Introduction to IoT

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E- Yantra Lab

- GCOE Nagpur developed E-Yantra Lab , under NMEICT project of IIT Mumbai. Lab run by students.

Achievements of E-Yantra lab

- Device for blind people.
- GCOE Nagpur won 'B' category prize of Rs 4000/- from IIT Mumbai.
- developed content-6 of e-Yantra Resource Development Center and Received Honorarium of Rs. 7000/-
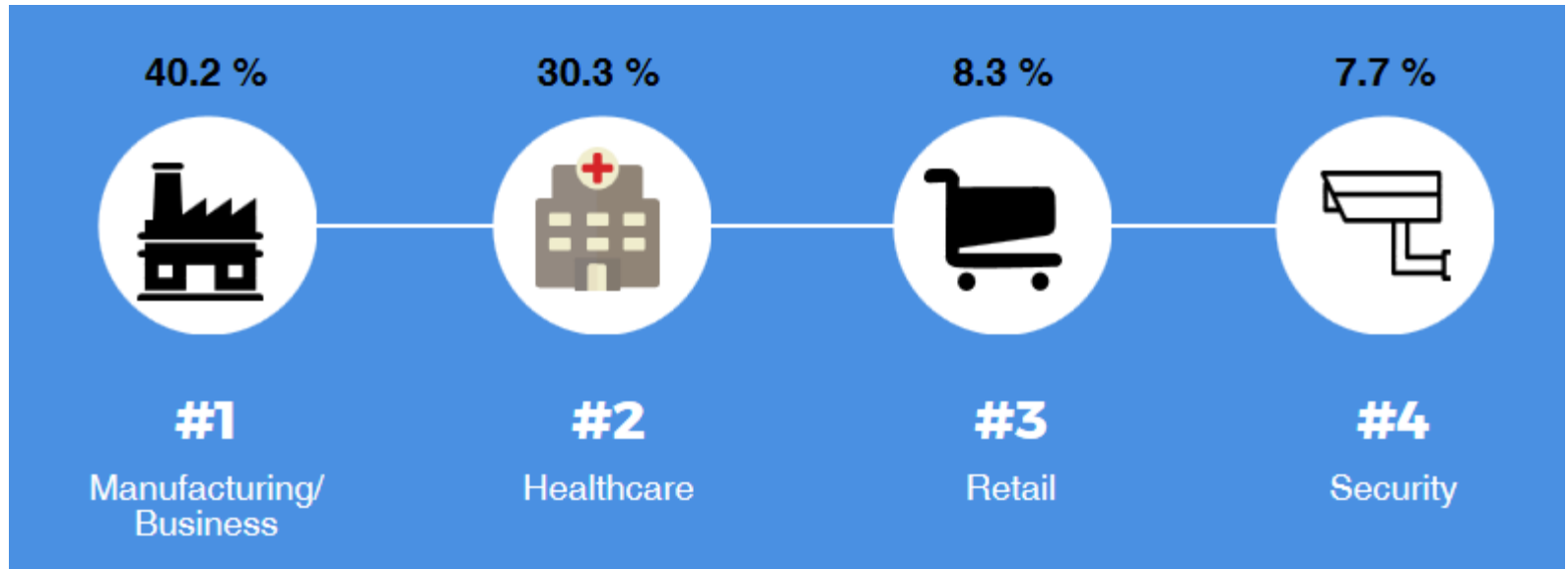- Set up E - Farm

Introduction

- Internet technology connecting devices, machines and tools to the internet by means of wireless technologies.

- Over 9 billion 'Things' connected to the Internet, as of now.

- 'Things' connected to the Internet are projected to cross 20 billion in the near future.

Characteristics

- Efficient, scalable and associated architecture
- Unambiguous naming and addressing
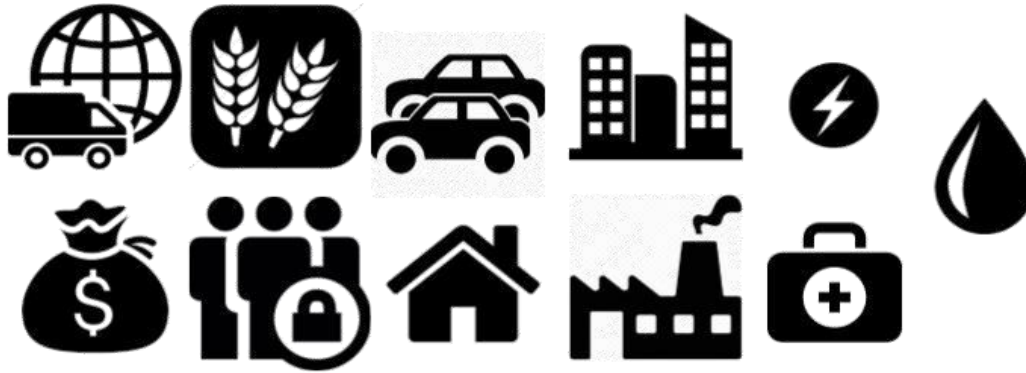- Abundance of sleeping nodes, mobile and non-IP devices
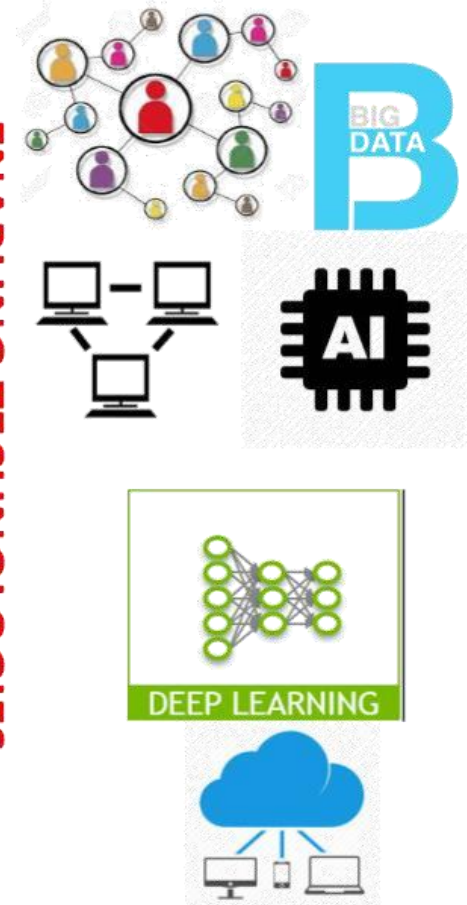- Intermittent connectivity

IOT Market Share

40.2 %	30.3 %	8.3 %	7.7 %
#1	#2	#3	#4
Manufacturing/ Business	Healthcare	Retail	Security

Source:Intel

IOT Enablers

IMPLEMENTATION

CONNECTIVITY

ENABLING TECHNOLOGIES

ZigBee®

RFID

LoWPAN
IPv6-based Low-power
Wireless Personal Area Networks

LoRa®

INSTEON

BIG DATA

AI

DEEP LEARNING

Connectivity Layers

SERVICES

ZigBee RFID Bluetooth

LOCAL CONNECTIVITY

SERVICE PROVIDERS

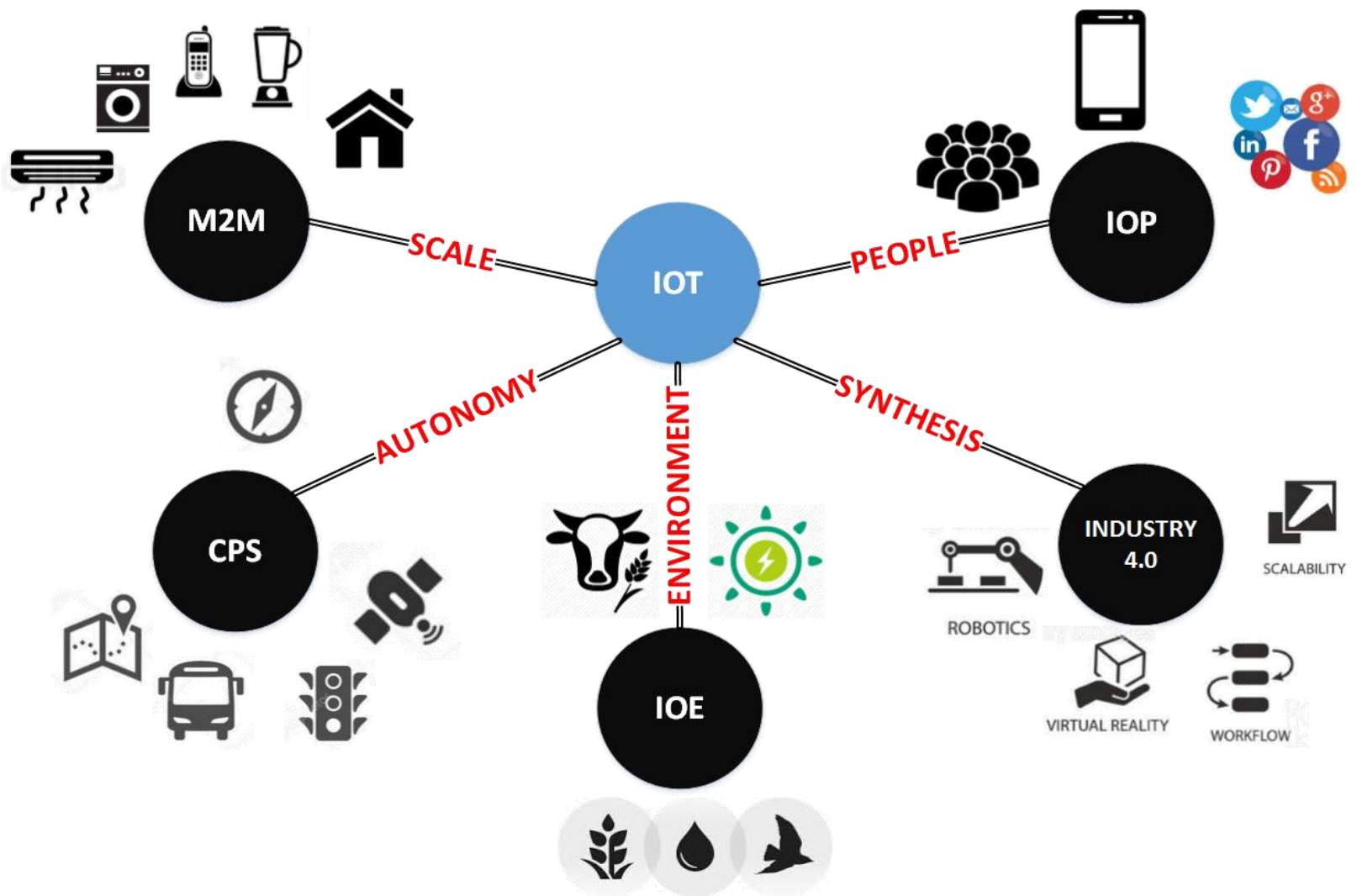GATEWAY   GATEWAY   GATEWAY

IOT MANAGEMENT

GLOBAL CONNECTIVITY

INTERNET

Baseline Technologies

A number of technologies that are very closely related to IoT include

- Machine-to-Machine (M2M) communications,
- Cyber-Physical-Systems (CPS)
- Web-of-Things (WoT).

Functional Components of IOT

- Component for interaction and communication with other IoT devices

- Component for processing and analysis of operations

- Component for Internet interaction

- Components for handling Web services of applications

- Component to integrate application services

- User interface to access IoT

Things **Local Network** **Internet** **Backend Services**

Communication

Processing

Analytics

Server/ Storage
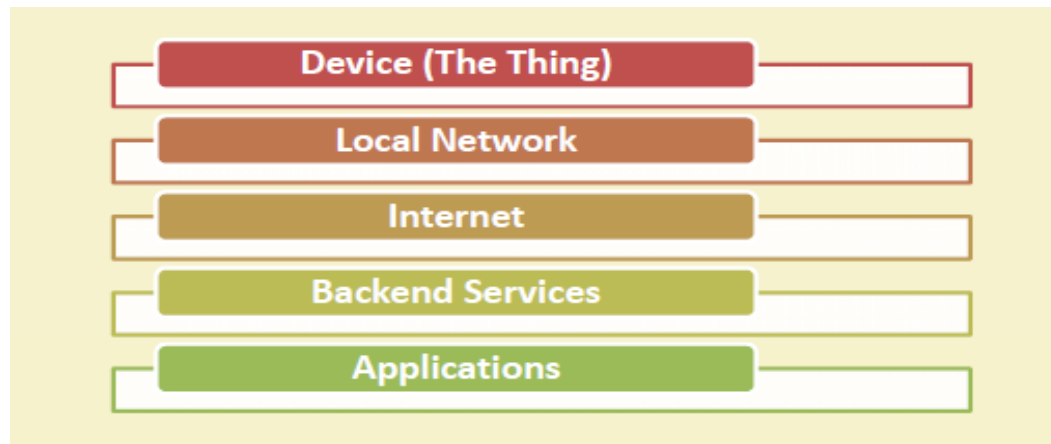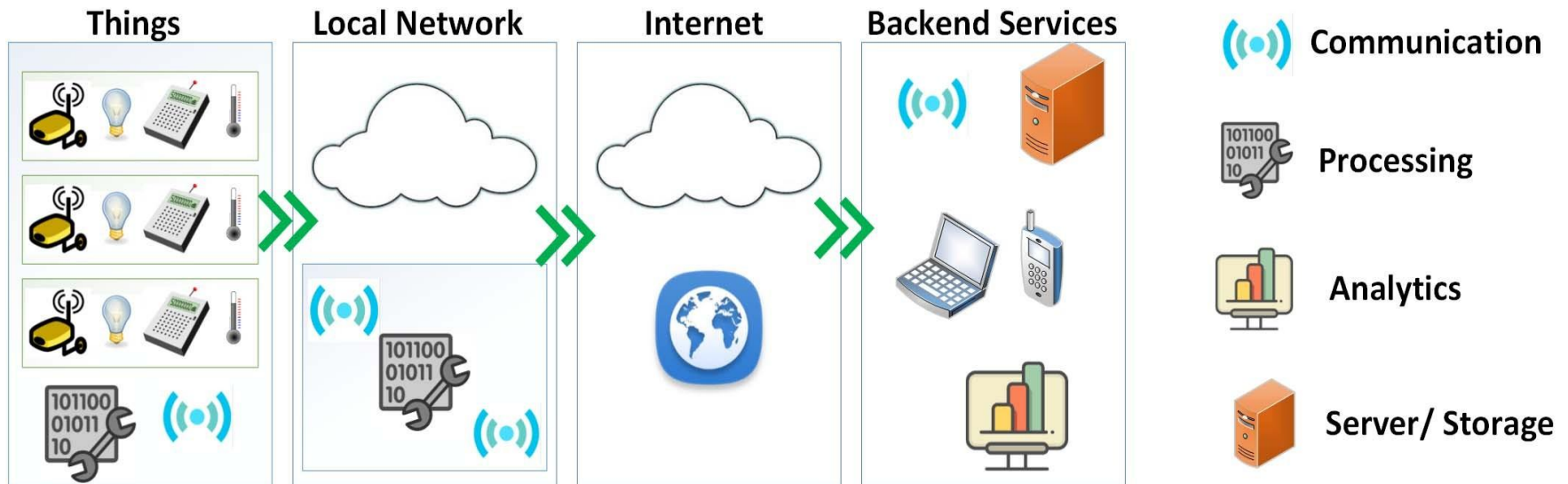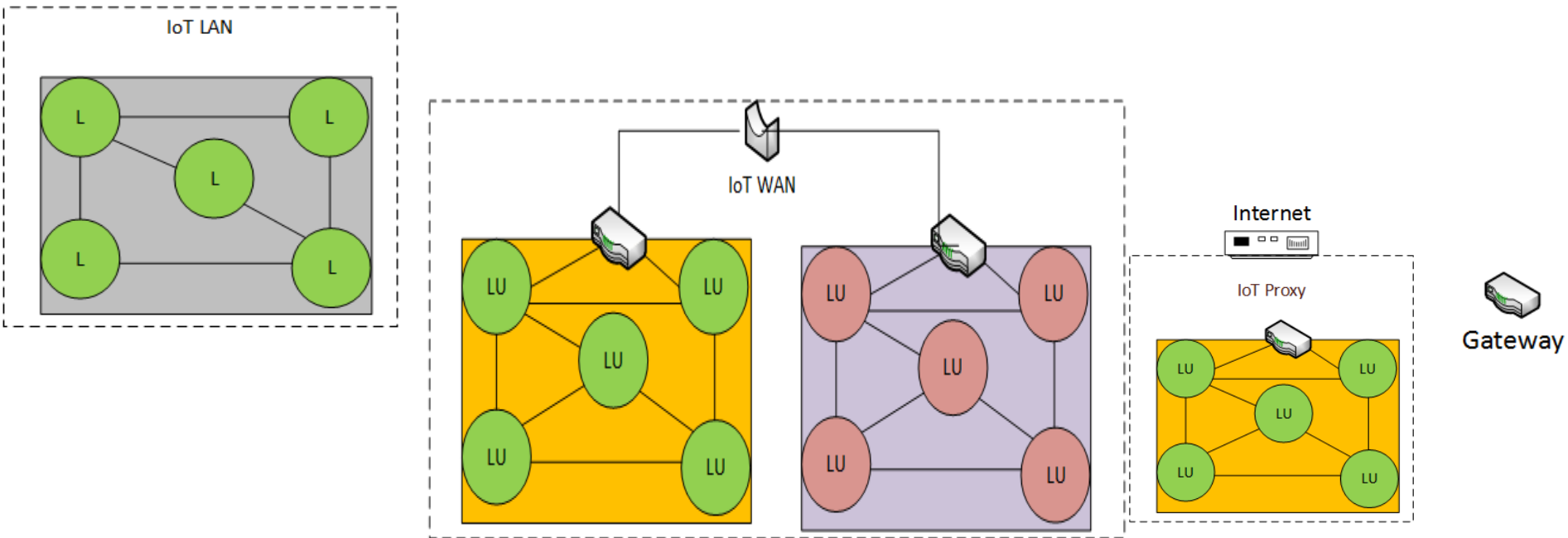
Address Crunch

- Estimated 20-50 billion devices by 2021
- Reason is the integration of existing devices, smart devices as well as constrained nodes in a singular framework.
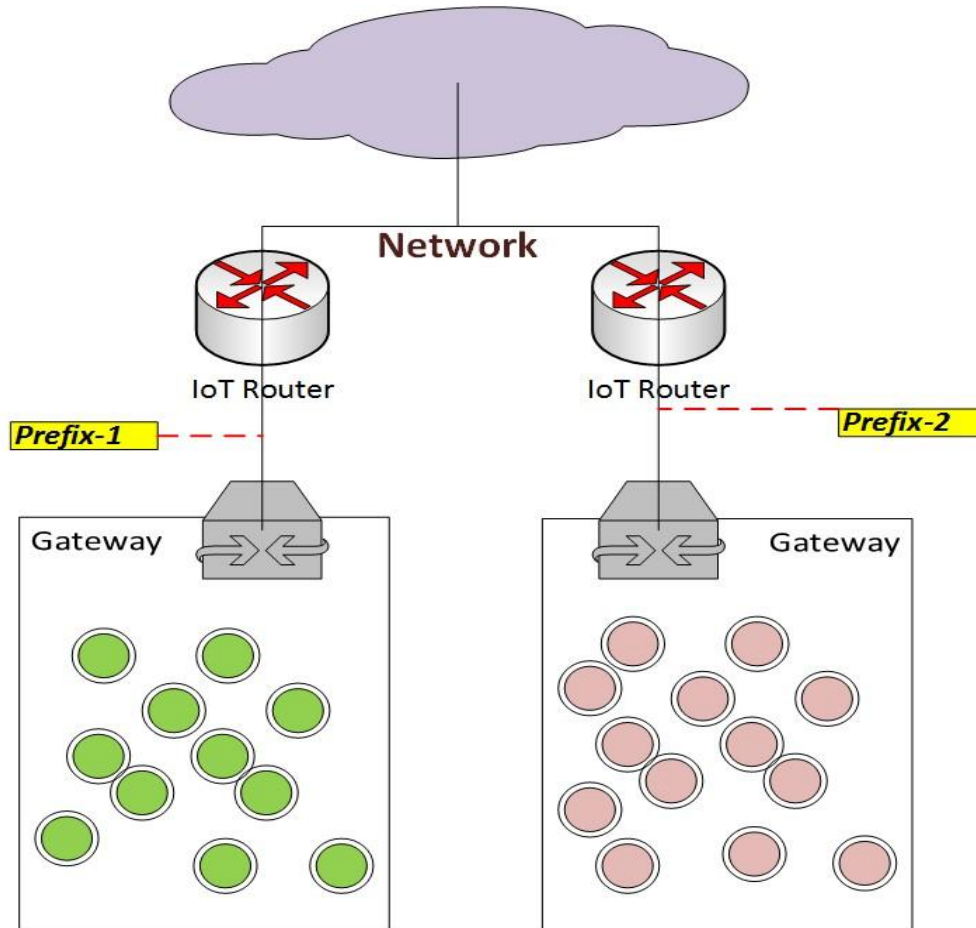
IOT Network Configurations

Source: Teemu Savolainen, Jonne Soininen, and Bilhanan Silverajan,*"IPv6 Addressing Strategies for IoT",* IEEE Sensors Journal, Vol. 13, No. 10,
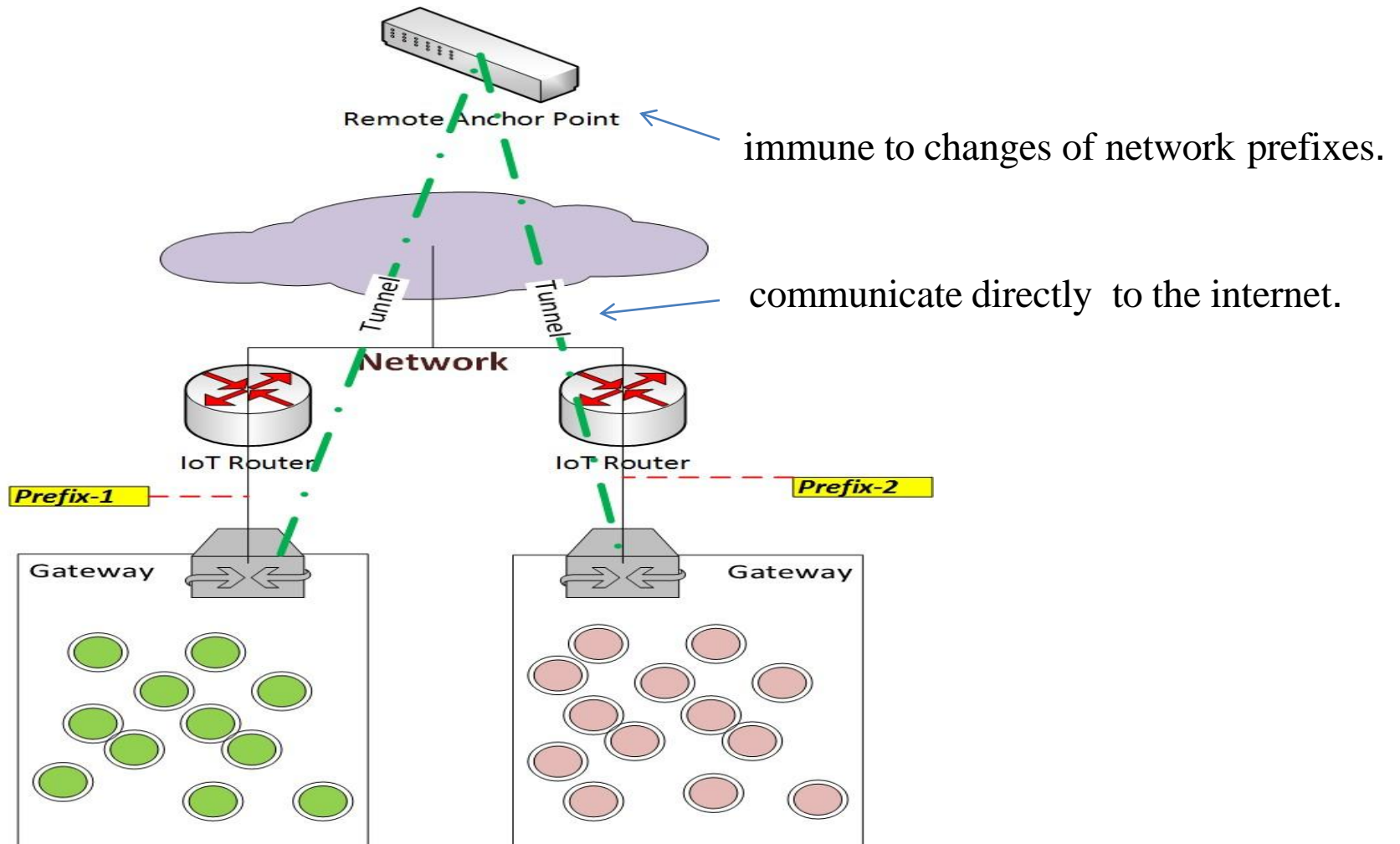
Gateway Prefix Allotment

The same addresses may be repeated in the domain of another gateway. The <u>gateway has a unique network prefix</u>, which can be used to identify them globally.

Teemu Savolainen, Jonne Soininen, and Bilhanan Silverajan,*"IPv6 Addressing Strategies for IoT",* IEEE Sensors Journal, Vol. 13, No. 10, Oct 2013

Impact of Mobility

Remote Anchor Point — immune to changes of network prefixes.

communicate directly to the internet.

Tunnel Tunnel

Network

IoT Router   IoT Router

Prefix-1   Prefix-2

Gateway   Gateway

SENSORS

Sensors

- They perform some input functions by sensing or feeling the physical changes in characteristics of a system in response to a stimuli.

- For example heat is converted to electrical signals in a temperature sensor, or atmospheric pressure is converted to electrical signals in a barometer.

Transducers

- Transducers convert or transduce energy of one kind into another.

- For example, in a sound system, a microphone (input device) converts sound waves into electrical signals for an amplifier to amplify (a process), and a loudspeaker (output device) converts these electrical signals back into sound waves.

Sensor Features

- It is only sensitive to the measured property

- It does not influence the measured property

- The resolution of a sensor is the smallest change it can detect in the quantity that it is measuring.

- The more is the resolution of a sensor, the more accurate is its precision.

Sensor Classes
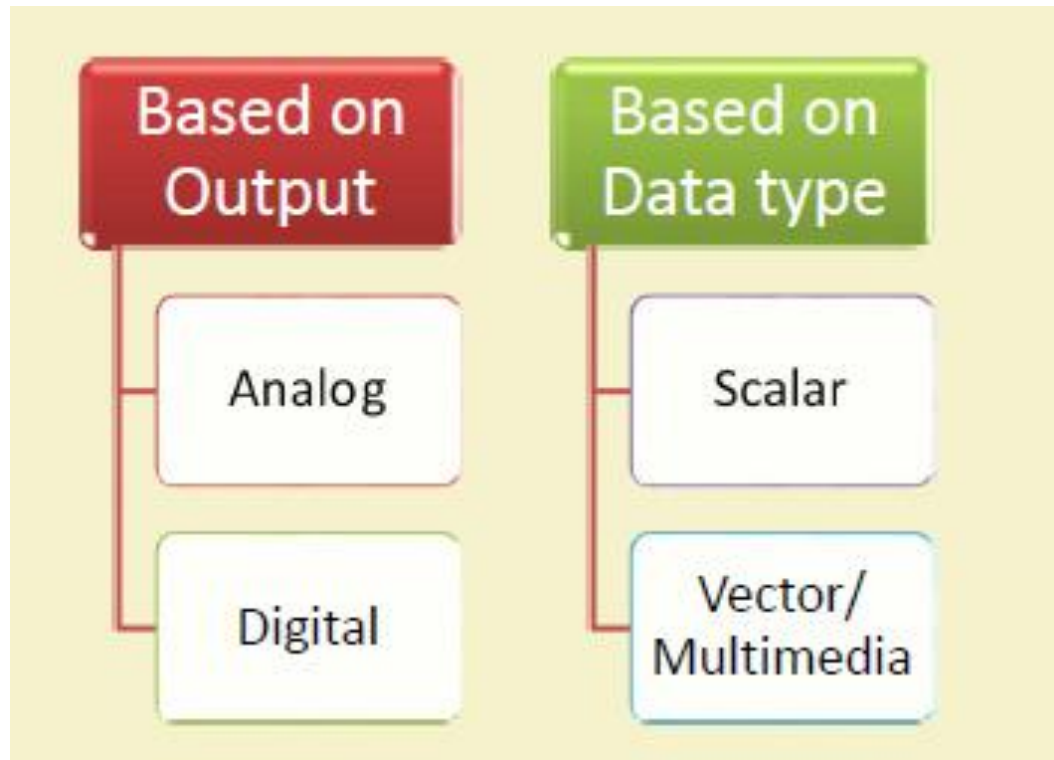
- **Analog Sensors** produce a continuous output signal or voltage which is generally proportional to the quantity being measured. Physical quantities such as Temperature, Speed, Pressure.

- **Digital Sensors** produce discrete digital output signals or voltages that are a digital representation of the quantity being measured. ON/OFF

- **Scalar Sensors** produce output signal or voltage which is generally proportional to the magnitude of the quantity being measured.

- **Vector Sensors** produce output signal or voltage which is generally proportional to the magnitude, direction, as well as the orientation of the quantity being measured.
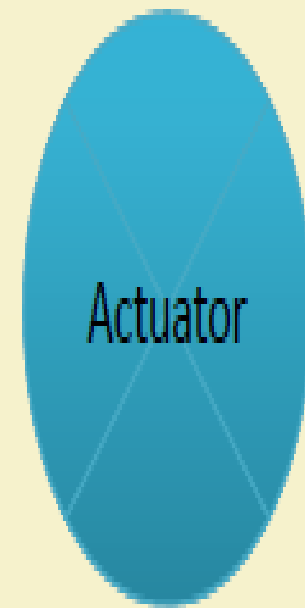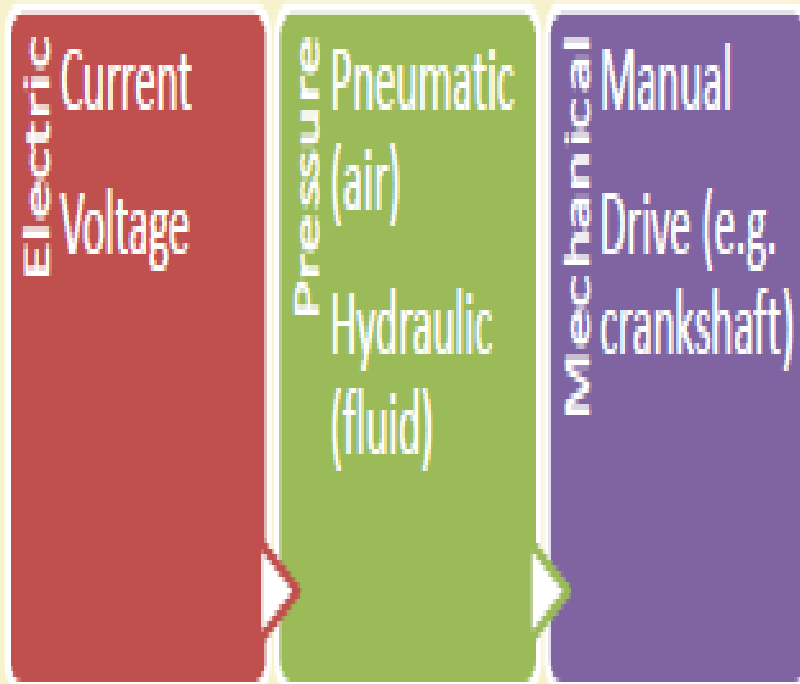
Sensor Types

Light	• Light Dependent resistor • Photo-diode
Temperature	• Thermocouple • Thermistor
Force	• Strain gauge • Pressure switch
Position	• Potentiometer, Encoders • Opto-coupler
Speed	• Reflective/ Opto-coupler • Doppler effect sensor
Sound	• Carbon Microphone • Piezoelectric Crystal
Chemical	• Liquid Chemical sensor • Gaseous chemical sensor

Pressure Sensor
Source: Wikimedia Commons

Ultrasonic Distance Sensor
Source: Wikimedia Commons

Tilt Sensor
Source: Wikimedia Commons

Infrared Motion Sensor
Source: Wikimedia Commons

Analog Temperature Sensor
Source: Wikimedia Commons

Camera Sensor
Source: Wikimedia Commons

Actuation

Actuator

- An actuator is a component of a machine or system that moves or controls the mechanism or the system.

- acts upon an environment

- An actuator requires a control signal and a source of energy.

Electric	Pressure	Mechanical		
Current	Pneumatic (air)	Manual	Control Signal	Actuator
Voltage	Hydraulic (fluid)	Drive (e.g. crankshaft)		

Hydraulic
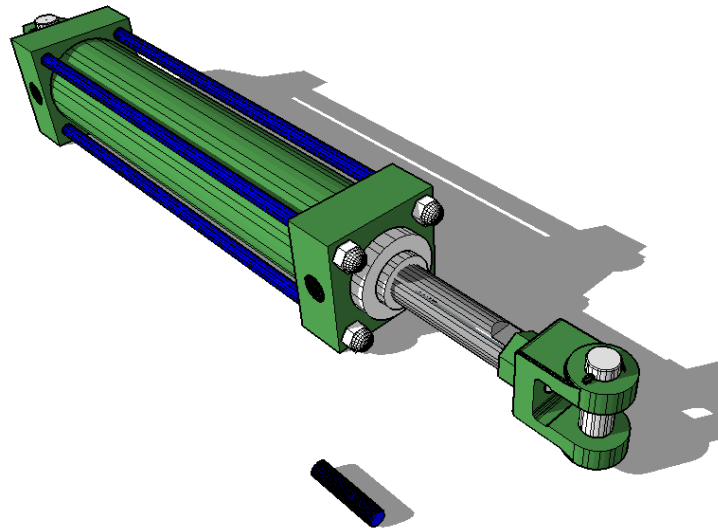
Pneumatic

Electrical

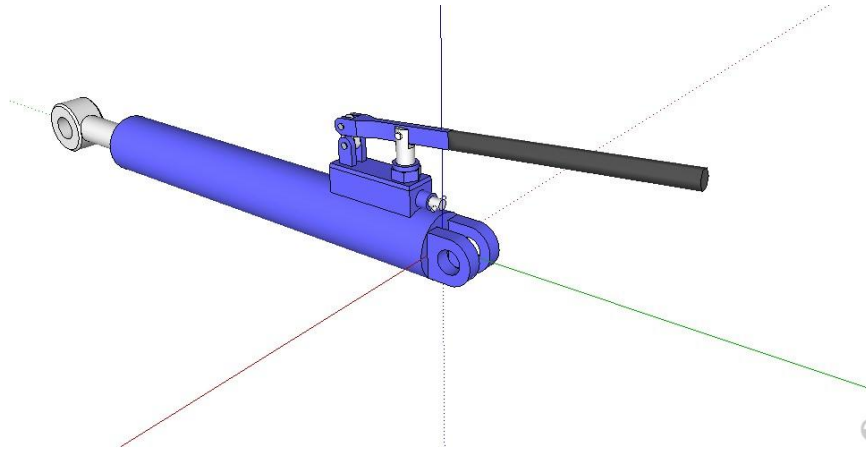**Thermal/ Magnetic**

Mechanical

Hydraulic Actuator

- A hydraulic actuator consists of a cylinder or fluid motor that uses hydraulic power to facilitate mechanical operation.
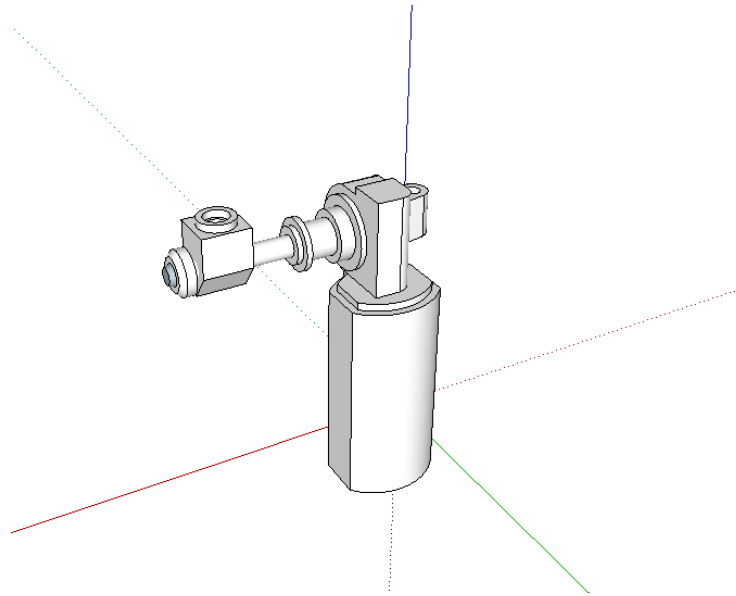
Pneumatic Actuator

- A pneumatic actuator converts energy formed by vacuum or compressed air at high pressure into either linear or rotary motion.
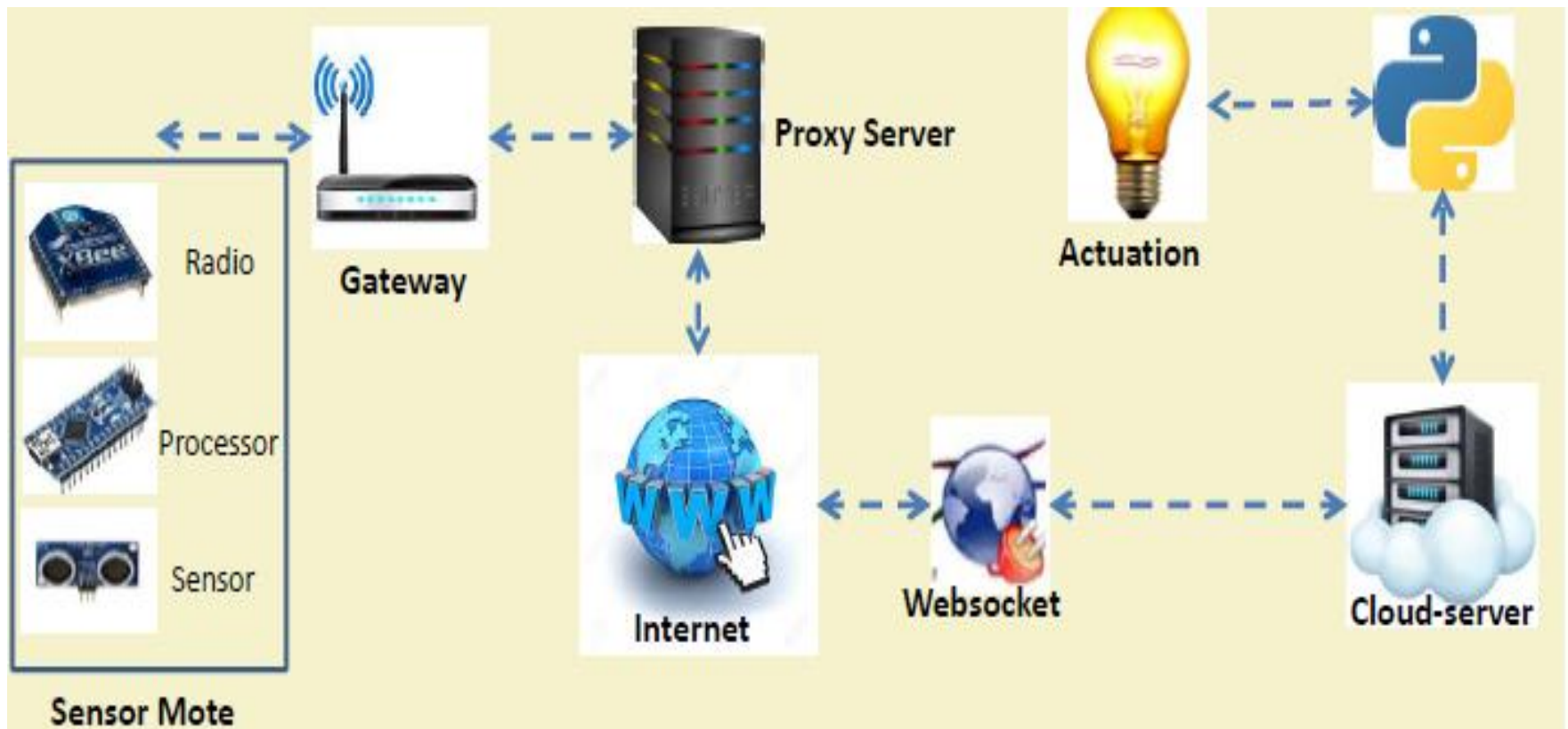
Electric Actuators

- An electric actuator is generally powered by a motor that converts electrical energy into mechanical torque.

IOT Implementation

IOT Associated Technologies

IOT Categories

- ✓ **Industrial IoT**
  - ▪ IoT device connects to an IP network and the global Internet.
  - ▪ Communication between the nodes done using regular as well as industry specific technologies.
- ✓ **Consumer IoT**
  - ▪ IoT device communicates within the locally networked devices.
  - ▪ Local communication is done mainly via Bluetooth, Zigbee or WiFi.
  - ▪ Generally limited to local communication by a Gateway

IOT Applications

- Forest Fire Detection
- Air Pollution
- Snow Level Monitoring
- Landslide and Avalanche Prevention
- Earthquake Early Detection
- Water Leakages
- NFC Payment
- Intelligent Shopping Applications
- E Farming

12.45 PM - Speaker : Swanand Jugade
       Topic   : Core component of IoT

01.15 PM - Speaker : Mihir Patwari
       Topic   : Cloud in IoT

01.35 PM - Speaker : Rohit Suryawanshi
       Topic   : E-farming project

02.05 PM - QnA session

12.15 PM - Speaker : Shrinit Patil
       Topic   : Introduction to NodeMCU

12.25 PM - Speaker : Ameya Shahu
       Topic   : Demo of programming with NodeMCU

01.00 PM - Speaker : Swanand Jugade
       Topic   : Introduction to Rpi

01.10 PM - Speaker : Ameya Shahu
          Topic   : Programming with Rpi

01.40 PM - QnA session

01.50 PM - Quiz

Thanks