Internet of things

Computer Literacy
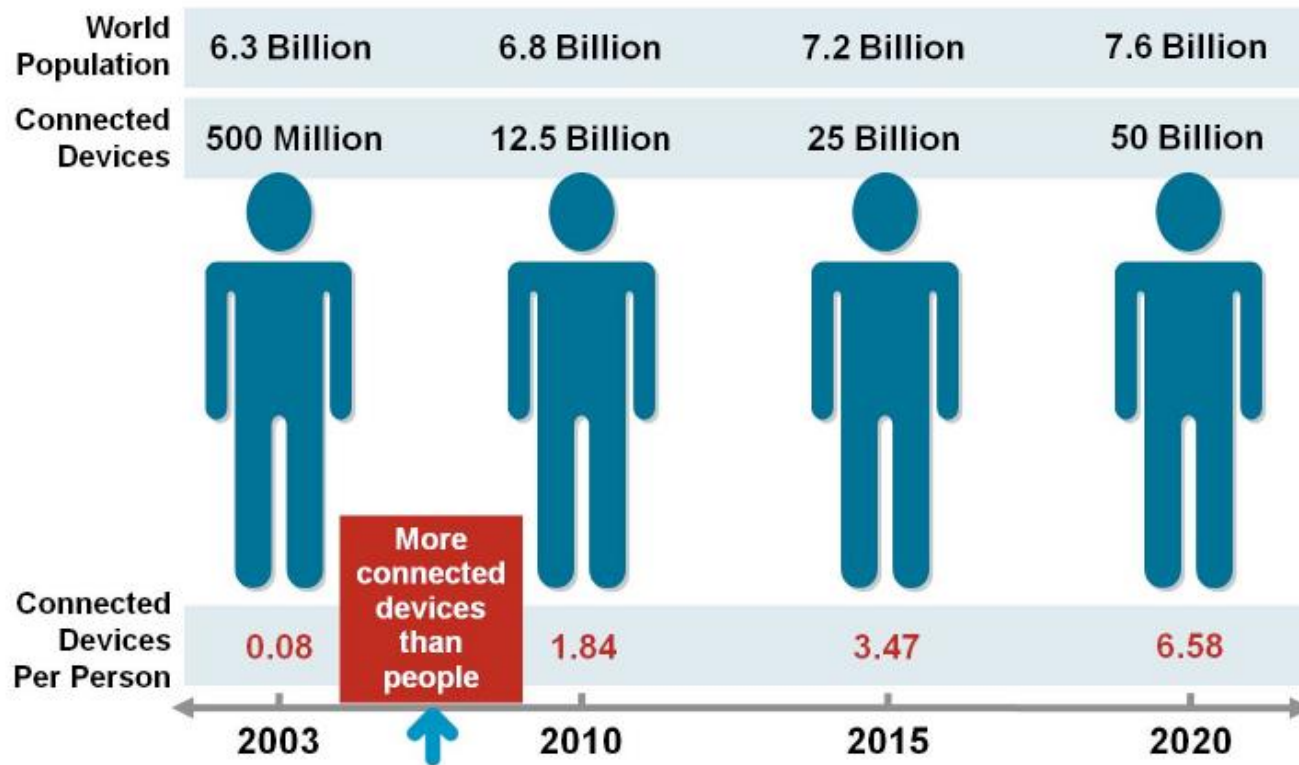
KENT STATE

Cisco Commercial

Birth of IOT

Figure 1. The Internet of Things Was "Born" Between 2008 and 2009

World Population	6.3 Billion	6.8 Billion	7.2 Billion	7.6 Billion
Connected Devices	500 Million	12.5 Billion	25 Billion	50 Billion

More connected devices than people

Connected Devices Per Person	0.08	1.84	3.47	6.58
	2003	2010	2015	2020

Source: Cisco IBSG, April 2011
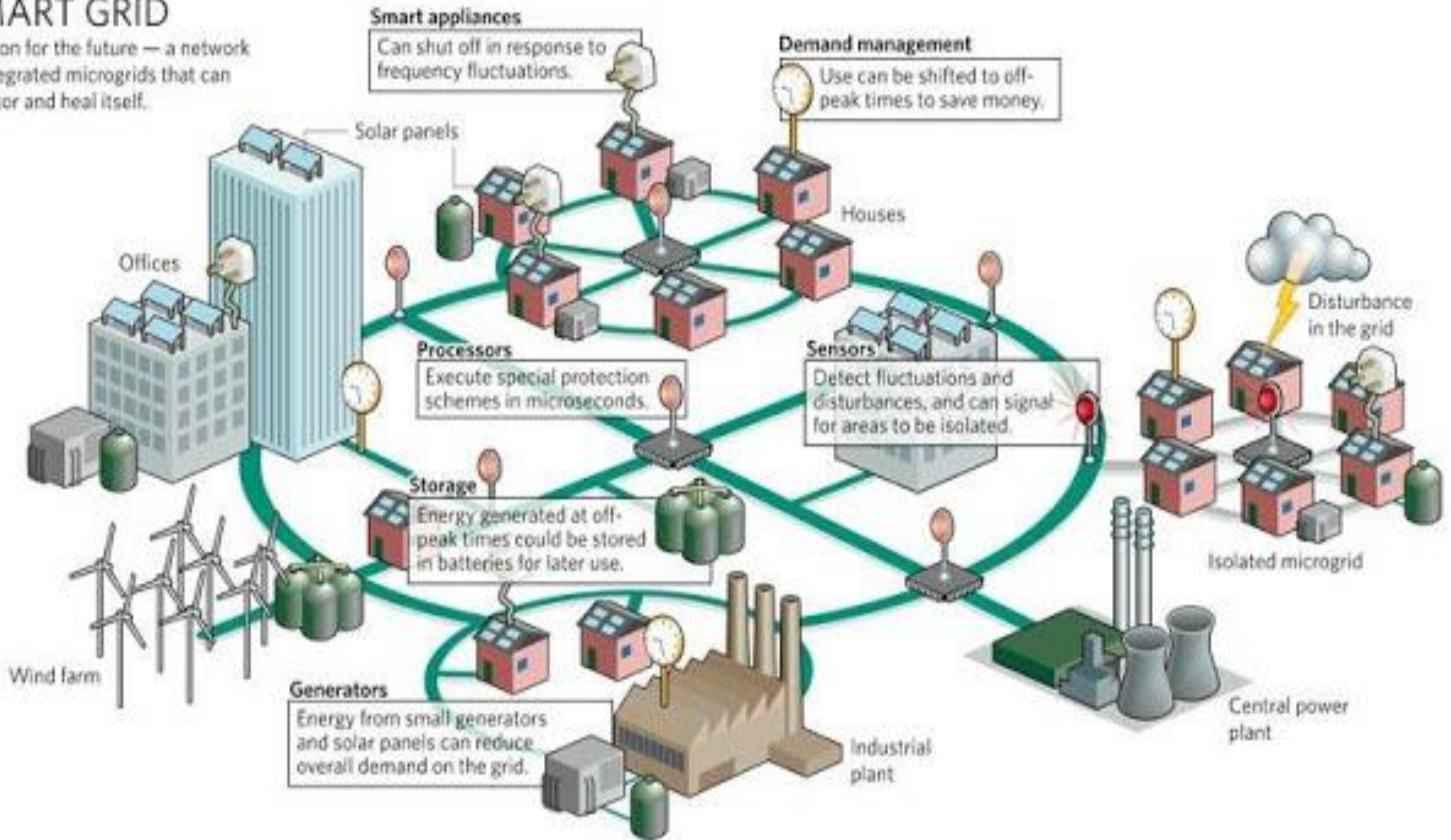
Internet of Things

- Beyond human communication

- Communication between devices
  - People-to-people
  - People-to-things
  - Things-to-things

Smart Grid

SMART GRID

A vision for the future — a network of integrated microgrids that can monitor and heal itself.

Smart appliances
Can shut off in response to frequency fluctuations.

Demand management
Use can be shifted to off-peak times to save money.

Solar panels

Offices

Houses

Processors
Execute special protection schemes in microseconds.

Sensors
Detect fluctuations and disturbances, and can signal for areas to be isolated.

Disturbance in the grid

Storage
Energy generated at off-peak times could be stored in batteries for later use.

Isolated microgrid

Wind farm

Generators
Energy from small generators and solar panels can reduce overall demand on the grid.

Industrial plant

Central power plant

Smart Home

Figure 3 – Smart home for smart people

Source: ITU adapted from Line9

Applications

- **Environmental or habitat monitoring**
  - Scientific, ecological applications
  - Seismic detection
- **Surveillance and tracking**
  - Intrusion detection
  - Pursuer-evader
- **Smart environments**
  - Agriculture
  - Manufacturing / Industry
  - Smart Grid
- **Medical applications**
  - Hospital or clinic
  - Retirement / Assisted Living
- Many others…

IOT – network of smart objects

- IoT is a network of smart objects.

- A **smart object** is a tiny, low cost computer that may contain:
  - A sensor which may contain physical data (e.g., temperature, vibration, pollution, camera, microphone, GPS)
  - An actuator capable of performing a task (e.g., change traffic lights, rotate a mirror)
  - A communication device to receive instructions, send data, or route information

- This device is embedded into objects to make them "smart".
  - Thermometers, car engines, light switches, gas meters

Smart Object Characteristics

- Small in size

- Limited CPU power

- Limited Memory

- Limited Bandwidth

- May operate in harsh environments

- Power consumption is critical – battery may need to last for a few years

Wireless Sensor Networks

- A distributed connection of nodes that coordinate to perform a common task

- Nodes can sensory information, perform some processing, and communicate with other nodes

- Enabling technologies (designed for nodes with limitations)
  - Bluetooth
  - Zigbee
  - RFID

Scenario: Shopping

- Entering store, scanners will identify tags on our clothes

- Goods will introduce themselves

- Exiting store, scanners detect merchandise that you have and automatically charge your credit card