

S10: Industry 4.0

DTSL

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Industry 4.0 Technologies

- Cloud Computing
- Internet of Things versus Machine to Machine (M2M) - Digital Twins
- Big Data Analytics/ Artificial Intelligence
- Robotics & Robotics Process Automation
- Additive Manufacturing - 3D Printing
- Advanced HCI - Augments Reality/ Virtual Reality & Metaverse (by extension)
- Drones

Cloud Computing

IaaS

- Highly scalable and automated computer resources; Resources on-demand and as-needed; Most flexible
- Concerns: Data security, Runtime efficiency issues
- AWS, Meghdoot, Microsoft Azure, Rackspace

PaaS

- Server, storage and networking managed; Platform for software creation; Middleware available; Integrates web services & databases
- Concerns: Data security, Vendor lock-in, Run-time efficiency
- Windows Azure, Google App Engine, AWS Beanstalk

Cloud Computing

SaaS

- Most common; Uses Internet to deliver apps, Primarily through web browser, No installation, Streamlined maintenance
- Concerns: Interoperability, vendor lock-in, data security, less control & customization
- Gsuite, WebEx, Dropbox

Cloud Computing – Business Impact

Technology

- Private, Public or Hybrid
- IaaS, PaaS, SaaS

Business Impact

- On-demand access; Scalability; Cost; Organizational Agility; Extension Developers
- Flexibility & mobility, Data - Integrity, Reliability & Availability, Security
- Patch management, Disaster Mgmt., Business Continuity Planning
- Foundation for Social Web, Analytics, Mobile Computing to work together

Digital Twins

- <https://www.youtube.com/watch?v=iVS-AuSjpOQ> - In-class
- https://www.youtube.com/watch?v=Szjz_4QY628

Robotics & Robotic Process Automation

- Primary target processes
 - Highly manual; Repetitive
 - Rule-based - with low exceptions rate
 - Standard electronic readable input
- <https://www.youtube.com/watch?v=9URSbTOE4YI>
- Benefits
 - Freeing up staff for higher value task; Reduced Operational Risk
 - Cost saving; High Accuracy; Improved Employee Productivity

Additive Manufacturing

Technology

- 3D Printing

Business Impact

- Prototyping: shorter processing and lead time, automation, simpler assembly
- Operational Improvements: reduced stocking (JIT), Less down time
- Lifetime benefits: product reliability, increased performance

AR/VR/Metaverse

Technology/ Key Themes

- Merging of Virtual & Physical Reality, Games-as-a-Platform
- NFTs, Avatar (Digital Twins) & Identity

Business Impact

- Training, Maintenance
- AR/VR - Fashion/Retail

Virtuality Continuum



Mixed Reality

Any environment where the real and virtual objects are combined within a single display

Real Environment

Consists solely of real or *physical* objects

Augmented Reality

The *real world* is augmented with digital elements

Augmented Virtuality

The *virtual world* is augmented with real or physical objects

Virtual Environment

Consists solely of real or *digital* objects

Advanced HCI

- Augments Reality Maintenance Training:
<https://www.youtube.com/watch?v=G5qnu15WOuU>

Metaverse

- Sandbox versus Decentraland
 - SAND versus MANA
 - Build, create, buy, sell assets versus primary entertainment (buy and sell digital real estate)

Some interesting developments

- NFTs: Jack Dorsey's first tweet; "MetaKovan" purchase from Beeple
- HSBC & the Sandbox
- A few others
 - Gucci (NFTs for digital collectibles), Adidas, The Smurfs,
 - Decentraland - JPMorgan - customer lounge
- Virtual Gucci bag (not an NFT - no value, use or transferability outside the Roblox world) was sold on Roblox for 350,000 Robux, (\$4,115 at that time), Physical cost of the purse being \$3,400
- Prada, Dolce & Gabbana have all launched their NFT collection
- However, Elon Musk's response on Metaverse!!!

Industry Adaptation

- <https://www.youtube.com/watch?v=j62U089HDx0> - Future of Manufacturing: Global Lighthouse Network
- <https://www.youtube.com/watch?v=lnSYF1ibb-4>
- Industry 5.0

References

- Establishing a Digital Lighthouse Capability: CIPLA
<https://www.youtube.com/watch?v=0KYKI75gfg4>
- <https://www.youtube.com/watch?v=LrM2DZd2dak>; From 22:13 to 42:00
- <https://www.youtube.com/watch?v=66WYARKYz5c> - Robotics & Automation
- NFTs: <https://www.voguebusiness.com/technology/gucci-is-rewarding-nft-holders-with-physical-pieces>
- <https://power.xyz/engage/story/top-brands-nft-revenue/>
- <https://zenledger.io/blog/sandbox-vs-decentraland/>