INDUSTRIAL TRAINING
INTERNET OF THINGS
IOT

shreeji
CHARAN ELEETRONICS

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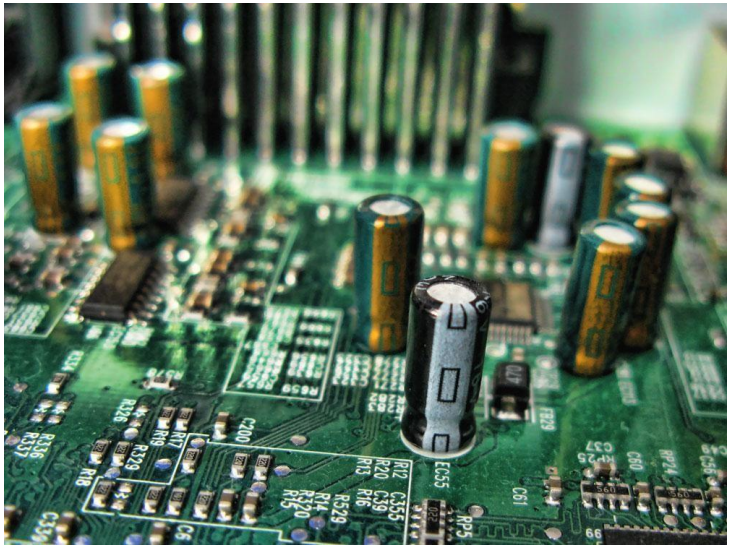
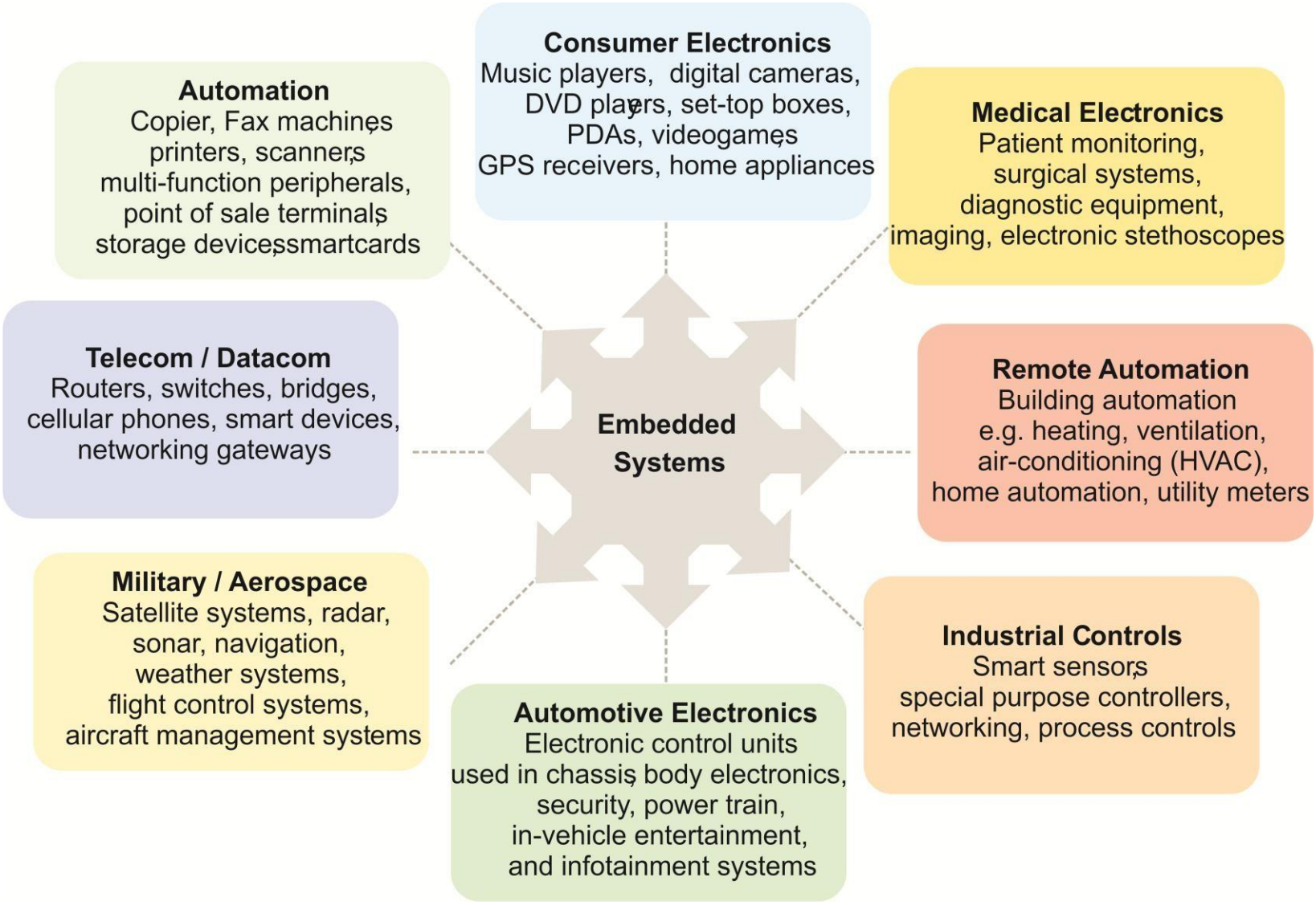
What is an Embedded System?

- An embedded is an electronic/electro mechanical system designed to perform a specific function and is a combination of hardware and software.



Applications of Embedded Systems



History of Embedded System

- In the earliest years of computers in the 1930-40s, computers were sometimes dedicated to a single task, but were far too large and expensive for most kinds of tasks performed by embedded computers of today.
- Over time however, the concept of programmable controllers evolved from traditional electromechanical sequencers, via solid state devices, to the use of computer technology.
- One of the first recognizably modern embedded systems was the Apollo Guidance Computer, developed by Charles Stark Draper at the MIT Instrumentation Laboratory.

History of Embedded System

-Continued

- At the project's inception, the Apollo guidance computer was considered the riskiest item in the Apollo project as it employed the then newly developed monolithic integrated circuits to reduce the size and weight.
- An early mass-produced embedded system was the Autonetics D- 17 guidance computer for the Minuteman missile, released in 1961. It was built from transistor logic and had a hard disk for main memory.
- When the Minuteman II went into production in 1966, the D-17 was replaced with a new computer that was the first high-volume use of integrated circuits.

History of Embedded System

-Continued

- This program alone reduced prices on quad nand gate ICs from $1000/each to $3/each, permitting their use in commercial products.
- Since these early applications in the 1970s, embedded systems have come down in price and there has been a dramatic rise in processing power and functionality.
- The first microprocessor for example, the Intel 4004 was designed for calculators and other small systems but still required many external memory and support chips.
- In 1978 National Engineering Manufacturers Association released a "standard" for programmable microcontrollers, including almost any computer-based controllers, such as single board computers, numerical, and event-based controllers.

History of Embedded System

-Continued

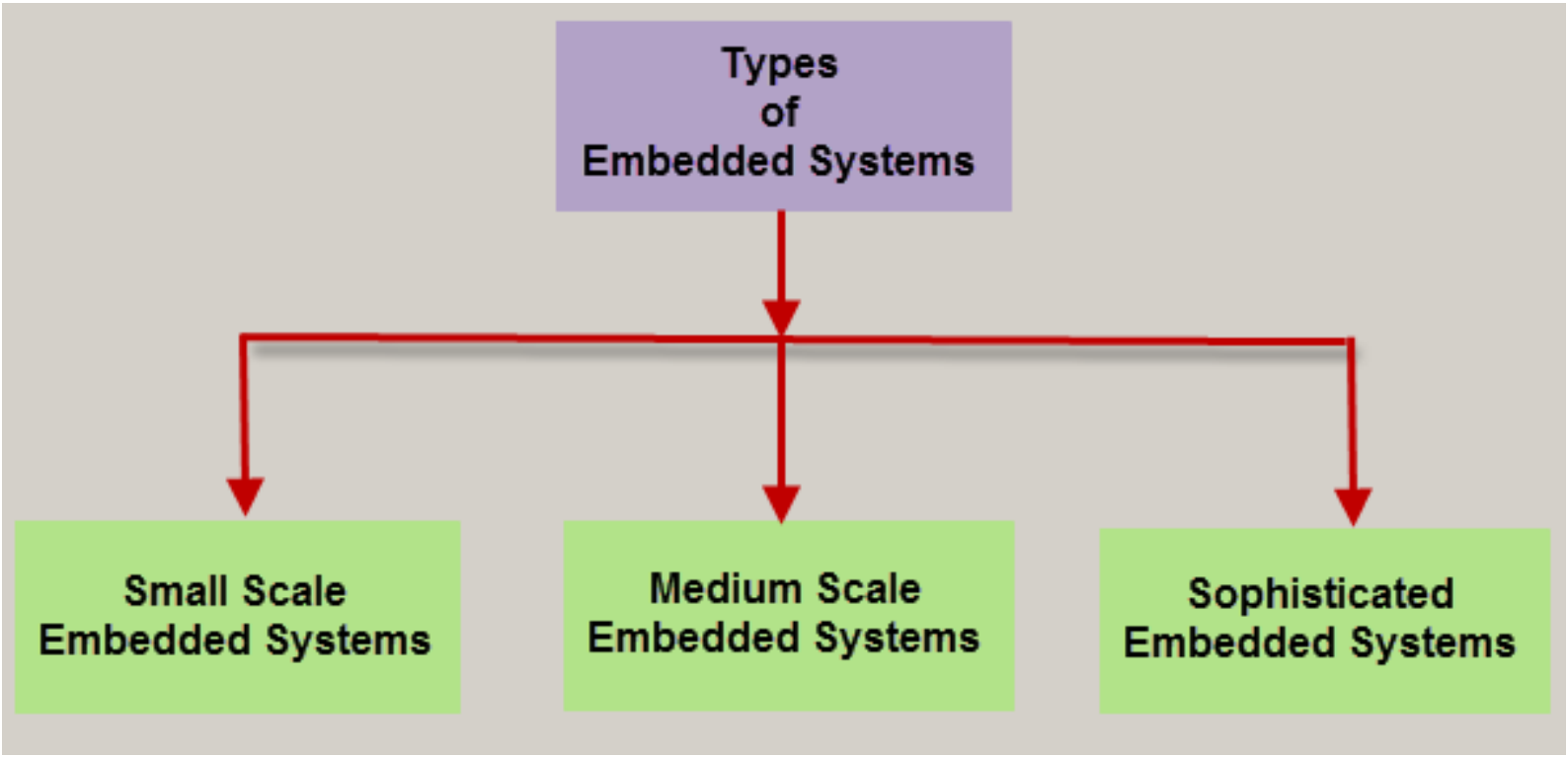
- As the cost of microprocessors and microcontrollers fell it became feasible to replace expensive knob-based analog components such as potentiometers and variable capacitors with up/down buttons or knobs read out by a microprocessor even in some consumer products.
- By the mid-1980s, most of the common previously external system components had been integrated into the same chip as the processor and this modern form of the microcontroller allowed an even more widespread use, which by the end of the decade were the norm rather than the exception for almost all electronics devices.

History (Summarized)

-Continued

- The first mass-produced embedded system was the guidance computer for the Minuteman missile in 1961. It was the Autonetics D-17 guidance computer.
- In 1970's the first consumer-oriented microprocessor was Intel 4004. (Which was used in calculators and small systems.)
- In 1972's 8 bit microprocessor was norm. but in general still required external memory chips, and decoding logic, as well as any interfaces to the external world.
- In mid 1980's higher level of integration meant that most of the previously external systems components moved onto the same chip as the processor. Such integrated systems were called microcontrollers.
- By the end of 1980's embedded system were the norm rather then the exception for almost all electronic devices this trend has continued since.

Classification of Embedded System



Small Scale Embedded System

- Small scale embedded systems are designed with a single 8 or 16 - bit microcontroller which may even be operated with a battery.
- They have little Hardware and Software Complexity
- They need to limit power dissipation when system is running continuously.
- For developing embedded software for these types of systems, an editor, assembler, (IDE) integrated development environment, and cross assembler are the main programming tools.

Medium Scale Embedded System

- Medium scale embedded systems are designed with a single or few
  16 or 32 bit microcontrollers, DSPs or RISCs.
- These systems have both hardware and software complexities.
- When developing embedded software for these types of systems, the following programming tools are available.

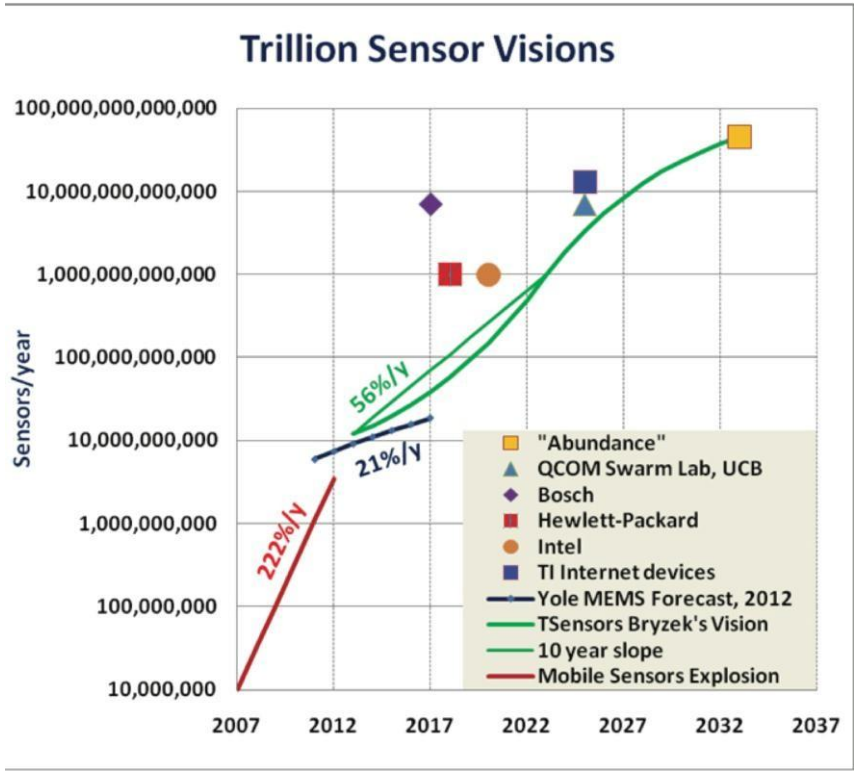
  They are
  - C, C++, Visual C++
  - Java
  - RTOS
  - Source-Code Engineering Tool, Debugger, Simulator and Integrated Development Environment.

Sophisticated Embedded System

- Sophisticated embedded systems have huge hardware and software complexities
- They need PLAs, IPs, ASIPs, scalable processors or configurable processors.
- They are used for cutting-edge applications that need hardware and software co-design & components which have to combine in the final system.
- They are usually constrained by the processing speed available in their hardware units.
- Programming tools for these devices may not be readily available. A compiler or re-targetable compile requires to be developed for such systems.

Internet of Things

Internet of Things Wave



Internet of Things Definition:

- IoT is simply the network of interconnected things/devices which are embedded with sensors, software, network connectivity and necessary electronics that enables data collection and exchange making responsive.

- More than a concept Internet of Things is essentially an architectural framework which allows integration and data exchange between the physical world and computer systems over existing network infrastructure.

History of Internet of Things

1800s

The first electronic communication devices are created, including the telegraph, fax machine, and radio

1926

Nikola Tesla envisions a wirelessly interconnected world

"When wireless is perfectly applied the whole earth will be converted into a huge brain."

1989

Tim Berners-Lee proposed the **World Wide Web**

1990

The first connected devices are created – a toaster and drink machine

MID 1990s

The **rise of the Internet** and more experimental devices

1993 *Trojan Room Coffee Pot*

1998 *InTouch Project*

1998 *Mark Weiser's Stock Market Water Fountain*

1999

Kevin Ashton coins **'Internet of Things'** and founds the **MIT Auto-ID Center**

2000

LG announces plans for the first Internet refrigerator

2002

Ambient Orb is released, which displays Dow Jones, personal finance, and weather information based on Internet data

2005

The United Nations first mentions IoT in a published **International Telecommunications Union** report

A new dimension has been added to the world of information and communication...from anytime, anyplace connectivity for anyone, we will now have connectivity for anything. Connections will multiply and create an entirely new dynamic network of networks – an Internet of Things.

2008

IPSO alliance launches to promote the use of Internet Protocol (IP) in connected devices

2011

IPV6

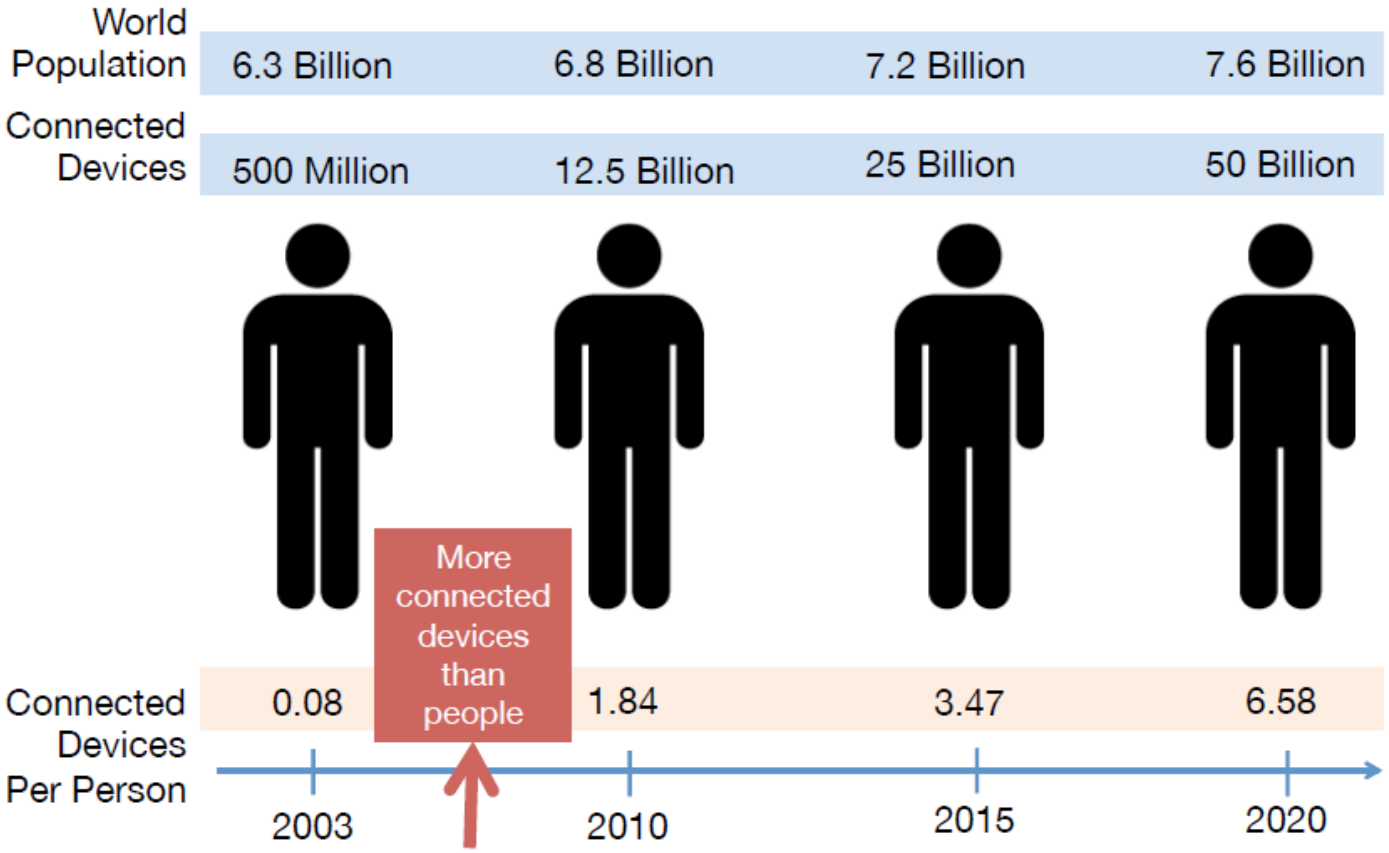
Internet Protocol version 6 (IPv6) launches, which allows around 340 undecillion IP addresses (340,282,366,920,938,463,463,374,607,431,768,211,456)

"We could assign an IPV6 address to every atom on the surface of the earth, and still have enough addresses left to do another 100+ earths."

2013

Intel launches 'Internet of Things Solutions Group'

More Connected Devices Than People



[Source: Cisco IBSG, April 2011]

Fundamental Components of IoT

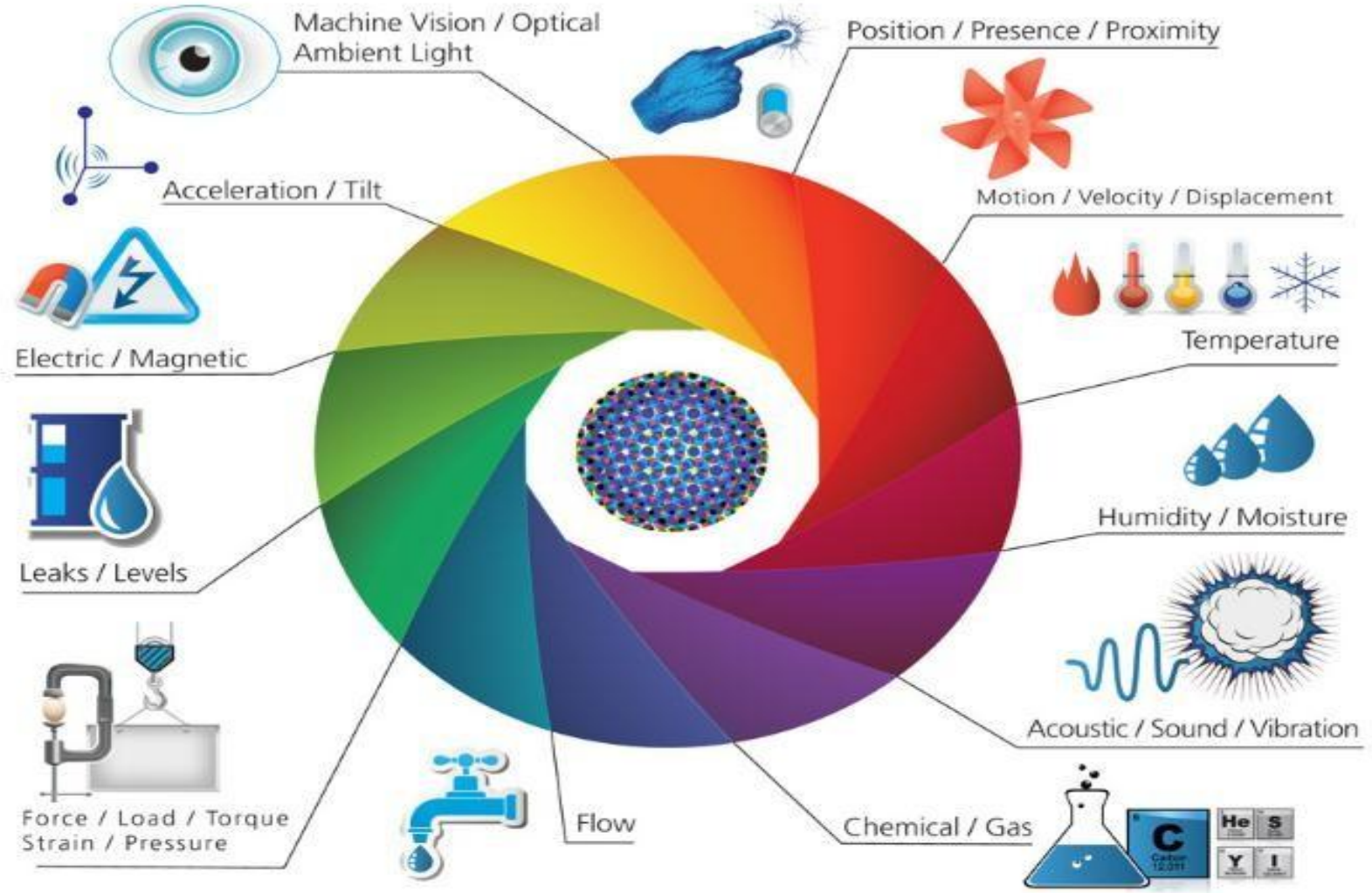
- Many people mistakenly think of IoT as an independent technology.
- Interestingly internet of things is being enabled by the presence of other independent technologies which make fundamental components of IoT.
- These components are:
  - Hardware : Making physical objects responsive and giving them capability to retrieve data and respond to instructions
  - Software : Enabling the data collection, storage, processing, manipulating and instructing
  - Communication Interface : Most important of all is the communication infrastructure which consists of protocols and technologies which enable two physical objects to exchange data

Smart Systems and the Internet of Things are driven by a combination of:

[Source: Postscape - http://postscapes.com/what-exactly-is-the-internet-of-things-infographic]

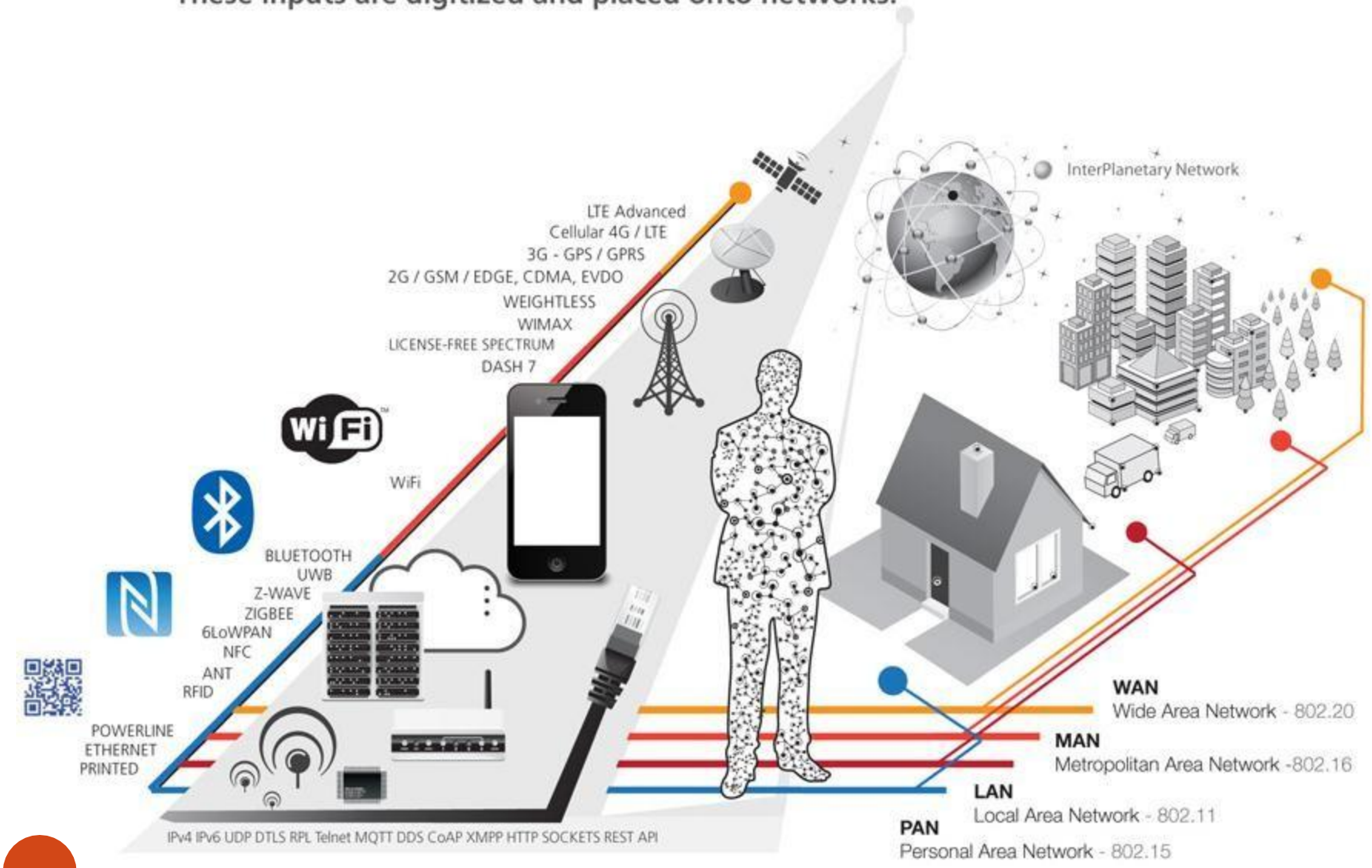
1 SENSORS & *ACTUATORS*

We are giving our world a digital nervous system. Location data using GPS sensors. Eyes and ears using cameras and microphones, along with sensory organs that can measure everything from temperature to pressure changes.



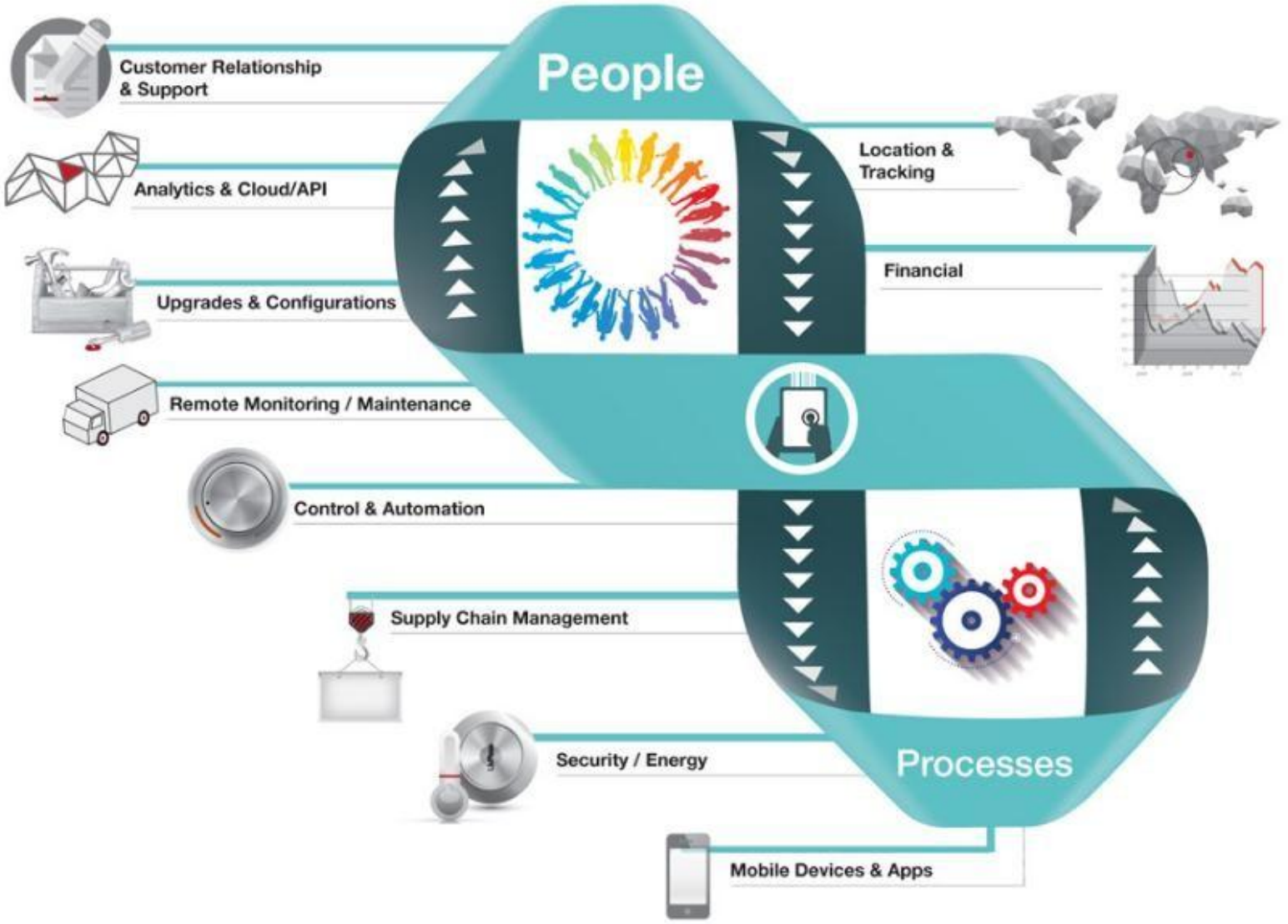
2 CONNECTIVITY

These inputs are digitized and placed onto networks.



3 PEOPLE & *PROCESSES*

These networked inputs can then be combined into bi-directional systems that integrate data, people, processes and systems for better decision making.



The interactions between these SENSORS + CONNECTIVITY + PEOPLE + PROCESSES entities are creating new types of smart applications and services.

Starting with popular connected devices already on the market

SMART THERMOSTATS

nest

Save resources and money on your heating bills by adapting to your usage patterns and turning the temperature down when you're away from home.

CONNECTED CARS

CAR 2GO

Tracked and rented using a smartphone. Car2Go also handles billing, parking and insurance automatically.

ACTIVITY TRACKERS

BASIS

Continuously capture heart rate patterns, activity levels, calorie expenditure and skin temperature on your wrist 24/7.

SMART OUTLETS

belkin

Remotely turn any device or appliance on or off. Track a device's energy usage and receive personalized notifications from your smartphone.

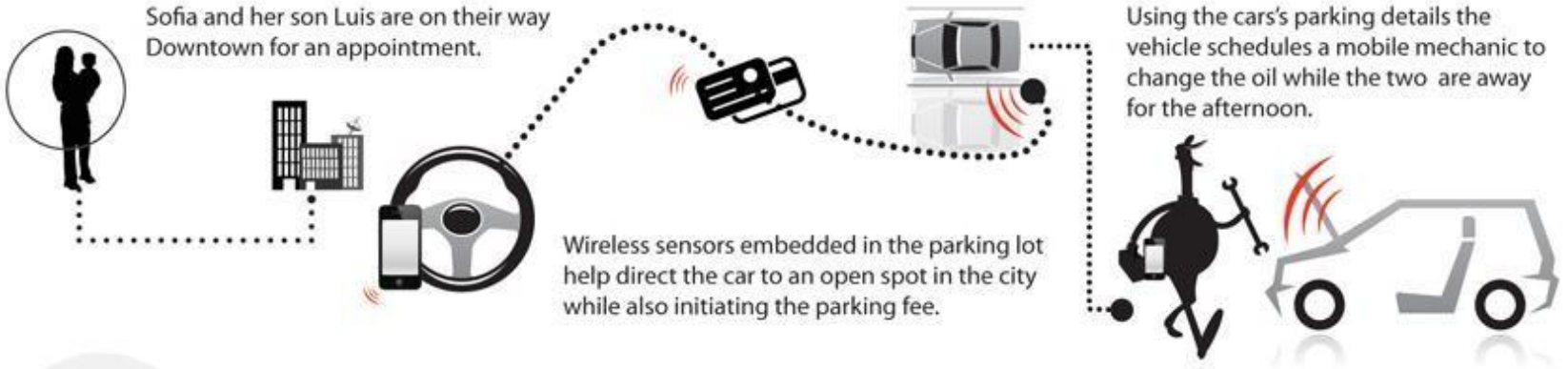
PARKING SENSORS

STREETLINE
CONNECTING THE REAL WORLD

Using embedded street sensors, users can identify real-time availability of parking spaces on their phone. City officials can manage and price their resources based on actual use.

Examples

TRANSPORTATION + SMART CITIES



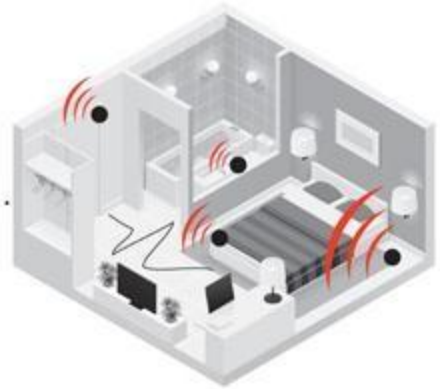
In Downtown San Francisco 20-30% of all traffic congestion is caused by people hunting for a parking spot.

- San Francisco Municipal Transportation Agency (SFMTA)

Examples

HEALTHCARE + SMART HOME

Aging uncle Earl is still living isolated at his home and you are concerned about his safety.



Wireless sensors throughout his house help measure healthy activity levels, sleeping patterns and medication schedules.

Alerts are automatically sent to health care services and authorized family members if any abnormal activity is detected.

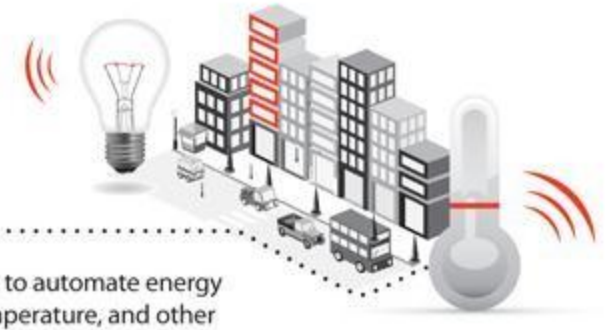
40 million adults age 65 and over will be living alone in the U.S, Canada and Europe.

- U.S. Department of Health and Human Services: Administration for Community Living (ACL)

Examples

SMART BUILDINGS + MOBILITY

Anna is being pressured to reduce her company's expenses for their new corporate office.

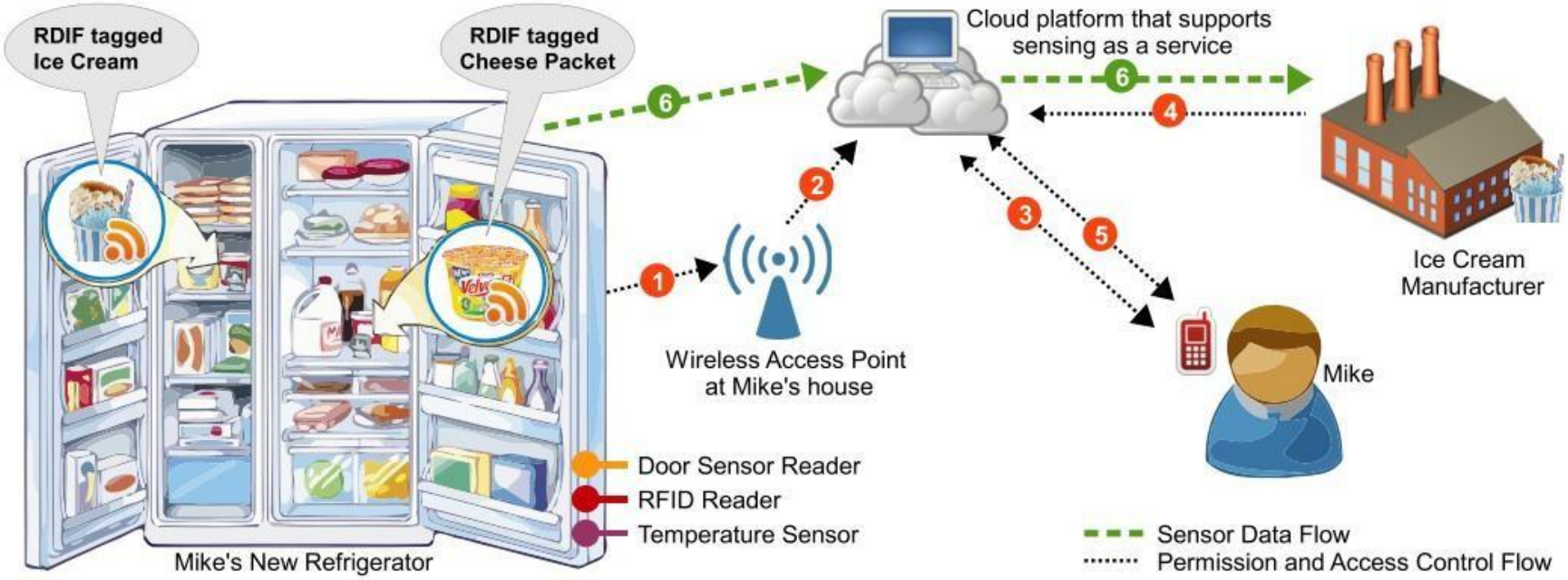


After speaking with experts she decides to install sensors to automate energy usage according to building occupancy, people flow, temperature, and other ambient conditions -- improving the building's overall efficiency.

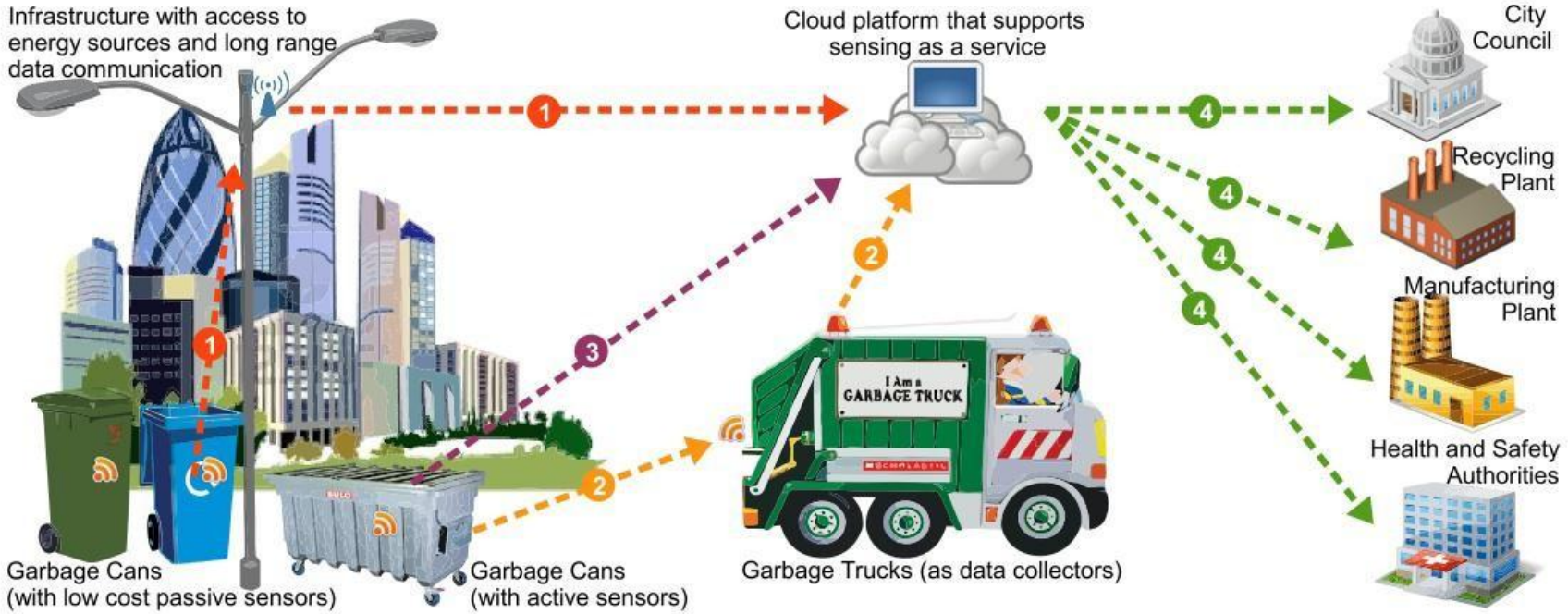
Energy used by commercial and industrial buildings in the US creates nearly 50% of our national emissions of greenhouse gases.

- United States Environmental Protection Agency

Example: A Smart Home Scenario



Example: Efficient Waste Management in Smart Cities



Example:

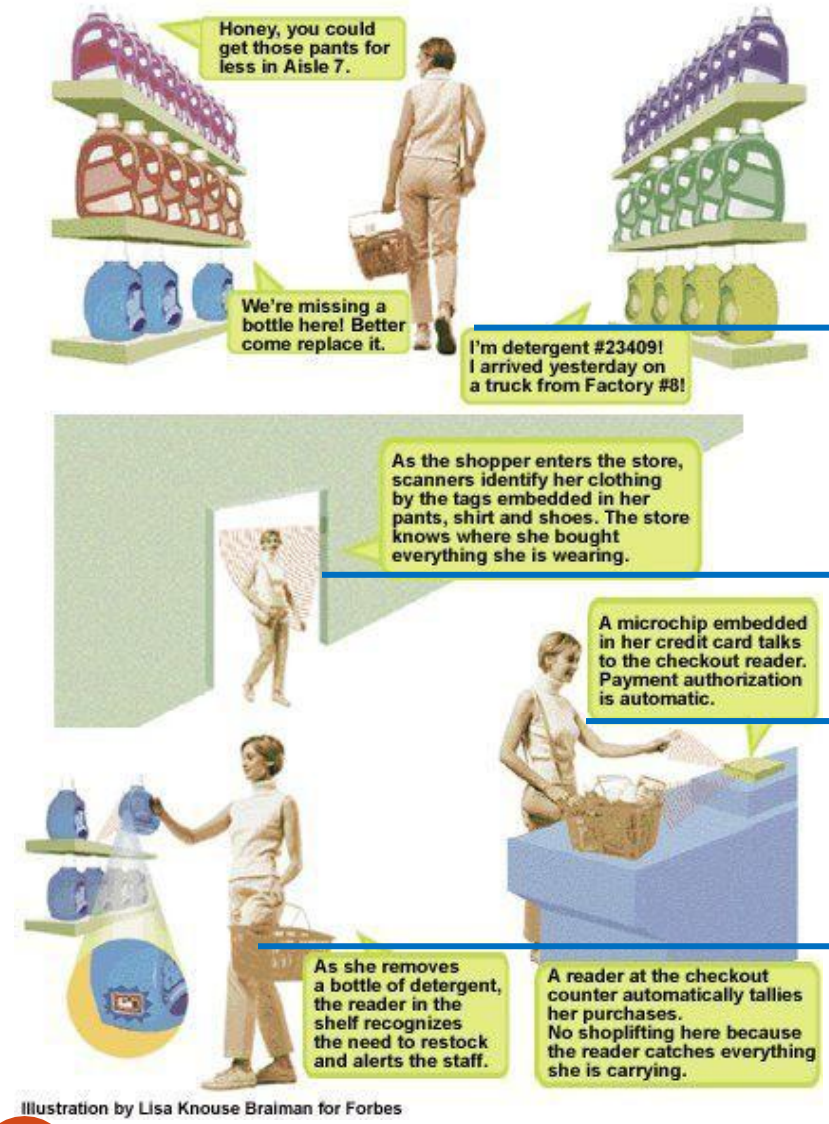


Illustration by Lisa Knouse Braiman for Forbes

2. When shopping in the market, the goods will introduce themselves.

1. When entering the doors, scanners will identify the tags on her clothing.

4. When paying for the goods, the microchip of the credit card will communicate with checkout reader.

3. When moving the goods, the reader will tell the staff to put a new one.

Questions?


Thank you!