UNIVERSITY OF SCIENCE - VNUHCM
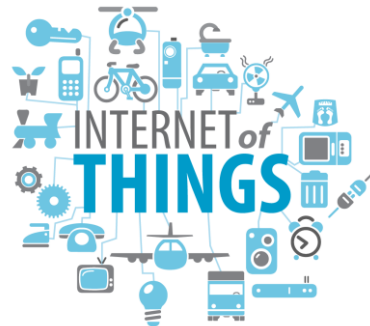## Faculty of Information Technology

INTERNET OF THINGS

INTRODUCE TO INTERNET OF THINGS

Contents

INTERNET OF THINGS (IoT)

The Internet of things (IoT) describes physical objects (or groups of such objects) that are embedded with sensors, processing ability, software, and other technologies, and that connect and exchange data with other devices and systems over the Internet or other communications networks.
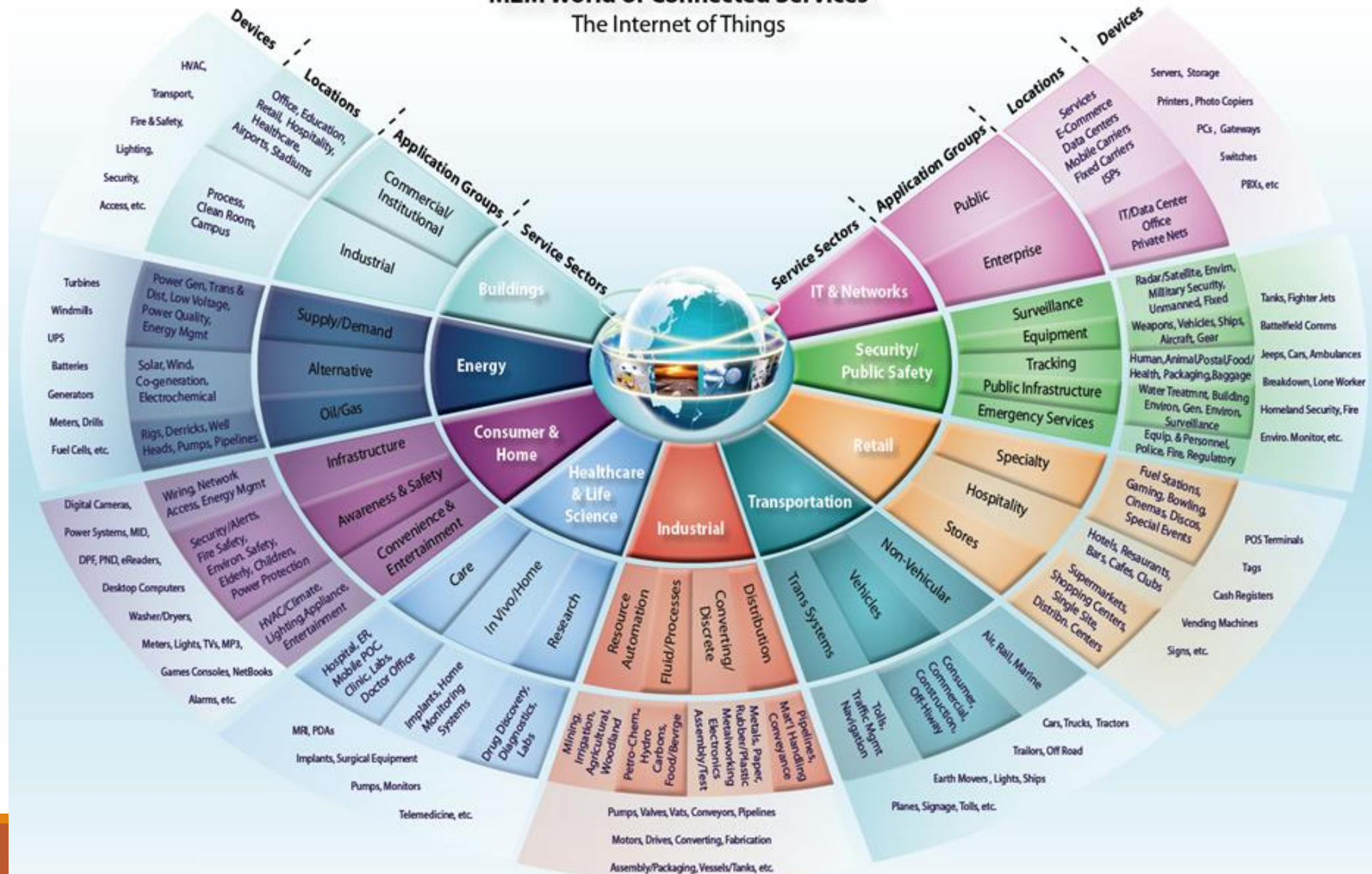
INTERNET OF THINGS IN 2020

Source: Mario Morales, IDC

M2M World of Connected Services
The Internet of Things

Sector 1: Buildings and Offices

Target objects: buildings, factories, office centers, universities, government agencies, etc.

The equipment in the buildings, the departments are connected, and strictly managed. Manual control systems such as lighting control, temperature control, fire alarm, customer and staff management will all be automated according to the change of the external environment.
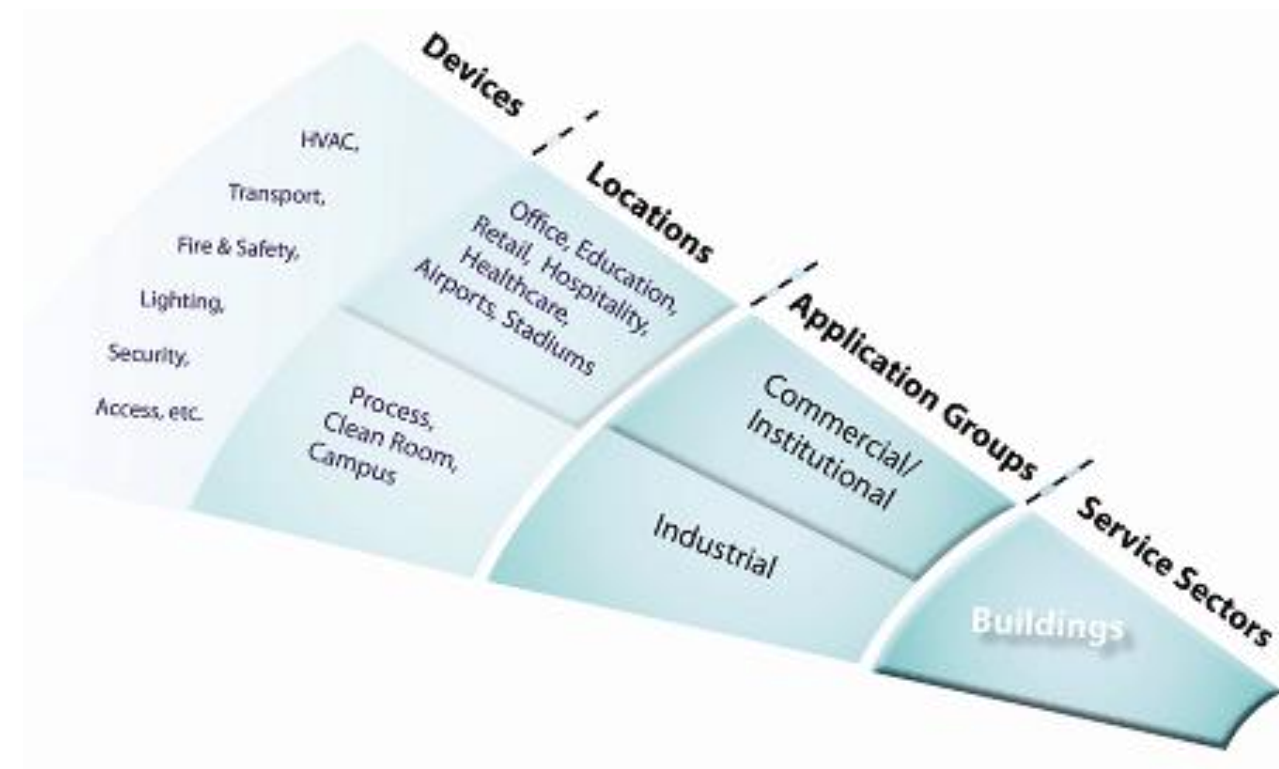
The Smart *Internet of Things* School

Personalized learning with adaptive eTextbooks

Digital classroom white boards and display

iBeacons

Complete coverage with high performance Wi-Fi

Wearables for athletics and attendance tracking

Video recorders for lecture capture

International Collaboration and social exchange

Online testing

Sensors on trash receptacles

Supplies and inventory tracking by sensor with auto-reorder

Student devices & eTextbooks
- Notebooks
- Tablets
- Smartphones

Robot cleaning

Augmented and virtual reality

Makerspaces with 3D printers and laser trimmers

Internet of Things-based HVAC

File and program storage, local or cloud-based
- Demographics, academics, behavior, interests
- LMS, CMS, SIS
- Educational programs and applications
- Video files: lectures and recorded lab experiments

Robotics for STEM and remote presence

Monitor and display of air quality throughout school

Surveillance security cameras

Wi-Fi sensors and locks
- Entrances and exits
- Classroom doors

Sensors track buses and verify student passengers

Network application analytics to monitor devices and network behavior
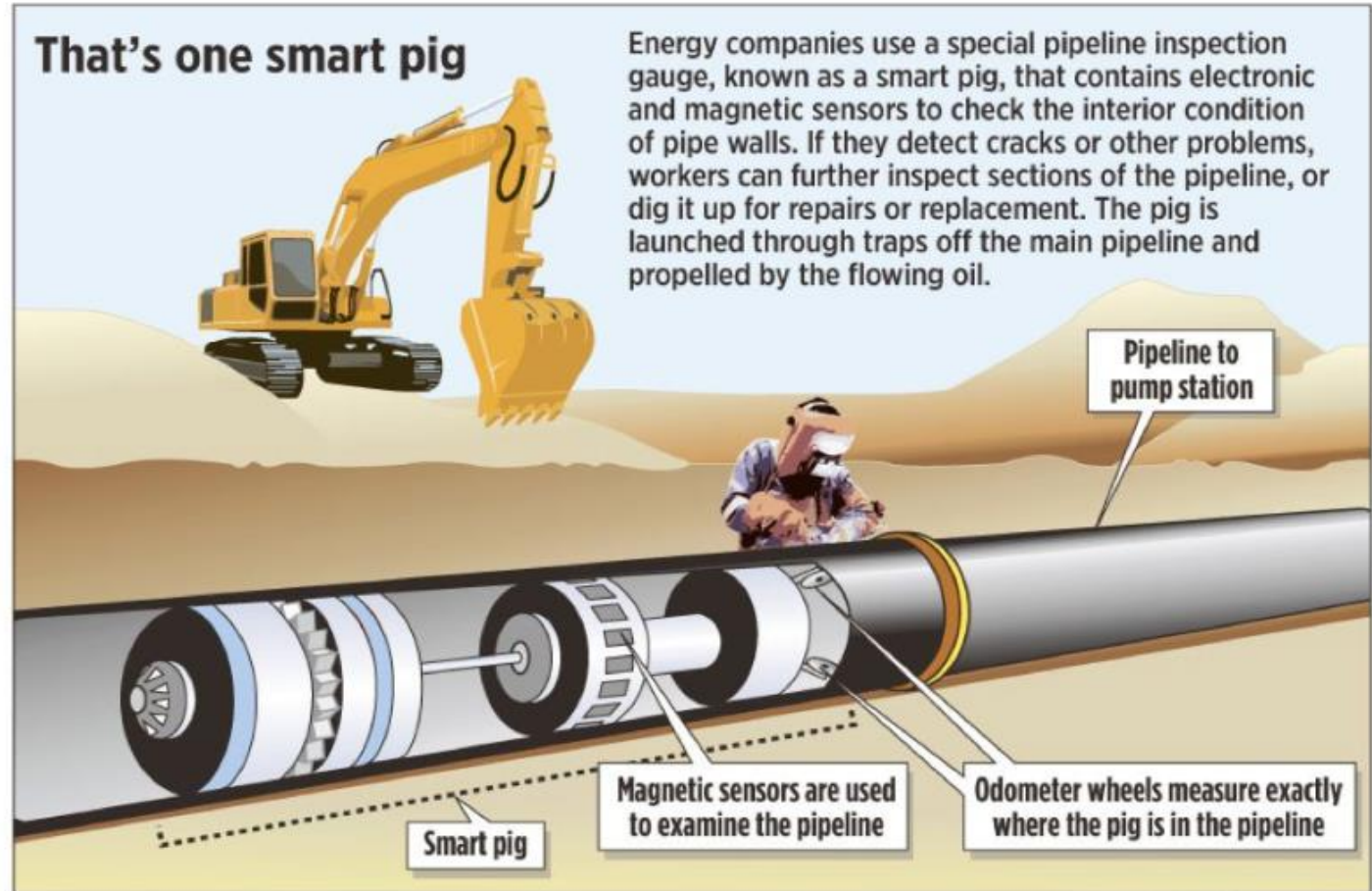
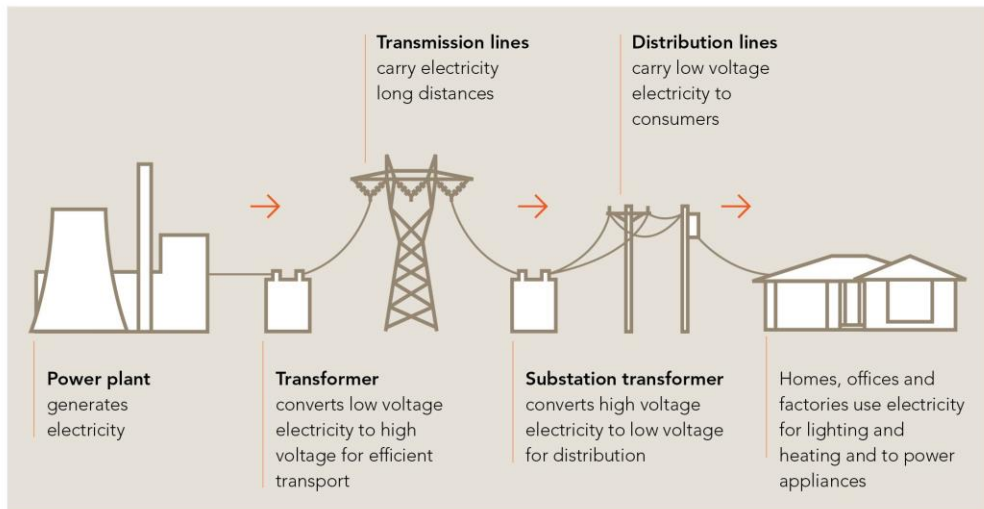Sensors in parking lot and driveways

Sector 2: Energy

- Flexible response in energy production and supply, management of power plants, quality control and management of energy resources such as wind, solar energy, thermal power, hydroelectricity, etc.

- Intelligent systems manage oil and gas pipelines: pumps, pipes, valves, meters.
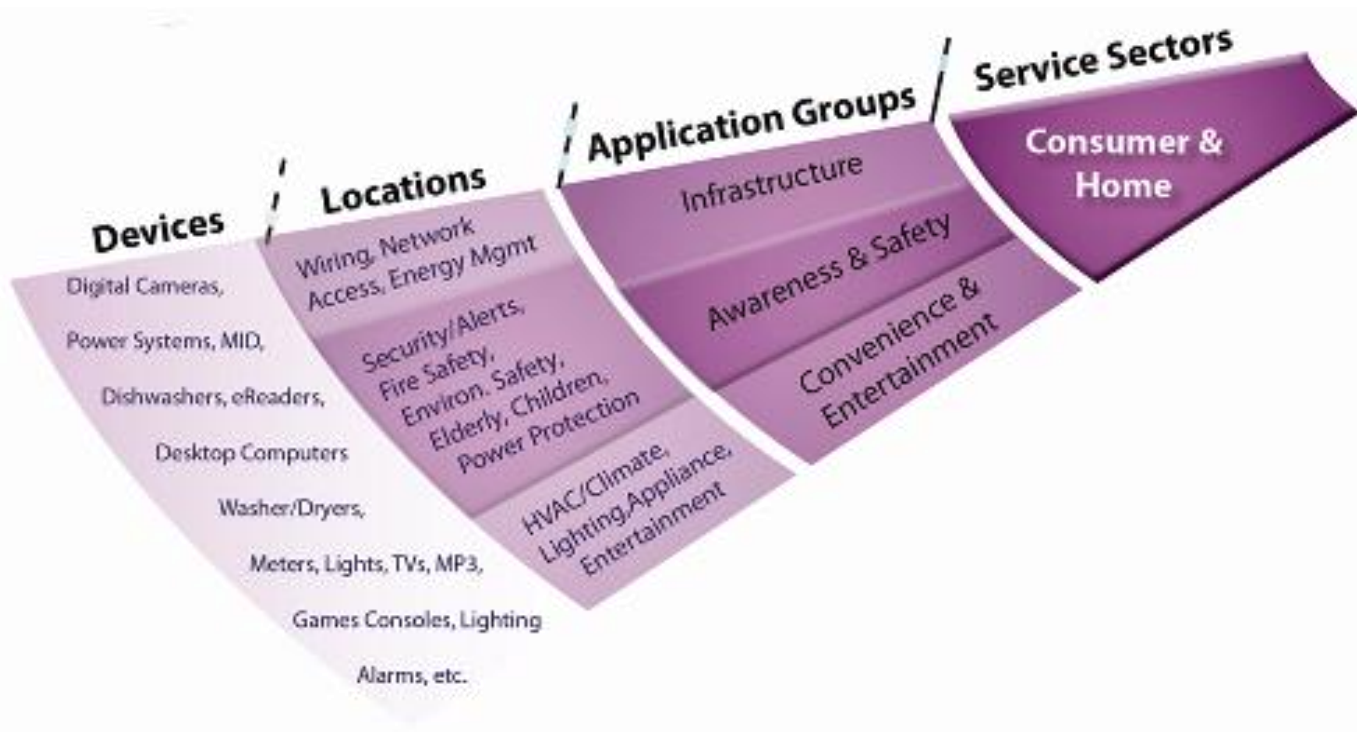
Sector 2: Energy

Transmission lines
carry electricity
long distances

Distribution lines
carry low voltage
electricity to
consumers

Power plant
generates
electricity

Transformer
converts low voltage
electricity to high
voltage for efficient
transport

Substation transformer
converts high voltage
electricity to low voltage
for distribution

Homes, offices and
factories use electricity
for lighting and
heating and to power
appliances

That's one smart pig

Energy companies use a special pipeline inspection
gauge, known as a smart pig, that contains electronic
and magnetic sensors to check the interior condition
of pipe walls. If they detect cracks or other problems,
workers can further inspect sections of the pipeline, or
dig it up for repairs or replacement. The pig is
launched through traps off the main pipeline and
propelled by the flowing oil.

Pipeline to
pump station

Magnetic sensors are used
to examine the pipeline

Odometer wheels measure exactly
where the pig is in the pipeline

Smart pig

STAFF GRAPHIC | MICHAEL FISHER

Sector 3: Smarthome

- Manage electricity, water, gas, network access, energy systems in smart homes

- Security protection, fire alarm, gas leak, anti-theft, child management

- Automatic control of room temperature, electric lighting system adapts to the environment

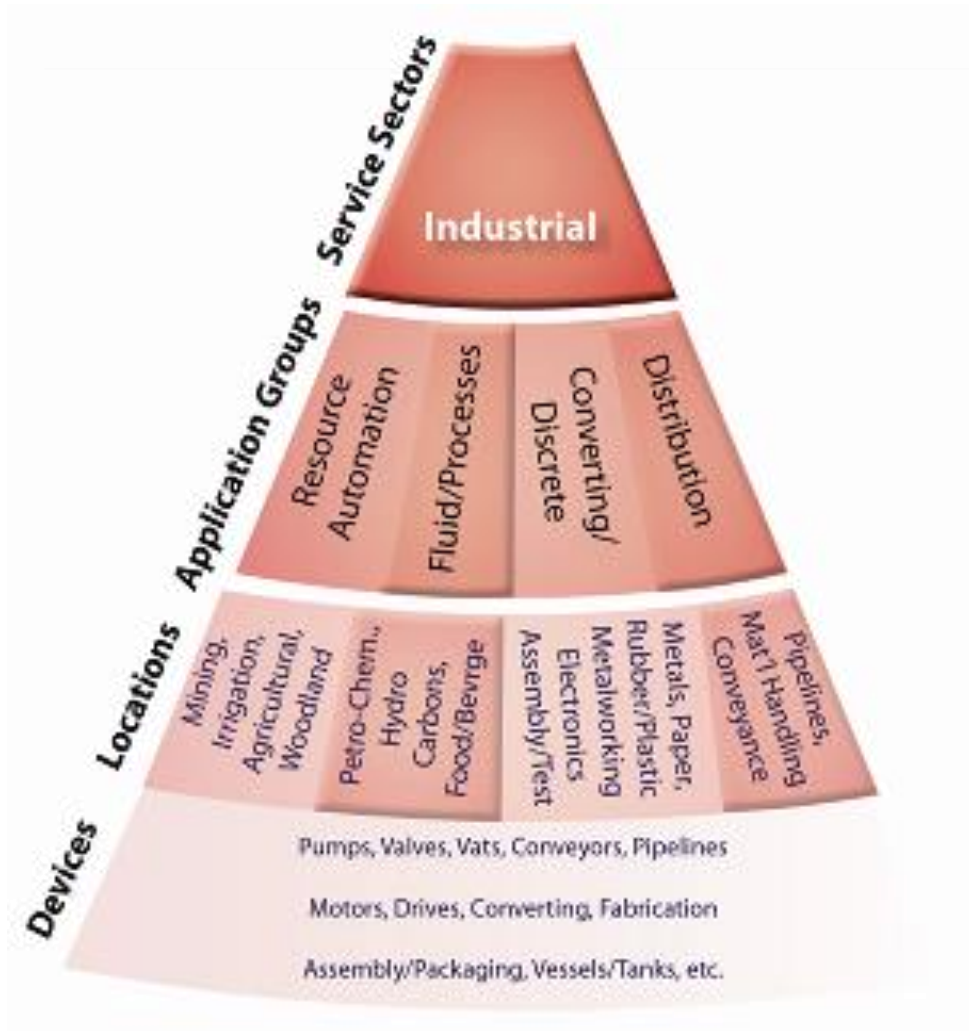- Other smart home applications

Smart Home

Sector 4: Healthcare & Life Science
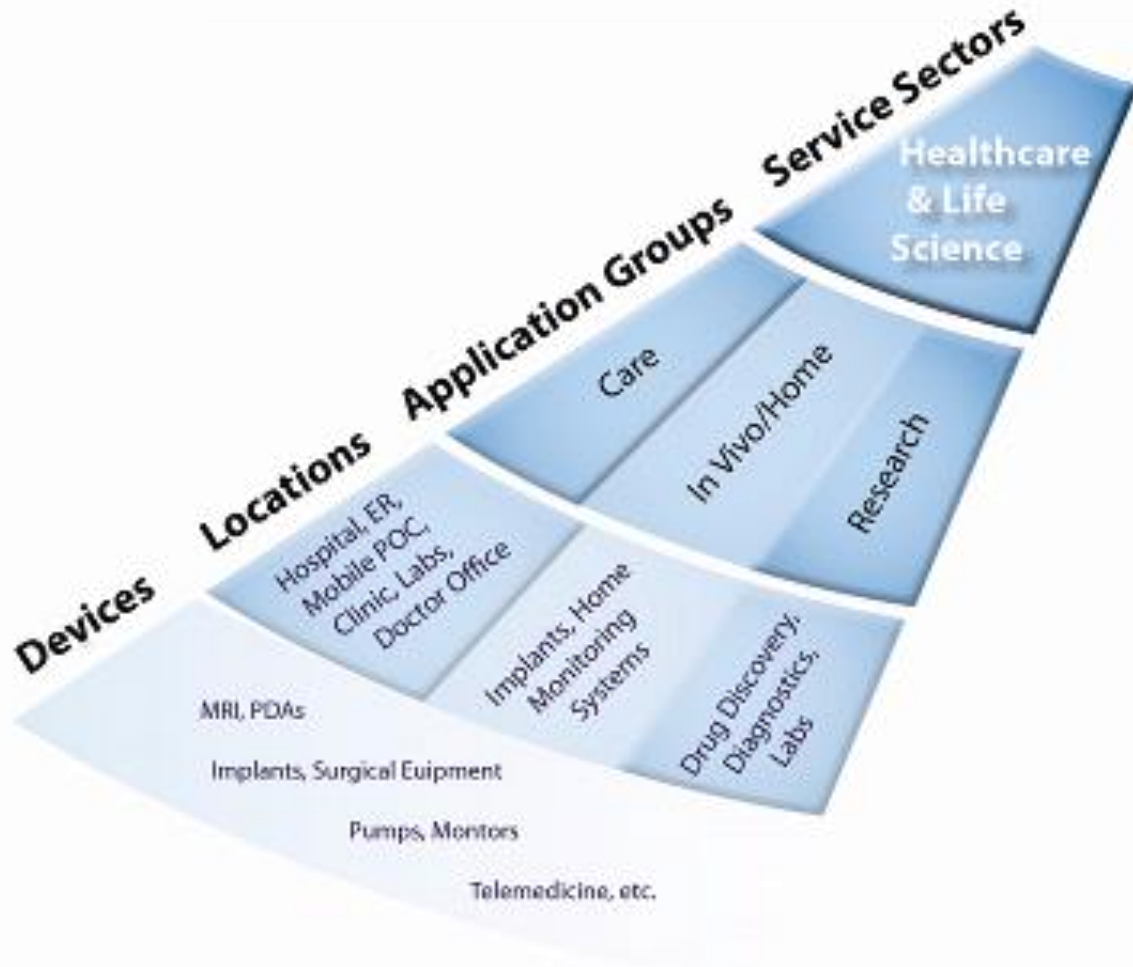
- Healthcare: apply IoT in hospitals, clinics, medical centers

- Ensure a safe living and working environment

- Applications in medical equipment

Sector 5: Industrial

- Management of industrial systems, tanks, production lines, packaging.

- Infrastructure management, supply chains

- Automation in high-tech agriculture, management of warehouses, factories, farms

IoT & Smart agriculture

Sensor-based field and resource mapping

Remote equipment monitoring

Remote crop monitoring

Predictive analytics for crops and livestock

Climate monitoring and forecasting
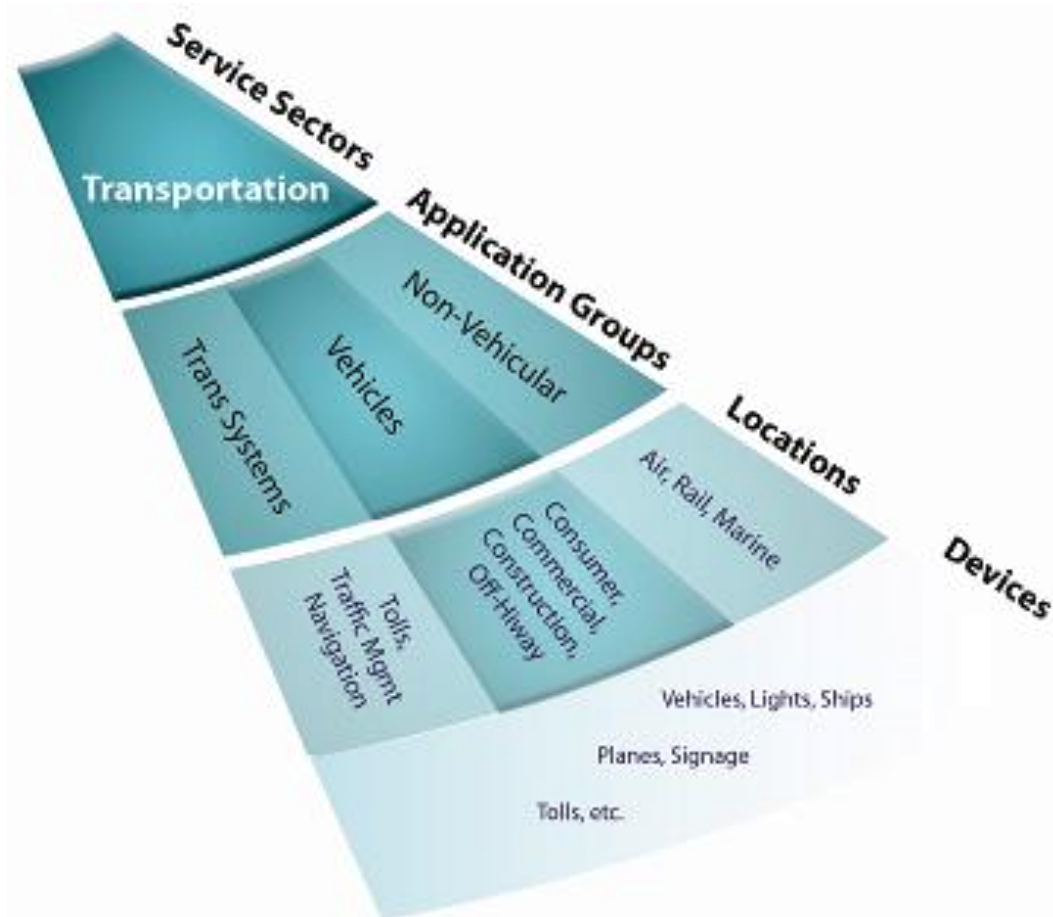
Livestock tracking and geofencing
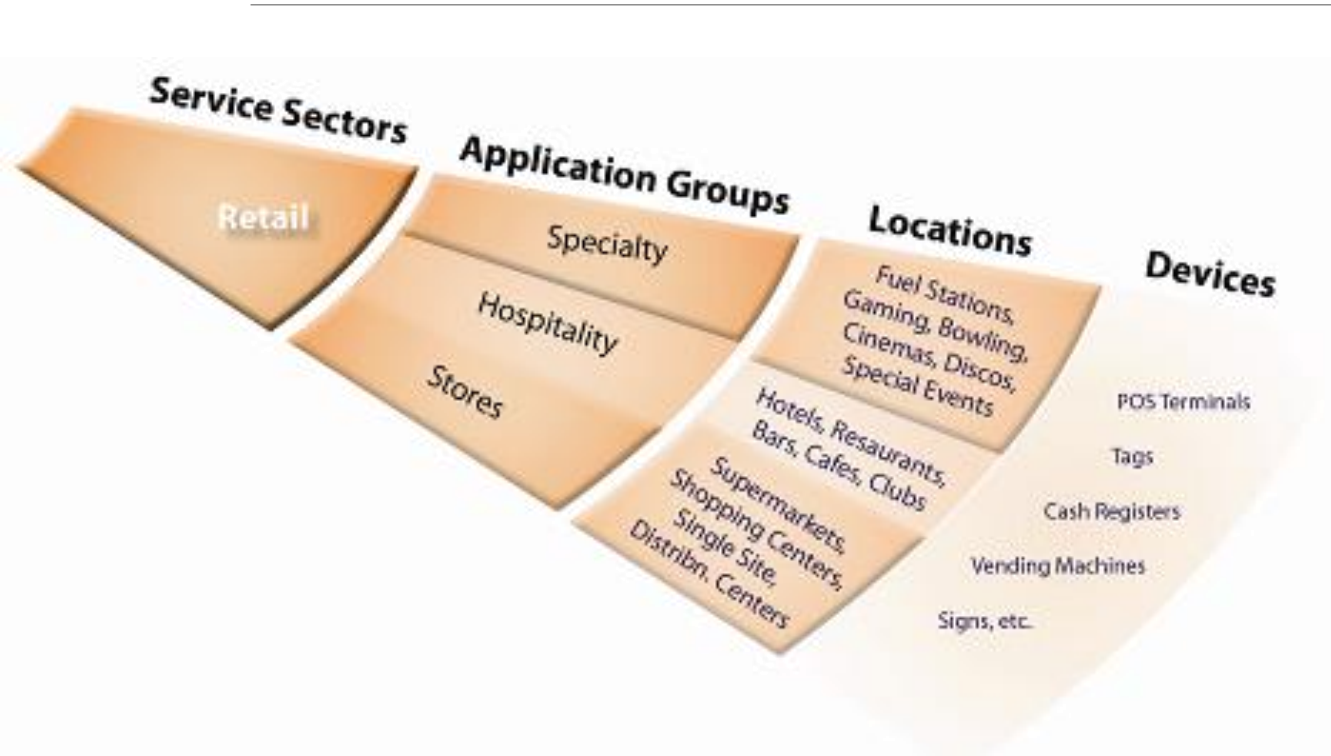
Stats on livestock feeding and produce

Smart logistics and warehousing

Sector 6: Transportation

- Road vehicles: Traffic management, equipment status analysis

- Autonomous vehicle

- Intelligent traffic management system, passenger information management, smart parking

Sector 7: Retail

Strengthening the supply chain, providing more information for products, vending machines, services such as gas stations, car washes, ..., entertainment, advertising screens

Stores: shopping malls, supermarkets

Entertainment services: including hotels, restaurants, bars, cafes, clubs.
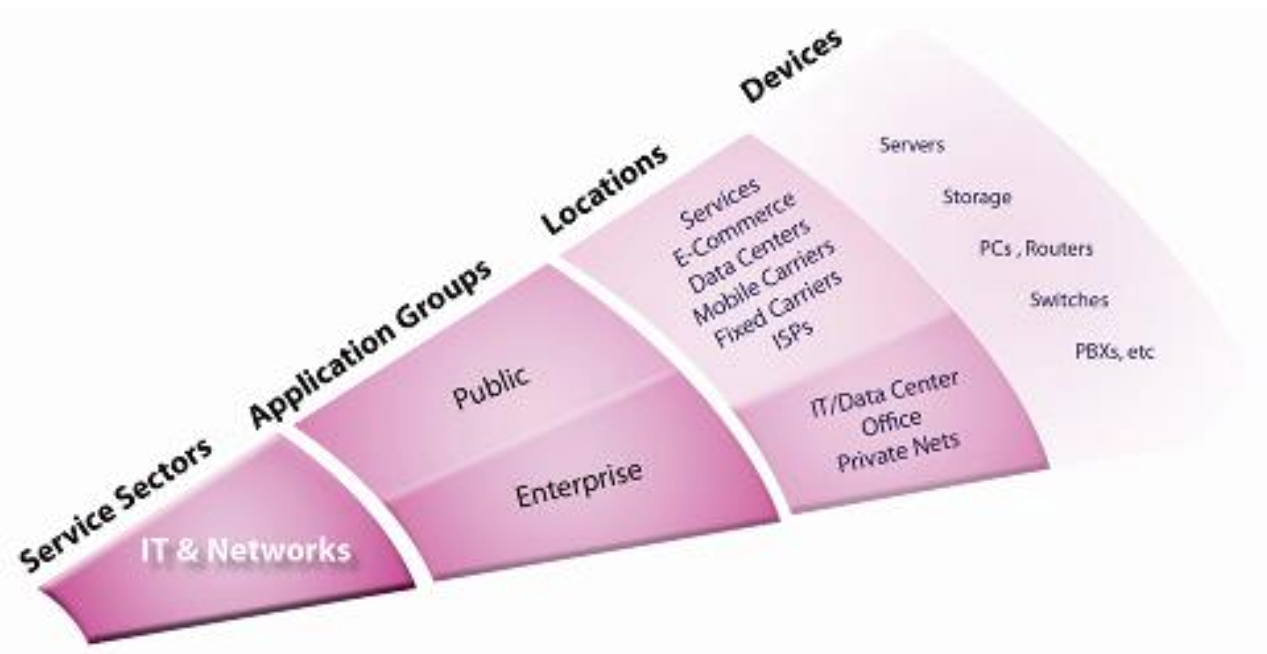
Sector 8: Security

Emergency services such as police, fire, ambulance, traffic accident detection, personal warning device.

CCTV, speed camera, detecting and tracking suspects, detecting theft, terrorism...

Military application equipment, weapons.

Sector 9: IT & Networks

Network of office equipment such as copiers, printers

Connection of smart devices to data centers

Control system of public broadcasting stations, signal towers, remote control systems

Challenges!

The issue of protecting personal information becomes very complicated

Ensure security for the entire system when there are many connected devices

Challenges!

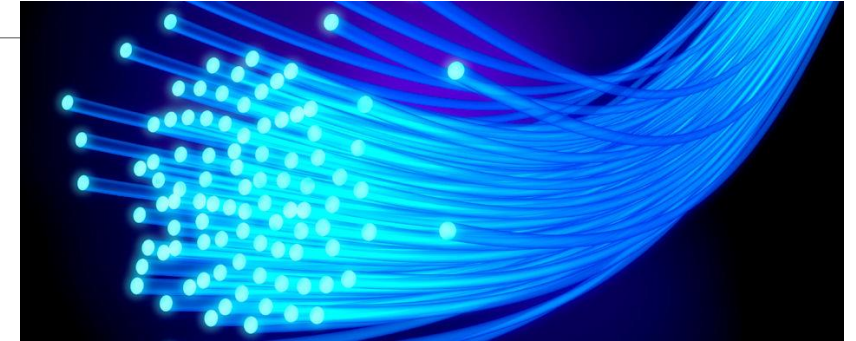Make sure millions of devices connect at the same time

Bandwidth coordination problem

Energy saving

Low cost

Make sure all equipment works stably

Find a common platform for all devices

The system needs to be designed with fast response and high load capacity

The advent of compact devices poses a problem of energy saving