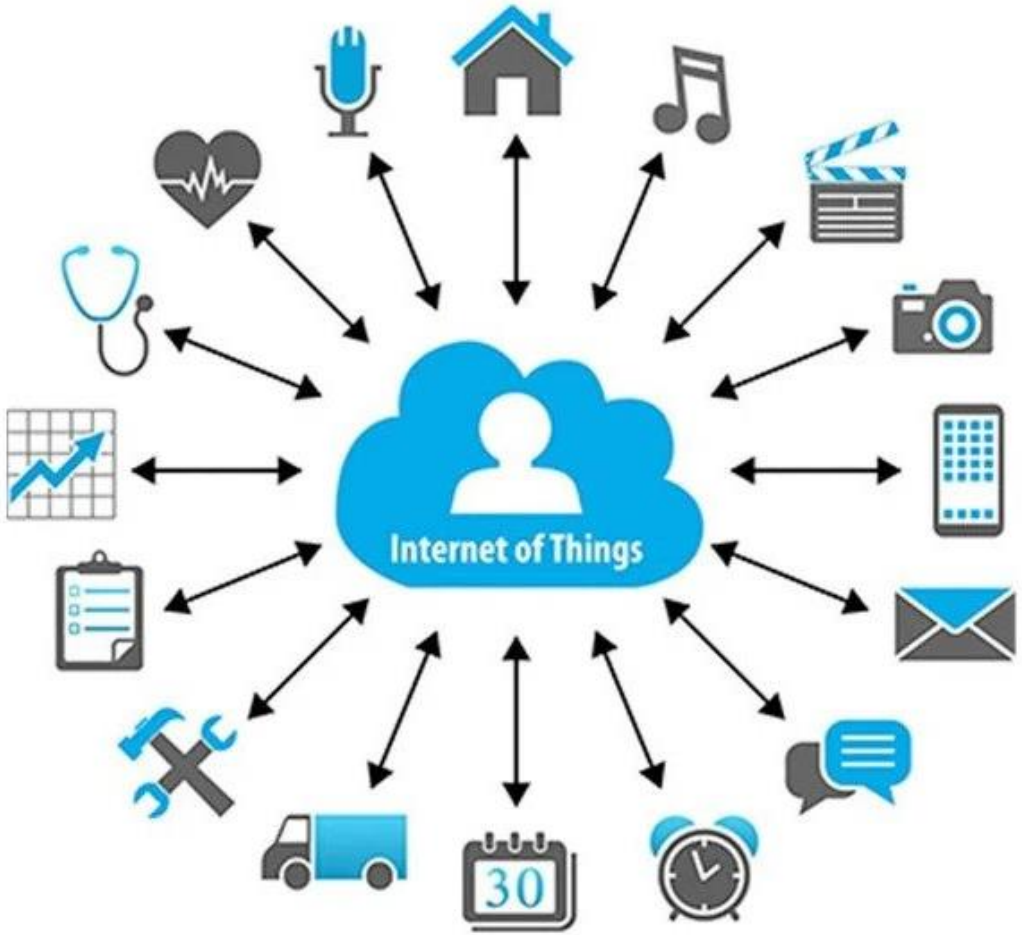
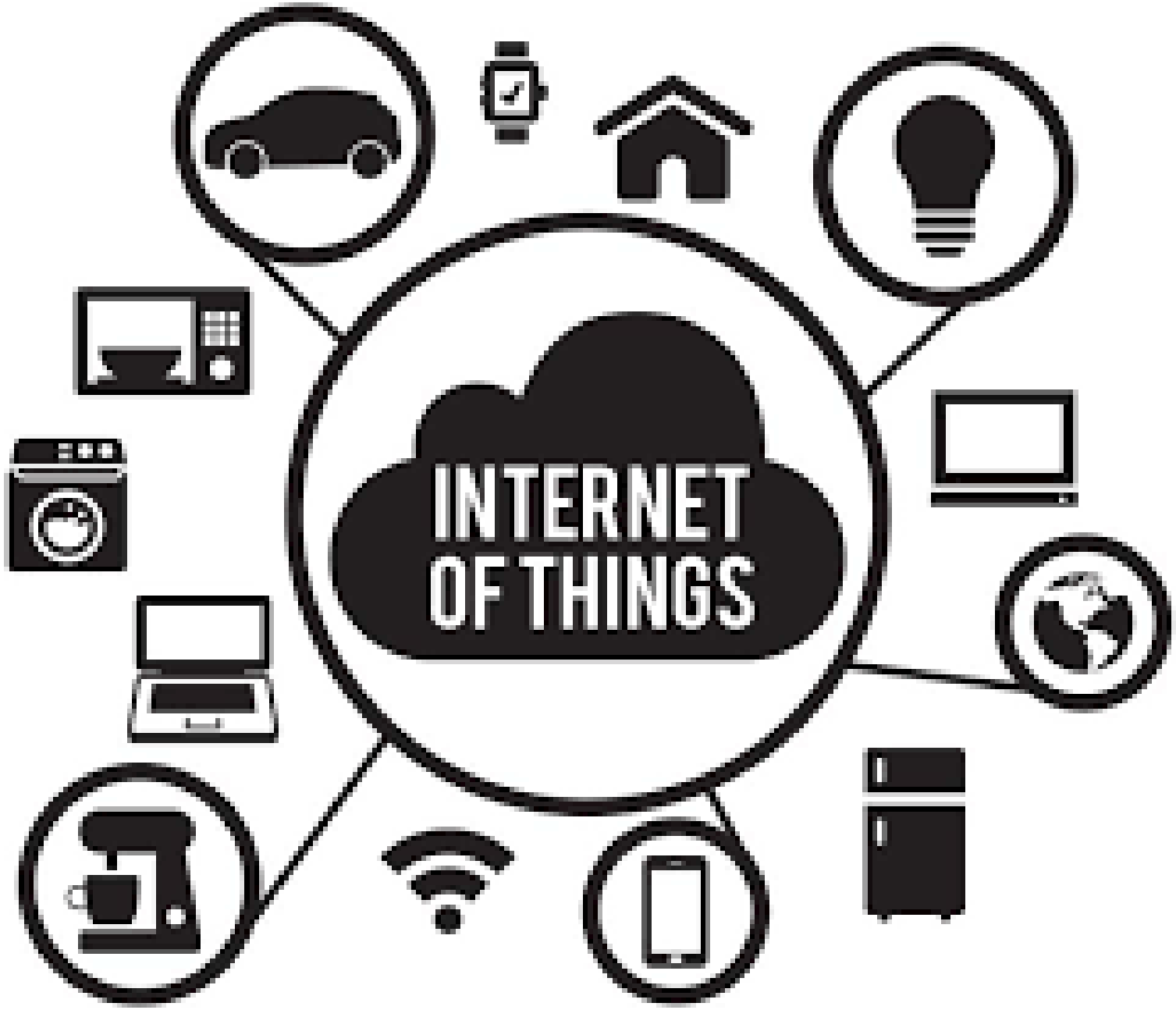


IoT : Overview and Introduction

Overview and Introduction :

- Internet of Things (IoT) and Web of Things (WoT)
- What's WoT?
- The Internet of Things Today
- Time for Convergence
- Towards the IoT Universe
- Internet of Things Vision
- IoT Strategic
- Research and Innovation Directions
- IoT Applications
- Future Internet Technologies
- Infrastructure
- Networks and Communication
- Processes
- Data Management
- Security, Privacy & Trust
- Device Level Energy Issues
- IoT Related Standardization
- Recommendations on Research Topics


INTERNET
OF THINGS

Internet of Things (IoT)

Internet connects all people -> "Internet of People"

Internet connects all things -> "Internet of Things"

'Interconnection of Things or Objects or Machines'

e.g., sensors, actuators, mobile phones, electronic devices, home appliances, any existing items and interact with each other via Internet.

IoT – Why should we care?

1. Cutting Edge Technology

50 Billion connected devices by 2025.

“What was the last piece of technology you purchased that didn't have Wi-Fi or Bluetooth built in?

2. We are Engineers !!!

Definition

- **Wikipedia**: The Internet of Things (IoT) refers to uniquely identifiable objects and their virtual representations in an Internet-like structure.

[http://en.wikipedia.org/wiki/Internet_of_things - 21-Jun-2014]

- **Cisco**: The Internet of Things (IoT) is the network of physical objects accessed through the Internet, as defined by technology analysts and visionaries. These objects contain embedded technology to interact with internal states or the external environment. In other words, when objects can sense and communicate, it changes how and where decisions are made, and who makes them.

[http://www.cisco.com/web/solutions/trends/iot/overview.html - 21-Jun-2014]

- The Internet of Things, also called The Internet of Objects, refers to a wireless network between objects, usually the network will be wireless and self-configuring, such as household appliances. **(Wikipedia)**
- The term "Internet of Things" has come to describe a number of technologies and research disciplines that enable the Internet to reach out into the real world of physical objects. **(IoT 2008)**
- "Things having identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental, and user contexts". **(IoT in 2020)**

The **Internet of Things** (**IoT**) is the network of physical objects—devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity—that enables these objects to collect and exchange data.

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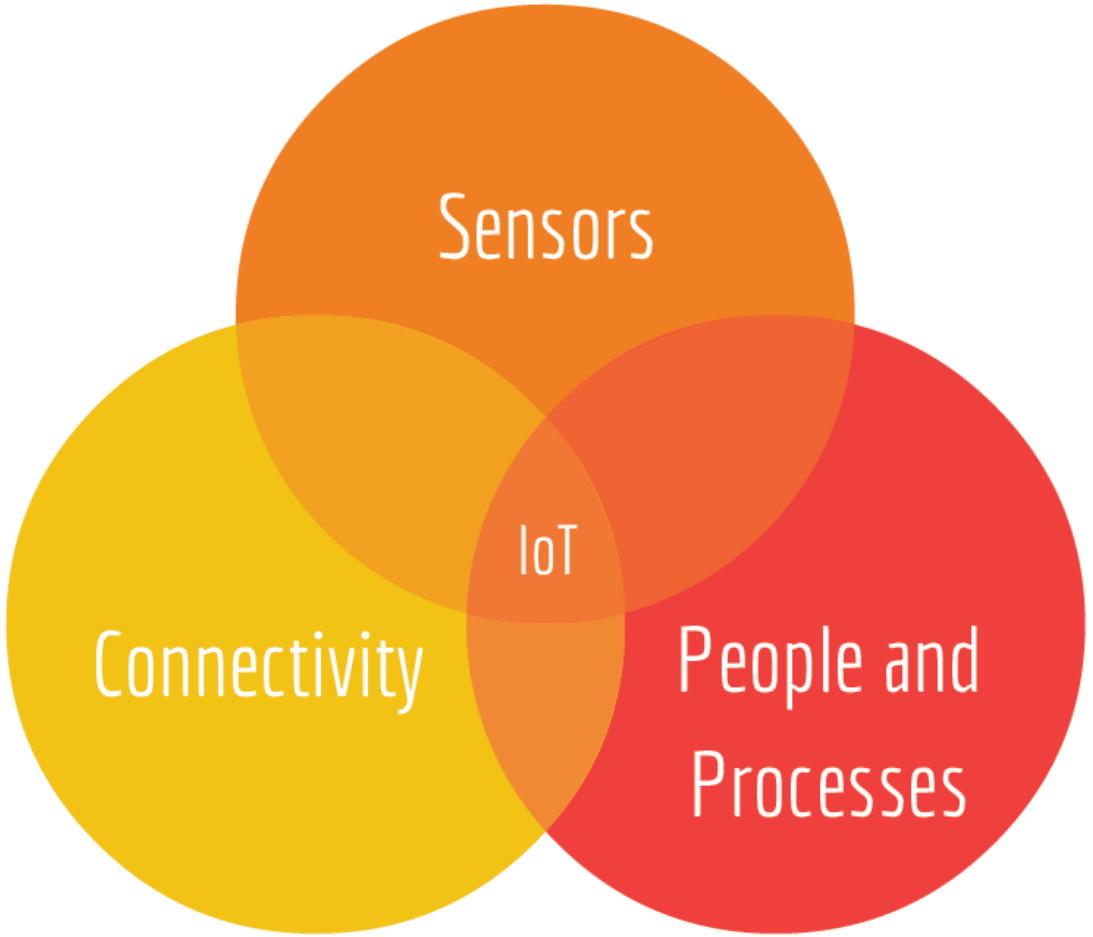
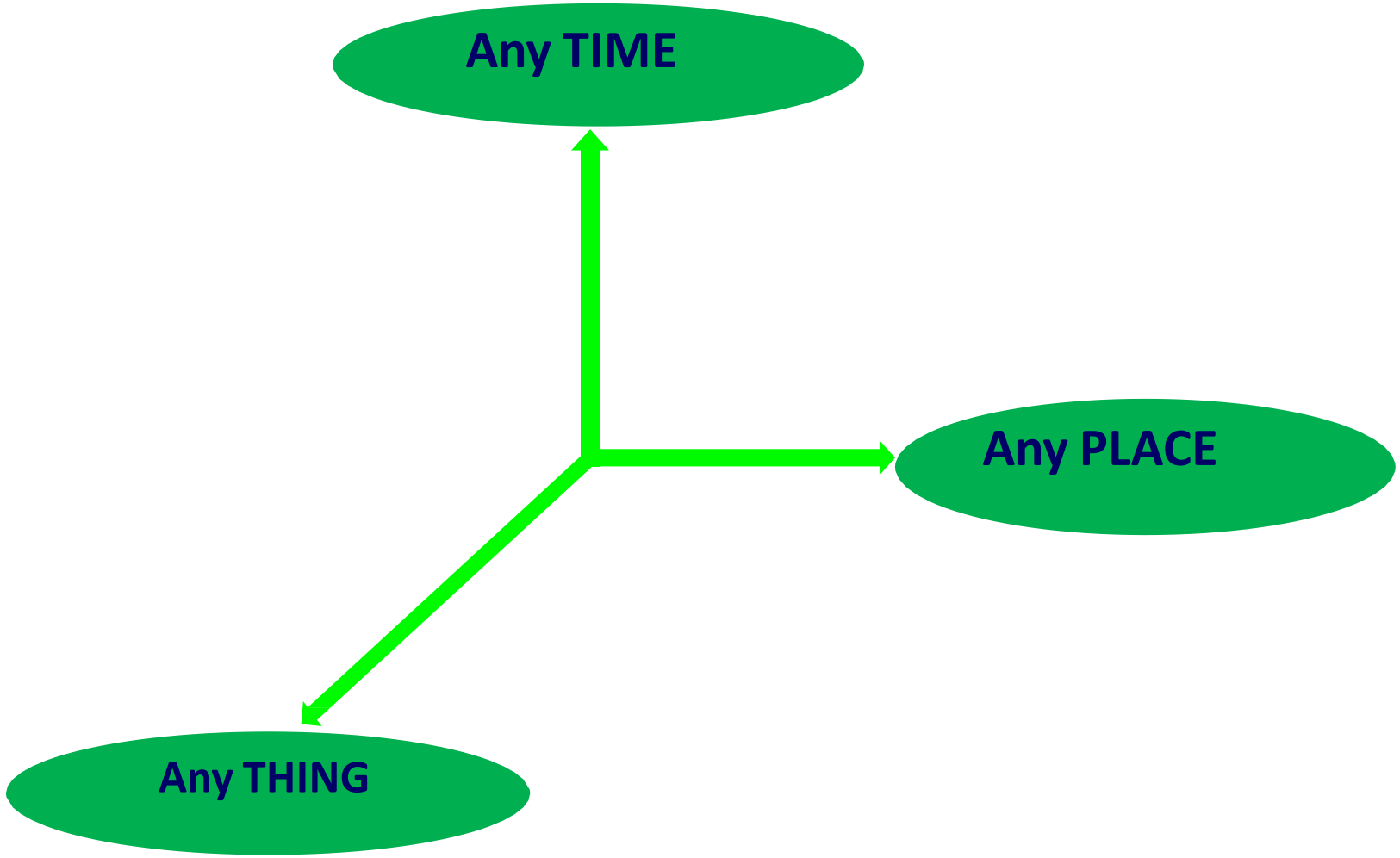
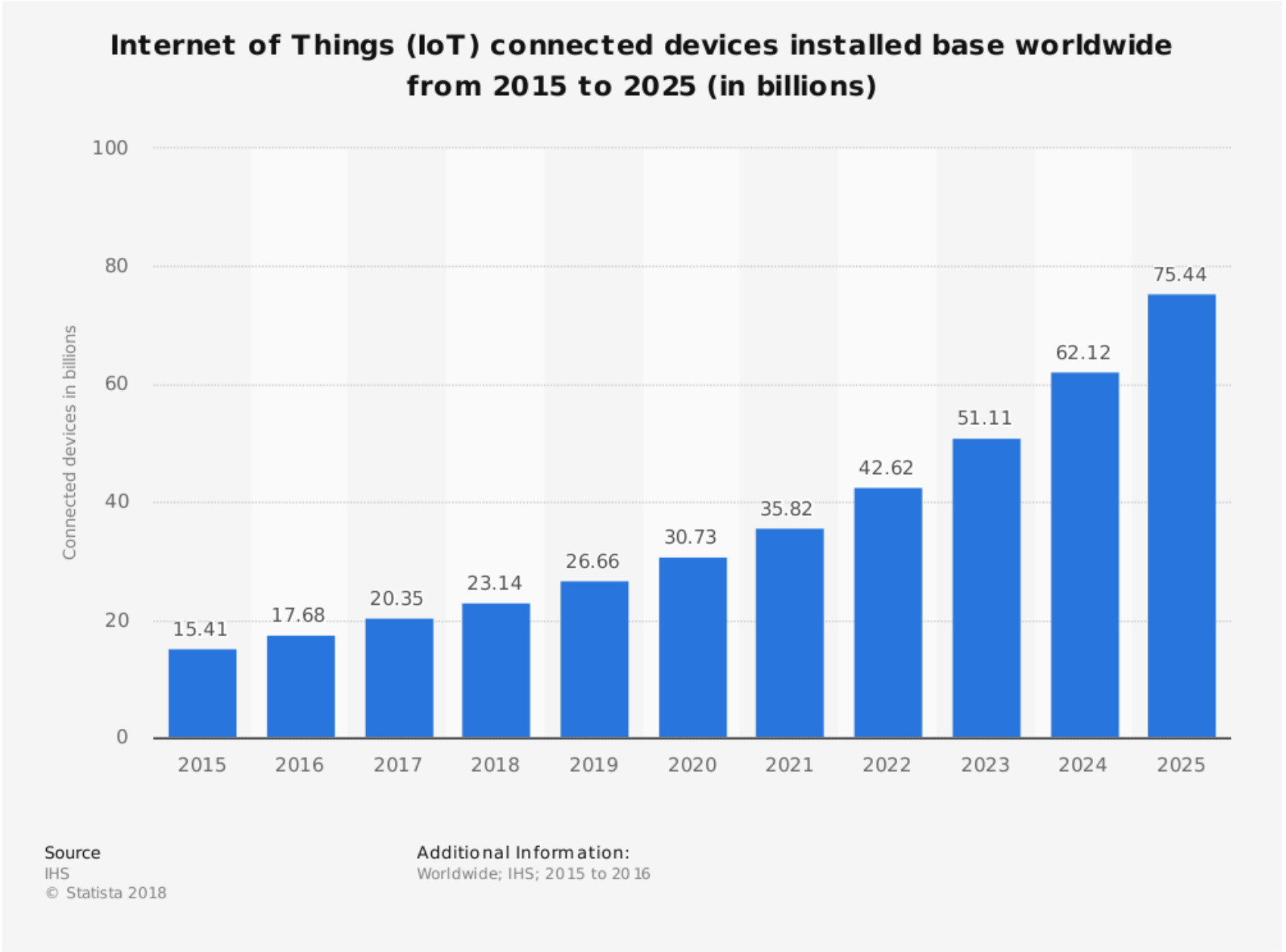


Internet of Things : Perspective




Internet of Things (IoT) connected devices installed base worldwide from 2015 to 2025 (in billions)
Connected devices in billions
100
80
60
40
20
0
15.41
17.68
20.35
23.14
26.66
30.73
35.82
42.62
51.11
62.12
75.44
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Source
IHS
© Statista 2018
Additional Information:
Worldwide; IHS; 2015 to 2016

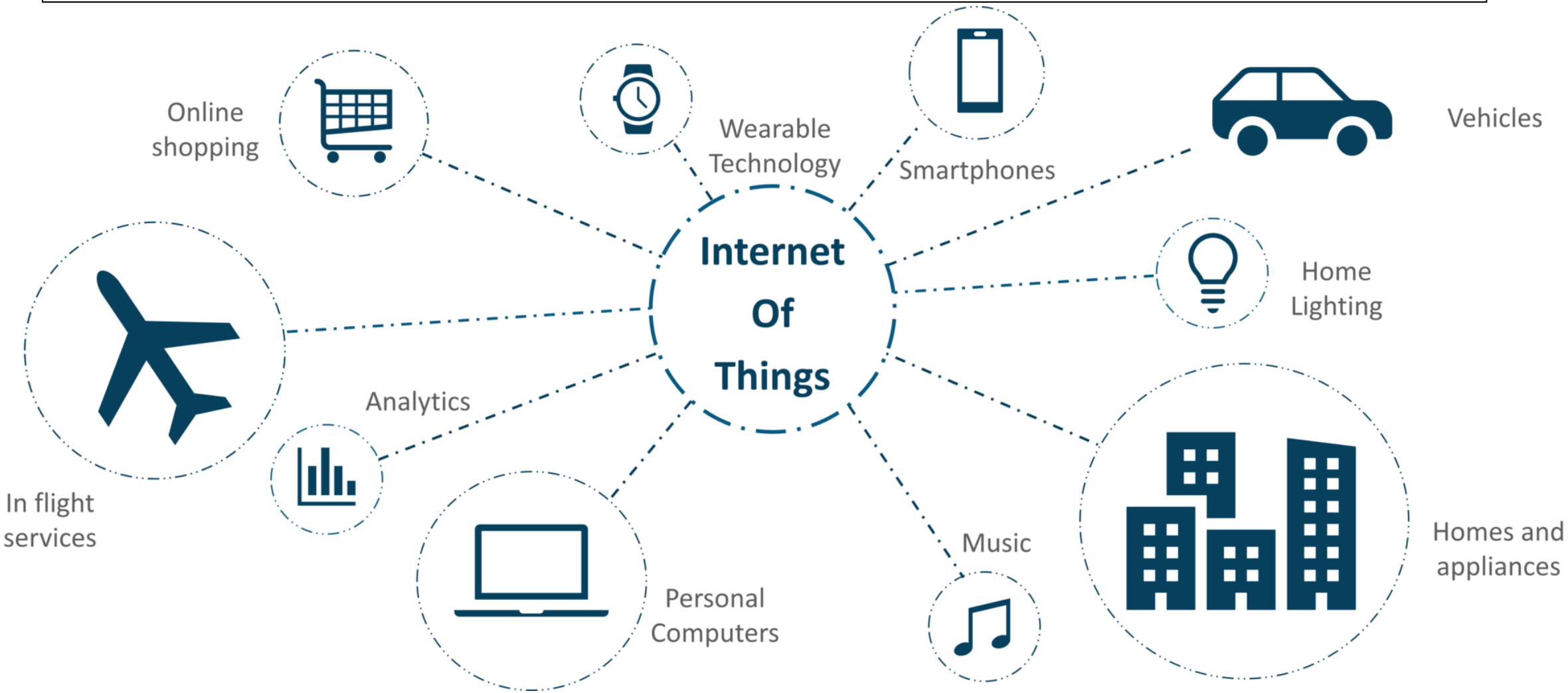
Internet of Things Vision

The vision of the Internet of Things (IoT) can be seen from two perspectives

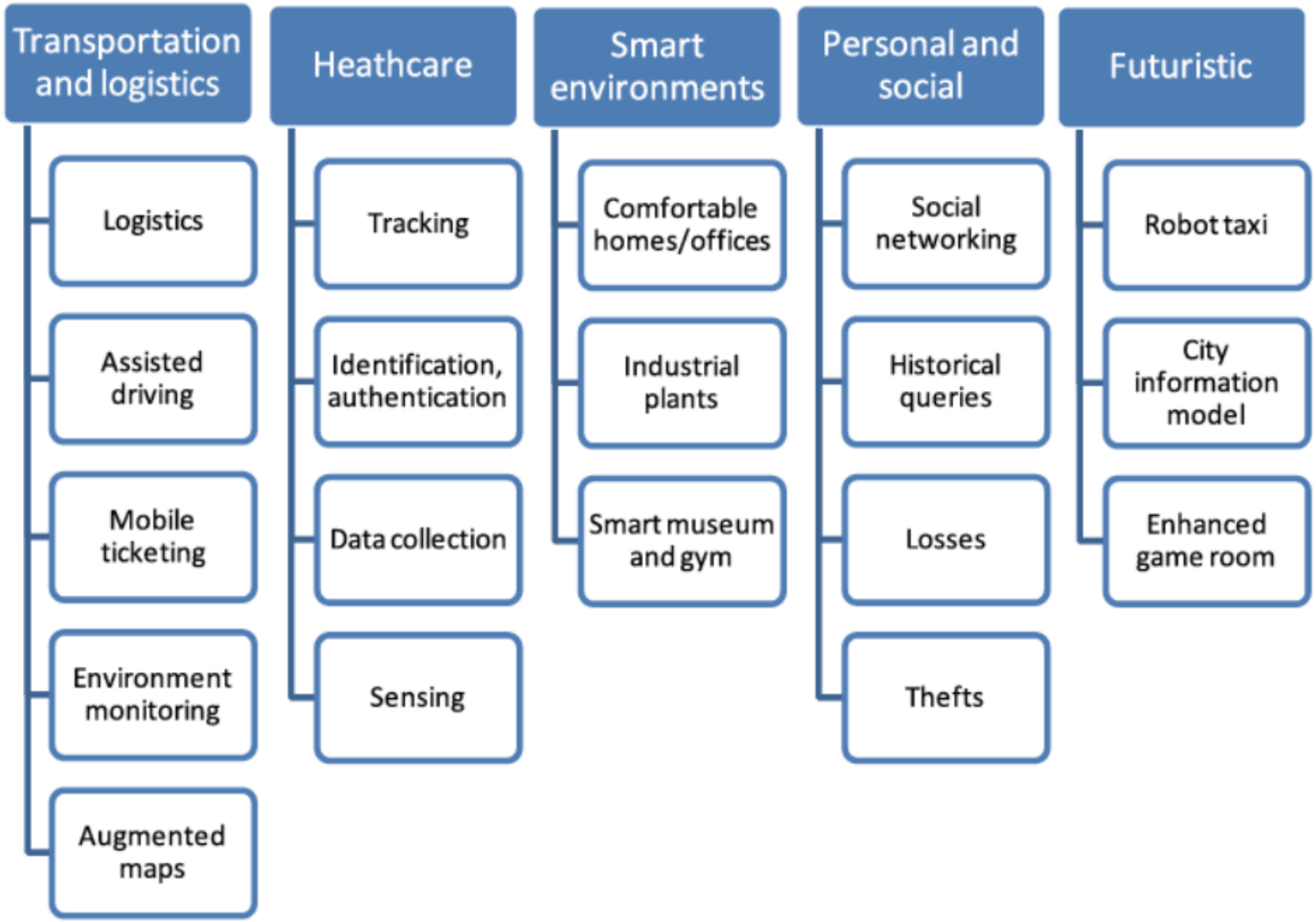
'Internet-centric' and 'thing-centric'

The end goal is to have plug-n-play smart objects that can be deployed in any environment with an interoperable interconnection backbone that allows them to blend with other smart objects around them.

IoT Applications

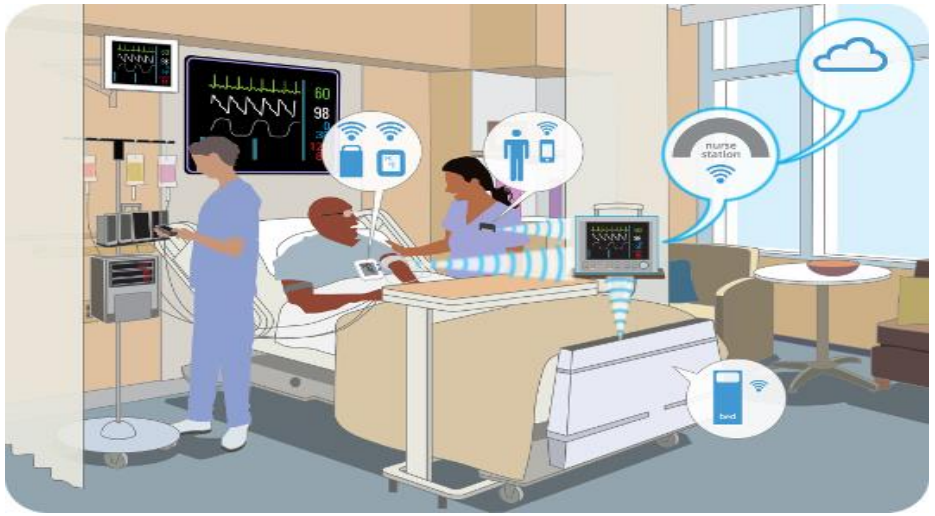


IoT Application domains and scenarios



Wearable Tech

Smart Appliances



Healthcare

Environmental Application

- Air quality monitoring project

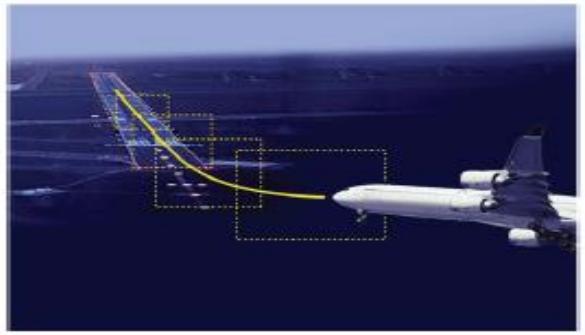
- Environmental application

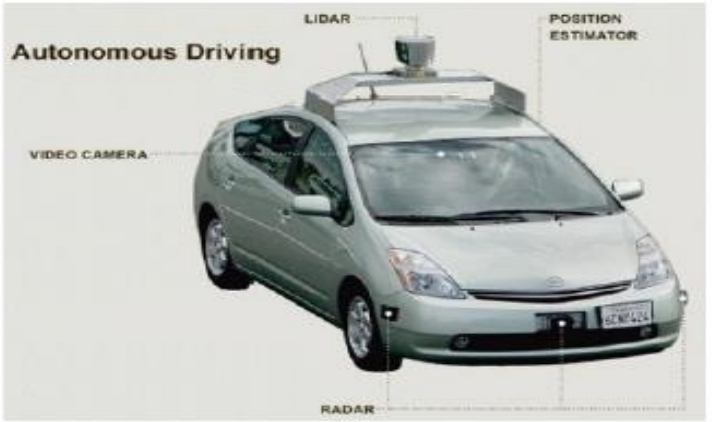
- Electrochemical **sensors**, **microcontroller** for data collection and transmission to an **Android** app

- **Actuation**: air quality is immediately reported, as well as retransmitted to a backend for larger-scale analysis

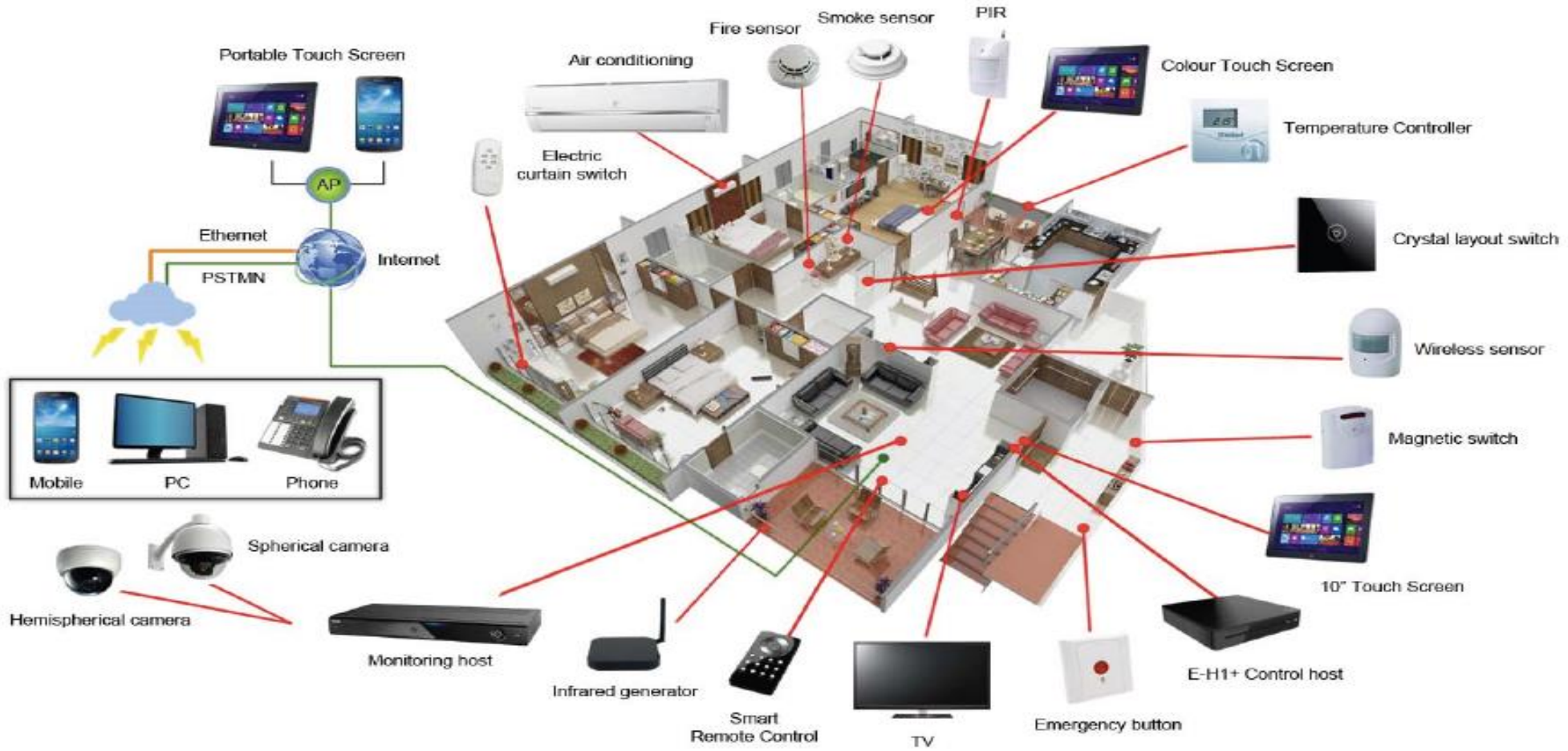
Transportation Application

- **Vehicle control:** Airplanes, automobiles, autonomous vehicles
  - All kinds of sensors to provide accurate, redundant view of the world
  - Several processors in cars (Engine control, break system, airbag deployment system, windshield wiper, door locks, entertainment system, etc.)
  - Actuation is maintaining control of the vehicle
  - Very tight timing constraints and requirements enforced by the platforms





Smart home Applications



Smart meters, heating/cooling, motion/temperature/ lighting sensors, smart appliances, security, etc.

What are the skills needed?

- Basic Electronics
- Basic Embedded Programming (c / c++ / Scripting / Python)
- Basic Networking
- Server app development
- Either web app or just an app server
- Mobile app (optional)

Link Layer Protocols

- 802.3 – Ethernet
- 802.11 - wifi
- 802.16 – WiMax
- 802.15.4 - Low Rate WPAN
- 2G/3G/4G - Mobile Communication

Network Layer Protocols

- IPv4

  Exhausted in 2011

  32bit address
- IPv6

  128 bit addresses
- 6LoWPAN

  Limited processing capability

  Shows compression mechanism with IPv6 over 802.15.4

Transport Layer Protocols

- TCP
- UDP

Application Layer Protocols

- HTTP
- CoAP
- WebSocket
- MQTT
- XMPP
- DDS
- AMQP