Module 1 : Introduction to Industry 4.0

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MODULE OUTLINE

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MODULE 1.4

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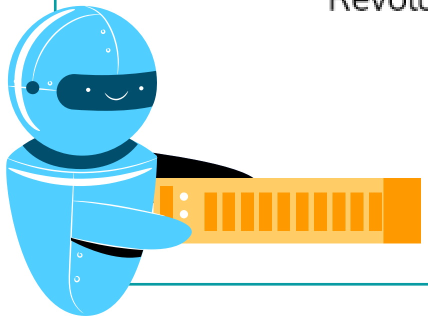

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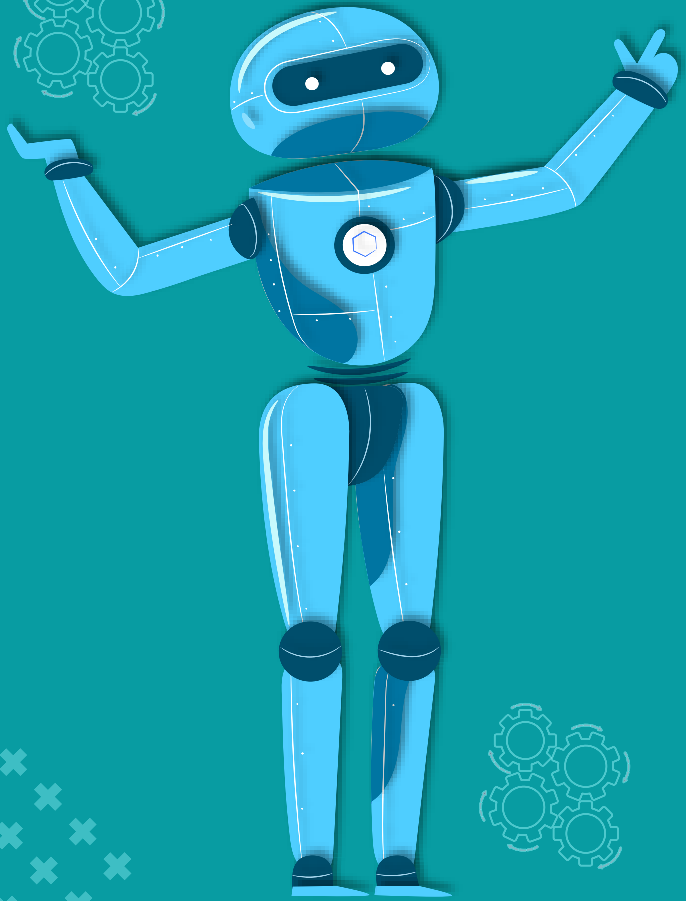


Industrial Revolution

- First Industrial Revolution
- Technology Evolution in 1^{st} Industrial Revolution
- Second Industrial Revolution
- Third Industrial Revolution
- Technology Evolution in the 3rd Industrial Revolution
- Complexity of Industrial Revolution

1.1 Industrial Revolution

1.1.1 First Industrial Revolution

- The industrial revolution in **Britain** came in to introduce machines into production by the end of the **18th century (1760-1840)**. This included going from manual production to the use of **steam-powered engines** and **water** as a **source of power.**

- The term **"factory"** were introduced and the industry that benefited a lot from such changes is the **textile industry**.

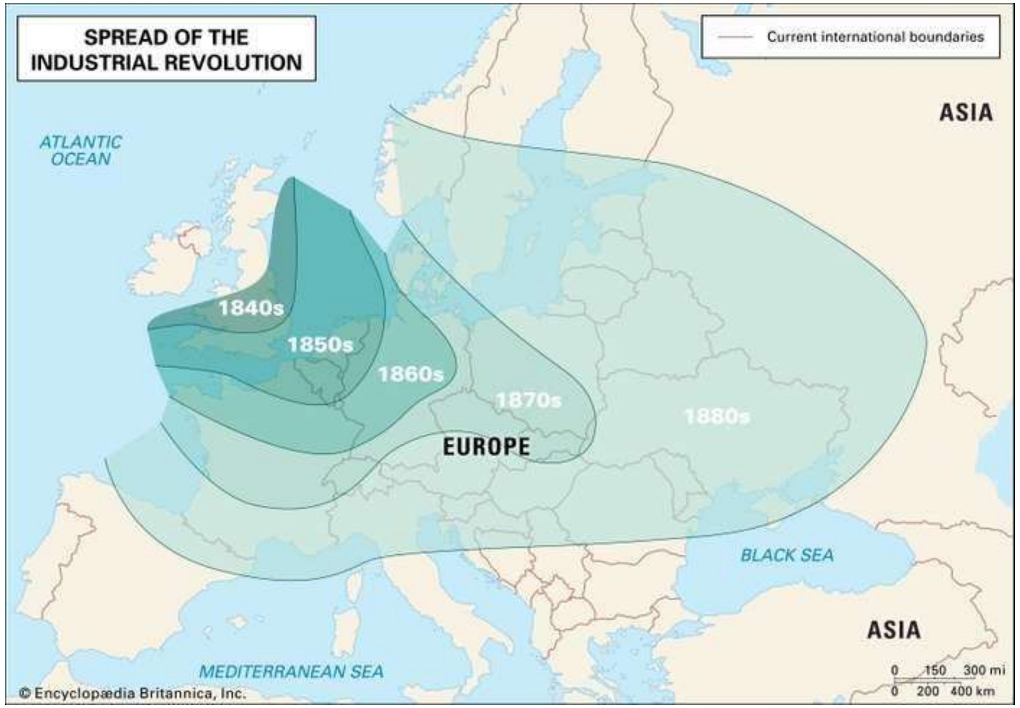


Figure 1: Industrial Revolution *Encyclopædia Britannica, Inc./Kenny Chmielewski*

1.1.2 Technology Evolution in the 1st Industrial Revolution

- **Waterwheel** or **watermill** is a mechanical device that converts the motion of a falling or running water on a set of paddle mounted on the wheels into energy.
- The rotation of the wheel is transmitted to machinery via the shaft of the wheel.
- The invention of the waterwheel **replaces the use of human labour and animals in moving a rotary mechanical devices** and it was exploited for tasks such as water lifting, fulling cloth and grinding grain.

Figure 2: Watermill

1.1.2 Technology Evolution in the 1st Industrial Revolution

- The start of Industrial Revolution was with the invention of **steam powered engine**.
- It all started in a **coal mine**, where people started to mine coal as a source of fuel. **Thomas Newcomen** designed the prototype for the first modern steam engine. Called the "atmospheric steam engine," Newcomen's invention was originally **applied to power the machines used to pump water out of mine shafts**.
- Then, **James Watt** began tinkering with one of Newcomen's models. Watt later collaborated with **Matthew Boulton** to **invent a steam engine with a rotary motion**, a key innovation that would allow steam power to spread across British industries, including flour, paper, and cotton mills, iron works, distilleries, waterworks and canals.
- The invention of steam engines were exploited into the steam locomotive and steamships.

Figure 3: Steam powered train

1.1.2 Technology Evolution in the 1st Industrial Revolution

- The **power loom** is a **mechanized device used to weave cloth and tapestry.**
- It was one of the key developments in the industrialization of wavering during the early Industrial Revolution.
- The first loom was designed in **1784 by Edmund Cartwright**, but it was built in 1785.
- The invention of power loom sped up the process of the **textile manufacturing.**

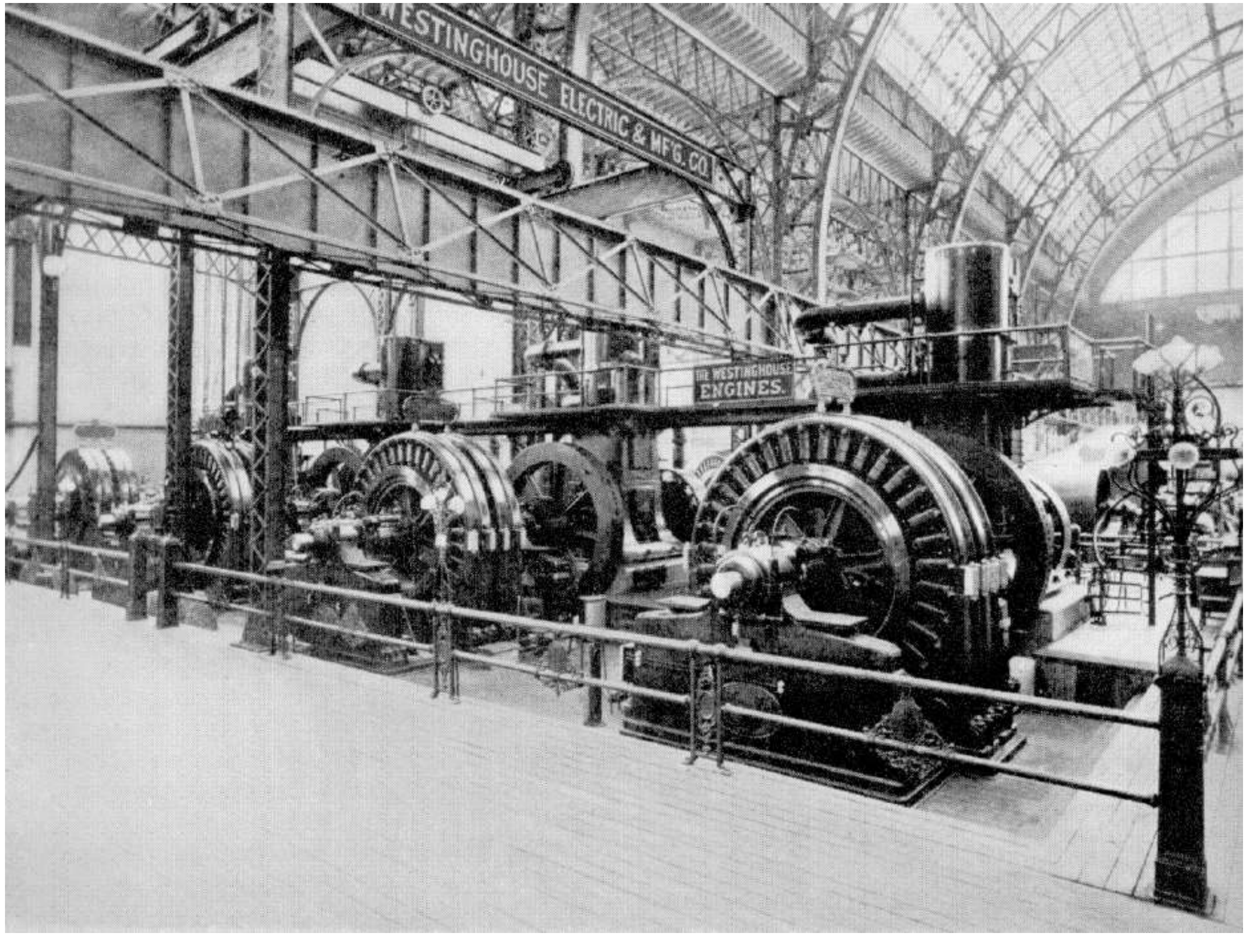


Figure 4: Power loom machine

1.1.2 Technology Evolution in the 1st Industrial Revolution

The **technological changes** included the following:

1) the use of **new basic materials**, chiefly iron and steel,
2) the **use of new energy sources**, including both fuels and motive power, such as **coal**, the **steam** engine, **electricity**, **petroleum**, and the **internal-combustion engine**,
3) the **invention of new machines**, such as the **spinning jenny** and the **power loom** that permitted increased production with a smaller expenditure of human energy,
4) a new **organization of work** known as the **factory system**, which entailed increased division of labour and specialization of function,
5) important developments in transportation and communication, including the steam locomotive, steamship, automobile, airplane, telegraph, and radio, and
6) the increasing application of science to industry. These technological changes made possible a tremendously increased use of natural resources and the mass production of manufactured goods.

1.1.3 Second Industrial Revolution

- The second industrial revolution begins between 1870 and 1914.
- The **electrification of factories** contributed hugely to production rates. The mass production of steel helped introduce railways into the system, which consequently contributed to **mass production**.
- **Assembly line** were introduced during this era. It started in a meat processing industry. The carcasses were hooked on chains and power used to move the carcasses from worker to worker.
- Henry Ford then adopted this idea into his factory in the chassis assembly.

Figure 5: Henry Ford chassis assembly line.

1.1.4 Third Industrial Revolution

- The third industrial revolution started between 1950 and 1970. This era was also known as the Digital Revolution.
- This era brought forth the rise of electronics, telecommunications and of course computers. Through the new technologies, the third industrial revolution open the doors to space expeditions, research, and biotechnology.
- There are two (2) major inventions during this era which are the **Programmable Logic Controllers (PLCs)** and **Robots** that helped give rise to an era of high-level automation.

Figure 6: Proton Manufacturing Factory

1.1.5 Technology Evolution in the 3rd Industrial Revolution

- The PLC or Programmable Logic Controller has revolutionized the automation industry.
- The first PLCs had the ability to work with input and output signals, relay coil/contact internal logic, timers and counters.
- PLC development began in 1968 in response to a request from an US car manufacturer (GE). The request were:
  - A solid-state system that was flexible like a computer but priced competitively with a like kind relay logic system.
  - Easily maintained and programmed in line with the already accepted relay ladder logic way of doing things.
  - It had to work in an industrial environment with all its dirt, moisture, electromagnetism and vibration.
  - It had to be modular in form to allow for easy exchange of components and expandability.

Figure 7: Modicon PLC

1.1.5 Technology Evolution in the 3rd Industrial Revolution

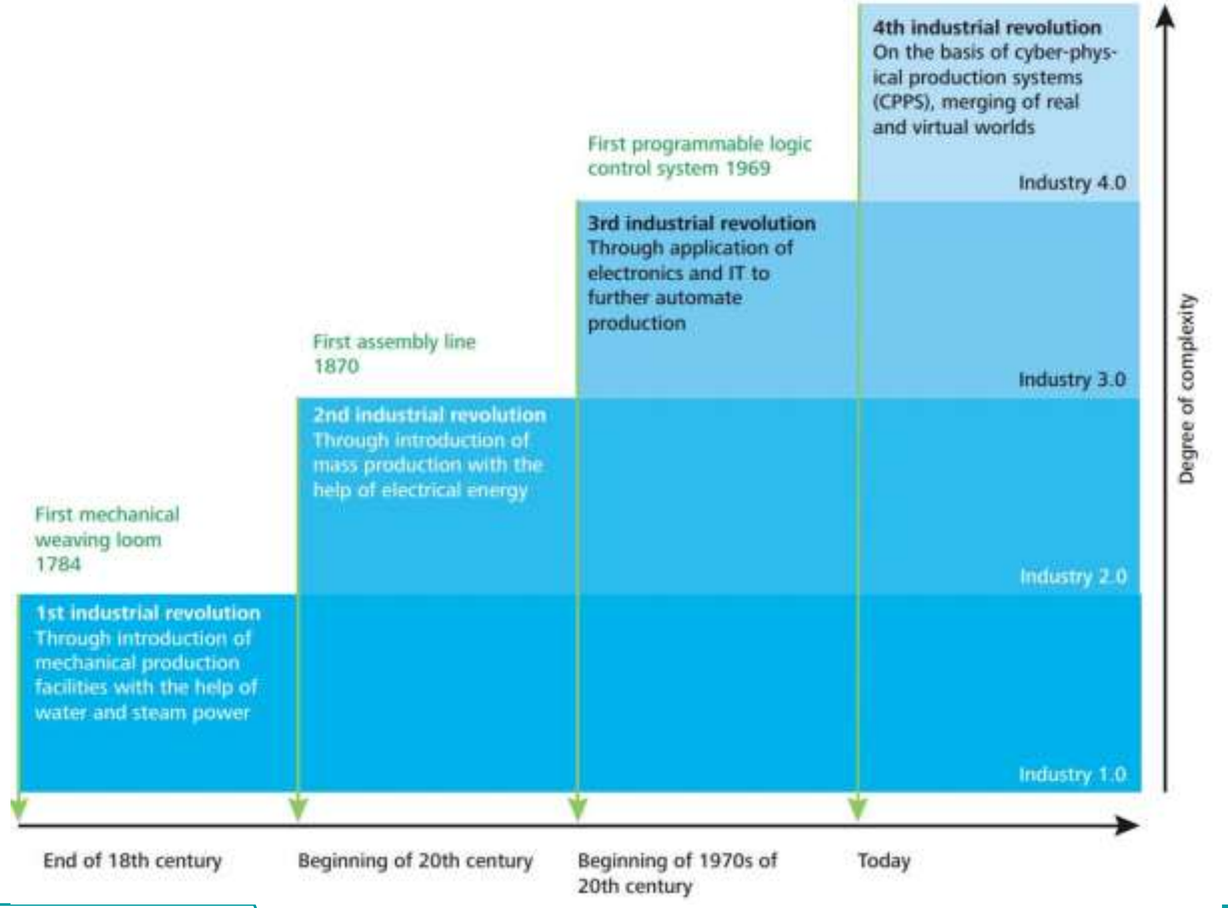
- The invention of the **Numerically Controlled (NC) machines**, the popularity of the computer (1950), and the **integrated circuit** (1970s) all helped to make it possible to begin to develop the very first, yet simple, **industrial robot**.
- Robots were able to **replace humans for the heavy, dangerous, and monotonous tasks.** However, they had zero external sensing and were used for simple tasks such as **pick and place.**
- Eventually, developers were able to create more complex motions, put on external sensors, and add more applications such as welding, grinding, deburring, and assembly..

Figure 8: Industrial Robotic Arms

1.1 Industrial Revolution

1.1.6 Complexity of Industrial Revolution

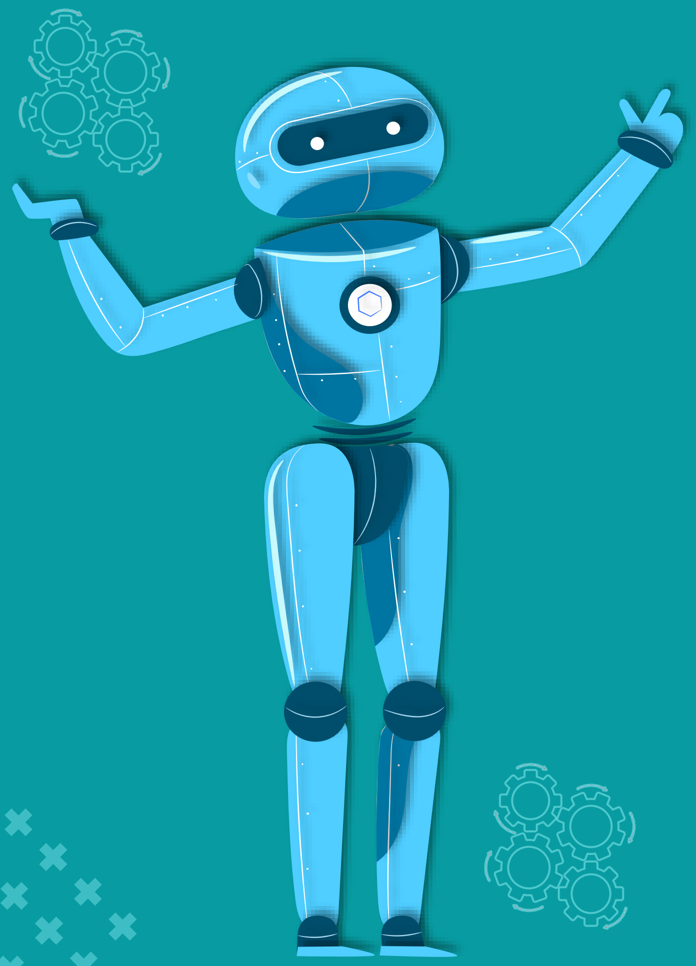
- As we are moving towards the fourth industrial revolution, it is worth noting that as the industrial revolution further, the degree of complexity increases.
- This is due to the enhancement of technology.
- Business model has changed throughout the industrial revolution.
- This can be seen in the 1st industrial revolution where the concept of factory were introduced.



QUICK RECAP!

1. Where and when did the 1st industrial took place?
2. The 2nd industrial revolution introduces us with the creation of assembly line. What is the benefit of making an assembly line in manufacturing?
3. Explain in your own words about mass production.

1.2



4th Industrial Revolution

- What is Industry 4.0?
- Cyber Physical Systems
- Today’s Factory vs. Industry 4.0 Factory
- Six Design Principles
- Top 10 Skills to be relevant in Industry 4.0

1.2 4th Industrial Revolution

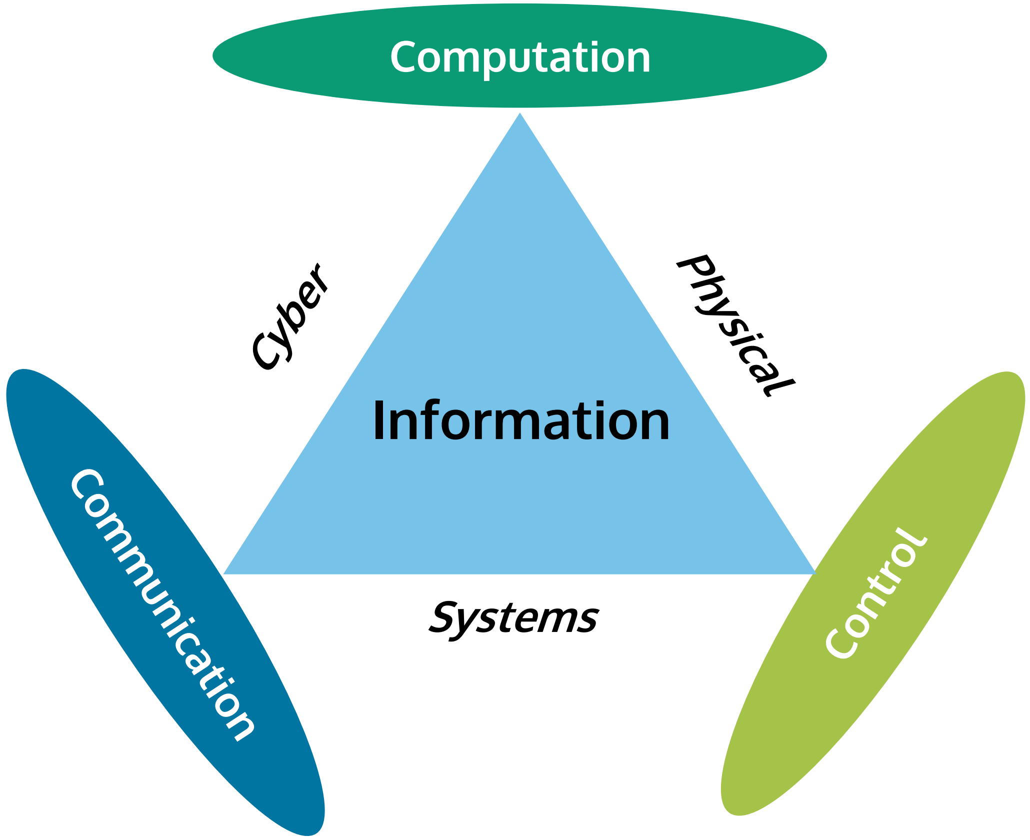
1.2.1 What is Industry 4.0?

An initiative called “Industry 4.0” where an association of representatives from **business**, **politics**, and **academia** promote the idea as an approach to strengthen the competitiveness of German manufacturing industry.

1.2.1 What is Industry 4.0?

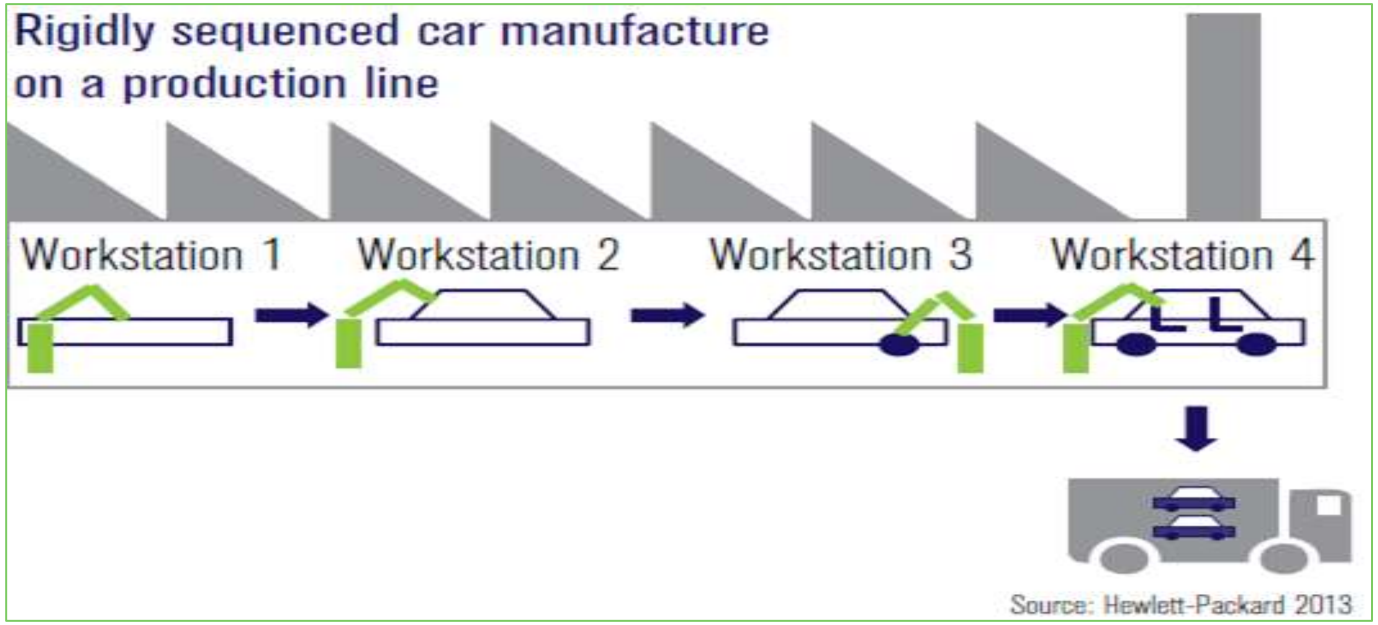
1.2.2 Cyber Physical systems

A **cyber-physical system (CPS)** is a system of collaborating **computational elements** controlling **physical entities**. CPS are physical and engineered systems whose operations are **monitored**, **coordinated**, **controlled** and **integrated** by **a computing and communication core**. They allow us to add capabilities to physical systems by merging computing and communication with physical processes.



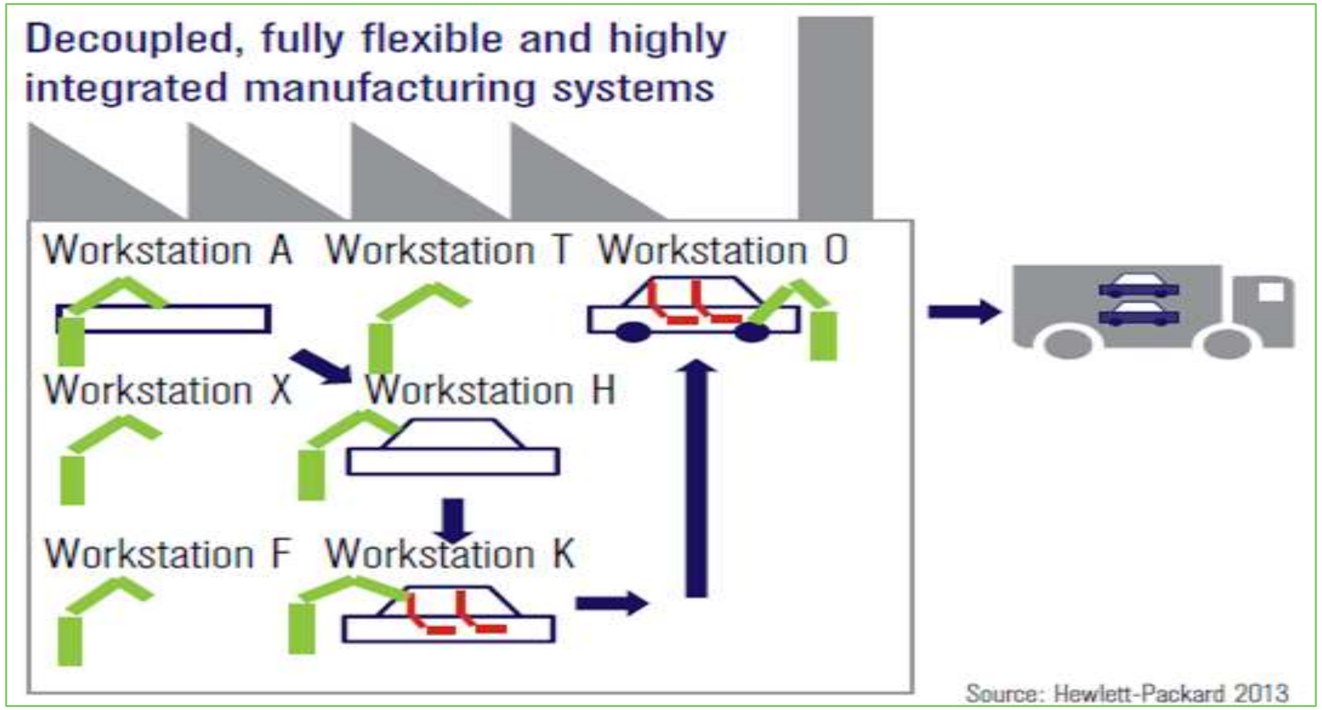
1.2.3 Today's Factory vs. Industry 4.0 Factory

Today's Factory

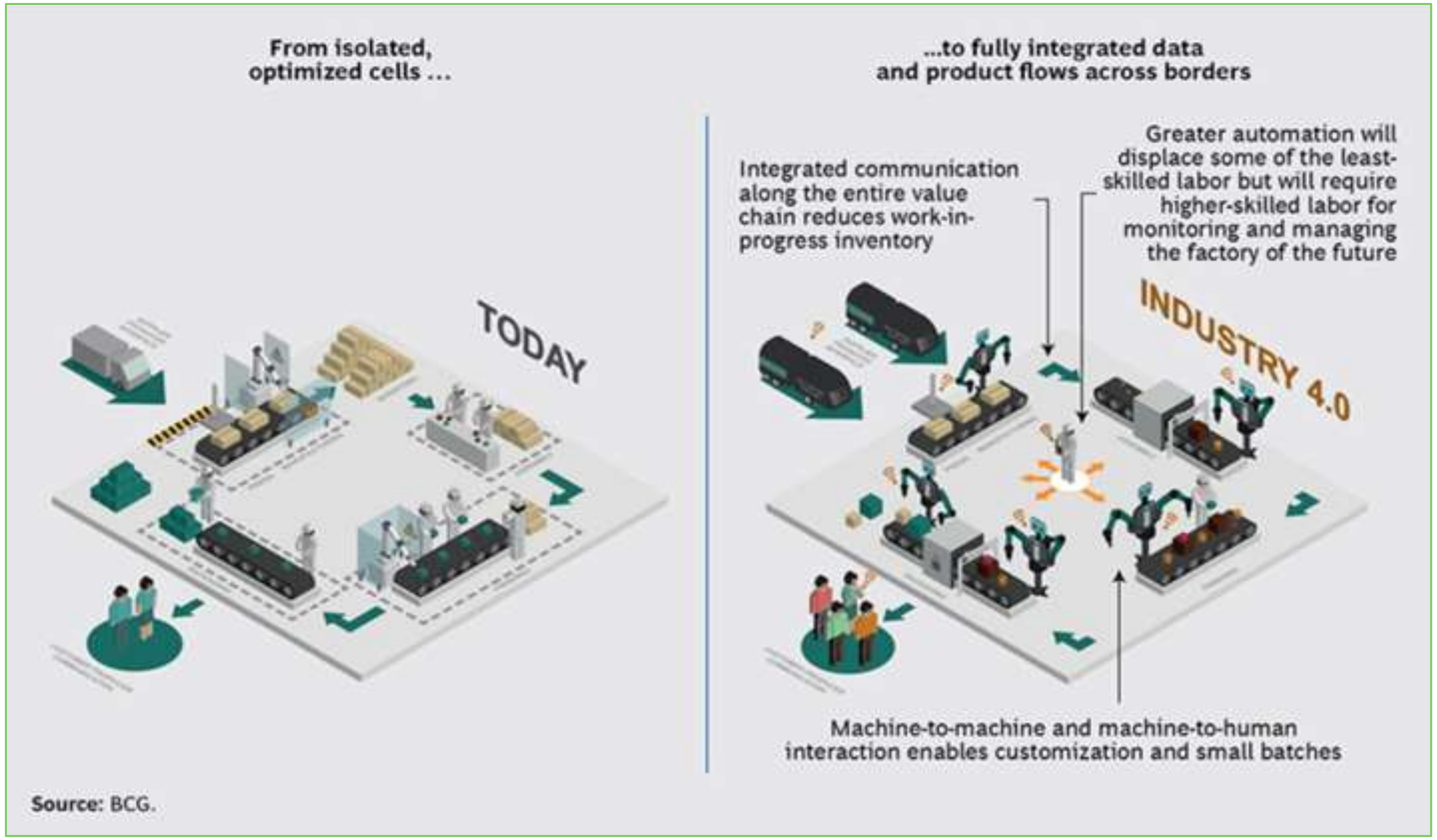


1.2.3 Today's Factory vs. Industry 4.0 Factory

Tomorrow's Factory



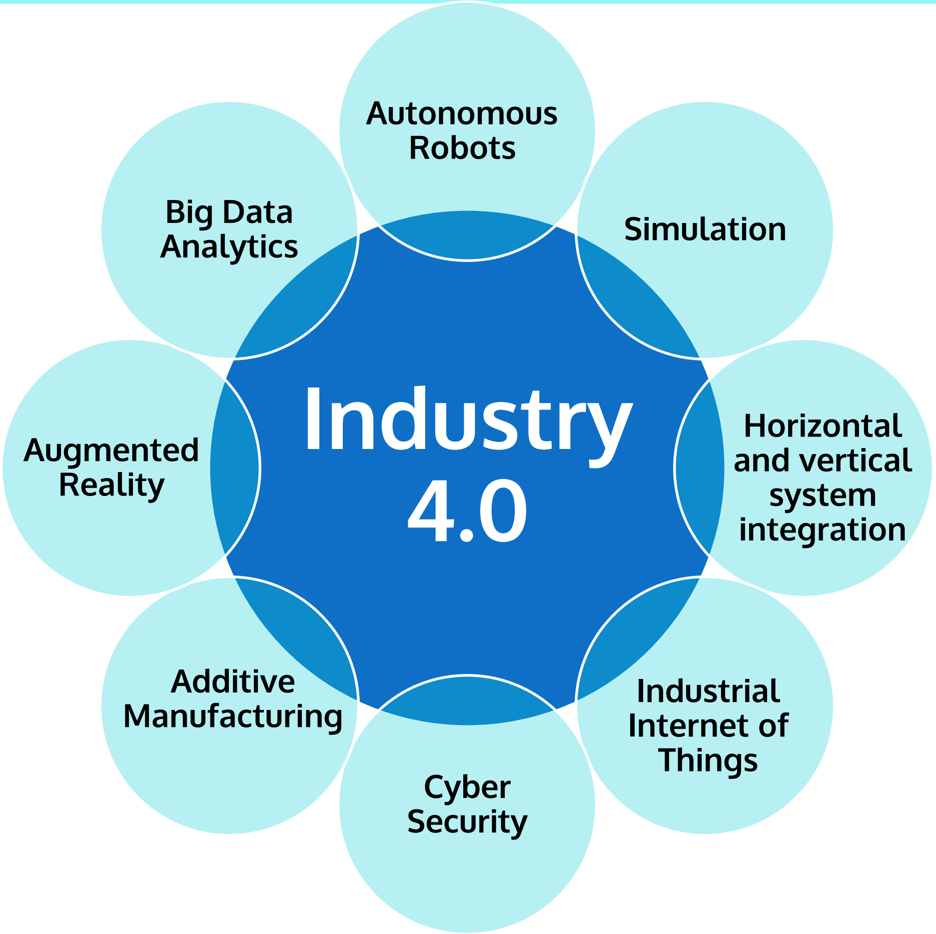
1.2.3 Today's Factory vs. Industry 4.0 Factory



1.2.4 Six Design Principles

- **Interoperability**: the ability of **cyber-physical systems** (i.e. work piece carriers, assembly stations and products), humans and Smart Factories to connect and communicate with each other via the **Internet of Things** and the **Internet of Services**
- **Virtualization**: a virtual copy of the Smart Factory which is created by linking sensor data (from monitoring physical processes) with virtual plant models and simulation models
- **Decentralization**: the ability of **cyber-physical systems** within Smart Factories to make decisions on their own
- **Real-Time Capability**: the capability to collect and analyze data and provide the insights immediately
- **Service Orientation**: offering of services (of **cyber-physical systems**, humans and Smart Factories) via the **Internet of Services**
- **Modularity**: flexible adaptation of Smart Factories for changing requirements of individual modules

1.2.5 Building Blocks of Industry 4.0



1.2.6 Top 10 Skills to be relevant in Industry 4.0

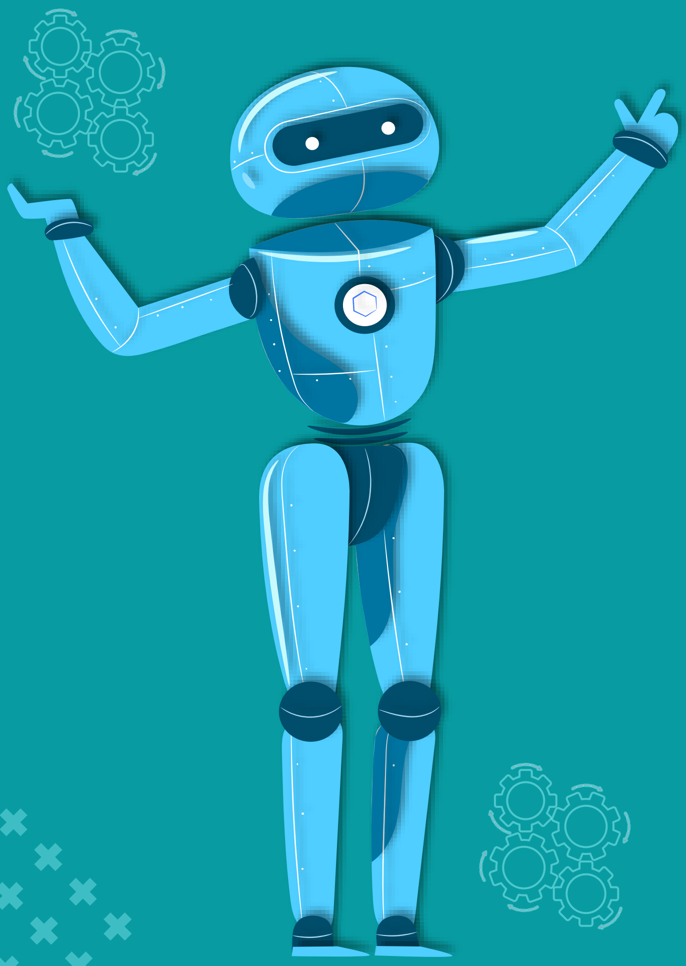
in 2020	in 2015
1. Complex Problem Solving	1. Complex Problem Solving
2. Critical Thinking	2. Coordinating with Others
3. Creativity	3. People Management
4. People Management	4. Critical Thinking
5. Coordinating with Others	5. Negotiation
6. Emotional Intelligence	6. Quality Control
7. Judgment and Decision Making	7. Service Orientation
8. Service Orientation	8. Judgment and Decision Making
9. Negotiation	9. Active Listening
10. Cognitive Flexibility	10. Creativity

Source: Future of Jobs Report, World Economic Forum

QUICK RECAP!

1. In your own words, explain CPS.
2. Do you think Malaysia has already embraced Industry 4.0?
3. Choose 3 top skills to be relevant in Industry 4.0 and elaborate why you have selected those skills.

1.3



Building Blocks of Industry 4.0

1) Internet of Things
2) Autonomous Robots
3) Additive Manufacturing
4) Simulation
5) Augmented Reality
6) Big Data Analytics
7) Systems Integrations
8) Cloud Computing
9) Cyber Security

1.3.1 Internet of Things

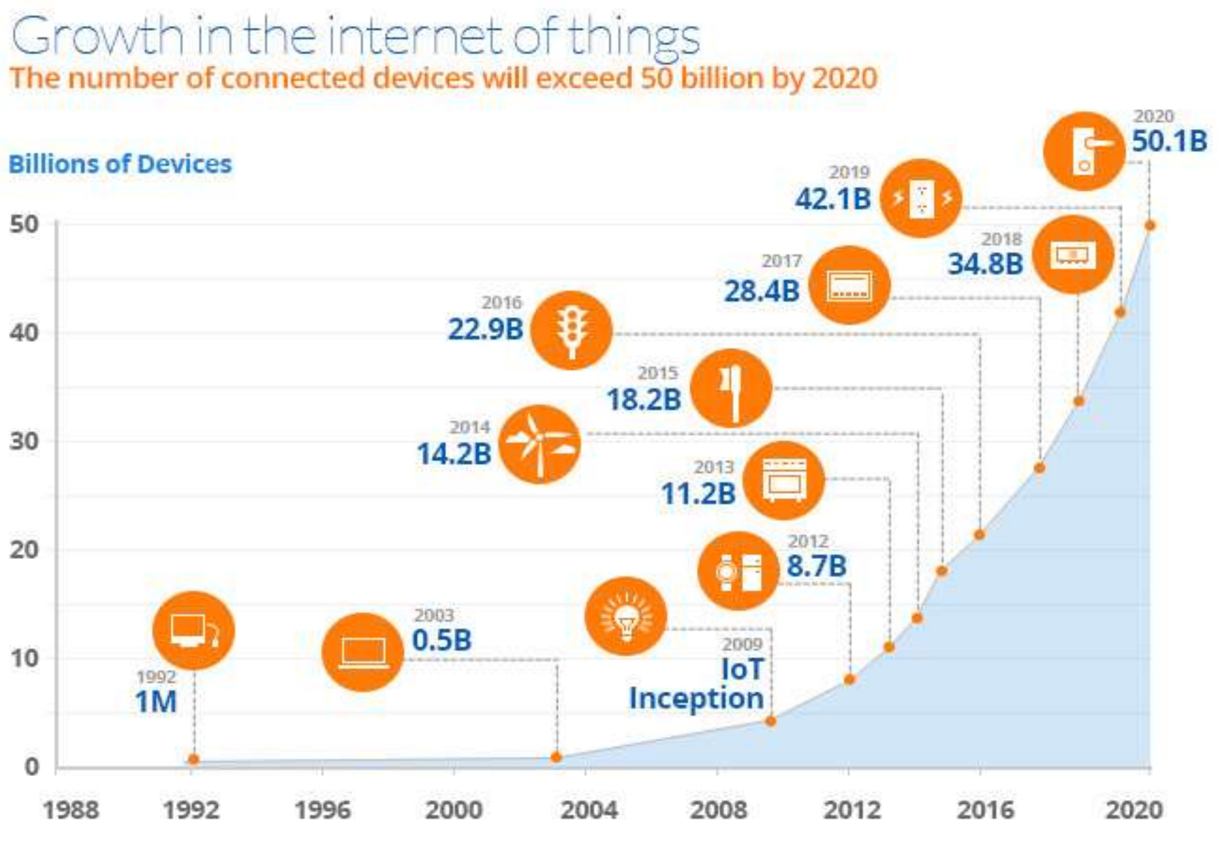
IoT

- The Internet of Things (IoT) refers to **network of physical objects** that **feature** an **IP address for internet connectivity**, and the **communication** that **occurs between** these **objects** and other **Internet-enabled devices** and **systems.**

- In simple words, Internet of Things (IoT) is an ecosystem of **connected physical objects that are accessible through the internet.**

- It is also referred to as Machine-to-Machine (M2M),
- Skynet or Internet of Everything.

1.3.1 Internet of Things



Cisco Internet Business Solutions Group predicts:"50 billion connected devices by 2020"

source: www.iotonlinestore.com

1.3.1 Internet of Things

IIoT

- The **industrial internet of things (IIoT)** is a term for all of the various sets of **hardware pieces that work together through internet of things connectivity** to help **enhance manufacturing and industrial processes.**
- **The application of the IoT to the manufacturing industry is called the IIoT** (or Industrial Internet or Industry 4.0). The IIoT will **revolutionize manufacturing** by enabling the **acquisition** and **accessibility** of **far greater amounts of data**, at far greater **speeds**, and far more **efficiently** than before.
- When people talk about the industrial internet of things, they're talking about all of the **sensors, devices and machines that contribute to physical business processes in industrial settings.**

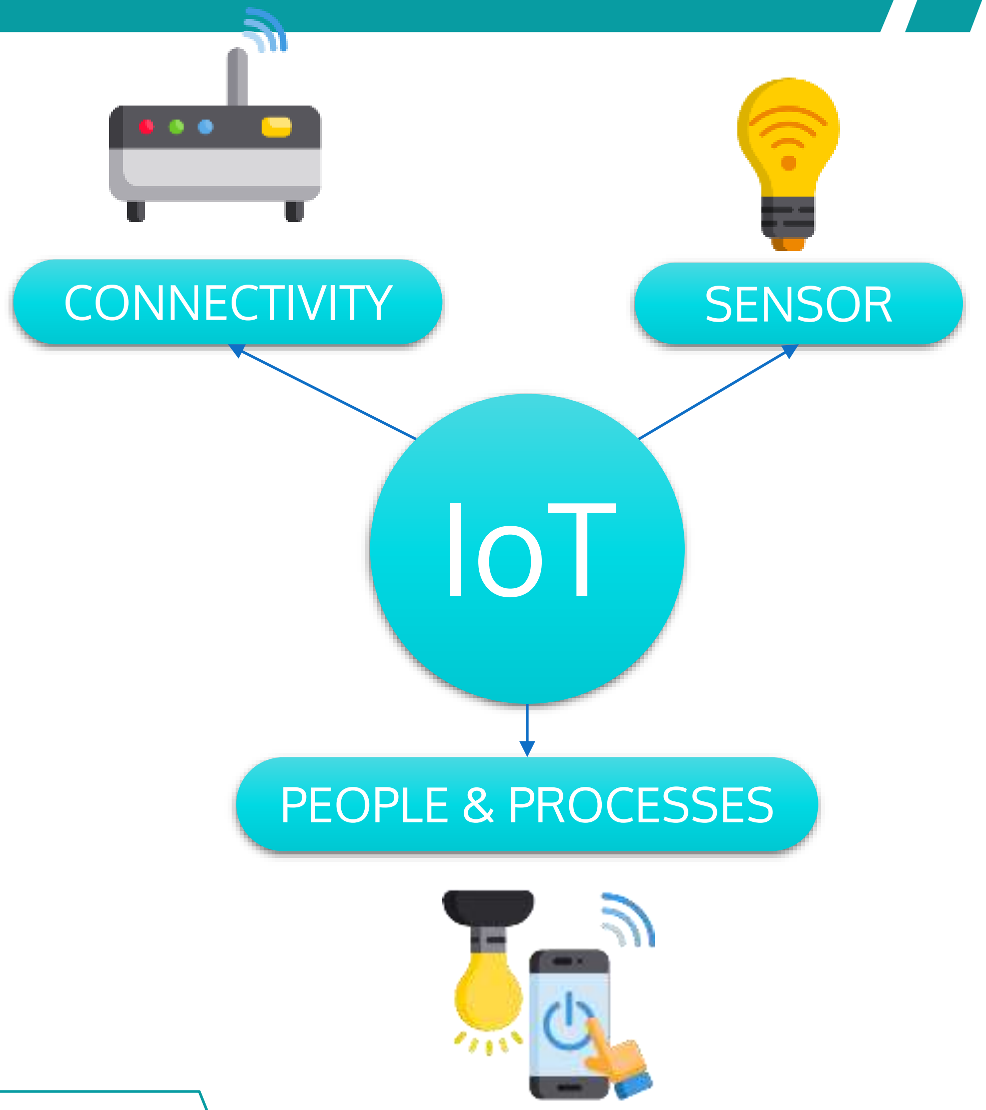
source: https://inductiveautomation.com/what-is-iiot

1.3 Building Blocks of Industry 4.0

1.3.1 Internet of Things

Components of IoT

1) Sensors
2) Connectivity
3) People and Processes



1.3 Building Blocks of Industry 4.0

IoT Sensors

- Humidity sensor
- Level/tilt sensor
- Pressure sensor
- Temperature sensor
- Motion Sensors
- Proximity Sensors
- Optical Sensors
- Acceleration sensors
- Load sensors
- Vibration sensors
- Chemical sensors
- Flow sensors

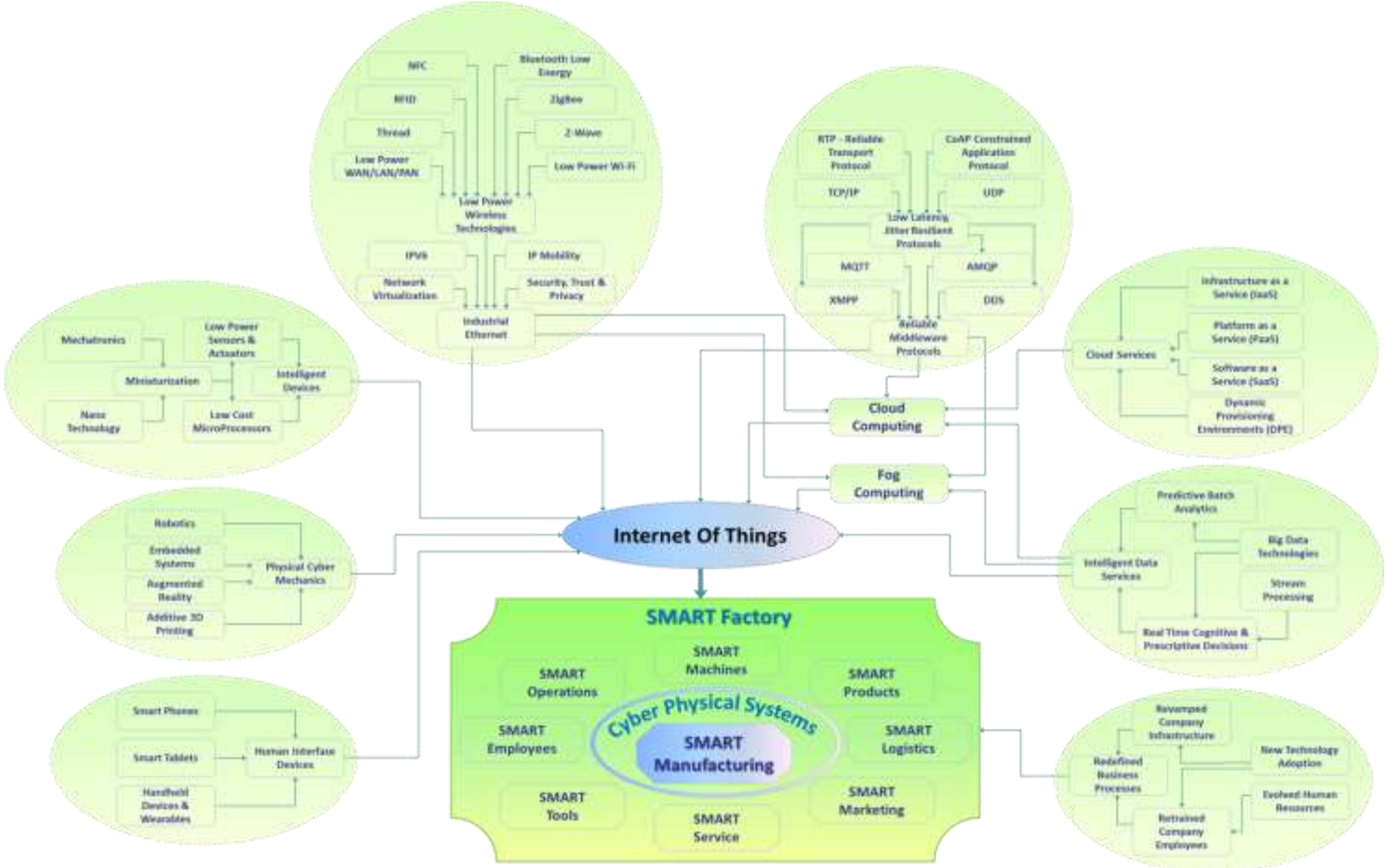
IoT Actuators

- Light emitting Diodes
- Relays
- Motors
- Linear actuators
- Lasers
- Solenoids
- Speakers
- LCD or Plasma displays

1.3.1 Internet of Things

source: http://ssgnet.com/role-internet-things-iot-manufacturing

1.3.1 Internet of Things



Entrigna's macroscopic view of the network of 'Greenfield' Innovations enabling IoT

Benefits of implementing IIoT

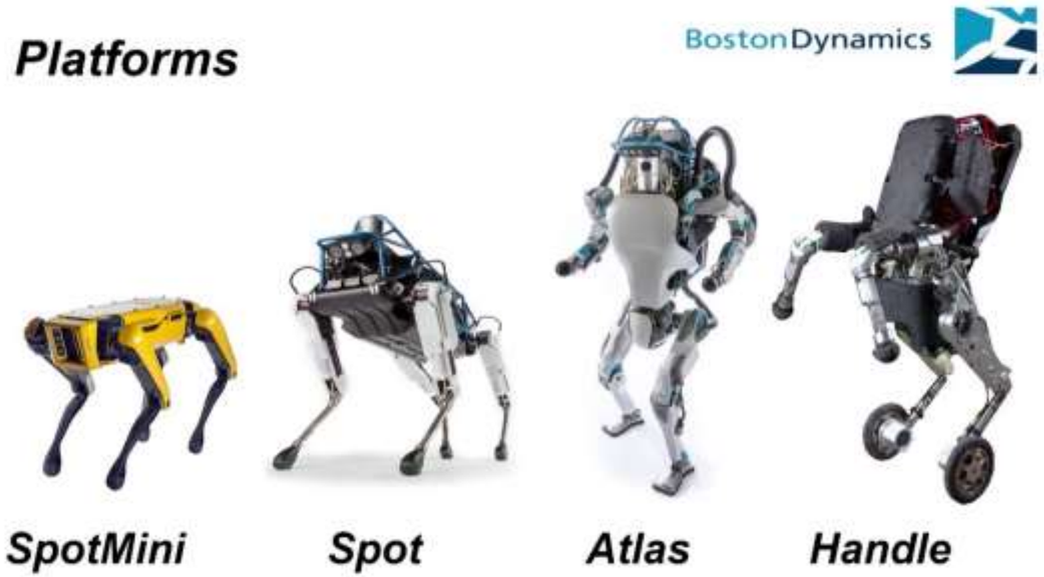
- Real time data
- Efficient
- Accurate
- Safe time
- Safe costs
- Predictive
- Smart
- Collaborative
- Less error

Challenges of implementing IIoT

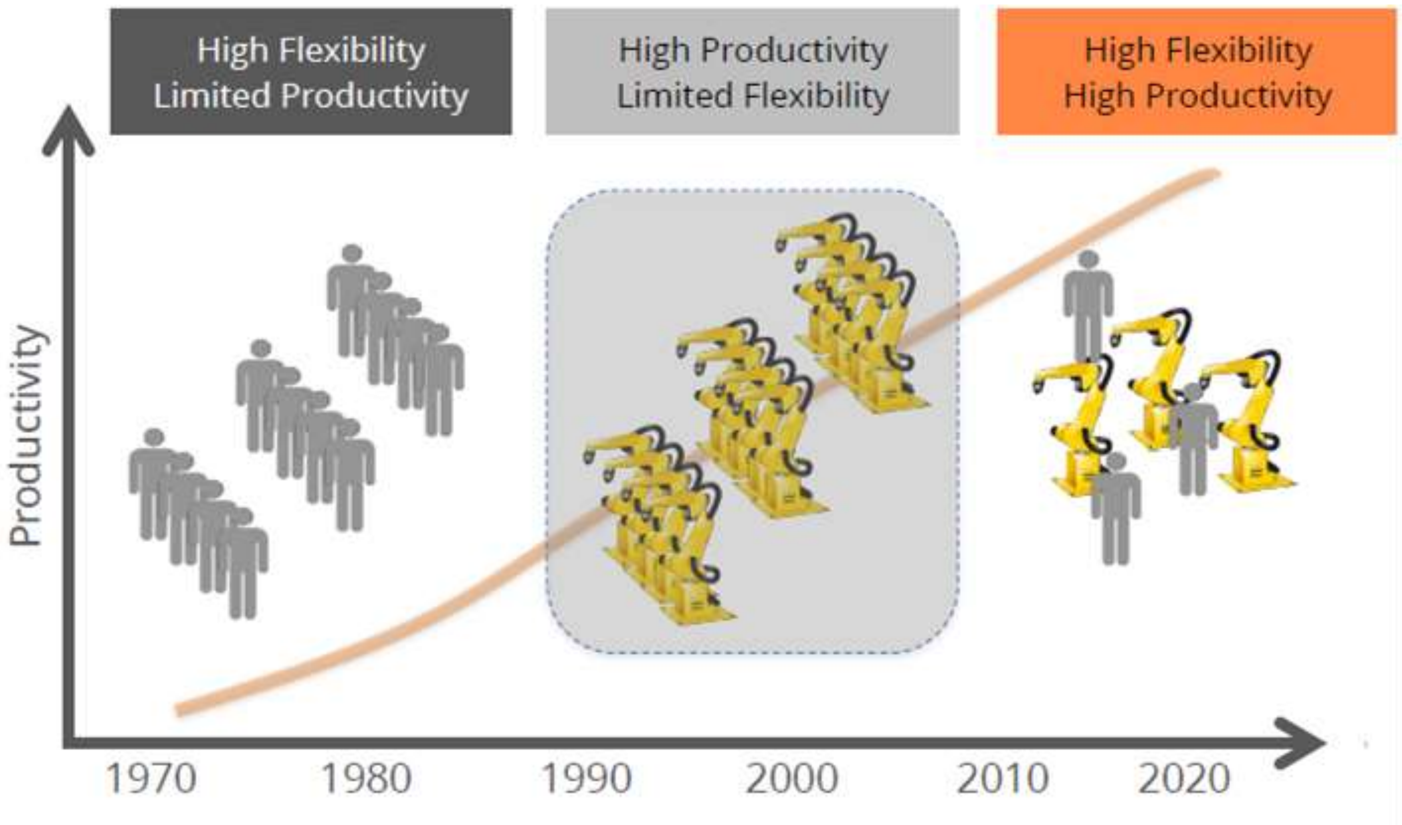
- Security - cyber attack
- Scalability
- Technical requirement
- Software complexity
- Technological standardization (compatibility)

1.3.2 Autonomous Robots

Autonomous Robots are **intelligent machines** capable of **performing tasks** in the world by themselves, without explicit human control.

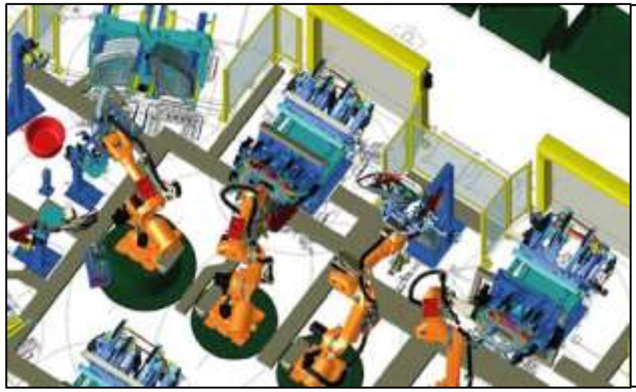


1.3.2 Autonomous Robots



1.3.2 Autonomous Robots

Robot and Industrial Revolution



Third industrial revolution (1980 – 2015)
Digital manufacturing - RobCAD is a popular software used in digital manufacturing. Models of automated machinery and production lines can be created and simulated in real time (emergence of computing, simulation and communication technologies support new methods for digital manufacturing)

Fourth industrial revolution (2016-2020)
Illustration of a Factory of the Future (convergence of robotic and ICT technologies to create cyber-physical manufacturing systems that have the potential to be more productive, resource efficient and responsive to customer needs)

1.3 Building Blocks of Industry 4.0

1.3.2 Autonomous Robots

Collaborative Robots

- A new generation of ***"collaborative" robots*** will also enhance the impact of intelligent automation by ***maximising the abilities of both humans and machines***.

- As robots become safer and allow close working with humans, the potential applications widen beyond the traditional industries of aerospace and automotive to food and drink, agriculture, biotechnology and the creative industries.

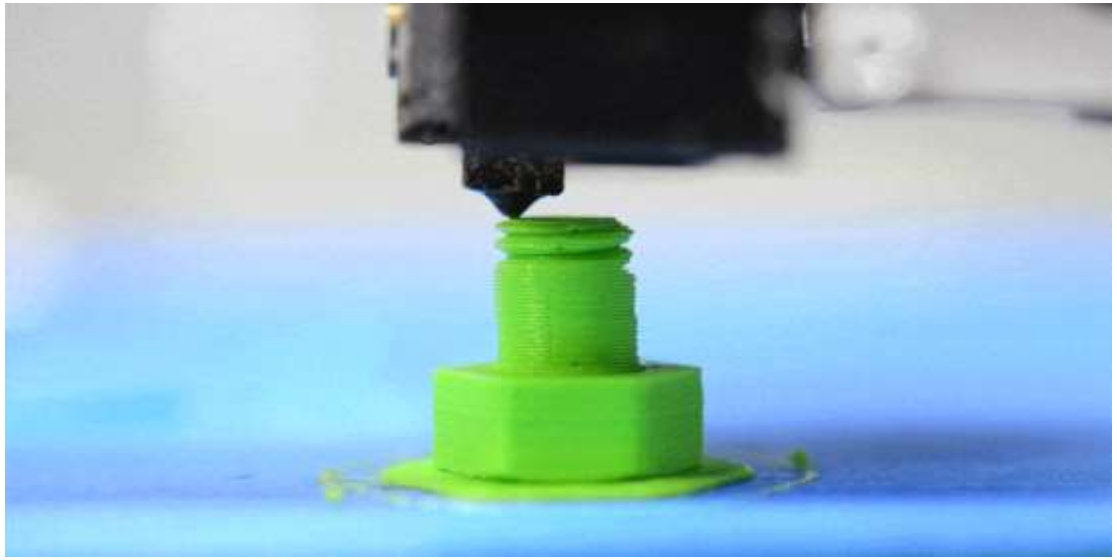
1.3.2 Autonomous Robots

Warehouse Robot

AGV (Automated Guided Vehicle)

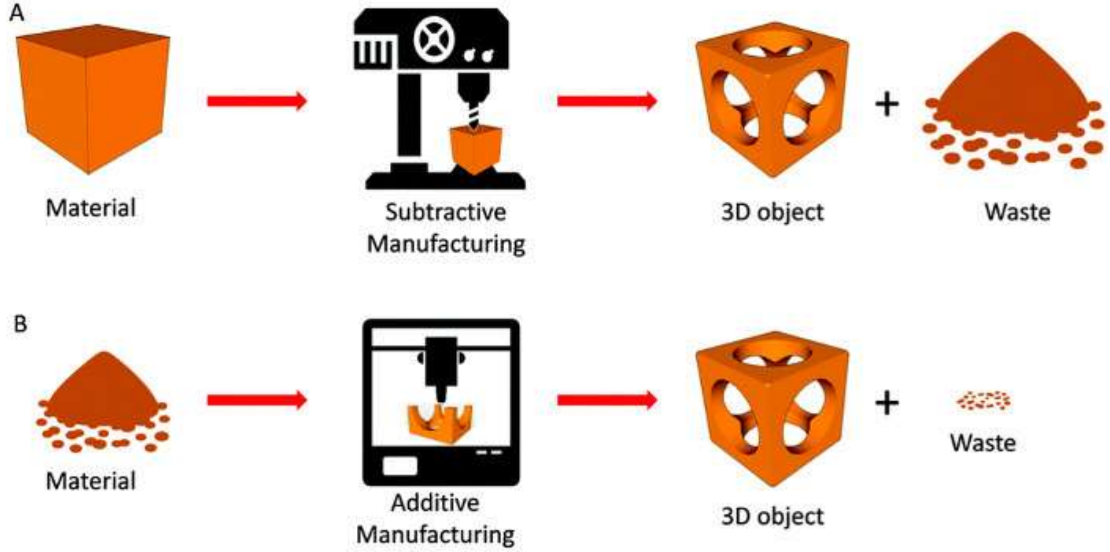
1.3.3 Additive Manufacturing

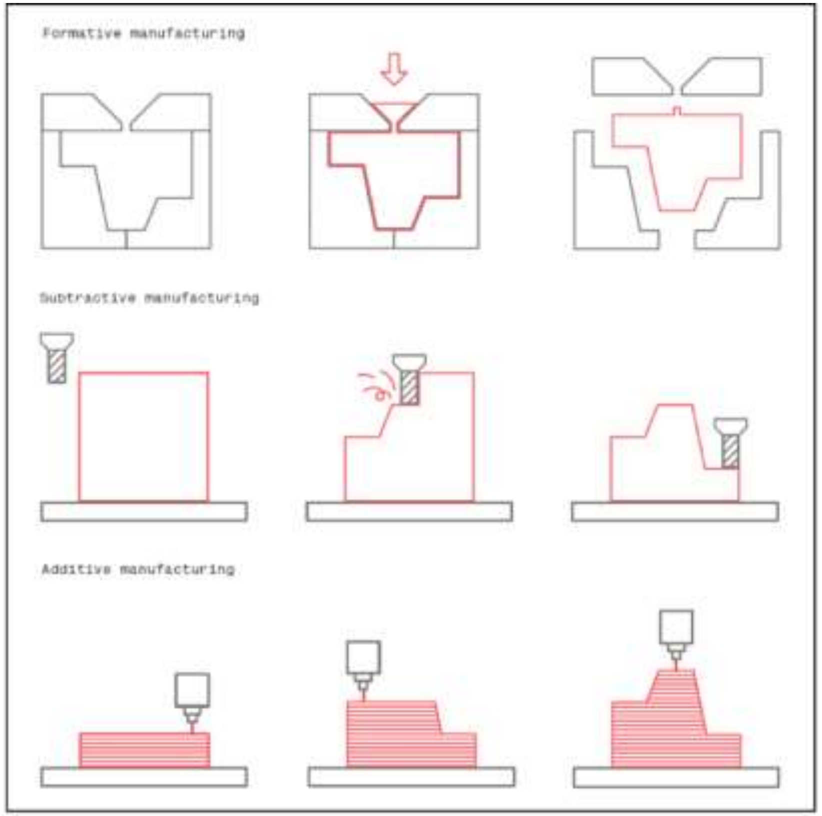
Additive manufacturing (AM) is a term used to describe the technologies that **build 3D objects** from a digital model **by adding layer-upon-layer** of material in different 2D shapes.



1.3.3 Additive Manufacturing

Types of material manufacturing

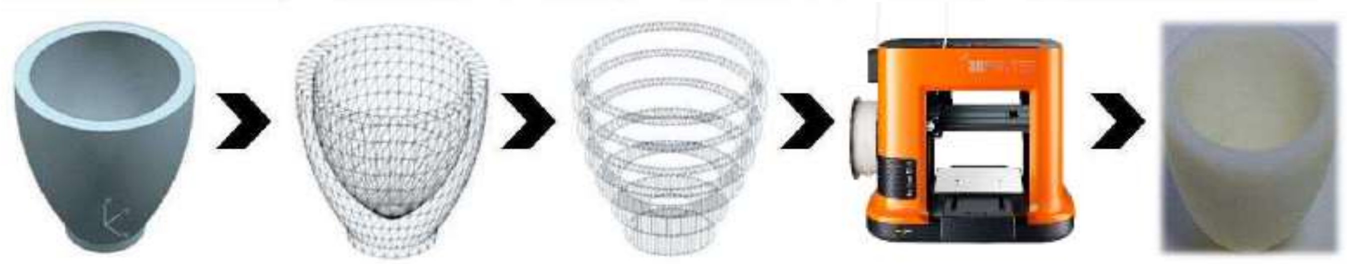




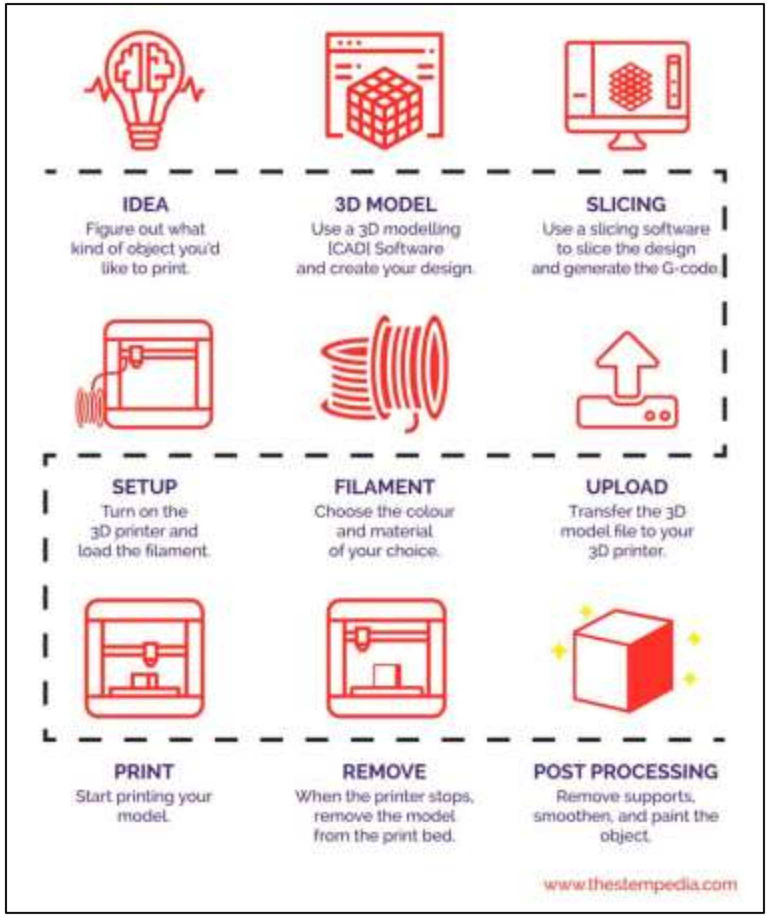
1.3.3 Additive Manufacturing

Processes involves in making a 3D Object

Material Development → **Design, Modelling & Simulation** → **Materials processing & layering** → **Final Product**



3D CAD Model | *.STL File* | *Sliced Layers & Path Tools* | *Printing and Layering* | *3D Object*



1.3.3 Additive Manufacturing

Differences between additive manufacturing and subtractive manufacturing

Additive Manufacturing	Subtractive Manufacturing
3D Printing is not limited by the same restrictions that come from using rigid tooling, so features such as curved holes, which would be impossible to cut with a rotating end mill or drill, can be printed without issue.	Restriction in design. Cannot print design that have high level of complexity
Waste product can be removed at the end of the product completion	Waste product have to be removed at the beginning of product development
Different materials requires different method of creating layers, thus making it difficult in finding	Selecting material for a subtraction process is easier due to availability in multiple size and shapes.

1.3.3 Additive Manufacturing

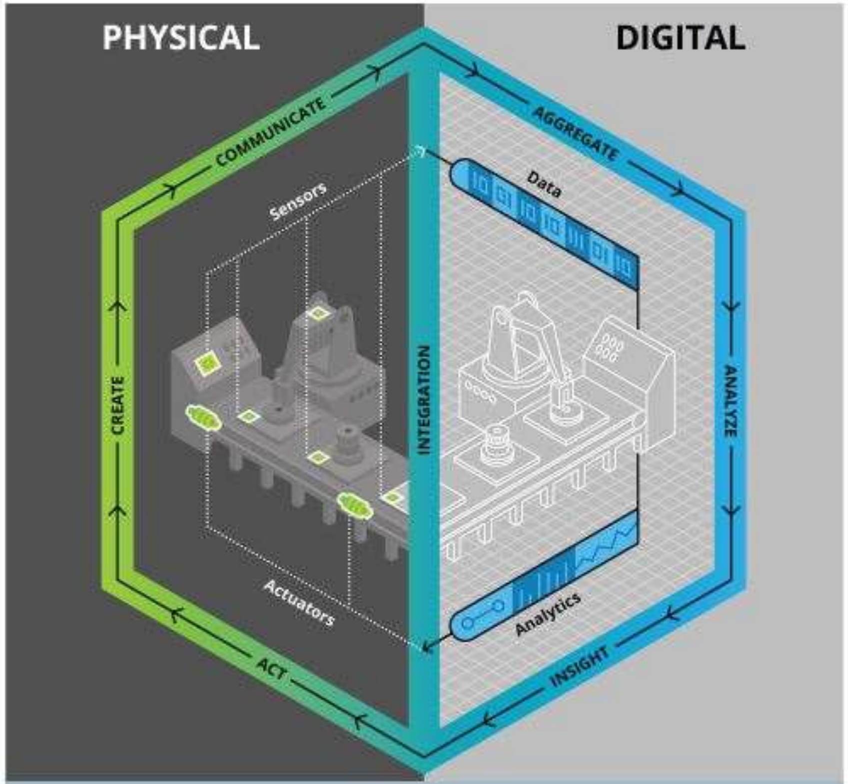
Different types of 3D printing method

	VAT PHOTOPOLYMERIZATION	POWDER BED FUSION (PBF)	BINDER JETTING	MATERIAL JETTING	SHEET LAMINATION	MATERIAL EXTRUSION	DIRECTED ENERGY DEPOSITION (DED)
Alternative Names:	SLA™ - Stereolithography Apparatus DLP™ - Digital Light Processing 3SP™ - Scan, Spin, and Selectively Photocure CLIP™ – Continuous Liquid Interface Production	SLS™ - Selective Laser Sintering; DMLS™ - Direct Metal Laser Sintering; SLM™ - Selective Laser Melting; EBM™ - Electron Beam Melting; SHS™ - Selective Heat Sintering; MJF™ - Multi-Jet Fusion	3DP™ - 3D Printing ExOne Voxeljet	Polyjet™ SCP™ - Smooth Curvatures Printing MJM - Multi-Jet Modeling Projet™	LOM - Laminated Object Manufacture SDL - Selective Deposition Lamination UAM - Ultrasonic Additive Manufacturing	FFF - Fused Filament Fabrication FDM™ - Fused Deposition Modeling	LMD - Laser Metal Deposition LENS™ - Laser Engineered Net Shaping DMD™ - Direct Metal Deposition (DM3D) LENS™ – Laser Engineered Net Shaping DMD™ – Direct Metal Deposition DM3D,
Description:	A vat of liquid photopolymer resin is cured through selective exposure to light (via a laser or projector) which then initiates polymerization and converts the exposed areas to a solid part.	Powdered materials is selectively consolidated by melting it together using a heat source such as a laser or electron beam. The powder surrounding the consolidated part acts assupport material for overhanging features.	Liquid bonding agents are selectively applied onto thin layers of powdered material to build up parts layer by layer. The binders include organic and inorganic materials. Metal or ceramic powdered parts are typically fired in a furnace after they are printed.	Droplets of material are deposited layer by layer to make parts. Common varieties include jetting a photocurable resin and curing it with UV light, as well as jetting thermally molten materials that then solidify in ambient temperatures.	Sheets of material are stacked and laminated together to form an object. The lamination method can be adhesives or chemical (paper/ plastics), ultrasonic welding, or brazing (metals). Unneeded regions are cut out layer by layer and removed after the object is built.	Material is extruded through a nozzle or orifice in tracks or beads, which are then combined into multi-layer models. Common varieties include heated thermoplastic extrusion (similar to a hot glue gun) and syringe dispensing.	Powder or wire is fed into a melt pool which has been generated on the surface of the part where it adheres to the underlying part or layers by using an energy source such as a laser or electron beam.This is essentially a form of automated build-up welding.
Strengths:	• High level of accuracy and complexity • Smooth surface finish • Accommodates large build areas	• High level of complexity • Powder acts as support material • Wide range of materials	• Allows for full color printing • High productivity • Uses a wide range of materials	• High level of accuracy • Allows for full color parts • Enables multiple materials in a single part	• High volumetric build rates • Relatively low cost (non-metals) • Allows for combinations of metal foils, including embedding components.	• Inexpensive and economical • Allows for multiple colors • Can be used in an office environment • Parts have good structural properties	• Not limited by direction or axis • Effective for repairs and adding features • Multiple materials in a single part • Highest single-point deposition rates
Typical Materials	UV-Curable Photopolymer Resins	Plastics, Metal and Ceramic Powders, and Sand	Powdered Plastic, Metal, Ceramics, Glass, and Sand.	Photopolymers, Polymers, Waxes	Paper, Plastic Sheets, and Metal Foils/Tapes	Thermoplastic Filaments and Pellets (FFF); Liquids, and Slurries (Syringe Types)	Metal Wire and Powder, with Ceramics

1.3.4 Simulation

What is Simulation?

- Simulation in the Industry 4.0 era is referred as “Digital Twin”.
- Digital Twin are designed to model complicated processes for which it is difficult to predict outcomes over an entire production cycle.
- Most industrial automation platforms support the Functional Mock-up Interface (FMI) as a way of integrating a real-time implementation of the
- Digital Twin so it can be run in-line with the real machine



Manufacturing process digital twin model

Some of us in this room has experienced *Augmented Reality*.

But where?....

1.3.5 Augmented Reality

Instagram

Photo Credit https://instagram-press.com/blog/2017/06/15/new-face-filters-and-more/

Source https://www.instagram.com/?hl=en

1.3 Building Blocks of Industry 4.0

1.3.5 Augmented Reality

Snapchat

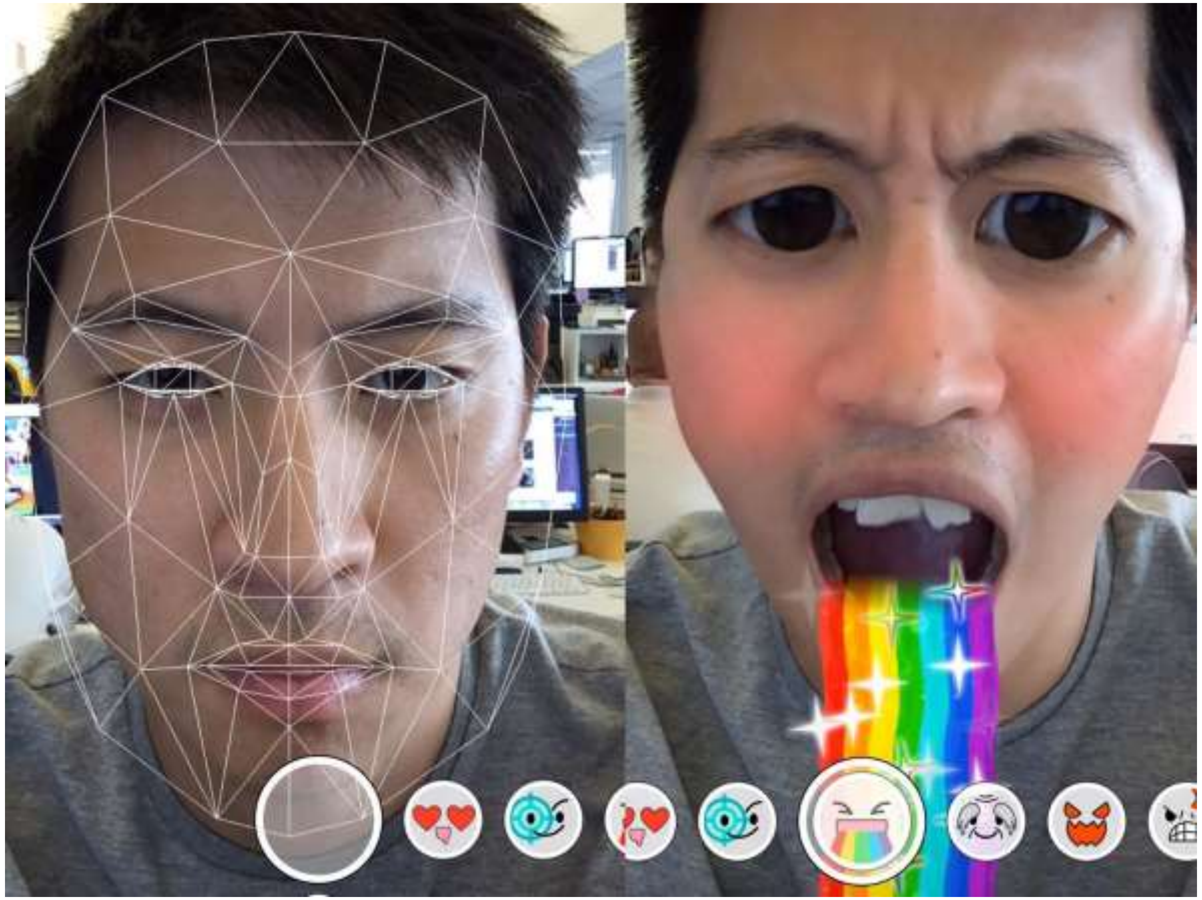


Photo Credit : Google.com

1.3.5 Augmented Reality

What is Augmented Reality?

- Augmented Reality (AR) system generates a composite view for the user.
- Basically, AR overlays digital information onto the physical world.
- AR combines a real scene from the real world and a virtual scene generated by a computer.

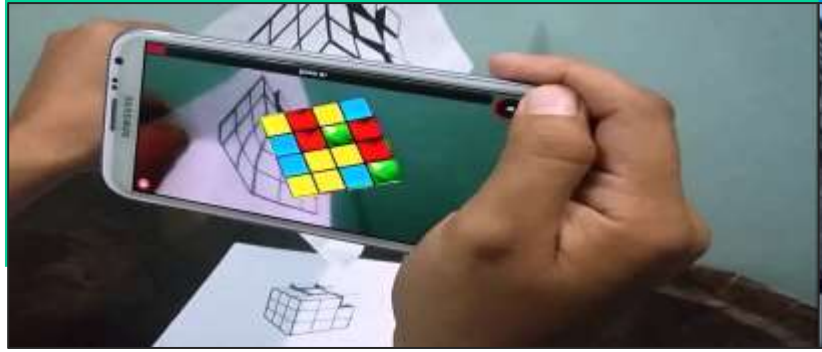
1.3.5 Augmented Reality

- **Augmented Reality (AR)** augments 3D objects onto the real world by either **recognizing a specific pattern image** or **recognizing a specific location**.
- AR then adds on the 3D object onto the image or location.
- AR uses **camera lens** to read image data or location data.
- The augmented 3D objects can be view through a **monitor** or **screen** and also a **goggle** like device.

1.3.5 Augmented Reality

How does Augmented Reality augment a 3D object?

Marker based AR	Location based AR
• In marker based AR, the images to be recognized beforehand are provided to the apps beforehand. • The camera data will dissect the image provided and matches it with the marker provided.	• Instead of augmenting an object, AR can also augment a location. • Usually location based AR adds a digital layer of contextual information, over the physical world. • GPS, in this case, is sufficient to track location.



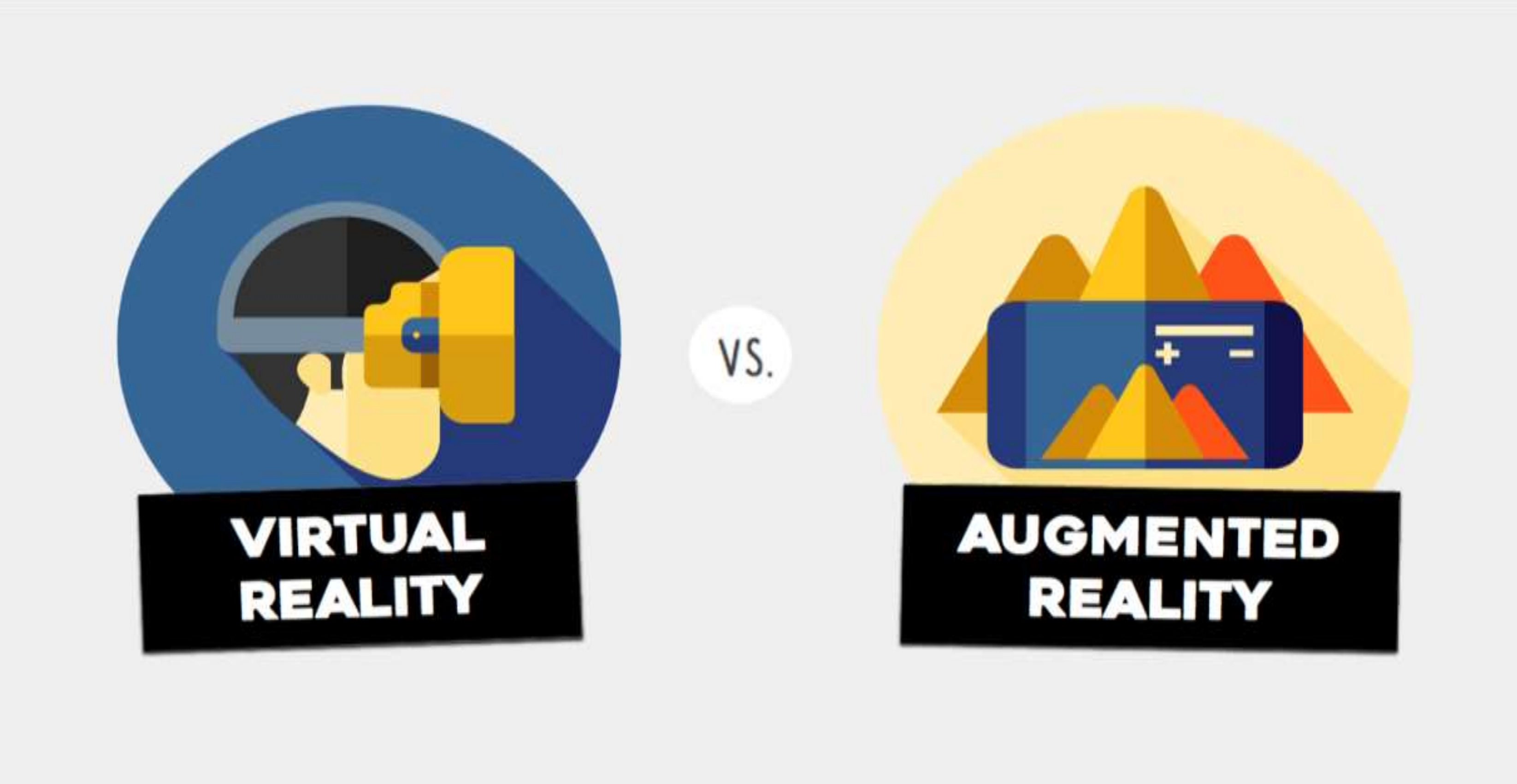
1.3 Building Blocks of Industry 4.0

1.3.5 Augmented Reality

How can we view augmented 3D object?

Monitor Based Display	Head Mounted Display
• Use the **screen** of your mobile phone, laptop, and tablet **to view digitally augmented object**. • Also, make use of the **lens** from your mobile phone, laptop and web camera **to capture real time scene.**	• Helmet like **device is mounted** on your head **and project visual directly to your eyes.** • Uses **head tracking** and **eyes tracking** to further enhance user peripheral vision. • Also, handheld device are used to enhance users senses.

1.3.5 Augmented Reality



1.3.5 Augmented Reality

Augmented Reality

- Augmented reality uses the real world environment or scene and overlays with digitally generated objects.

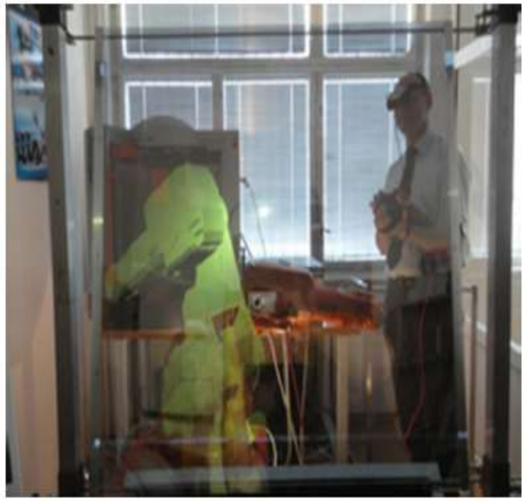
Virtual Reality

- Environment or scene is fully digitized and virtualized and tricking users into making them feel as if they are in a completely different world.

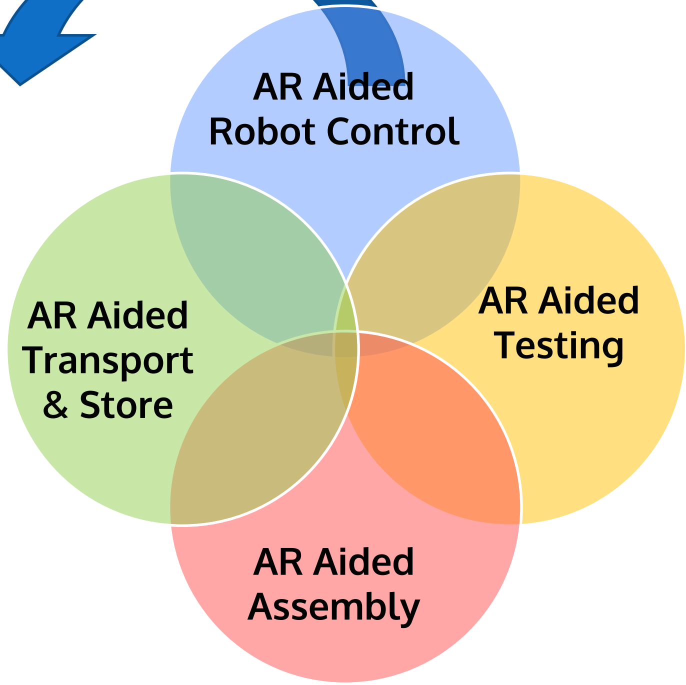
1.3 Building Blocks of Industry 4.0

1.3.5 Augmented Reality

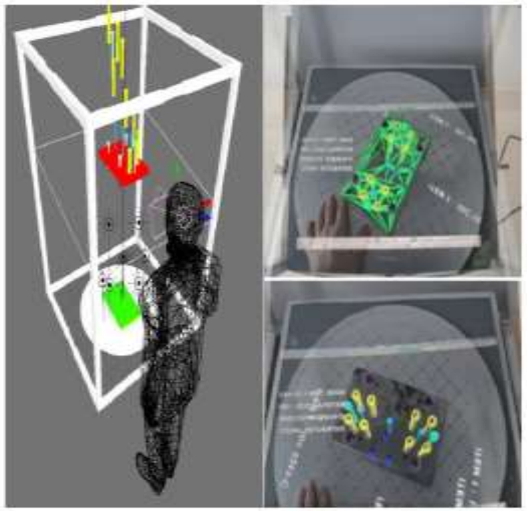
AR Aided Robot Control



User interacting with Industrial Robot through the Augmented Reality environment



AR Aided Assembly



Worker realizing the assembly task and his working view through Augmented Reality environment

1.3.6 Big Data Analytics

Big Data

Large amount of data can either be structured or unstructured with 5 Vs characteristics

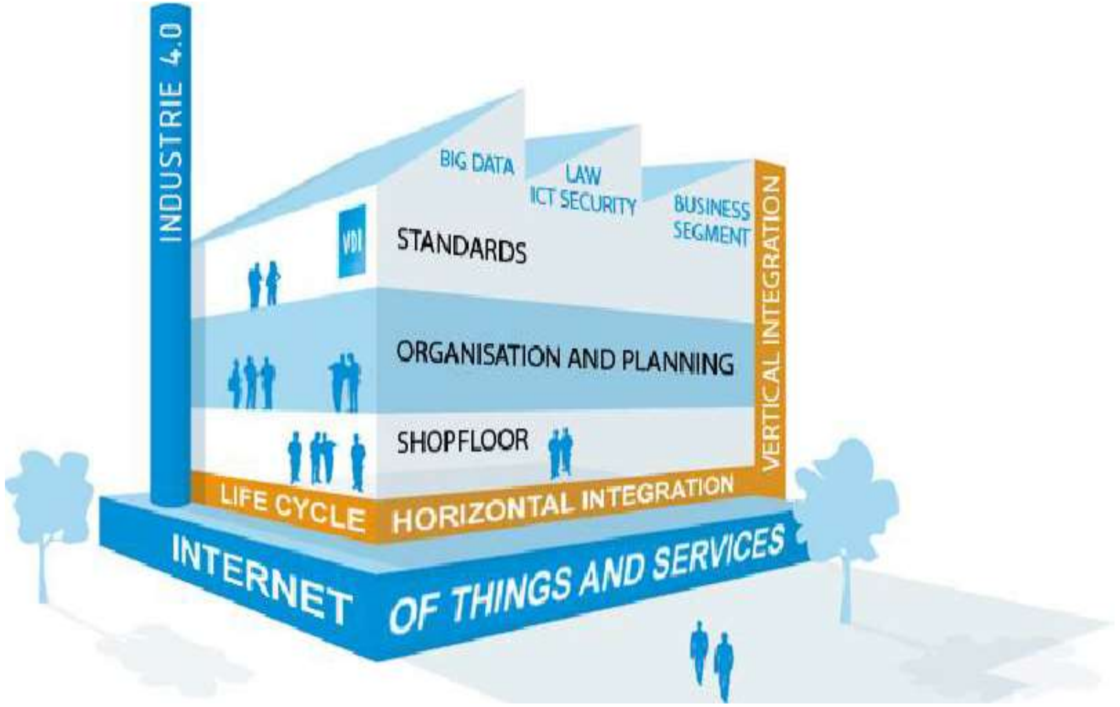
Volume	Typically large scale of data
Velocity	Data streaming
Variety	Data stores from equipment trace data through metrology, maintenance, yield, inventory management, MES and ERP
Veracity	Data quality (uncertainty of data)
Value	The measurement or application of analytics

1.3.6 Big Data Analytics

Data	Big Data
• Traditional enterprise data which include ERP transactional data, CRM systems, web transactions, and financial data.	• Data generated from various non-traditional data source such as sensor data, log data, device data, videos, images and etc.
• Usually data volume ranging from Gigabytes to Terabytes.	• Data volumes can go further than Terabytes and up to Zettabytes.
• Batch data or near real time data	• Often real-time data
• Structured or Unstructured	• Multi-structured
• Involves Business Intelligence, analysis and reporting	• Complex, advanced, predictive business analysis and insights

1.3.7 System Integrations

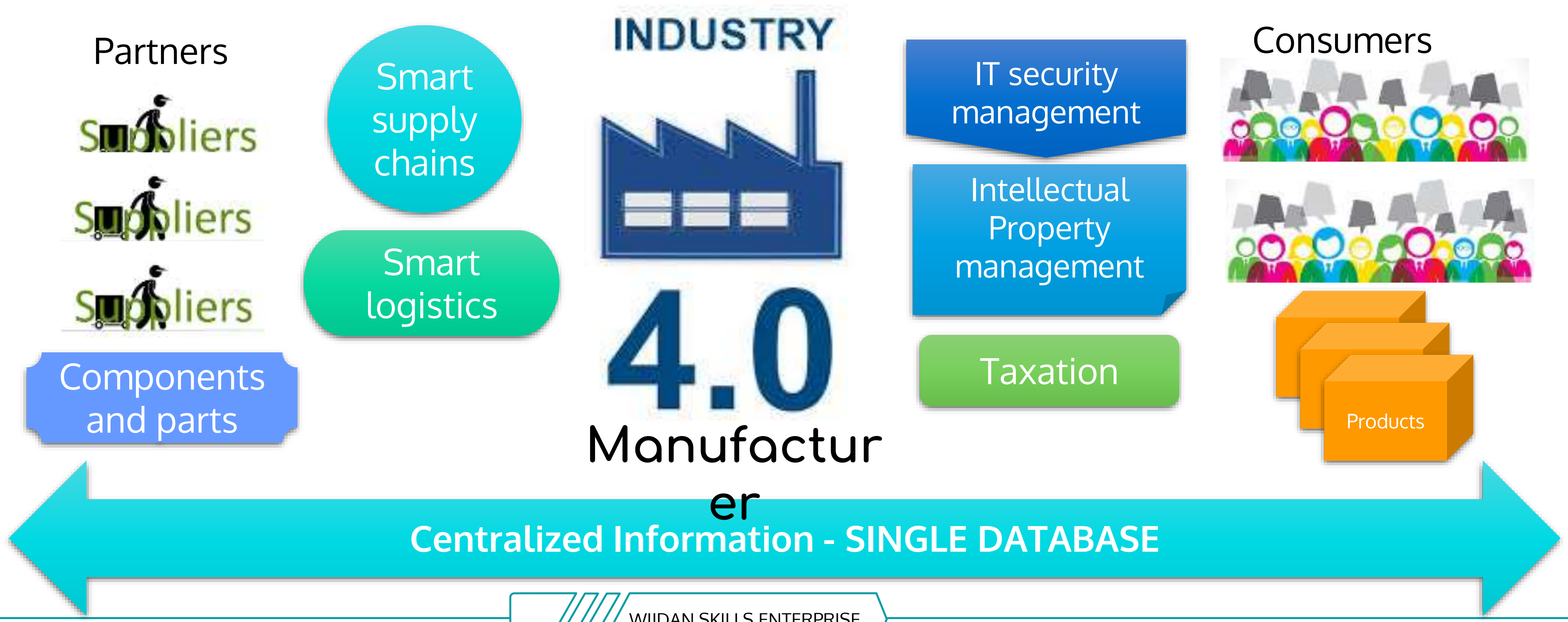
- A typical example of ***horizontal integration*** is Supply Chain Management, in
- which an organization tries to optimize the complete set of activities of
- order entry, purchasing, production, shipment etc. in order to minimize the
- lead-time and costs for production, and at the same time maximize value
- for the customer.
- ***Vertical intra-organizational integration*** is aimed to integrate systems
- implemented at different administrative levels of an organization.



1.3 Building Blocks of Industry 4.0

1.3.7 System Integrations

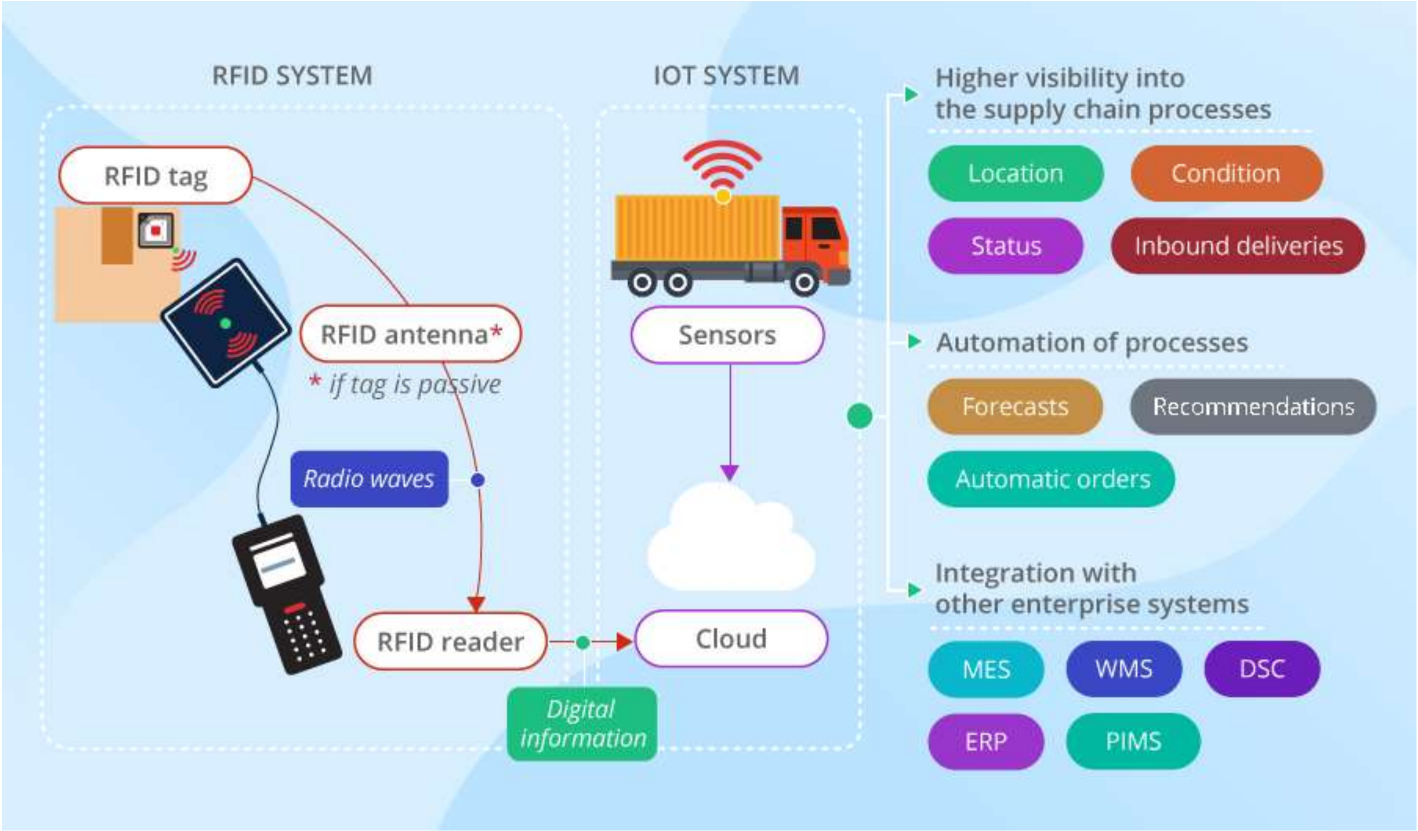
Horizontal Integration



1.3 Building Blocks of Industry 4.0

1.3.7 System Integrations

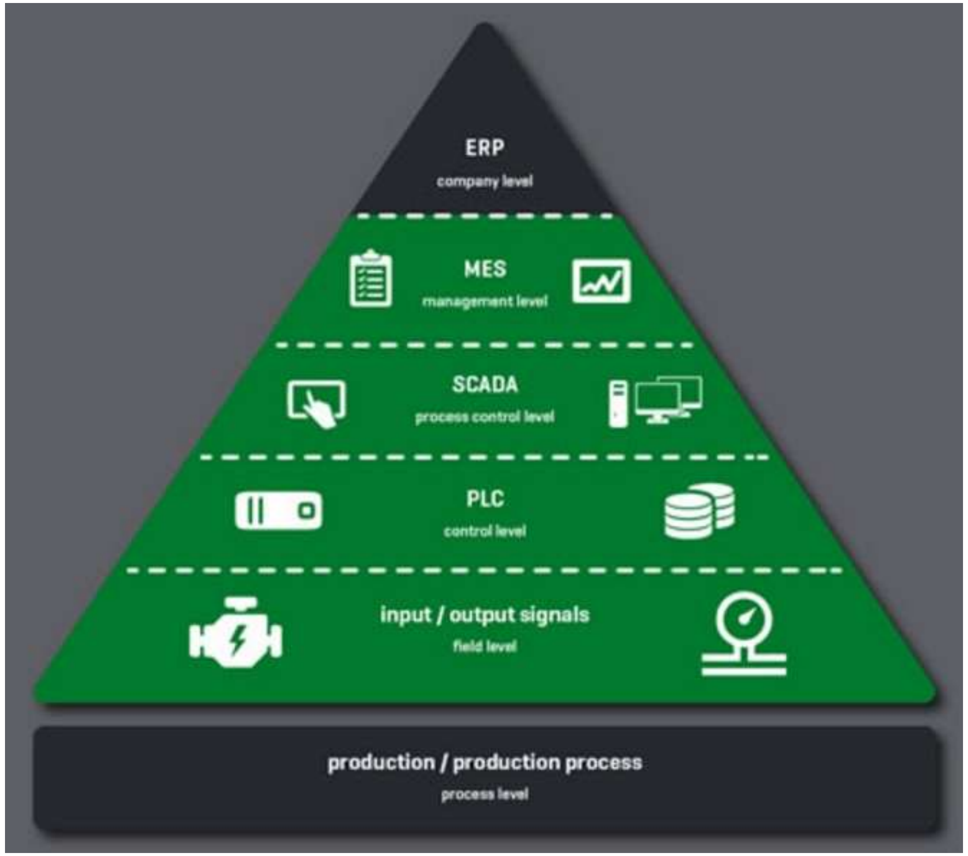
- **Smart Logistics** and **Smart Supply Chain** is the backbone for horizontal integration in the system integration.
- This can be done by the implementation of IoT technology and RFID technology in the Smart Logistic and Smart Supply Chain solution.



1.3 Building Blocks of Industry 4.0

1.3.7 System Integrations

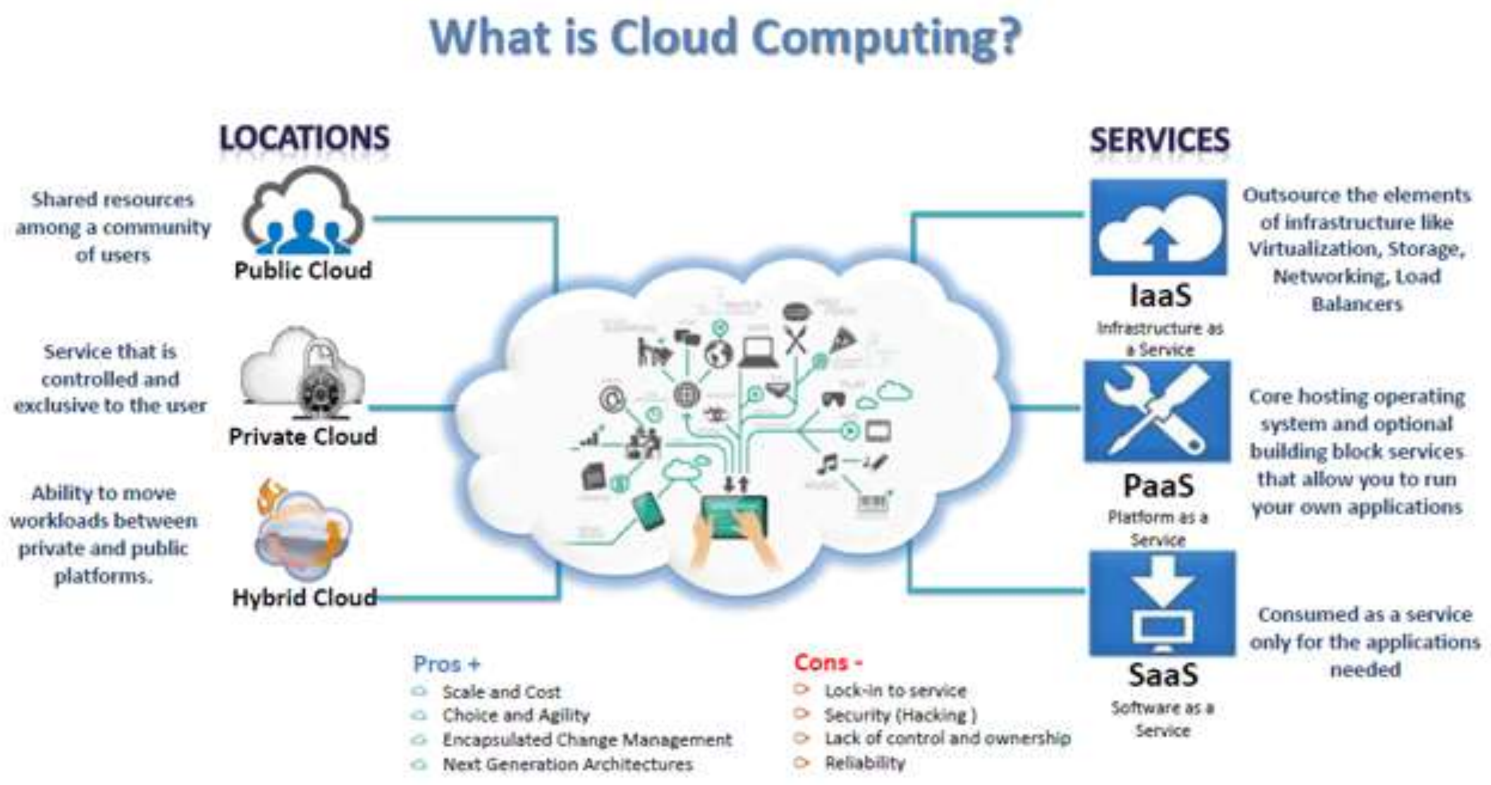
- Vertical Integration is about the **integration of IT systems** at various **hierarchical production** and **manufacturing levels / components:**
  - **Field Level** – **interfacing** with the **production process** via **sensors and actuators**
  - **Control Level – regulation** of both **machines** and **systems**
  - **Production Process Level – process monitoring** and **control**
  - **Operation Level – Production planning, quality management , etc**
  - **Enterprise Planning Level – Order management** and **processing** as well as **overall production planning**



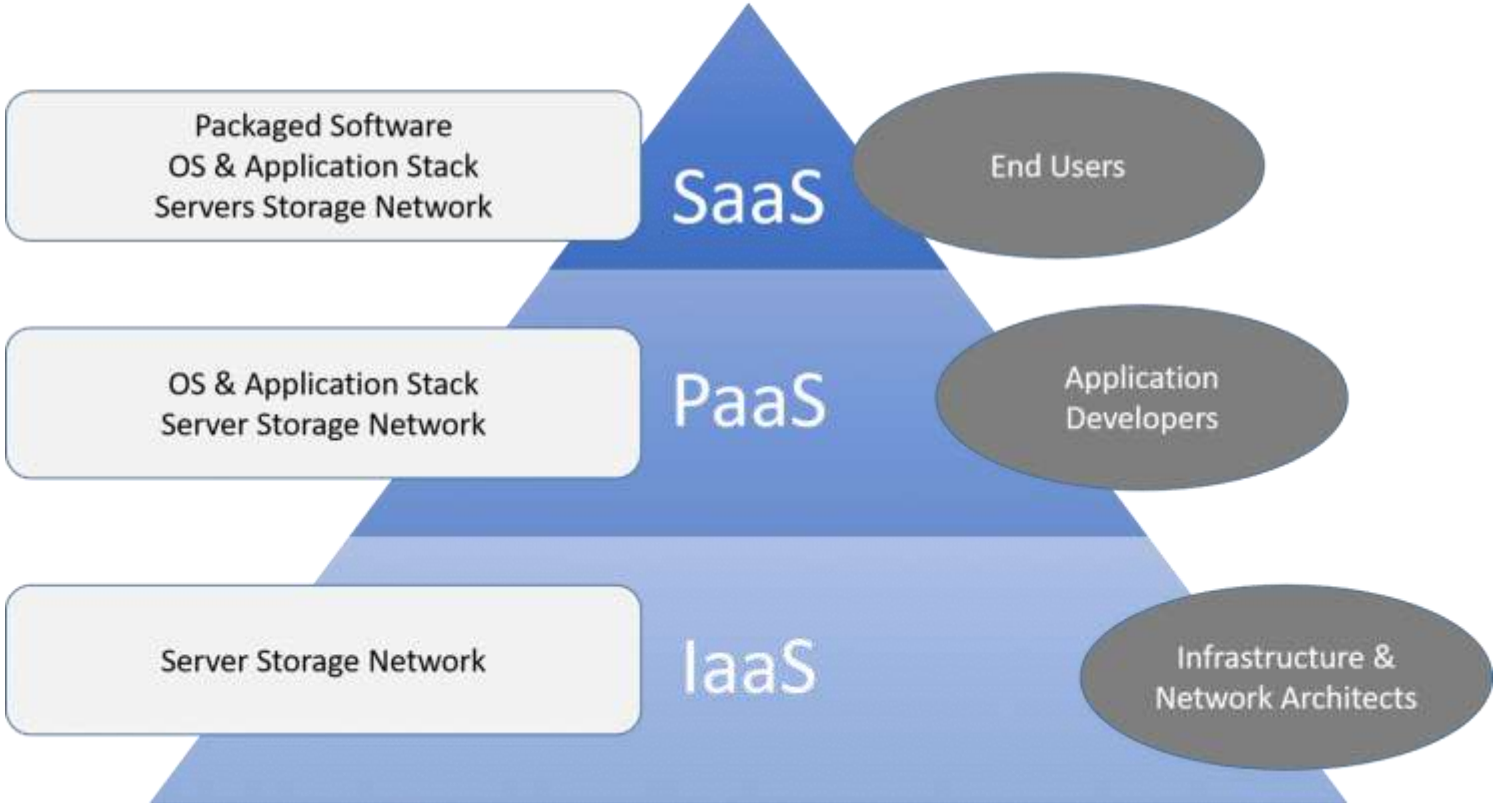
1.3.8 Cloud Computing

- Cloud Computing is a model for enabling ubiquitous, convenient, on demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provide interaction
- The Cloud is the connective tissue of Industry 4.0, the key element that makes it possible to develop a production strategy that is innovative, more effective and efficient by leveraging sensors, artificial intelligence and robotics.
- One of the keys to the success of Industry 4.0 and of smart manufacturing is the possibility, even for small to medium-sized companies, to choose flexible deployment models for largescale innovations, with the guarantee of a significant competitive edge.

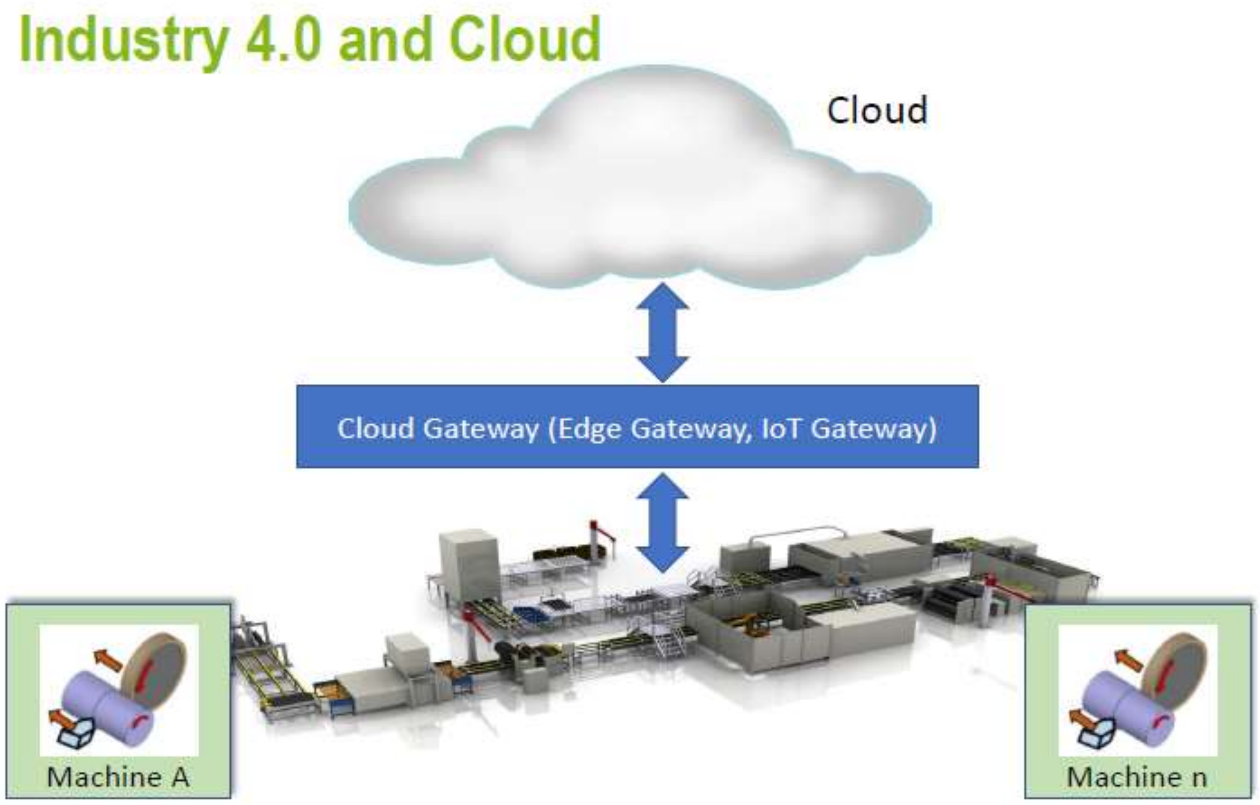
1.3.8 Cloud Computing



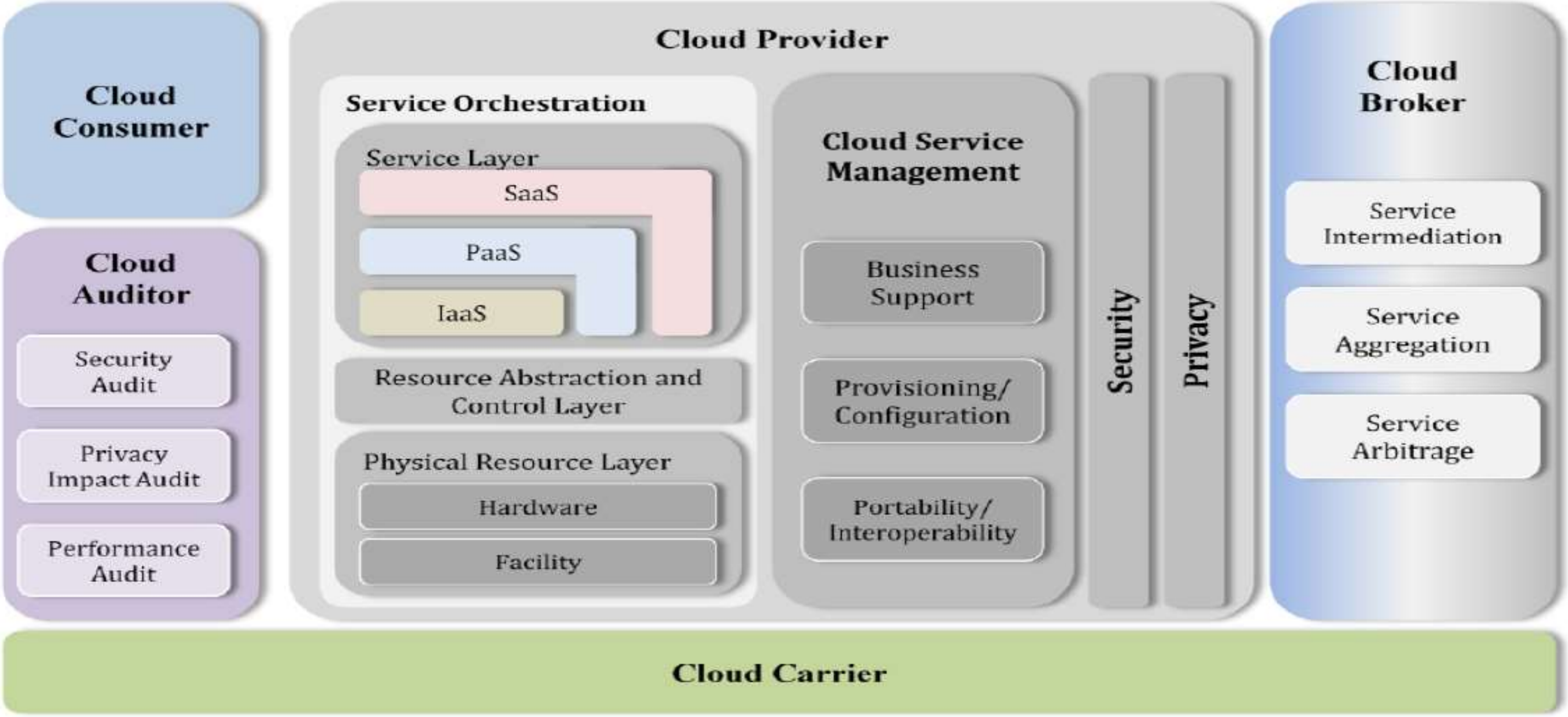
1.3.8 Cloud Computing



1.3.8 Cloud Computing



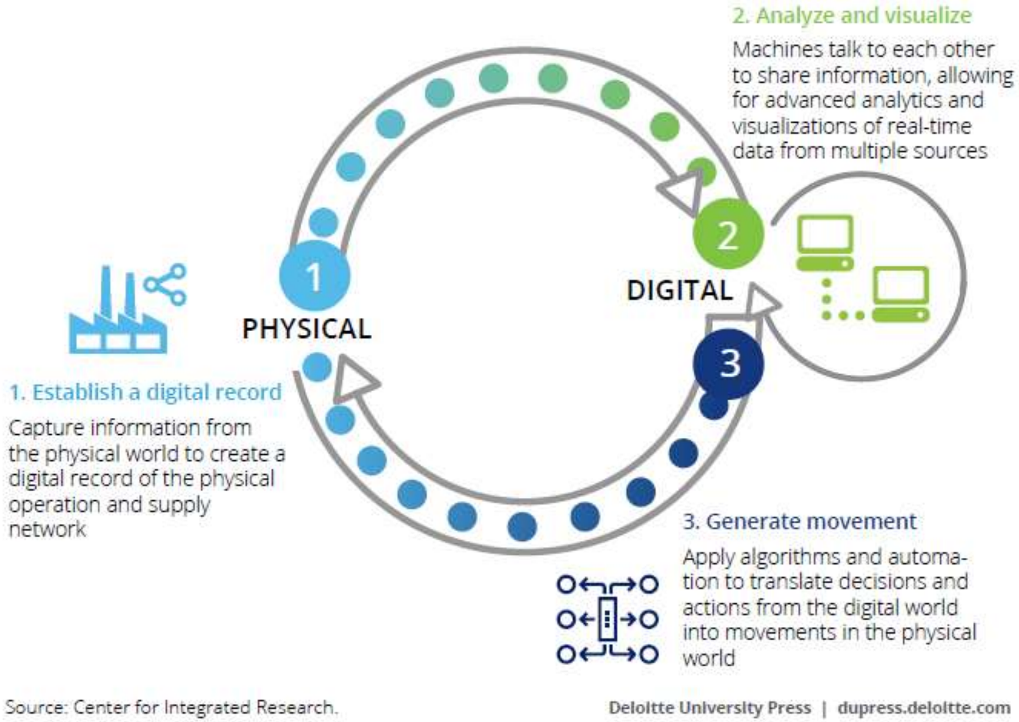
1.3.8 Cloud Computing



1.3.9 Cyber Security

- A successful organization should have multiple layers of security in place such as:
  - Physical Security
  - Personal Security
  - Operations security
  - Communications Security
  - Network Security

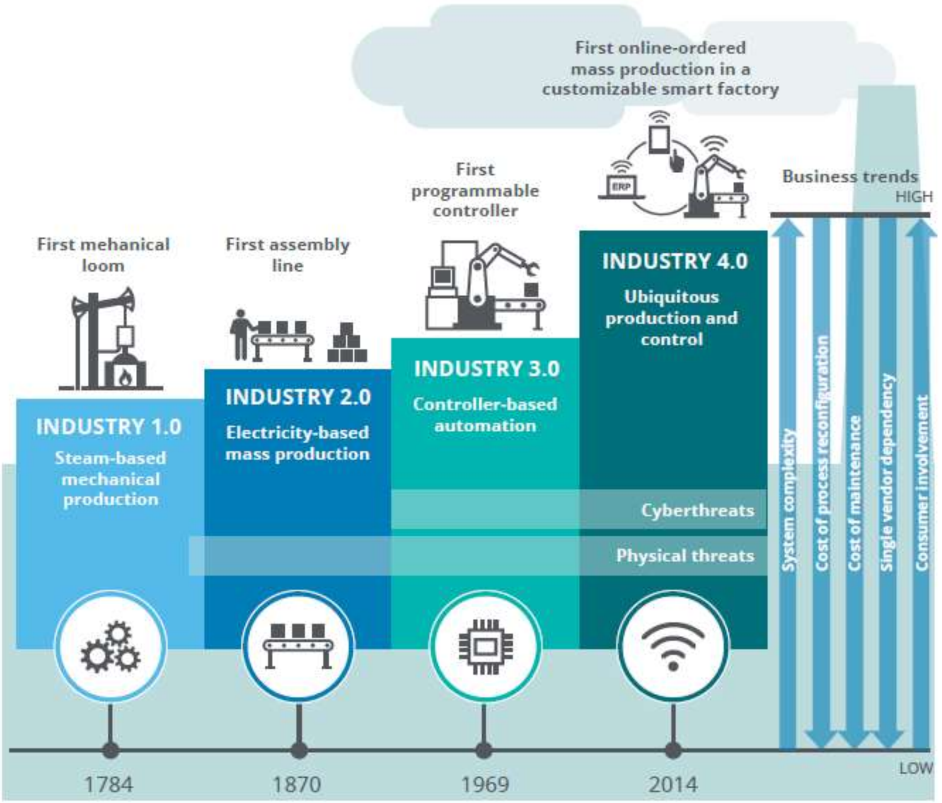
- Cyber Security is the body of technologies, processes and practices design to protect networks, computers, programs, and data from attacks, damage or unauthorised access.

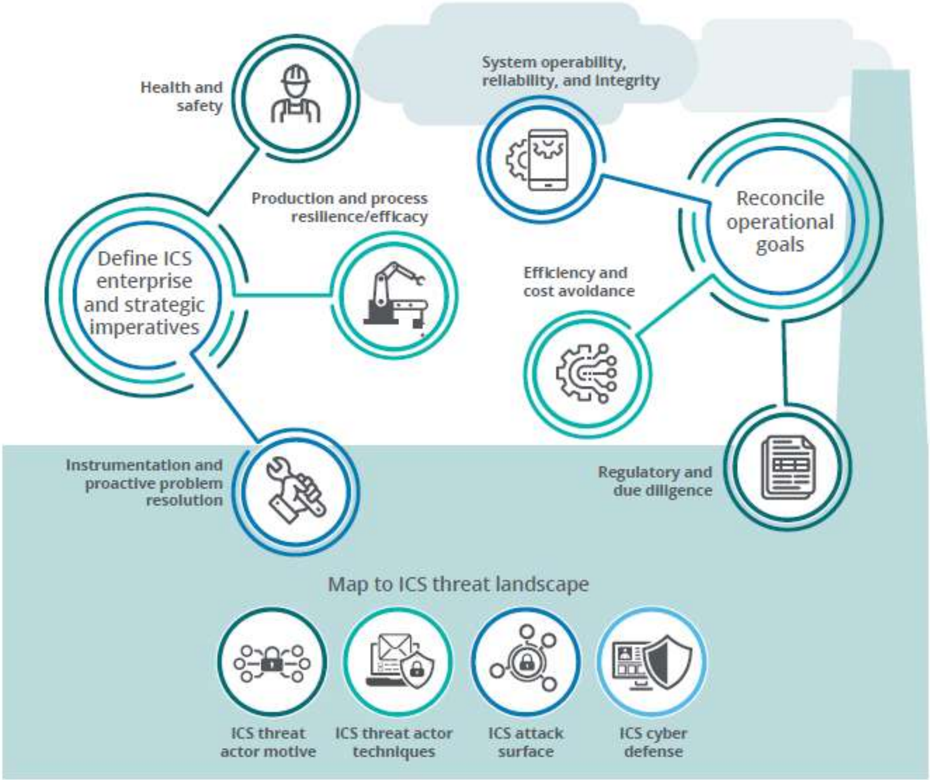


1.3 Building Blocks of Industry 4.0

1.3.9 Cyber Security

Industrial Revolutions and Progression of Cyber Threats





1.3.9 Cyber Security

- The magnitude of risks requires a secure, vigilant, and resilient approach to understand the dangers and address the threats:

- **Be secure.** Take a measured, risk-based approach to what is secured and how to secure it. Is your intellectual property safe? Is your supply chain or ICS environment vulnerable?

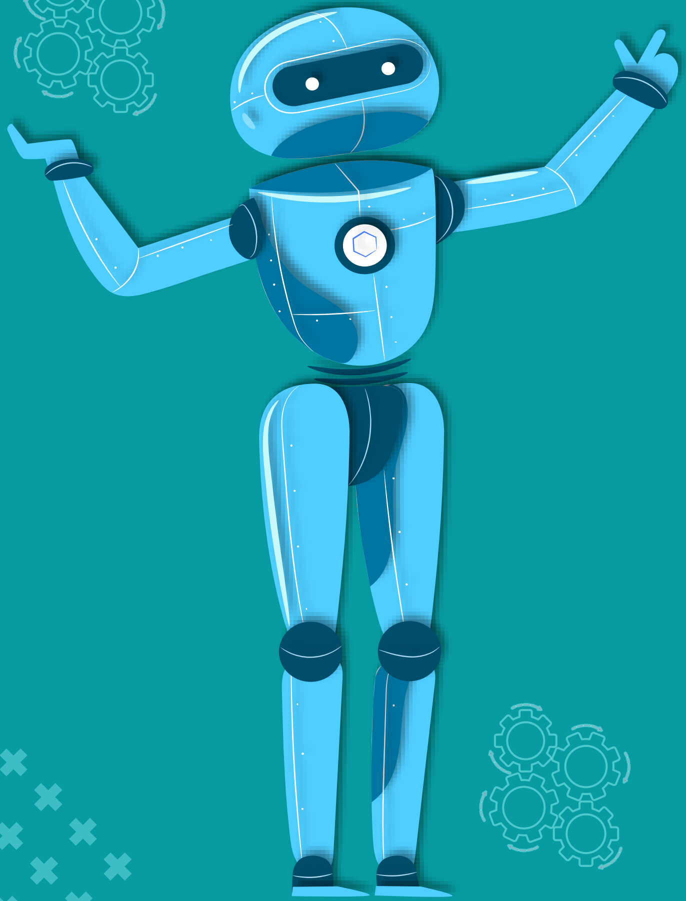
- **Be vigilant.** Continually monitor systems, networks, devices, personnel, and the environment for possible threats. Real-time threat intelligence and AI are often required to understand harmful actions and quickly identify threats across the multitude of new connected devices that are being introduced.

- **Be resilient**. An incident could happen. How would your organization respond? How long would it take to recover? How quickly could you remediate the effects of an incident?

QUICK RECAP!

1. Which of the 9 pillars are the most important core technology for Industry 4.0?

1.4



Potential Industrial Implications and Products Implications

1.4 Potential Industrial Implications and Products Implications

Philips Lighting

Users can control Philips Lighting hue lightbulbs via smartphone, turning them on and off, programming them to blink if they detect an intruder, or dimming them slowly at night.

Medtronic

Medtronic's implanted digital blood glucose meter connects wirelessly to a monitoring and display device and can alert patients to trends in glucose levels requiring attention.

Ralph Lauren

Ralph Lauren's Polo Tech Shirt, available in 2015, streams distance covered, calories burned, movement intensity, heart rate, and other data to the wearer's mobile device.

Babolat

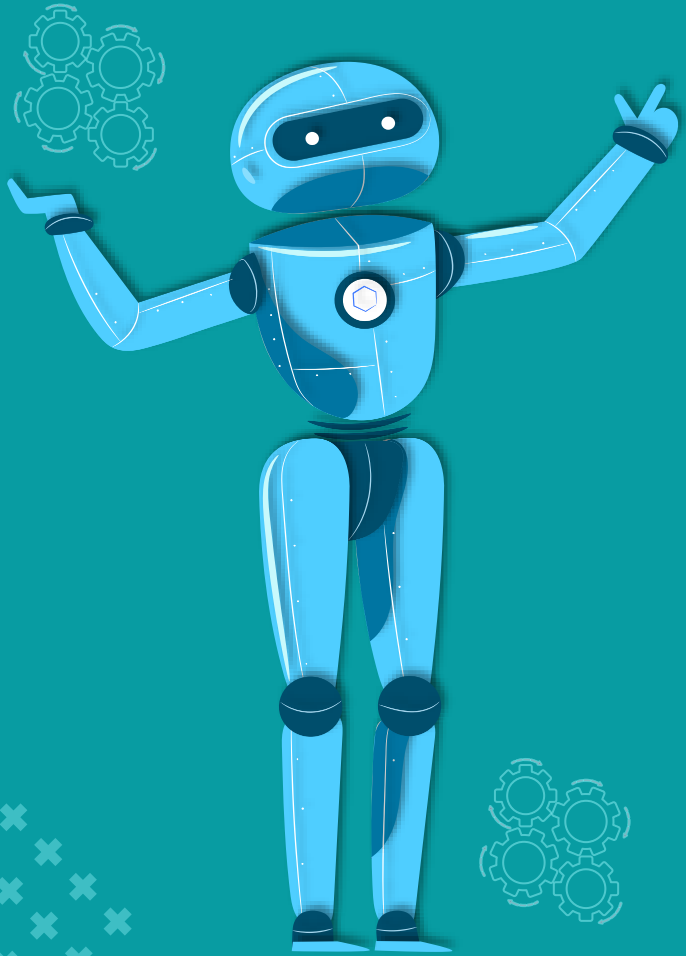
Babolat's Play Pure Drive product system puts sensors and connectivity in the tennis racket handle, allowing users to track and analyze ball speed, spin, and impact location to improve their game.

1.4 Potential Industrial Implications and Products Implications

QUICK RECAP!

1. In your opinion, what are other implication that we will be facing while migrating towards Industry 4.0 revolution?

1.5



Impact of Industry 4.0

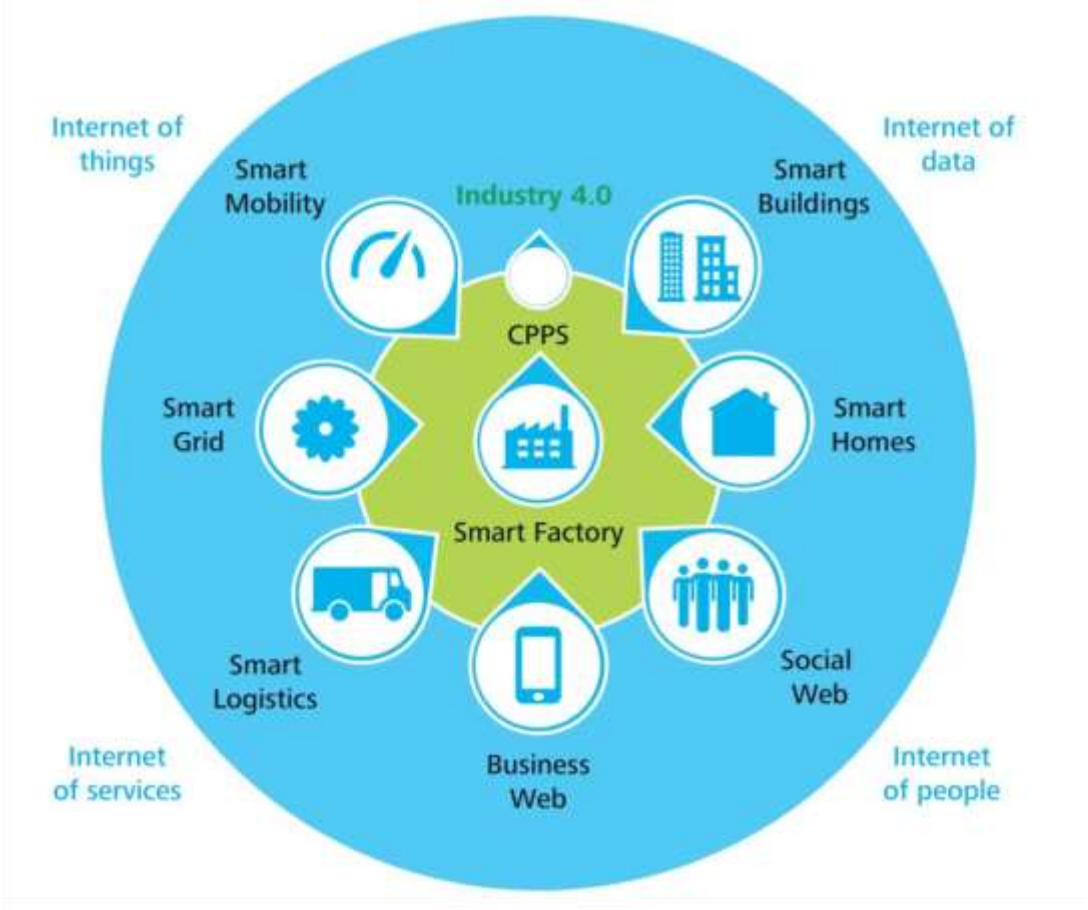
- Impacting all aspect of value chain
- Digital Enterprise
- Malaysia Readiness Towards Industry 4.0

1.5 Impact of Industry 4.0

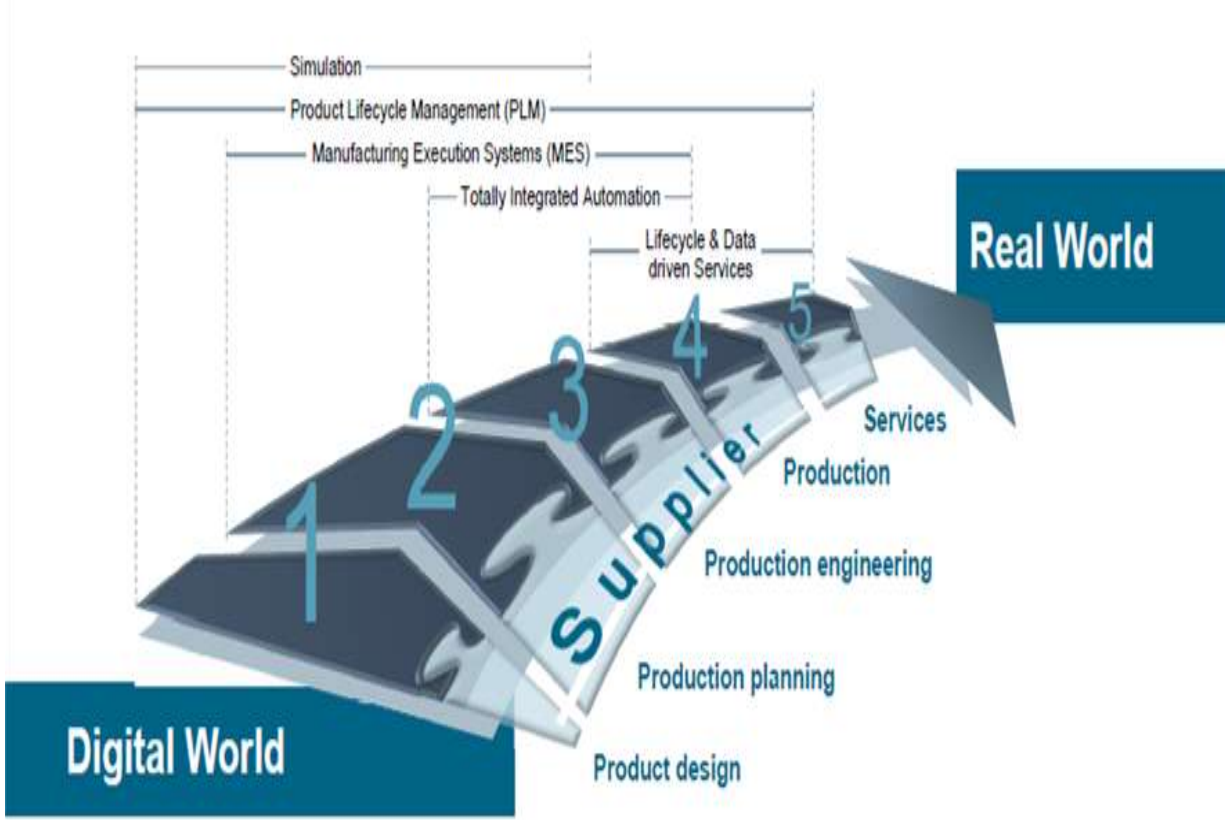
- The obvious impact of Industry 4.0 would the change in working and living environment.

- Figure on the right shows the industry 4.0 environment. The centre of the industry 4.0 environment is the **Smart Factory**.

- This environment are made possible by the implementation of:
  - Internet of things,
  - Internet of data
  - Internet of people
  - Internet of services



1.5.2 Digital Enterprise



What is Digitized?
Digitized is a process of taking something analogue and converting it into a digital form.

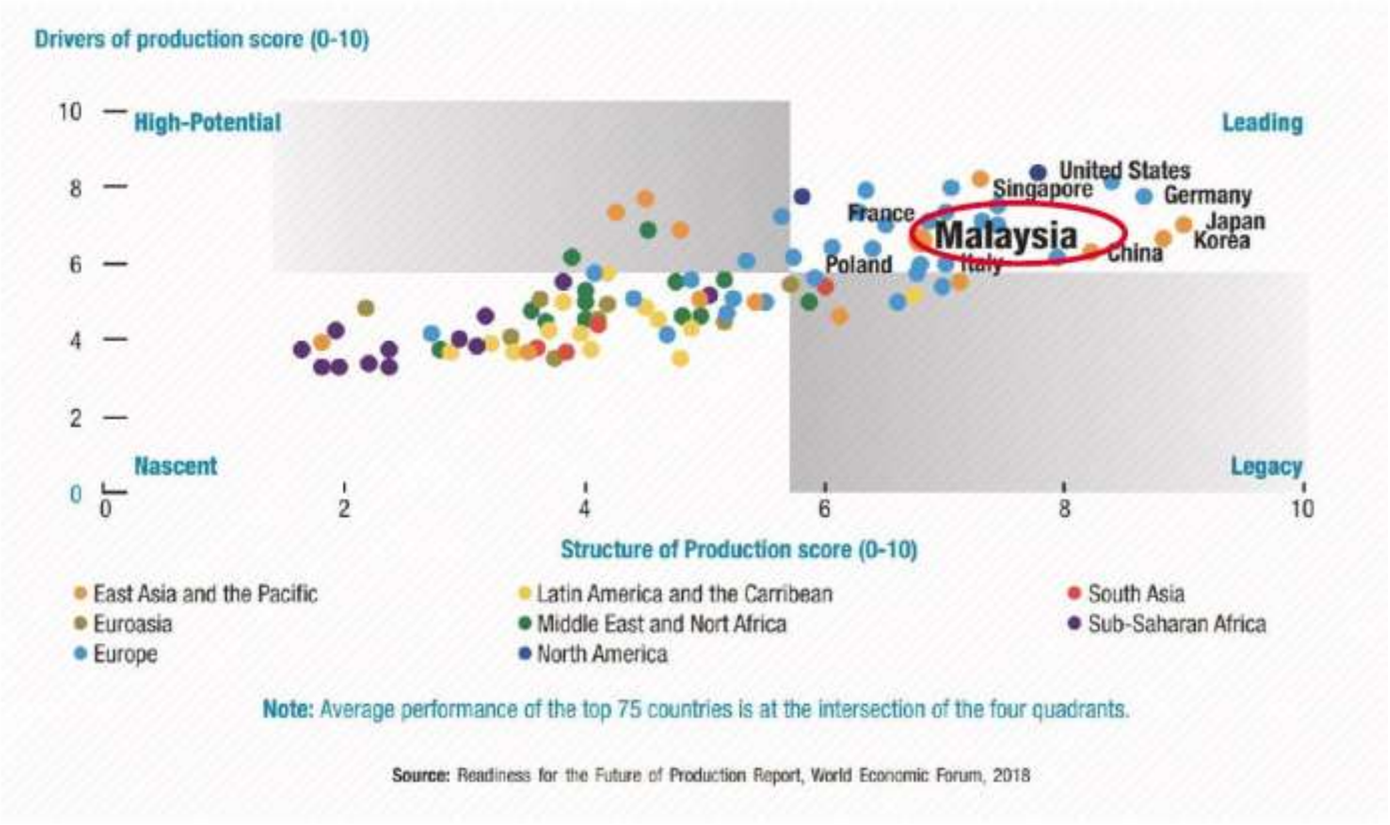
What is Digitalization?
Digitalization is a task of using digital technologies to change a business model and provide a new revenue and value producing opportunities: it is the process of moving to digital business.

What is Digital Transformation?
Digital transformation is the profound transformation of business and organizational activities, processes, competencies and models to fully leverage the changes and opportunities of a mix of digital technologies and their accelerating impact across society in a strategic and prioritized way, with present and future shifts in mind.

1.5.3 Malaysia Readiness Towards Industry 4.0

- On 31st of October 2018, our Prime Minister, YAB Tun Dr. Mahathir Mohamad launched the National Policy on
- Industry 4.0, known as **Industry*4WRD***. The Ministry of International Trade and Industry (MITI) has led the development of Industry*4WRD* since mid-2017 with several other ministries such as Ministry of Finance (MoF), Ministry of Multimedia and Communications (KKMM), Ministry of Human Resources (MoHR), Ministry of Education (MoE), and Ministry of Energy, Science, Technology, Environment and Climate Change (MESTEC), agencies and industry and stakeholders.

1.5.3 Malaysia Readiness Towards Industry 4.0



The recent report on the Readiness for the Future of Production Report 2018, jointly published by the World Economic Forum (WEF) and A.T. Kearney, provides a global assessment of 100 countries and positions Malaysia in the **"Leader"** quadrant. These are countries with a **"strong current production base"** and who are **"positioned well for the future"**.

QUICK RECAP!

1. Give two (2) example of Digital Enterprise business that are currently booming.