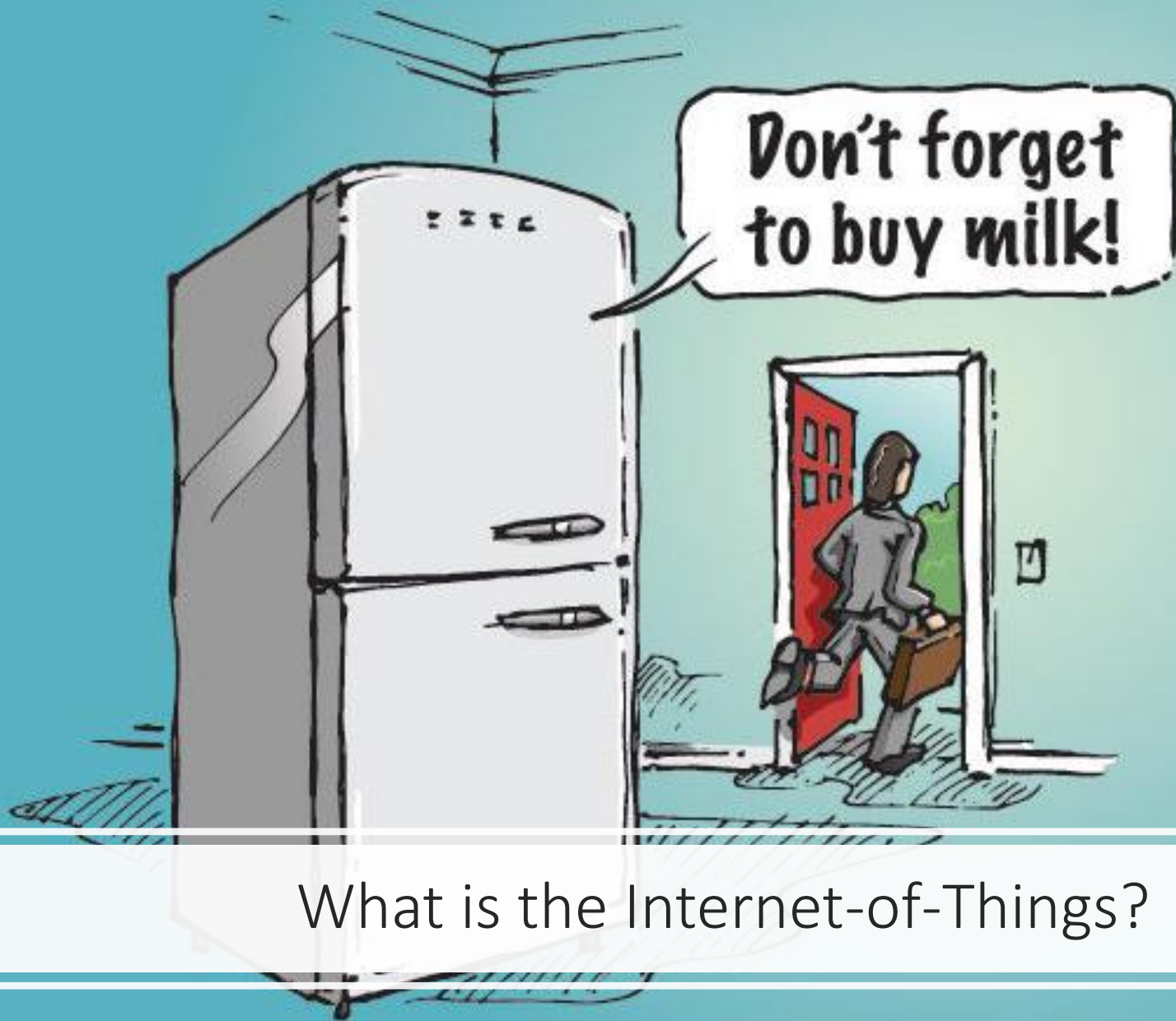


Internet-of-Things (IoT)

Introduction



What is the Internet-of-Things?

How Does My Fridge Do That?

- You are leaving the home (sense user)
- There's no milk in fridge (sense object)
- Use this information to make a decision (process)
- Inform user of decision (communicate)

You are leaving the home (sense user)

- What type of sensor?
- Distinguish between parent and child
- Identify reason for leaving home
- Identify other contexts (e.g., store hours)

There's no milk in fridge (sense object)

Use this information to make a decision (process)

Inform user of decision (notify)

How Does My Fridge Do That?

You are leaving the home (sense user)

There's no milk in fridge (sense object)

- What type of sensor?
- Is milk needed?
- No milk or "little" milk? (prediction)

Use this information to make a decision (process)

Inform user of decision (notify)

How Does My Fridge Do That?

You are leaving the home (sense user)

There's no milk in fridge (sense object)

Use this information to make a decision (process)

- Where is processor?
- What are the rules?
- Fixed rules versus dynamic rules (learning)

Inform user of decision (notify)

How Does My Fridge Do That?

You are leaving the home (sense user)

There's no milk in fridge (sense object)

Use this information to make a decision (process)

Inform user of decision (notify)

- How?
- When?
- Privacy?
- Subtleness?
- Information overflow?

How Does My Fridge Do That?

Internet-of-Things (IoT)

Physical object (“thing”)

+

Controller (“brain”)

+

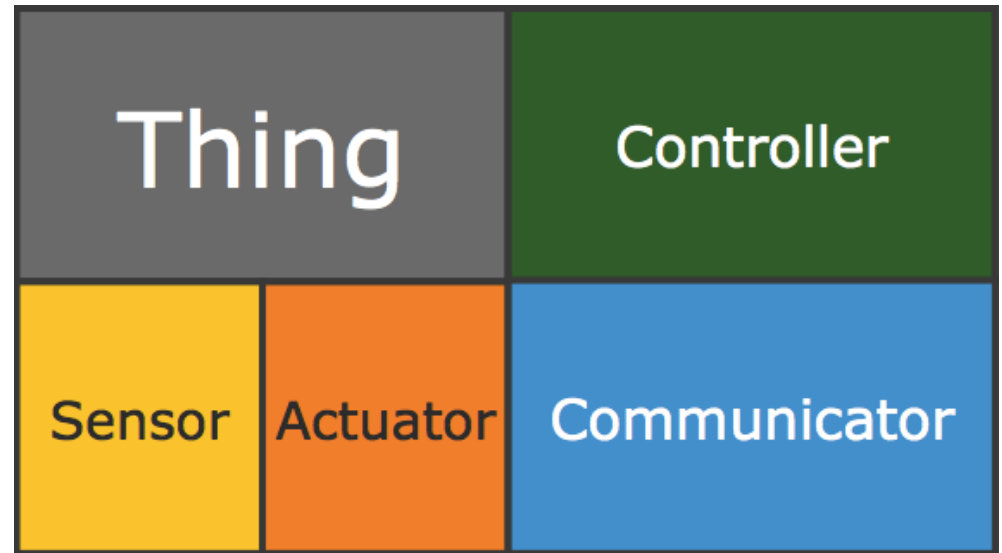
Sensors

+

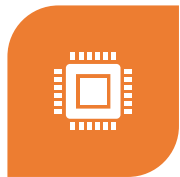
Actuators

+

Networks (Internet)



Related Areas/Terminology



EMBEDDED SYSTEMS:
NOT NECESSARILY
CONNECTED



SENSOR NETWORKS:
COLLECTION OF
SENSOR DEVICES
CONNECTED THROUGH
WIRELESS CHANNELS



**CYBER-PHYSICAL
SYSTEMS:** FOCUS ON
INTERACTION
BETWEEN PHYSICAL
AND CYBER SYSTEMS



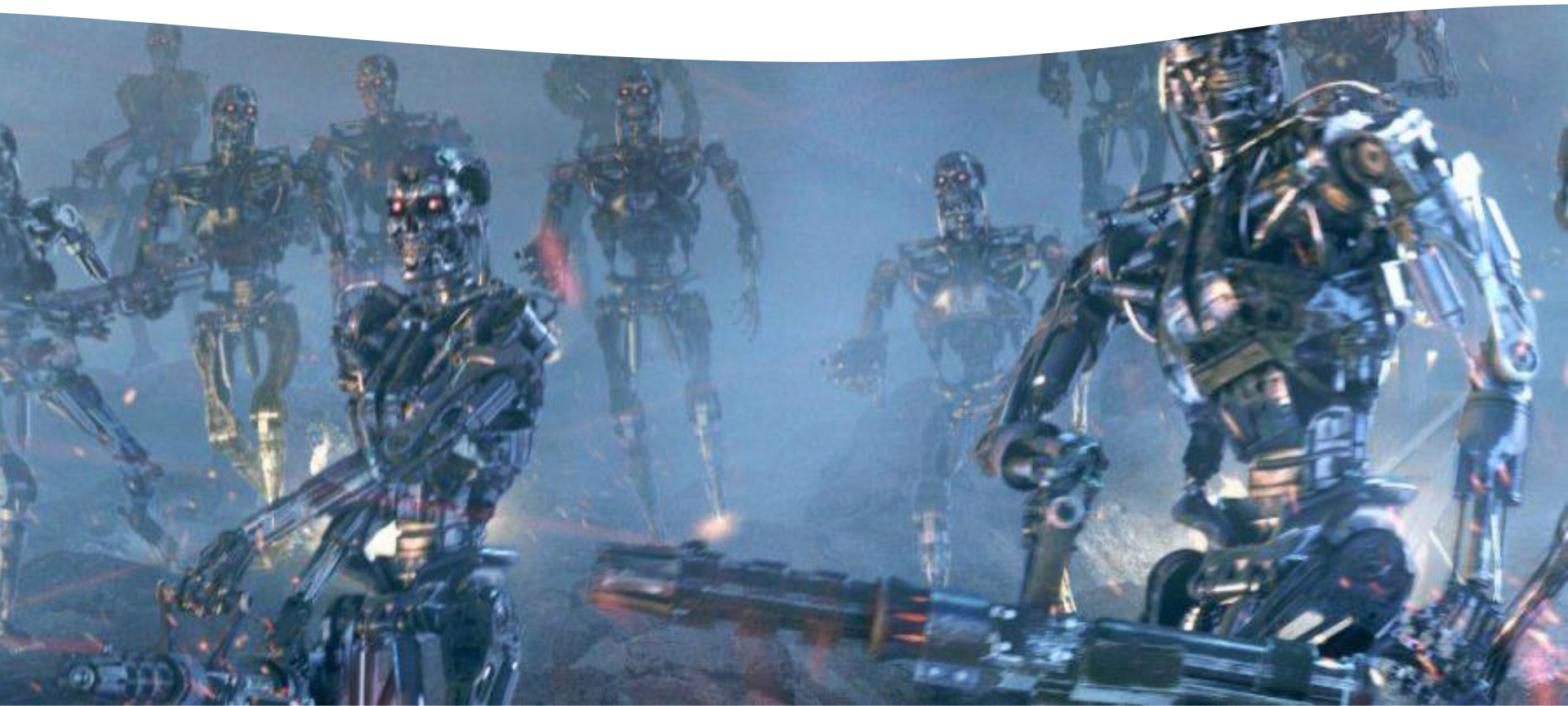
REAL-TIME SYSTEMS:
FOCUS ON TIME
CONSTRAINTS



**PERVASIVE/UBIQUITO
US COMPUTING:**
FOCUS ON
ANYTIME/ANYWHERE
COMPUTING

Related Areas

- Machine-to-machine (M2M) communications
- Internet of Everything (Cisco Systems)
- “Skynet” (Terminator movie)



“Internet-of-Things”

Term coined by British entrepreneur Kevin Ashton, while working at MIT Auto-ID Labs

Referred to (and envisioning) a future global network of objects connected specifically by RFID (radio-frequency identification)

Complete automation of data collection

First article about IoT in 2004 from MIT; called it ‘Internet 0’.

Internet-of-Things Vision & Growth

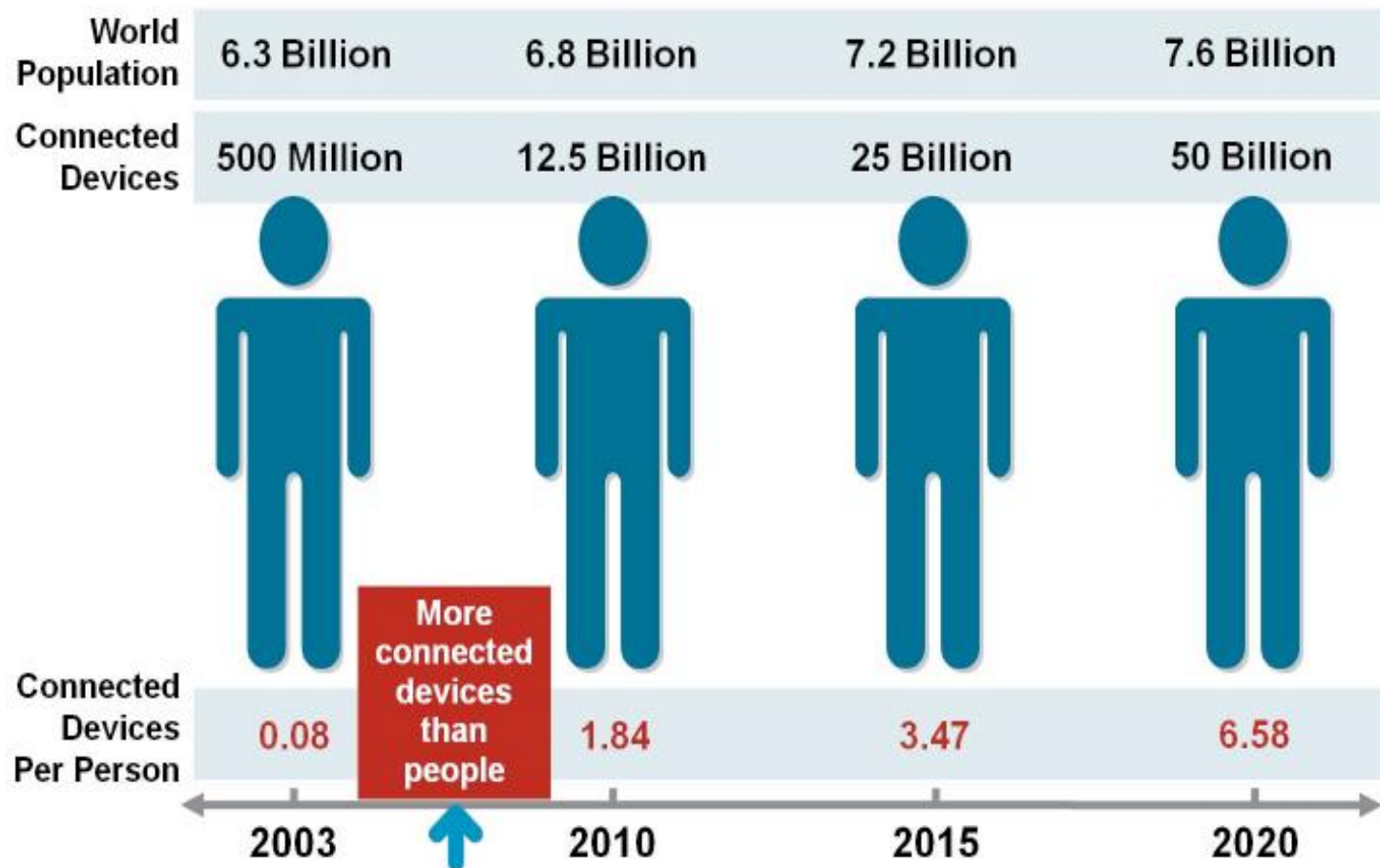
THE INTERNET OF THINGS

Connected devices (billions)



	15 billion	28 billion	CAGR 2015–2021
Cellular IoT	0.4	1.5	27%
Non-cellular IoT	4.2	14.2	22%
PC/laptop/tablet	1.7	1.8	1%
Mobile phones	7.1	8.6	3%
Fixed phones	1.3	1.4	0%

Internet-of-Things Vision & Growth



Source: Cisco IBSG, April 2011

What is IoT

- 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](#)¹.
- IoT refer to the connection of devices to the Internet.

¹https://en.wikipedia.org/wiki/Internet_of_things