 Devices that Connect to the IoT

# The Growth of IoT Devices

## What is the IoT?



- The Internet of Things (IoT) is the **connection of millions of smart devices and sensors** connected to the Internet.
- The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with **unique identifiers** and the **ability to transfer data over a network** without requiring human intervention.
- The Internet of things (IoT) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these things to **connect, collect and exchange data**.

# The Growth of IoT Devices

## What is the IoT?



- **IoT is** creating opportunities for more direct integration of the physical world into computer-based systems, resulting in **efficiency improvements, economic benefits, and reduced human exertions.**
- It is a global infrastructure for the information society, enabling **advanced services** by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies

# The Growth of IoT Devices

## What is the IoT?



- 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.



# What are the Benefits of Connecting these IoT Devices?



Many different organizations are benefitting from the data collected, saved, and analyzed from sensors



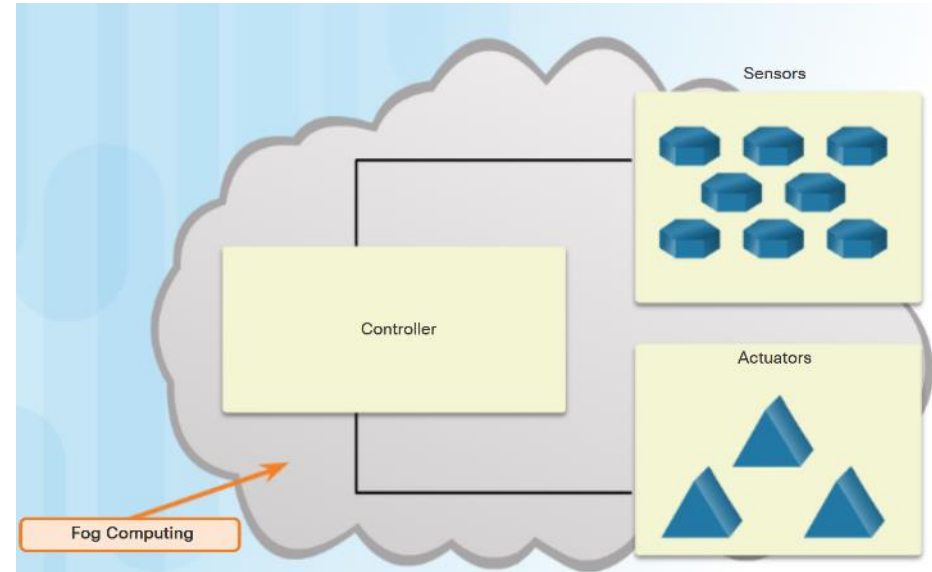


# What are the Benefits of Connecting these IoT Devices?

- **IoT is** creating opportunities for more direct integration of the physical world into computer-based systems, resulting in **efficiency improvements**, **economic benefits**, and **reduced human exertions**.
- It is a global infrastructure for the information society, enabling **advanced services** by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies

# 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.



# What Trends Are Driving IoT?

- **Ubiquitous connectivity**
  - Low cost, high-speed, pervasive network connectivity, especially through licensed and unlicensed wireless services and technology, makes almost anything connectable.
- **Wide spread adoption of IP-based networking**
  - IP has become the dominant global standard for networking, providing a well-defined and widely implemented platform of software and tools that can be incorporated into a broad range of devices easily and inexpensively.

# What Trends Are Driving IoT?

- **Computing economics**

- Driven by industry investment in research, development, and manufacturing, Moore's law continues to deliver greater computing power at lower price points and lower power consumption.

- **Miniaturization**

- Manufacturing advances allow cutting-edge computing and communications technology to be incorporated into very small objects. Coupled with greater computing economics, this has fueled the advancement of small and inexpensive sensor devices, which drive many IoT applications.

# What Trends Are Driving IoT?

- **Advances in data analytics**

- New algorithms and rapid increases in computing power, data storage, and cloud services enable the aggregation, correlation, and analysis of vast quantities of data; these large and dynamic datasets provide new opportunities for extracting information and knowledge.

- **Rise of cloud computing**

- Cloud computing, which leverages remote, networked computing resources to process, manage, and store data, allows small and distributed devices to interact with powerful back-end analytic and control capabilities.

## Connecting IoT Devices to the Network

# The Future of Networks

- **Artificial Intelligence (AI)** – Devices have the ability to “think” on their own.
- **Intent-Based Networking (IBN)** – Providing software with rules, guidelines, or intent so that data could modify the network, infrastructure features, or security features within a network.
- **Example** - A business defines that a contract employee is given access to only a specific set of data and applications. This is the intent. In an IBN system all the network devices will be automatically configured to fulfil this requirement across the network, no matter where the employee is connected.



# 1.3 Chapter Summary



## Chapter Summary

- As **digital networks** continue to grow around the world, we are seeing a Digital Transformation - the *application of digital technology to provide the stage for business and industry to innovate*.
- **Sensors** are now everywhere in the home, on traffic lights, in farm fields, and on our bodies. The analyzed data from sensors is used by governments, cities, businesses, and individuals to effect changes.
- **Networks** form the foundation of the digitized world. Types of Networks:
  - PAN: Bluetooth
  - LAN
  - WAN: Internet, the cloud, fog computing
  - Wireless: WiFi, Cellular
- The **Internet of Things** is the connection of millions of smart devices and sensors connected to the Internet.
- A **sensor** typically connects to a controller using a wireless connection. Controllers collect data from sensors and send the data for storage or analysis. Controllers may work together with a device called an actuator. Actuators take electrical input and transform the input into physical action.
- The future of networking will revolve around **artificial intelligence (AI)** and **intent-based networking (IBN)**.

