



# C1 module in Smart Products and Industrial Internet of Things

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# Smart Products and Industrial Internet of Things – 3\*1 point submodules

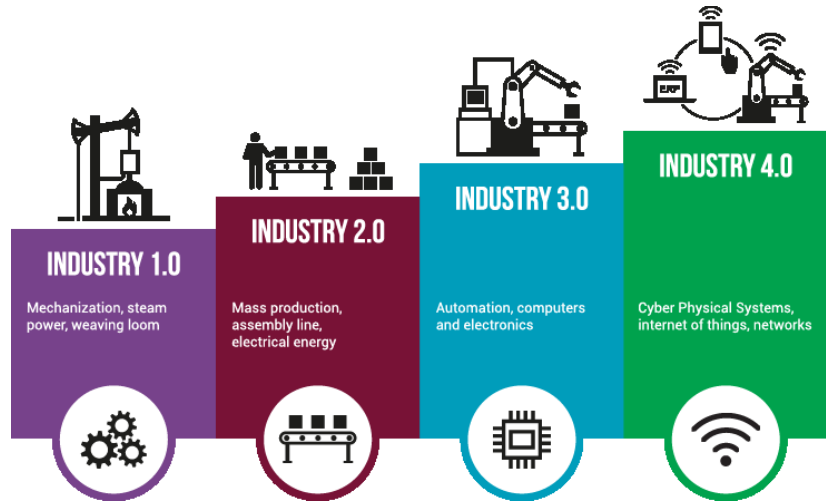
Module 1 Introduction to Industry 4.0 (1p)

Module 2 Ethical and Human Aspects in Industry 4.0 (1p)

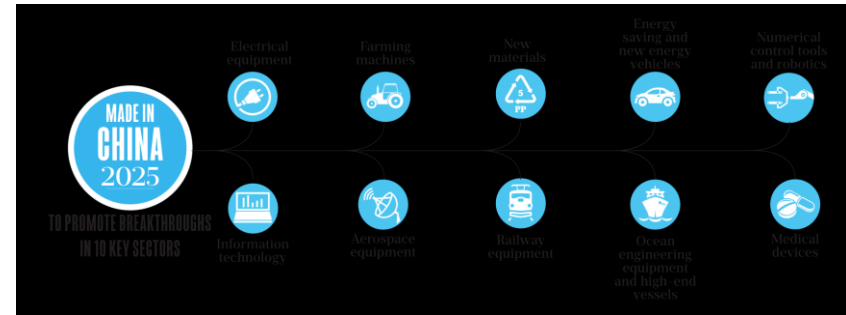
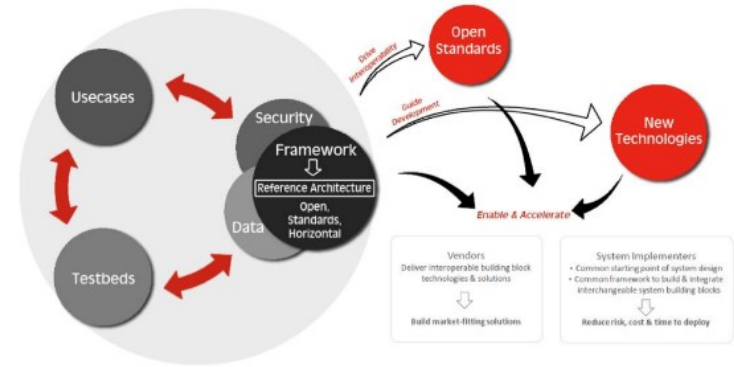
Module 3 Architectures for Smart Products and the Industrial Internet of Things(1p)

# Sub-Module 1 – Introduction to Industry 4.0

# SM1 - Overview



This module will position and introduce students to Industry 4.0. What it is? The main research programmes and development directions. The main system design concepts and ideas.



# SM1 – Learning Outcomes

- The Submodule on Introduction to Industry 4.0 has the following learning outcomes:
  - LO1 - Understand the main defining characteristics of the 4<sup>th</sup> Industrial Revolution, particularly compared to the 3<sup>rd</sup>.
  - LO2 - Get an overview of the main research programs worldwide (with emphasis on Europe) supporting the technical and scientific developments as well as their roadmaps.
  - LO3 - Understand the main system design concepts, at large, supporting the Industry 4.0.
  - LO4 - Understand the main technological landscape of Industry 4.0 and its implications in the design of smart production systems and smart products.

# SM1 – Planned Learning Activities (1/2)

- LO1 and LO2
  - Lectures
    - 1 2-hour introductory lecture.
    - 1 2-hour seminar with an invited expert from Industry (potential co-operation with SAP-DE or FESTO-DE (**to be decided upon acceptance of the modules contents**))
  - Homework assignments
    - Group presentation (groups of 4 students) including a summary of both lectures and a critical discussion establishing the parallels and differences between the views presented at both lectures. The presentation is followed by an open classroom discussion.

# SM1 – Planned Learning Activities (2/2)

- LO3 and LO4
  - Lectures
    - 2-hour lecture.
  - Laboratorial Activities
    - Demonstration and discussion of the Light Mechatronic Agent Development Environment Platform.
  - Homework assignments
    - Written reflection document of the entire modules.

# SM1 - Delivery

- Live Delivery of the SM1
  - During HT1 every year as part of the course TMPS35 at LiU
    - Local students attend physically
    - Other student attend through live streaming
- Offline Delivery of SM1
  - Through recorded lectures and presentation



# SM1 – Preliminary Budget

- No special costs if invited guests deliver the lecture online.

## Sub-Module 2 – Ethical and Human Aspects in Industry 4.0

# SM2 - Overview

## 1. Humans the next generation mechatronic devices for Industry 4.0?

“I think in decentralized control one has to be aware of the decision mechanisms. Control is granted to other parts of the system without any condition. If one understands these mechanisms they can be applied not only to technical systems but also to organizations and administrations. This could lead to improved conditions for employing people, more people instead of less. At the same time there is a research approach to improve the situation of humans in manufacturing by regarding them basically as an asset that needs mock up by augmented reality, by psychometric measurements, by some additional controllers and/or by improvement of the ergonomic environment. I want to draw the students’ attention to the fact that they for themselves have to take an active decision what road to follow for themselves in their respective work and what consequences this may have.”

Dr Christoph Hanisch (formely working at FESTO AG)

# SM1 – Learning Outcomes

- The Submodule on Introduction to Industry 4.0 has the following learning outcomes:
  - LO1 - Understand the main ethical and human aspects of I4.0.

# SM2 – Planned Learning Activities

- LO1
  - Seminar
    - 1 2-hour seminar from Dr Christoph Hanisch.
  - Homework assignments
    - Written reflection document of the seminar.

# SM2 - Delivery

- Live Delivery of the SM2
  - During HT1 every year as part of the course TMPS35 at LiU
    - Local students attend physically
    - Other student attend through live streaming
- Offline Delivery of SM2
  - Through recorded seminar

# SM2 – Preliminary Budget

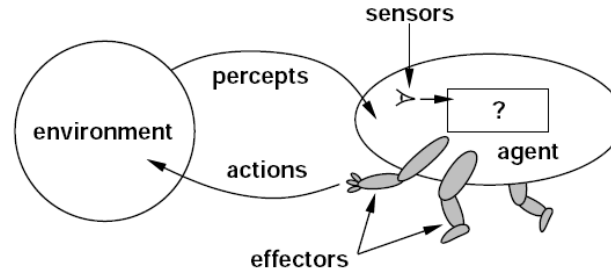
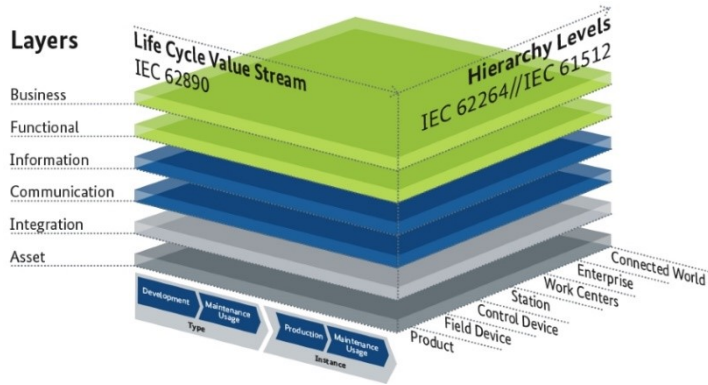
- No special costs if invited guests deliver the lecture online.

## Sub-Module 3 – Architectures for Smart Products and the Industrial Internet of Things

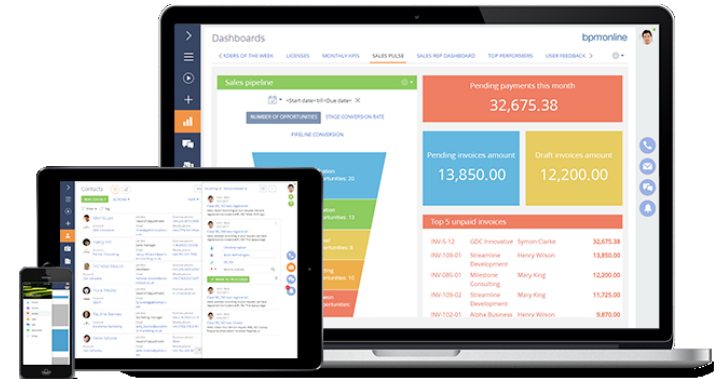


# SM3 - Overview

## Referenzarchitekturmodell Industrie 4.0 (RAMI 4.0)



This module will introduce the students to the design and implementation principles of intelligent automation systems as the basis for the smart factory as one component in the Industrial Internet of things connected to smart products.



# SM3 – Learning Outcomes

- The Submodule on Introduction to Industry 4.0 has the following learning outcomes:
  - LO1 - Understand some of the main technical reference architectures that have been proposed to support I4.0 systems.
  - LO2 – Understand how these architectures translate into the existing technologies.
  - LO3 – Understand how a smart product could look it when implemented using such technologies.
  - LO4 – Hands on experience in developing smart factories and smart products with the Light Mechatronic Agent Development Environment (LMADE) Platform.

# SM3 – Planned Learning Activities (1/2)

- LO1 and LO2
  - Lectures
    - 1 2-hour lecture on reference architectures and general design principles.
    - 1 2-hour seminar with an invited expert from Industry (potential co-operation with SICK-IVP (SE) or the Technical University of Munich (**to be decided upon acceptance of the modules contents**))
  - Homework assignments
    - Group presentation (groups of 4 students) including a summary of both lectures and a critical discussion establishing the parallels and differences between the views presented at both lectures. The presentation is followed by an open classroom discussion.

# SM3 – Planned Learning Activities (2/2)

- LO3 and LO4
  - Lectures
    - 3-hour seminar introducing the LMADE platform.
  - Laboratorial Activities
    - 4 hour assignment developing and testing systems with the LMADE platform.

# SM3 - Delivery

- Live Delivery of the SM1
  - During HT1 every year as part of the course TMPS35 at LiU
    - Local students attend physically
    - Other student attend through live streaming
    - Laboratorial work through remote connection to labs at LiU
- Offline Delivery of SM1
  - Through recorded lectures and presentation
  - Laboratorial work through remote connection to labs at LiU on a defined schedule

# SM3 – Preliminary Budget

- Extension of the existing mechatronic system to be able to accommodate an higher number of students including:
  - 4 Additional modular systems - **4\*25000 SEK = 100000 SEK**
  - 4 Additional compatible PLC and software licenses - **4\*15000 SEK = 60000 SEK**
  - Server and Network infrastructure for secure remote connection to the intelligent automation lab at LiU – **cost under investigation**
  - Additional costs to support the remote operation of the lab outside the HT1 – **to be discussed.**