iMOCO4.E

Intelligent Motion Control under Industry4.E

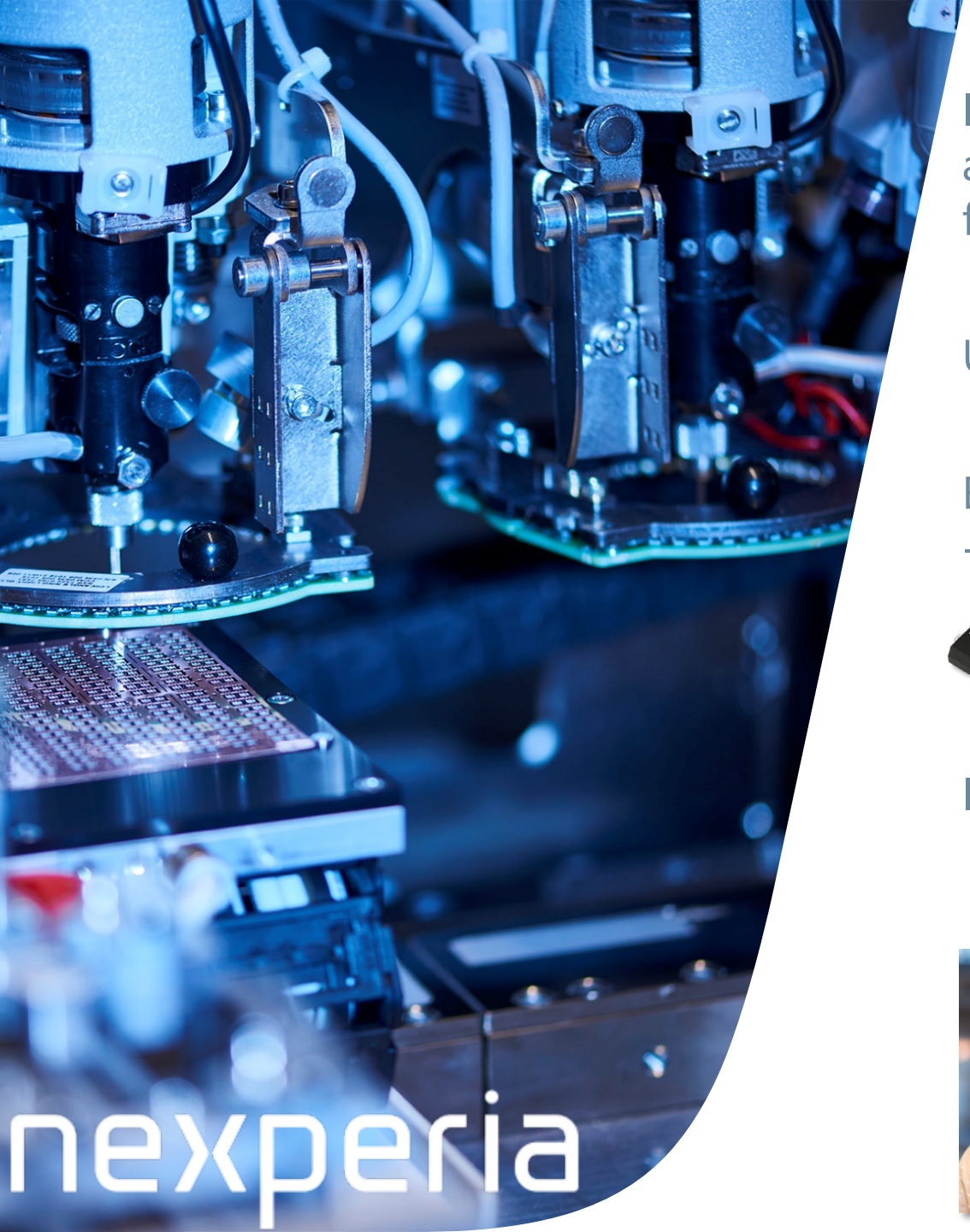
Edge-to-Cloud Intelligence for Resilient Manufacturing – The IMOCO4.E Initiative

Sajid Mohamed, Gijs van der Veen

Nexperia (ITEC)

Munich, November 18, 2021

The project has received funding from the Electronic Component Systems for European Leadership Joint Undertaking, under Grant Agreement n°101007311



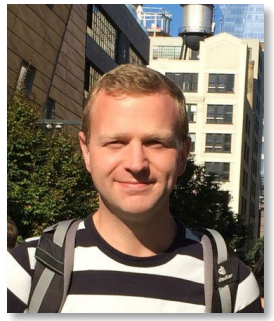
ITEC delivers the world's **most competitive** semiconductor assembly equipment and factory automation technologies for **high-volume**, **low-cost** semiconductor manufacturing

Up to 72.000 products per hour

Essential semiconductors
- 150 µm up to 5 mm

Installed base of >2500 systems

Sajid Mohamed
Principal R&D Engineer
- Vision-in-the-loop
- (Edge) computing



Gijs van der Veen
Technology architect
- Motion control
- Mechatronics

NEXPERIA ITEC BENCHMARK SOLUTIONS

For the Lowest Total Cost of Ownership in Semiconductor Manufacturing

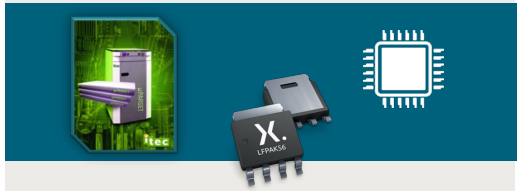
Lowest Integral Cost

ADAT3 Assembly Platform

- Process Portability
- Thinner wafers
- Flip Chip iso wires
- Placement accuracy
- 360º optical inspections
- Predictive Maintenance
- Versatility/ flexibility

Leading in high volume Small Die Pick & Place

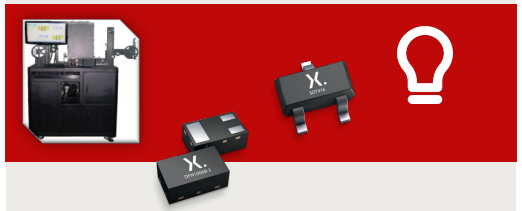
Parset Test platforms



- Multi-site testing
- High speed
- Integrated digital / analogue functions
- Test Platform consolidation/ wide Test coverage

Benchmark in Analog Testing of Small Signal to MOS devices

Inspection Platforms



- Higher Resolving power
- 3D imaging
- Infrared inspections
- Integration in IT infrastructure for traceability

Best-In-Class Mold Defect and In-Tape Inspections

Smart Manufacturing

- Full die level traceability
- Big Data analytics
- Data fusion
- Autonomous loops/ Machine learning

Leading in Industry 4.0 for mass production

Industry4.E

- A “Lighthouse initiative”
  - Concept introduced by ECSEL JU to signpost specific subjects of **common European Interest**

Industry4.E Lighthouse
@Industry4E

Industry4.E Lighthouse is a #ECSELJU -#H2020 funded collection of connected activities for Industry Digitalisation in the Electronic Components & Systems field.

Ireland industry4e.eu Joined October 2018

928 Following **529** Followers

- Industry4.E pulls together the necessary work that is core to the **“digitalisation of industry”**

ECSEL JU
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Intelligent Motion Control under Industry4.E

iMOCO4.E

Start: 1st September 2021

46 partners from **13 countries**

Coordinator: **Arend-Jan Beltman**, **SIOUX CCM B.V.** (Netherlands)

Contact: Arend-Jan.Beltman@sioux.eu

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About

- Harvesting the fruits of the digital transformation:
  - Data is all around us and computing power increases rapidly
    - Brings opportunities for new products and systems
      - Digital Twins
        - Verify/Grasp the function before realisation (digital systems engineering)
      - Application of AI methods
      - Prepare ourselves for the concept of ‘Servitization’
      - High performing embedded solutions (HW+SW)

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Why

- Market is **pushing machine performances** to their physical limits
- To improve, you have to **know more** about the system behavior
- Want to **visualize => understand => master** system dynamics
  - Digital transformation starts with generating [the right] data!
- Analyzing data and look for **correlations** to realize:
  - Less down-time
  - Less rejects
  - Higher output
  - More efficient operation etc.etc.
  - Data => Information

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Who

Machine builders and product developers, who:

- Seek for more **productivity/throughput**
- Face **fast & accurate** positioning challenges
- Seek for compensation of **disturbance sources** (like e.g. effect of temperature)
- Strive for ‘machine **data to information**’
- Strive for a more **agile development process** (without hardware cycle)
- Desire for **customized control & drive** hardware for series assembly
- Desire to **‘grasp’ the complexity** of their application(s)

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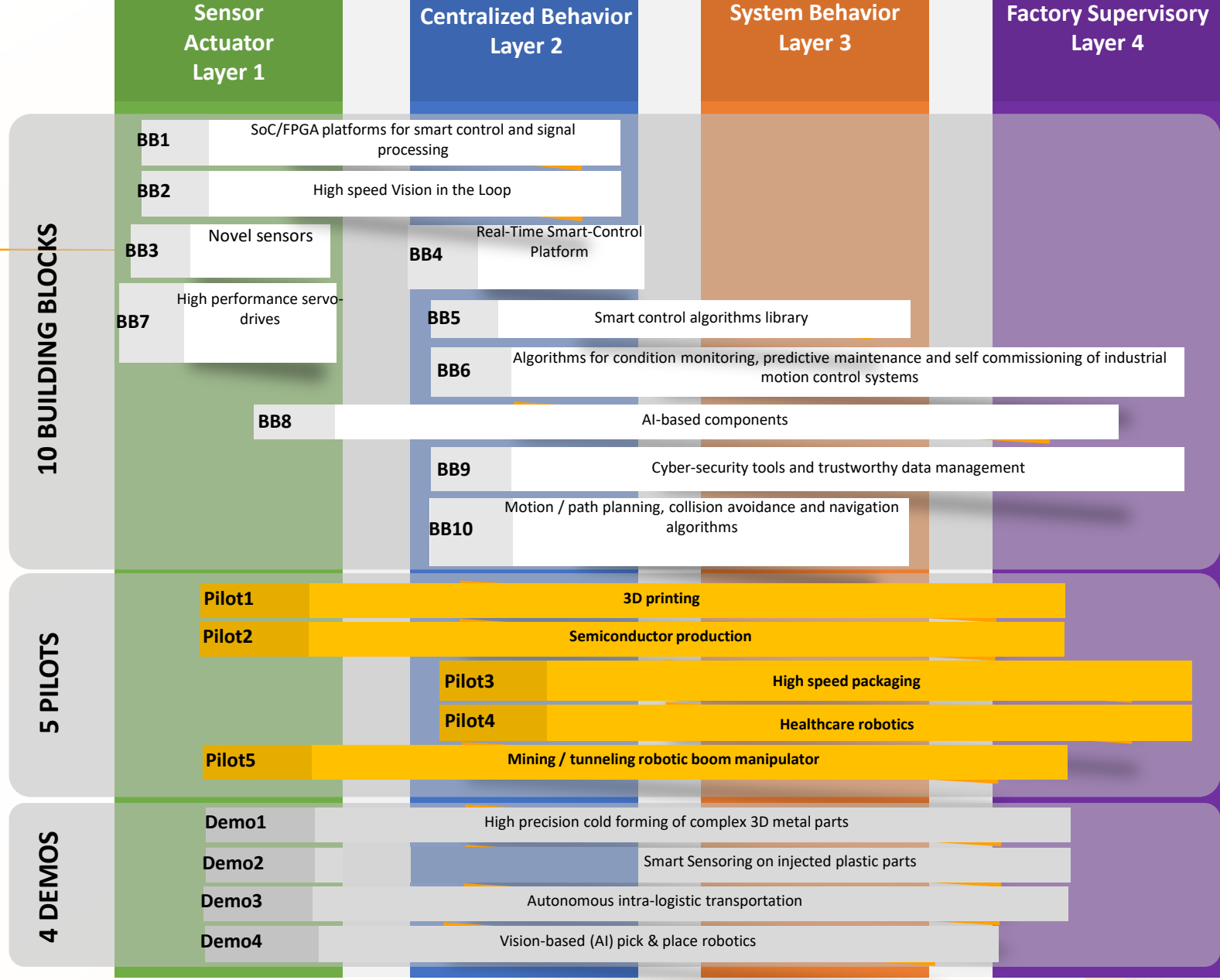
How

- 4 Architecture layers
- 10 Building blocks
- 5 Pilots
- 4 Demos
- 4 Use cases

- 8 Work Packages



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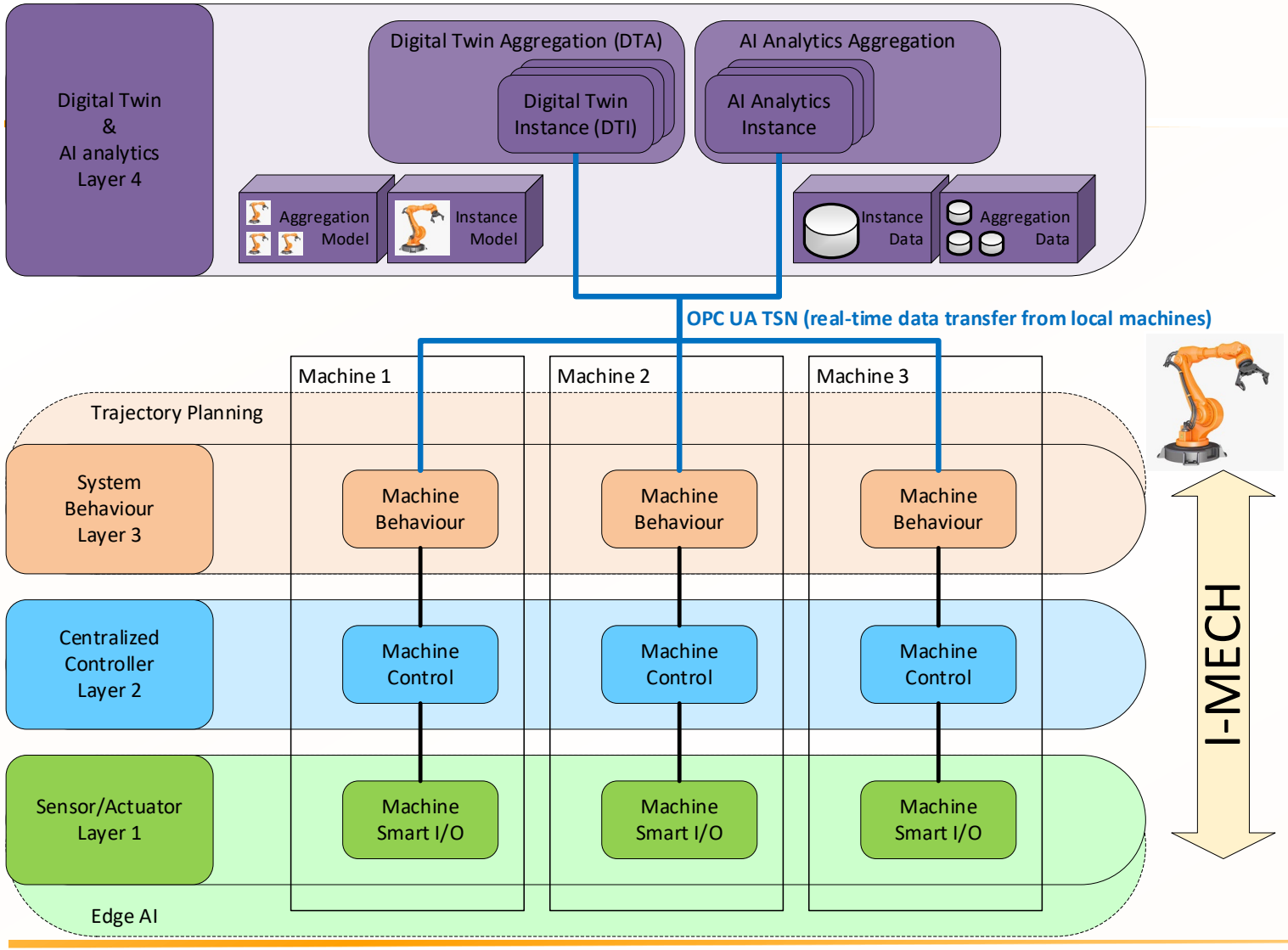
(Envisioned) Reference Architecture



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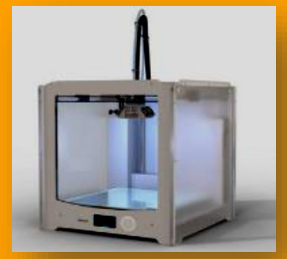
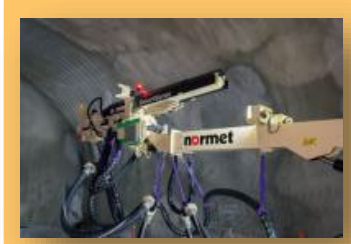
Pilot 1: SIOUX 3D printing



SIOUX TECHNOLOGIES

Pilot 2: ITEC Semiconductor production

normet



Pilot 5: Normet Mining / tunneling robotic boom manipulator

iMOCO4.E PILOTS

Pilot 4: Philips Healthcare robotics

Pilot 3: CRIT High speed packaging

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Demonstrators

1. High precision cold forming of complex 3D metal parts
2. Smart sensoring on injected plastic parts
3. Autonomous intra-logistic transportation
4. Vision-based AI pick & place robotics for randomly arranged and differently shaped bottles

Demo 3: STILL
Warehouse logistics

Demo 4: Madara
Cosmetics production

iMOCO4.E
DEMOS

Demo 1: Philips
Shaver blades

Demo 2: Edilasio
Plastic molding

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Tangible Results

- Pilots to hold* and demonstrate **building blocks (BBs):**

  3D Printing, Die (Chip) Placement, Packaging, Healthcare Robotics, Mining Robotics

- Demonstrators and Use Cases to demonstrate **BB methodologies**

  Forming 3D Parts, Injection Molding, (Intra) Logistics, (Pick & Place) Handling Bottles

  Smarter Inverters, (Milling) Highly Dynamical Loading, Tactile Robot Teleoperation, Advanced & Intuitive Robot Control and Planning

* = part of corporate platform

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The big (technical) picture

- WP2 brings the ‘System Engineering’ view how Building Blocks could click
- WP3,4,5 brings content that shall be mapped on reference architecture like brought by ‘System Engineering’ in WP2
- WP6 brings validation results of Building Blocks (First V of W approach)
- WP7 brings integration results of Building Blocks (2nd V of W approach)

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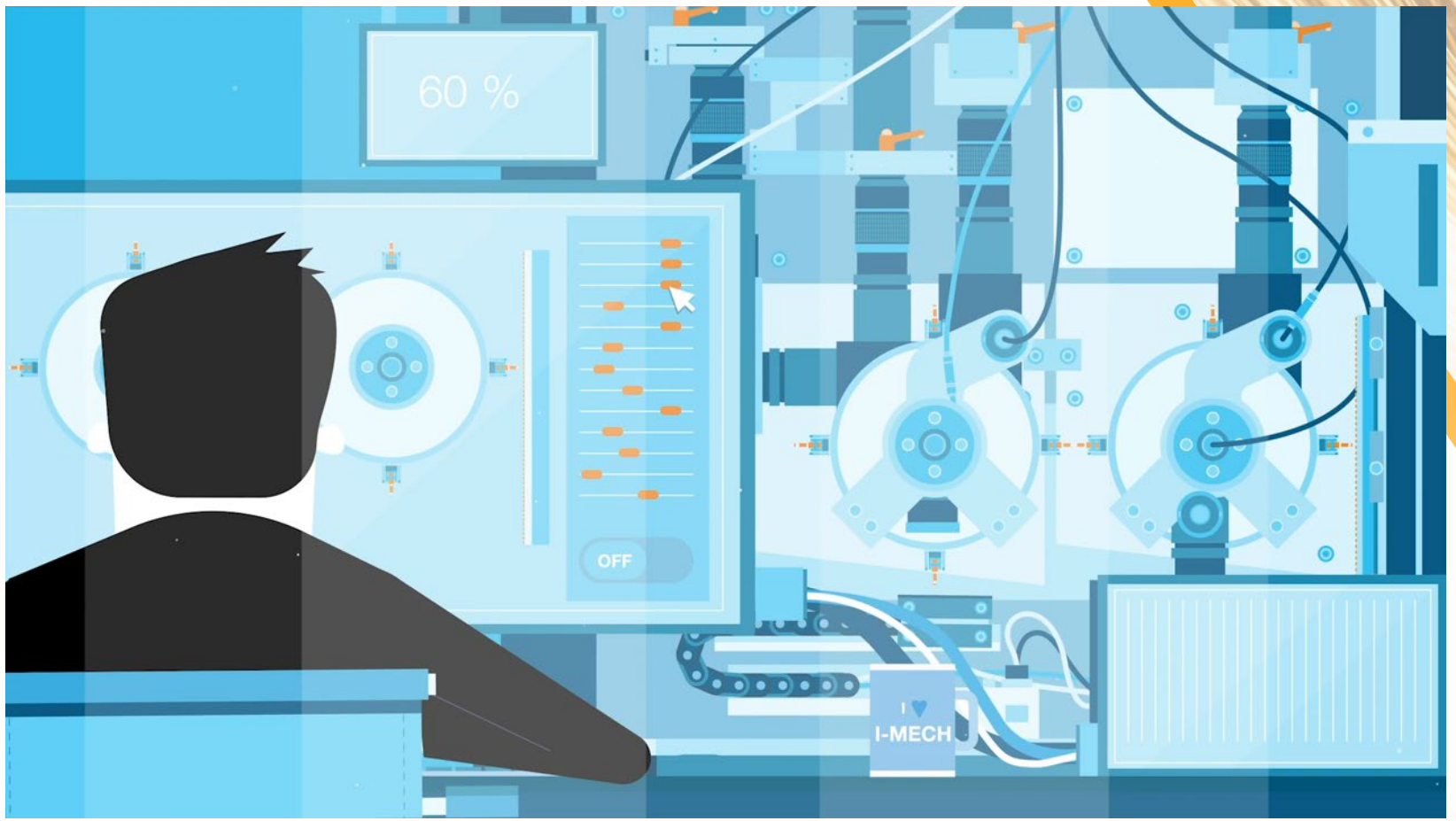
How you can benefit?
Flash-back I-MECH



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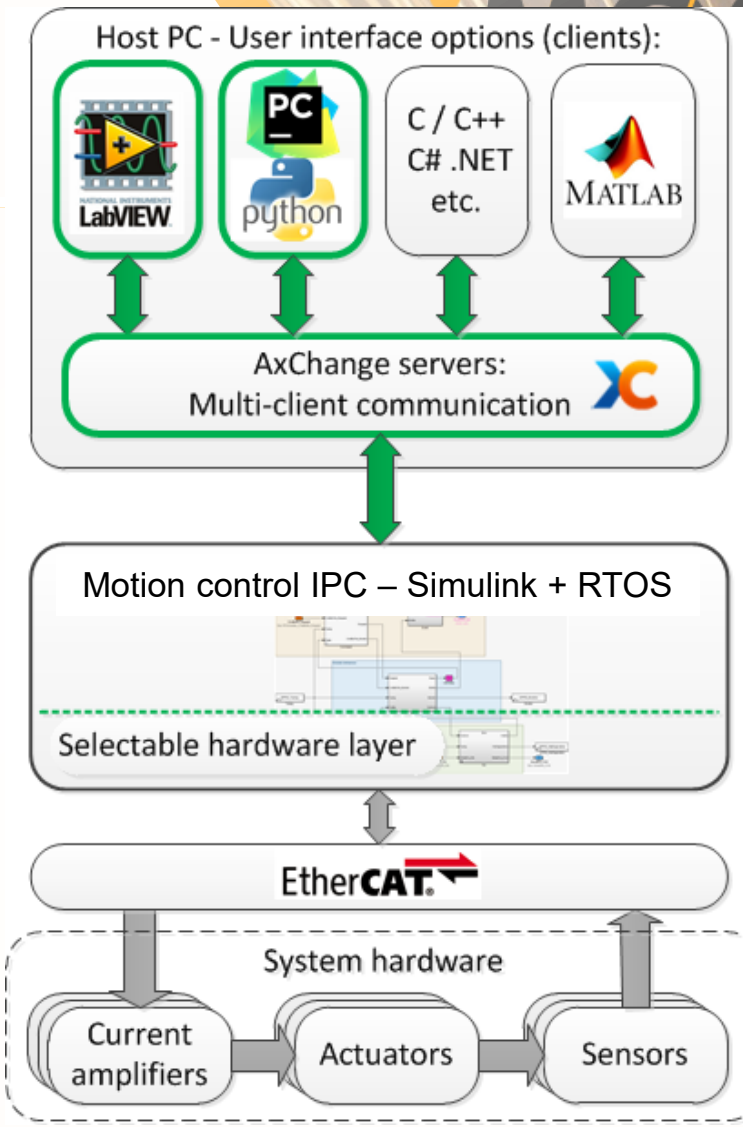
Whats included in “SAXCS”

- Libraries with controllers, filters, setpoints, etc.
- Communication framework (AxChange)
  - Multi-client (message based)
- Extensive graphical UI (**development + R&D**)
  - For basic operation, configuration and diagnostics (signal monitoring and tracing)
- Python script interface
  - For automation, experiments and regression tests
- Parameter management



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SAXCS: Lifecycle Management

- What <Customer> can do (as user) with SAXCS throughout entire product lifecycle
  - Normal usage (e.g. system commands & signal access)
  - Operational changes (e.g. change in system workflow, parameter adaptations)
  - Maintenance (e.g. predictive maintenance)
  - Sustaining (e.g. replacing end-of-life components)
  - Support (e.g. software updates)

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Conclusion
How can you benefit from IMOCO4.E?

- Reference architecture for edge-to-cloud intelligence
- Motion control systems will be
  - smarter
  - faster
  - resilient
  - highly configurable
  - highly reliable
  - highly accurate

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Thank you! Questions?

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