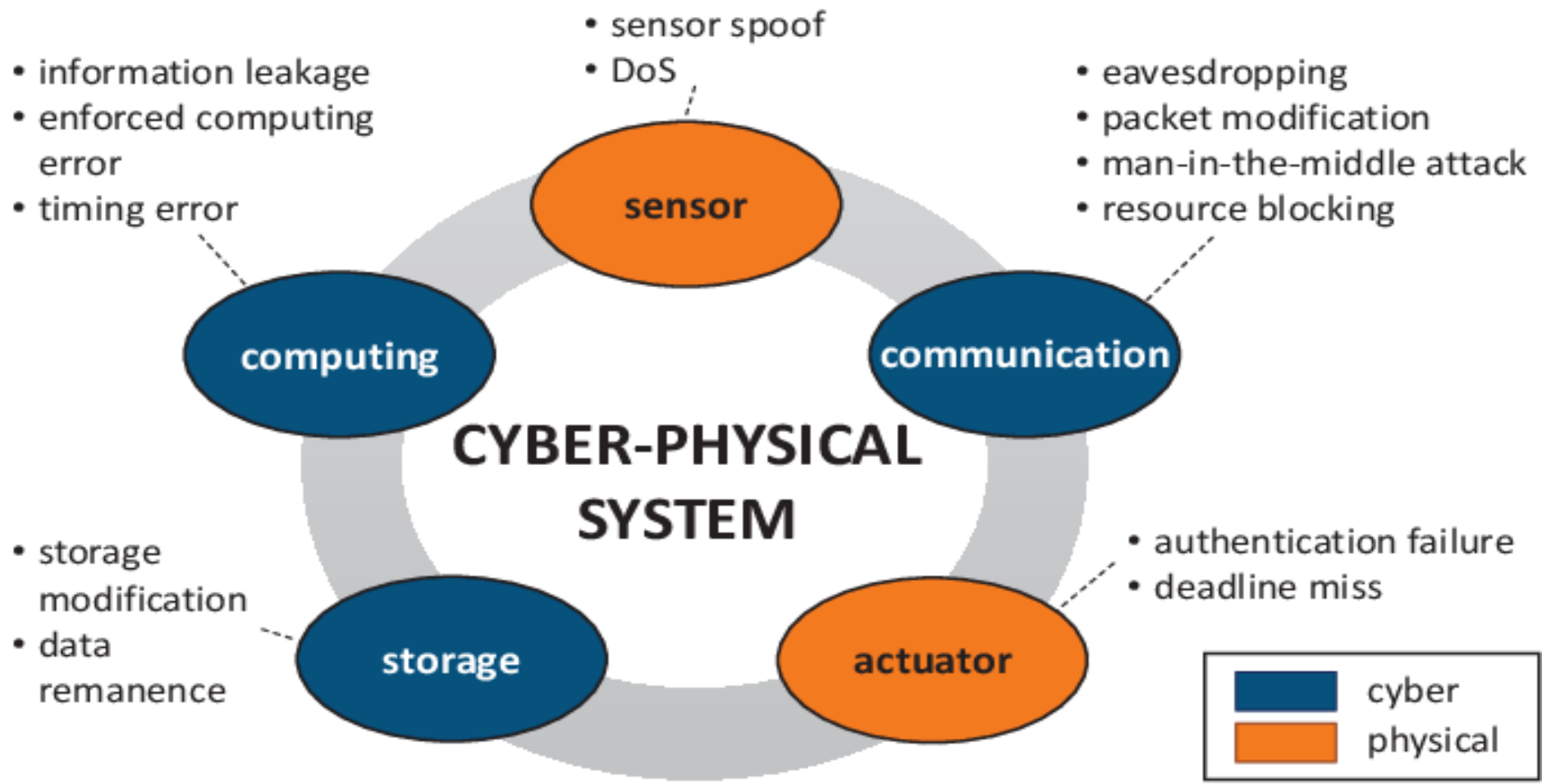
Cyber Physical Systems

UNIT 6

Cyber Physical Systems

- A cyberphysical system is a computer system in which a mechanism is controlled or monitored by computer-based algorithms
- **Cyber-Physical Systems** (CPS) are integrations of computation, networking, and **physical** processes. Embedded computers and networks monitor and control the **physical** processes, with feedback loops where **physical** processes affect computations and vice versa.
- **Cyber-Physical System** (CPS), a new generation of digital **system**, mainly focuses on complex interdependencies and integration between **cyberspace** and **physical** world. A CPS is composed of highly-integrated computation, communication, control, and **physical** elements.

Cyber Physical Systems



Internet of things

- The Internet of Things (**IoT**) refers to a system of interrelated, internet-connected objects that are able to collect and transfer data over a wireless network without human intervention. The personal or business possibilities are endless.
- In short, the Internet of Things refers to the rapidly growing network of connected objects that are able to collect and exchange data using embedded sensors. Thermostats, cars, lights, refrigerators, and more appliances can all be connected to the **IoT.**
- An **IoT** system consists of sensors/devices which “talk” to the cloud through some kind of connectivity. Once the data gets to the cloud, software processes it and then might decide to perform an action, such as sending an alert or automatically adjusting the sensors/devices without the need for the user.
- The **IoT** provides a platform that creates opportunities for people to connect these devices and control them with big data technology, which in return will promote efficiency in performance, economic benefits and minimize the need for human involvement. It's the most **important** development of the 21st century.

IOT

- The Internet of Things (IOT) is a worldwide network of intercommunicating devices. It integrates the ubiquitous communications, pervasive computing, and ambient intelligence. IOT is a vision where “things”, especially everyday objects, such as all home appliances, furniture, clothes, vehicles, roads and smart materials, etc. are readable, recognizable, locatable, addressable and/or controllable via the Internet.

History of IoT

The concept of the Internet of Things first became popular in 1999, through the Auto-ID Center at MIT and related market-analysis publications.

Radio-frequency identification (RFID) was seen as a prerequisite for the IoT at that point. If all objects and people in daily life were equipped with identifiers, computers could manage and inventory them. Besides using RFID, the tagging of things may be achieved through such technologies as near field communication, barcodes, QR codes, bluetooth, and digital watermarking.

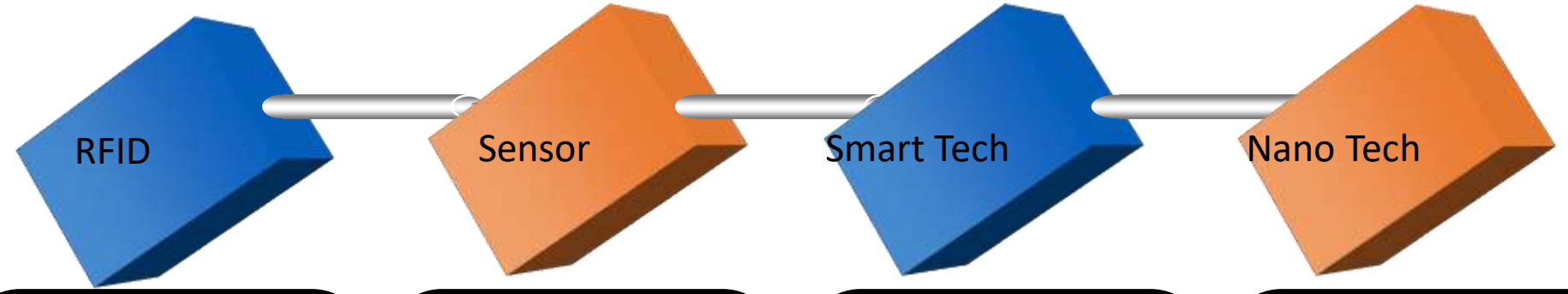
How IoT Works?

Internet of Things is not the result of a single novel technology; instead, several complementary technical developments provide capabilities that taken together help to bridge the gap between the virtual and physical world.

These capabilities include:

- ***Communication and cooperation***
- ***Addressability***
- ***Identification***
- ***Sensing***
- ***Actuation***
- ***Embedded information processing***
- ***Localization***
- ***User interfaces***

How IoT Works?



To identify and track the data of things	To collect and process the data to detect the changes in the physical status of things	To enhance the power of the network by devolving processing capabilities to different part of the network.	To make the smaller and smaller things have the ability to connect and interact.

Cloud Computing

- Simply put, **cloud computing** is the delivery of **computing** services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet ("the **cloud**") to offer faster innovation, flexible resources, and economies of scale.
- **Cloud computing** is the on-demand availability of **computer** system resources, especially data storage (**cloud** storage) and **computing** power, without direct active management by the user. The term is generally used to describe data centers available to many users over the Internet.
- A **simple** definition of **cloud computing** involves delivering different types of services over the Internet. ... You can access it from just about any computer that has internet access. For businesses, **cloud computing** means improved collaboration and productivity, as well as significant cost reductions.

Important applications of IOT

- **Wearables.**

- **Virtual glasses, fitness bands to monitor for example calorie expenditure and heart beats, or GPS tracking belts, are just some examples of wearable devices that we have been using for some time now**. Companies such as Google, Apple, Samsung and others have developed and introduced the Internet of Things and the application thereof into our daily lives.
- These are small and energy efficient devices, which are equipped with sensors, with the necessary hardware for measurements and readings, and with software to collect and organize data and information about users.

Health.

- The use of wearables or sensors connected to patients, allows doctors to monitor a patient's condition outside the hospital and in real-time. Through continuously monitoring certain metrics and automatic alerts on their vital signs, **the Internet of Things helps to improve the care for patients and the prevention of lethal events in high-risk patients.**
- Another use is the integration of IoT technology into hospital beds, giving way to smart beds, equipped with special sensors to observe vital signs, blood pressure, oximeter and body temperature, among others.


TELEHEALTH
SMART PILLS
IoT for Healthcare
INTERNET OF HEALTH THINGS
TRACKING HARDWARE PERFORMANCE
REAL TIME HEALTH SYSTEMS

Agriculture

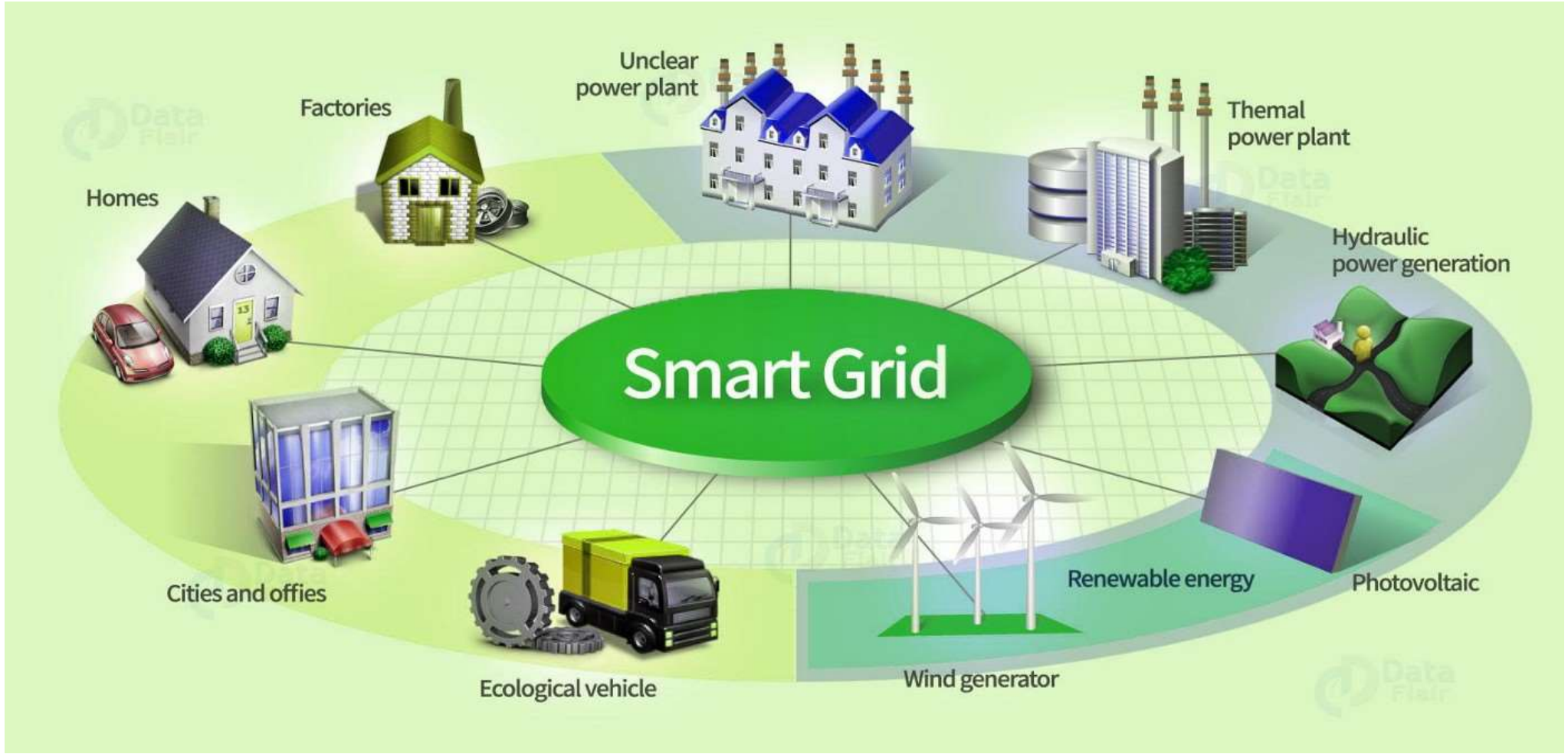
- Smart farms are a fact. The quality of soil is crucial to produce good crops, and the Internet of Things offers farmers the possibility to access detailed knowledge and valuable information of their soil condition.
- **Through the implementation of IoT sensors, a significant amount of data can be obtained on the state and stages of the soil.** Information such as soil moisture, level of acidity, the presence of certain nutrients, temperature and many other chemical characteristics, helps farmers control irrigation, make water use more efficient, specify the best times to start sowing, and even discover the presence of diseases in plants and soil.


IOT in Agriculture
DreamzTech Solutions
Diagnosis of Diseases
Variable rate of Fertility
Auto Spreading
Water Stress
Crop yield Analysis
Smart Data
Soil Erosion
Field Monitoring
Wednesday:
Hi: 90°F
Lo: 72°F
Thursday:
83°F
So far today:
Hi: 88°F Lo: 71°F
Rain: 0"
Gust: 6mph S
Heat Index: 89°F
Humidity: 72%
Dew Point: 73°F

Smart grid and energy saving

- The progressive use of intelligent energy meters, or meters equipped with sensors, and the installation of sensors in different strategic points that go from the production plants to the different distribution points, allows better monitoring and control of the electrical network.
- IoT can be used in customer side in smart meters to measure different types of parameters, intelligent power consumption, interoperability between different networks, charging and discharging of electric vehicles, manage energy efficiency and power demand.
- By establishing a bidirectional communication between the service provider company and the end user, information of enormous value can be obtained for the detection of faults, decision making and repair thereof.
- It also allows offering valuable information to the end user about their consumption patterns and about the best ways to reduce or adjust their energy expenditure.

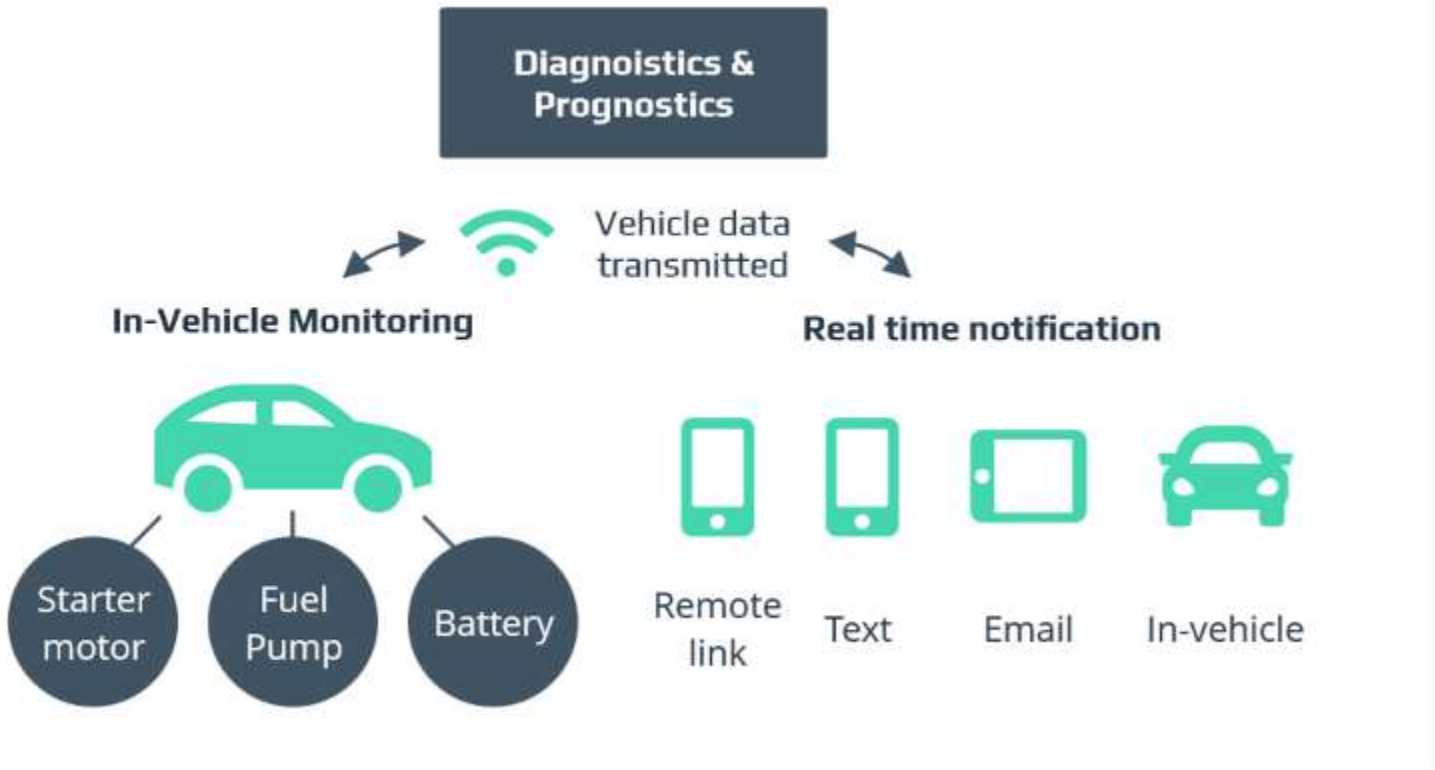
Smart Grid


Unclear
power plant
Factories
Themal
power plant
Homes
Hydraulic
power generation
Smart Grid
Cities and offies
Renewable energy
Photovoltaic
Ecological vehicle
Wind generator

IOT in automobiles

- **IoT** infused semi-autonomous cars take on-spot decisions while partly controlling the vehicle operations to avoid accidents and reduce the load from the driver. Along with different proximity sensors and cameras, cars are integrated with **IoT** systems to reduce human error and make driving more comfortable and safe.

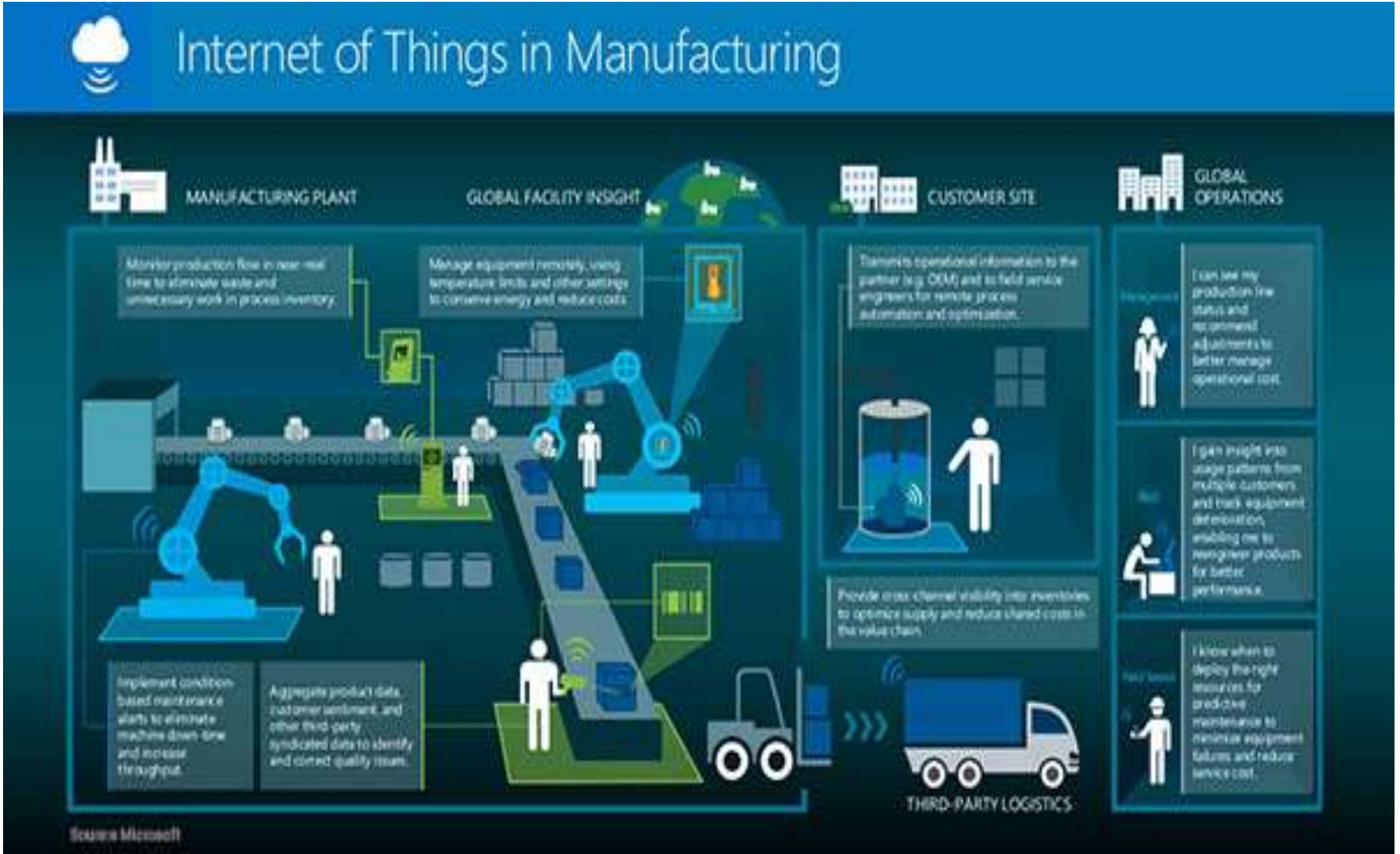
IOT in automobiles



Manufacturing

- Industrial Internet of Things (IIoT) is a way to digital transformation in **manufacturing**. Industrial **IoT** employs a network of sensors to collect critical **production** data and uses cloud software to turn this data into valuable insights about the efficiency of the **manufacturing** operations.

Internet of Things in Manufacturing



Quick Quiz (Poll 1)

- Point out the correct statement regarding Cloud computing:

a) A client can request access to a cloud service from any location
b) A cloud has multiple application instances and directs requests to an instance based on conditions
c) Computers can be partitioned into a set of virtual machines with each machine being assigned a workload
d) All of the mentioned

Quick Quiz (Poll 2)

- PWM stands for:

a) None of the above
b) Pulse Width Mode
c) Pulse With Modulation
d) Pulse Width Modulation