UNIT 1: 12M

1. INDUSTRIAL INTERENT SYSTEM

Industrial Internet system:

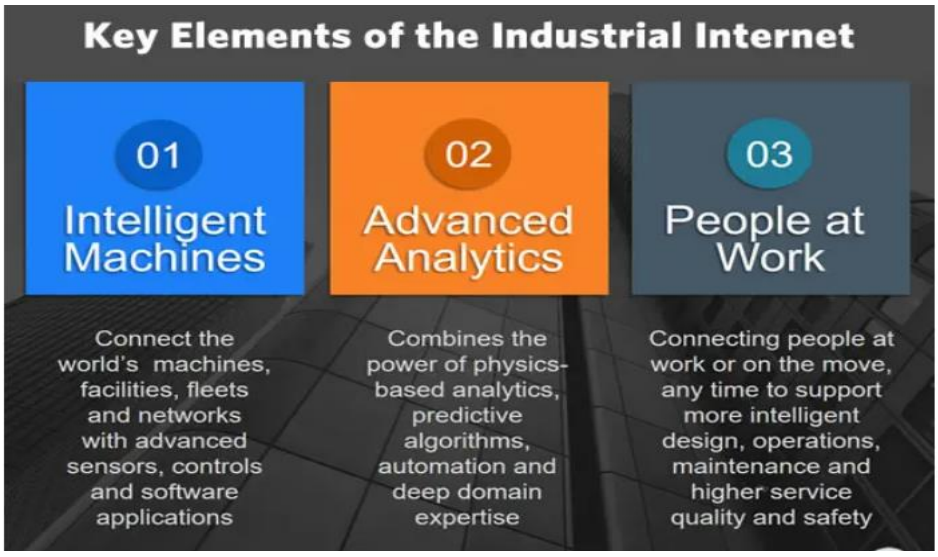
- The Industrial Internet is the integration and linking of big data, analytical tools and wireless networks with physical and industrial equipment, or otherwise applying meta-level networking functions, to distributed systems.
- The term was coined by General Electric (GE), a U.S. corporation.

Explains Industrial Internet:

- The Industrial Internet incorporates ideas of intelligent machines, or specific pieces of equipment, with embedded technology and the Internet of Things (IoT).

- Examples are pieces of machinery or vehicles that are equipped with intelligent technologies, including machine to machine (M2M) technologies that allow manufacturing equipment or other types of equipment to send data back and forth, or "talk among themselves."

- The Industrial Internet also is applied to transportation projects, such as driverless (or autonomous) cars and intelligent railroad systems..



2. INDUSTRY 4.0:

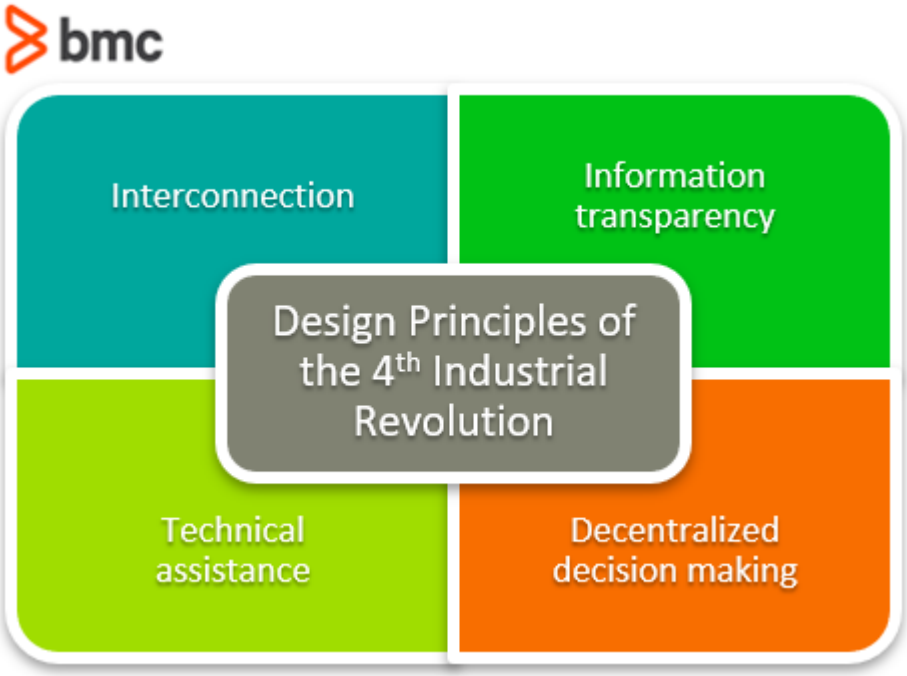
- Industry 4.0 is used interchangeably with the fourth industrial revolution and represents a new stage in the organization and control of the industrial value chain.

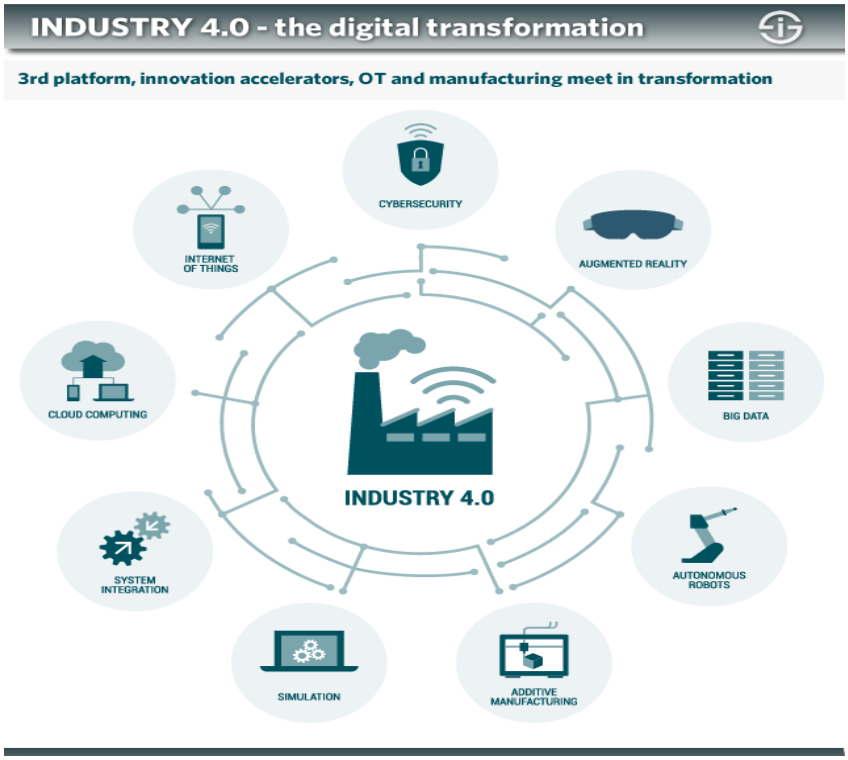
- Cyber-physical systems form the basis of Industry 4.0 (e.g., ‘smart machines’). They use modern control systems, have embedded software systems and dispose of an Internet address to connect and be addressed via the Internet of Things (IoT).
- This way, products and means of production get networked and can ‘communicate’, enabling new ways of production, value creation, and real-time optimization.

- Cyber-physical systems create the capabilities needed for smart factories.
- These are the same capabilities we know from the Industrial Internet of Things like remote monitoring or track and trace, to mention two.

Fourth industrial revolution

- We are now in the fourth industrial revolution, also referred to as Industry 4.0. Characterized by increasing automation and the employment of smart machines and smart factories, informed data helps to produce goods more efficiently and productively across the value chain.
- Flexibility is improved so that manufacturers can better meet customer demands using mass customization—ultimately seeking to achieve efficiency with, in many cases, a lot size of one





Industry 4.0 is often used interchangeably with the notion of the fourth industrial revolution. It is characterized by, among others,

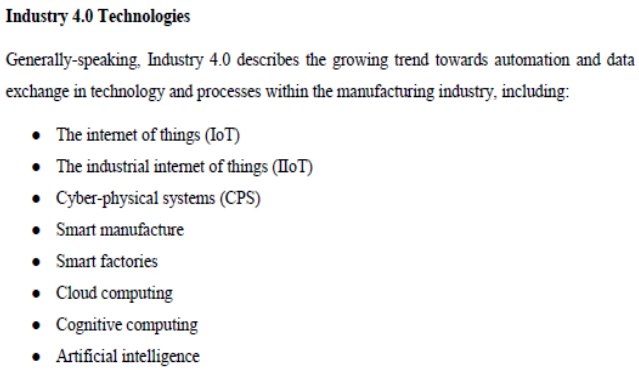
- even more automation than in the third industrial revolution,
- the bridging of the physical and digital world through cyber-physical systems, enabled by Industrial IoT,
- a shift from a central industrial control system to one where smart products define the production steps,
- closed-loop data models and control systems and
- personalization/customization of products.

Industry 4.0 is the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, the Internet of things and cloud computing. Industry 4.0 creates what has been called a "smart factory".

Industry 4.0 challenges and risks

- The definition of a strategy (for Industry 4.0), challenge number one.

- The rethinking of the organization and processes to maximize outcomes.
- Understanding the business case.
- Conducting successful pilots.
- Making the organization realize action is needed.
- Change management, so often overlooked.
- Company culture.
- A true interconnection of departments.



Industry 4.0 Technologies

Generally-speaking, Industry 4.0 describes the growing trend towards automation and data exchange in technology and processes within the manufacturing industry, including:

- The internet of things (IoT)
- The industrial internet of things (IIoT)
- Cyber-physical systems (CPS)
- Smart manufacture
- Smart factories
- Cloud computing
- Cognitive computing
- Artificial intelligence

3. Industrial internet of things (IIoT):

- The industrial internet of things (IIoT) is the use of smart sensors and actuators to enhance manufacturing and industrial processes.
- Also known as the industrial internet or Industry 4.0, IIoT uses the power of smart machines and real-time analytics to take advantage of the data that "dumb machines" have produced in industrial settings for years.
- IIoT is the use of those connected technologies to enhance manufacturing and industrial processes.
- It utilizes software, sensors, data systems, and more in manufacturing to improve speed, efficiency, and business performance.

- The worldwide market for the IoT was $16.3 billion in 2016 but is expected to reach $185.9
    - billion by 2023, illustrating the relevancy of IoT for all industries during the coming years and decades.

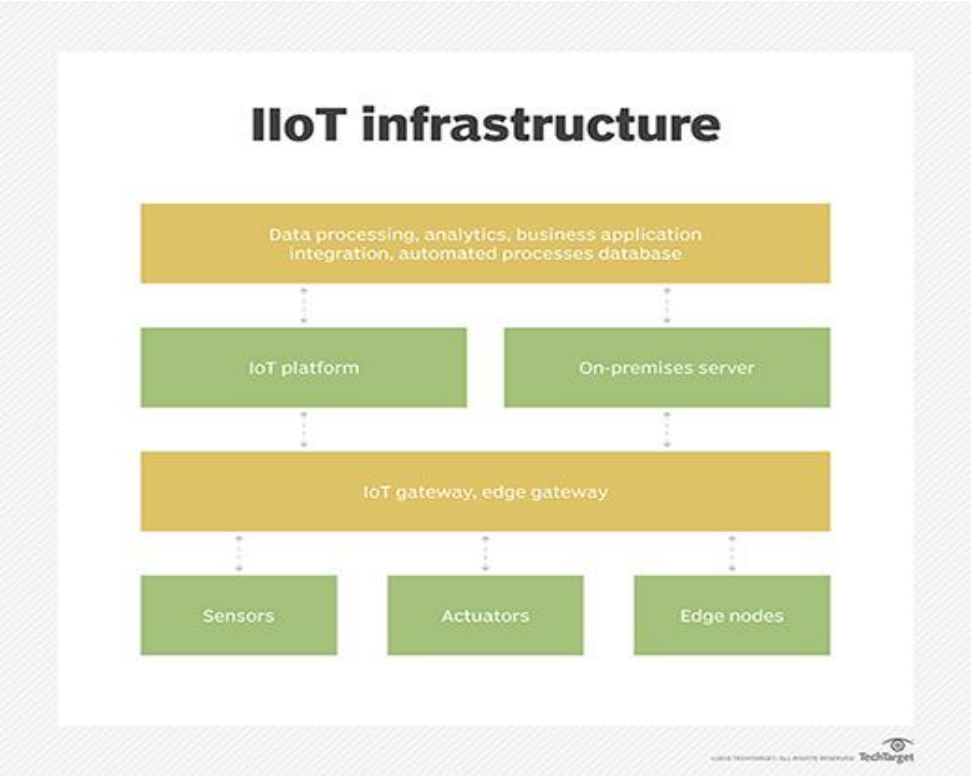
IIoT working:

IIoT is a network of intelligent devices connected to form systems that monitor,collect, exchange and analyze data. Each industrial IoT ecosystem consists of:

● connected devices that can sense, communicate and store information about themselves;

● public and/or private data communications infrastructure;

● analytics and applications that generate business information from raw data; storage for the data that is generated by the IIoT devices; and people.



some examples of common IIoT use cases available today:

- Preventive maintenance
- Predictive maintenance
- Energy consumption monitoring
- Batch optimization
- Proportional-integral-derivative (PID) loop

Benefits of IIoT

- Increase efficiency
- Reduce Errors
- Predictive Maintenance
- Improve Safety
- Reduce Costs

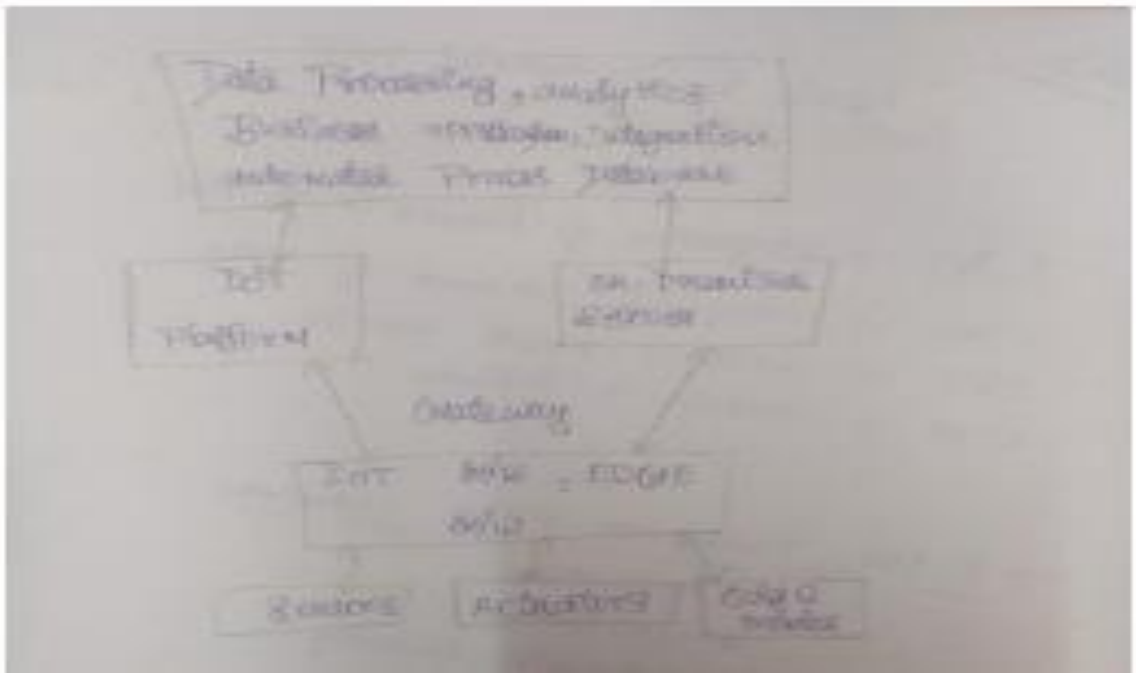
→ I IoT Transforms many Industries :-

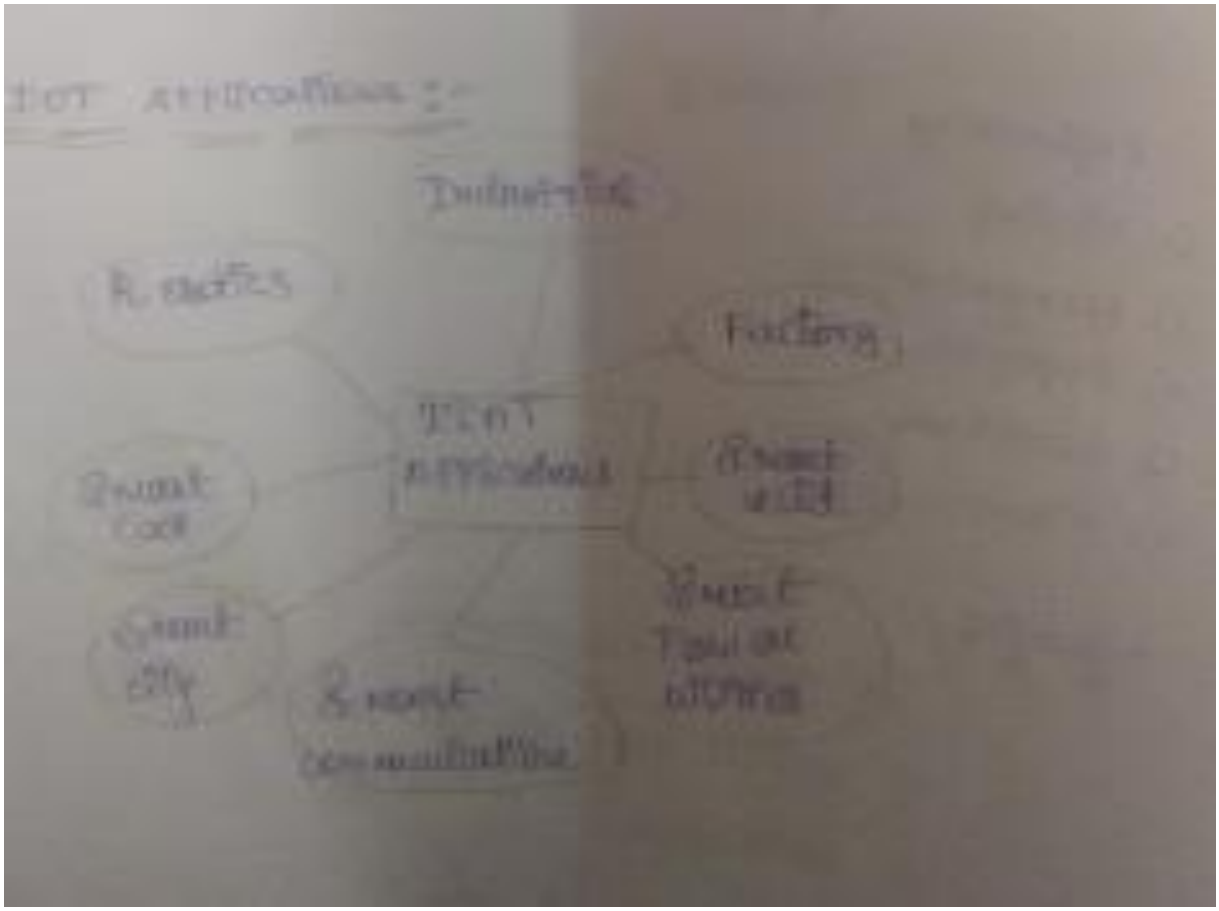
* agriculture
* temperatures
* automative Industry.

1) Engineering Industry
2) Mining
3) Manufacturing
4) Logistics.
5) Healthcare
6) others - Bank ATM etc...

→ Benefits :-

1) Predictive maintenance & connected devices
2) optimization of operational Efficiency
3) optimization of Process





4.BASIC PRINCIPLES OF DESIGN AND VALIDATION OF CPS

- The core principle of CPS is the bridging of engineering and physical world applications and the computer engineering hardware and computer science cyber worlds.
- Basic principles of the physical world include elements of physics, modeling, and real-world intangibles such as uncertainty and risk.
- They are the primary devices that collect data from the physical world that are then used as input to the cyber world.
- The required principles of signal processing include linear signals and systems theory, analog and digital filtering, time and frequency domain analysis, Once raw data are collected, they are processed via signal processing techniques.
- The required principles of signal processing include linear signals and systems theory, analog and digital filtering, time and frequency domain analysis, convolution,linear transforms like the discrete Fourier transform and fast Fourier transform,

Communication and networking.

- CPS requires an understanding from physical-layer principles to protocols, layered architectures, and the many real-world properties of wireless communications.

Real time.

- An understanding of topics like real-time scheduling theory, temporal semantics in programs, and clock synchronization in networks is needed.

Distributed systems.

- The distributed and networked nature of CPS in many of the applications of interest should be included in CPS education.
- CPS combines the hardware implementation with the software that runs the algorithms, all operating in a natural world setting.

Embedded systems.

- A strong education and training on the principles of embedded software, the many principles of programming, algorithms, software design, formal methods, and platforms (architectures and operating systems) are necessary to enable the development of reliable and high-quality cyber components of a CPS system.

Physical properties.

- It is important to understand and be able to model the physical properties of the environments and hardware platforms.

Human interaction.

- Human factors design, human-in-the-loop control, and understanding and accounting for the behavioral responses of humans are important for many CPS.
- One important design issue is making CPS easy for humans to operate, control, and maintain.
- Similar to other engineering disciplines, hands-on projects and interdisciplinary teamwork are also fundamental to understanding and seeing core principles applied.

5.write a short note on collaborative platform and analytics for smart business transformation

What is analytic transformation in business?

Businesses that embrace analytics technology **transform their business models, and encounter new opportunities for customers, products, revenue streams, and services**. From sourcing materials and forecasting demand to the accounting and human resource activities, every aspect of the business can be with analytics.

2 Smart Analytics is **precisely analyzing in a smart and profitable manner all that volume of information**, which was impossible to do using traditional analysis methods. The goal behind Smart Analytics is to make the most out of all that information that is meaningless when served raw, but when correctly treated and analyzed, may imply a paramount change in the balance sheet of our company.

3 The smart analysis of Big Data is also **transforming the business world**. According to data presented by the CeBIT organization –the most important computer, information technology, telecommunications, software and services fair in the world– companies that use Big Data Analytics programs **are capable of making decisions five times faster** than those that do not work with Big Data. Moreover, 50% of the companies that do analyze Big Data ensure that this action lets them get a better grasp on consumer demand, boosting company growth.

Internet of Things (IoT): Smart Analytics

This concept refers to the **digital interconnection of everyday objects with the internet**, such as, for example, a refrigerator or a car. In this regard, according to the Gartner technology research company, by 2020 there will be approximately 20.4 billion "things" connected to the internet. The purpose of the "Internet of Things" is to **make our lives easier** in that it will be the objects themselves that make decisions and execute actions without the need for human intervention. One practical example could be a refrigerator connected to the internet that, once it has detected that milk has ran out, places an order to replenish it. We are faced with a reality in which "smart" machines will completely revolutionize the entire industry and market.

The "Internet of Things" will digitalize everything in the real world and integrate it to the internet. Therefore, the challenge lies in being able to collect and analyze the entire stream of information heading our way. Again, the concept of IoT data analytics reappears, which will be closely related to Big Data analysis. In this landscape, a real-time data analysis that enables us to make smart decisions instantaneously gains.