Industrija 4.0 (Industry 4.0)

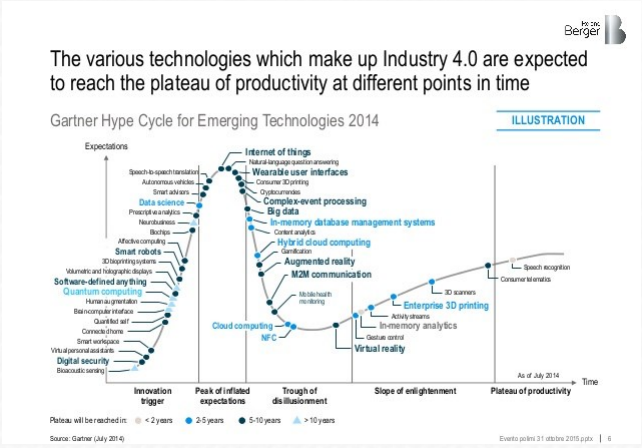
- Res nekaj novega ali le *buzzword*?
- Nekateri sorodni ali vezani pojmi/področja:
  - Računalništvo v oblaku (Cloud computing)
  - Digitalizacija
  - Internet stvari (IoT – Internet of Things)
  - Digitalni dvojček (Digital twin)

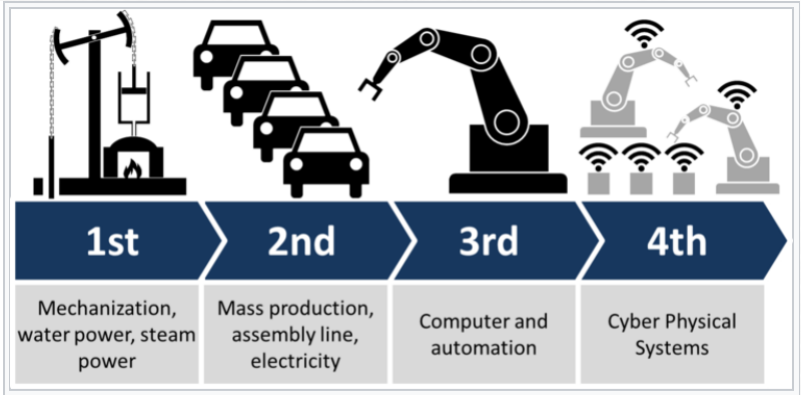
Cloud computing

- Primeri:
  - Office 365
  - Dynamics 365 bo na voljo le še kot SaaS/PaaS in ne več *on-premise*
  - Sales*Force*
- Pojmi:
  - SaaS: Software as a service
  - PaaS: Platform as a service
- Pasti računalništva v oblaku!!!

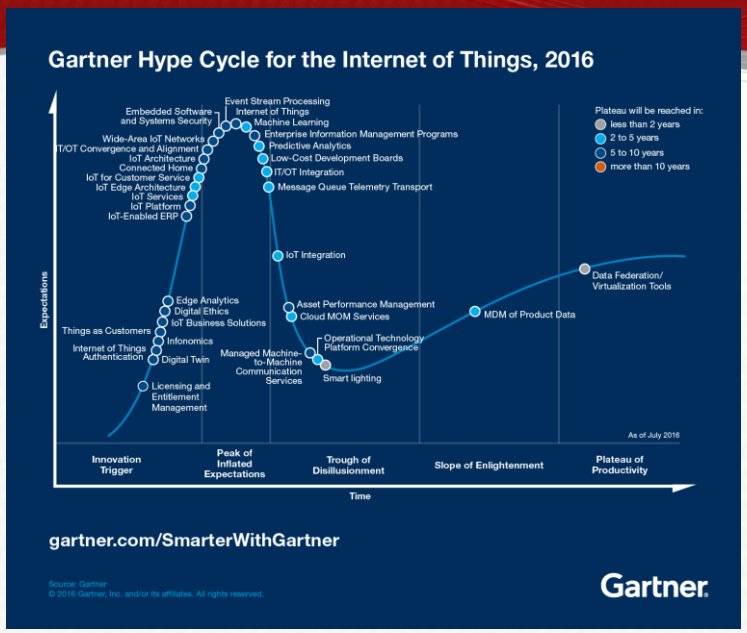
Industry 4.0

- Industry 4.0 is a name for the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, the Internet of things, cloud computing and cognitive computing





Industrial revolutions and future view



Industry 4.0 concepts

- Interoperability: The ability of machines, devices, sensors, and people to connect and communicate with each other via the Internet of Things (IoT) or the Internet of People (IoP). Adding IoT will further automate the process to a large extent
- Information transparency: The ability of information systems to create a virtual copy of the physical world by enriching digital plant models with sensor data. This requires the aggregation of raw sensor data to higher-value context information.
- Technical assistance: First, the ability of assistance systems to support humans by aggregating and visualizing information comprehensibly for making informed decisions and solving urgent problems on short notice. Second, the ability of cyber physical systems to physically support humans by conducting a range of tasks that are unpleasant, too exhausting, or unsafe for their human co-workers.
- Decentralized decisions: The ability of cyber physical systems to make decisions on their own and to perform their tasks as autonomously as possible. Only in the case of exceptions, interferences, or conflicting goals, are tasks delegated to a higher level

Povzeto po WikiPedia

PLM – Product Lifecycle Management

- PLM is the process of managing the entire lifecycle of a product from inception, through engineering design and manufacture, to service and disposal of manufactured product
- PLM integrates people, data, processes and business systems and provides a product information backbone for companies and their extended enterprise
- All companies need to manage communications and information with their customers (CRM-customer relationship management), their suppliers and fulfillment (SCM-supply chain), their resources within the enterprise (ERP-enterprise resource planning) and their product planning and development (PPD)

Povzeto po WikiPedia

PLM areas

- Systems engineering (SE) is focused on meeting all requirements, primarily meeting customer needs, and coordinating the systems design process by involving all relevant disciplines
- Product and portfolio management (PPM) is focused on managing resource allocation, tracking progress, plan for new product development projects that are in process (or in a holding status)
- Product design (CAx) is the process of creating a new product to be sold by a business to its customers
- Manufacturing process management (MPM) is a collection of technologies and methods used to define how products are to be manufactured
- Product data management (PDM) is focused on capturing and maintaining information on products and/or services through their development and useful life
- What about use and maintenance?

Stages of PLM

- Conceive
  - Specification
  - Concept design
- Design
  - **Detailed design**
  - **Validation and analysis (simulation)**
  - Tool design
- Realise
  - Plan manufacturing
  - **Manufacture**
  - **Build/Assemble**
  - Test (quality control)
- Service
  - Sell and deliver
  - **Use**
  - **Maintain and support**
  - Dispose

Digital Twin

- Digital twin refers to a digital replica of physical assets, processes and systems that can be used for various purposes
- Digital twins integrate artificial intelligence, machine learning and software analytics with data to create living digital simulation models that update and change as their physical counterparts change
- A digital twin continuously learns and updates itself from multiple sources to represent its near real-time status, working condition or position
- This learning system, learns from itself, using sensor data that conveys various aspects of its operating condition; from human experts, such as engineers with deep and relevant industry domain knowledge; from other similar machines; from other similar fleets of machines; and from the larger systems and environment in which it may be a part of. A digital twin also integrates historical data from past machine usage to factor into its digital model

- A digital twin also can be used for monitoring, diagnostics and prognostics to optimize asset performance and utilization. In this field, sensory data can be combined with historical data, human expertise and fleet and simulation learning to improve the outcome of prognostics
- Complex prognostics and Intelligent Maintenance System platforms can leverage the use of digital twins in finding the root cause of issues and improve productivity
- Examples:
  - Aircraft engine
  - Locomotive
  - Wind turbines

- https://www.youtube.com/watch?v=xObowMh6X0w&list=PLQYlqo5bjF7iueu7xadbcmQcBiikrtQPU&index=11
- https://www.youtube.com/watch?v=hiDgo7CIYr0&list=PLQYlqo5bjF7iueu7xadbcmQcBiikrtQPU&index=10
- https://www.youtube.com/watch?v=8ger1wrAonM&list=PLQYlqo5bjF7iueu7xadbcmQcBiikrtQPU&index=7
- https://www.youtube.com/watch?v=1IiMFyMGWIU&list=PLQYlqo5bjF7iueu7xadbcmQcBiikrtQPU&index=3