



AI in Industrial Systems

**From Digitalization to Autonomous
Cyber-Physical Environments**

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A photograph of a person's hands typing on a laptop keyboard, overlaid with a blue tint. Two white hand-drawn speech bubble icons are positioned over the hands. The left hand is on the left side of the keyboard, and the right hand is on the right side. The speech bubble on the left is larger and has three horizontal lines inside, while the speech bubble on the right is smaller and has four horizontal lines inside. The word "RISE" is written in large, bold, white capital letters in the bottom left corner.

RISE

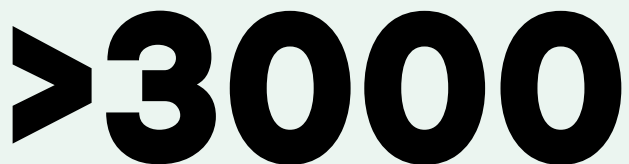
32

platser i Sverige



>30000

Anställda



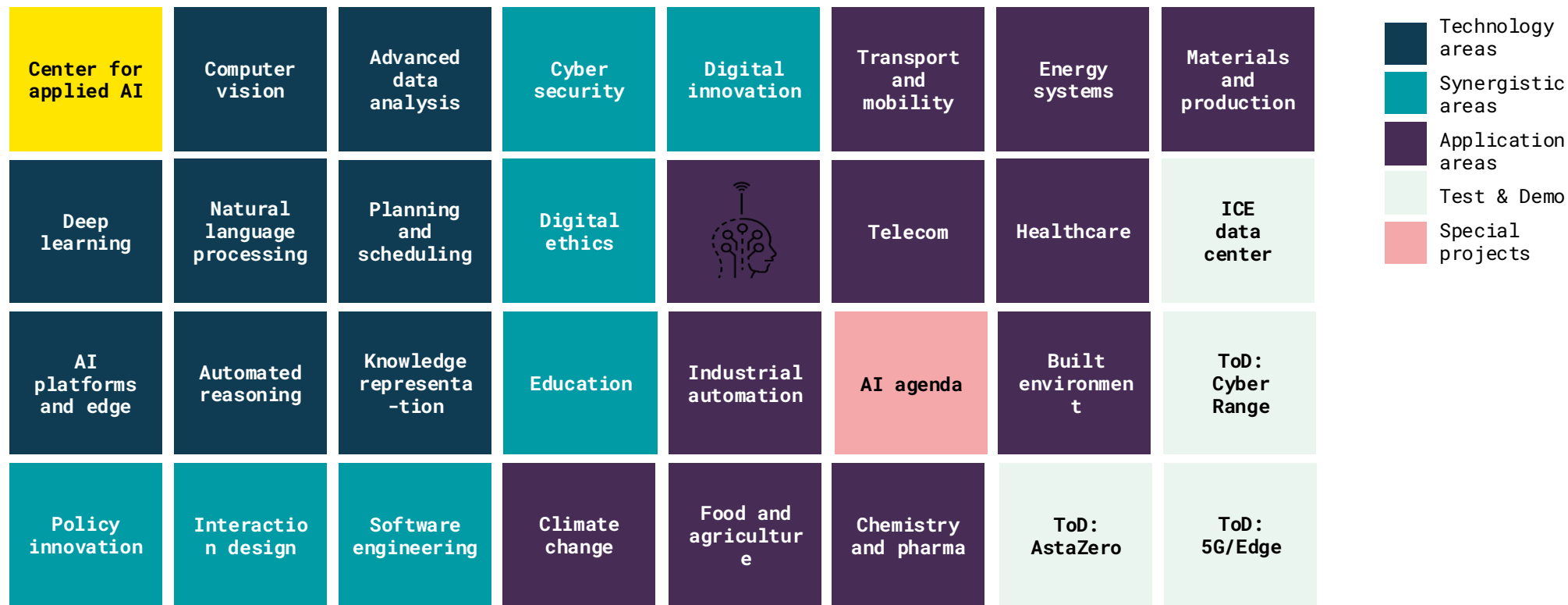
RISE Research Institutes of Sweden är ett svenskt statligt forskningsinstitut och innovationspartner. Genom internationellt samarbete med näringsliv, akademi och offentlig sektor säkerställer vi företagens konkurrenskraft och bidrar till ett hållbart samhälle.

130

Test- och demoanläggningar



AI at RISE





<https://www.scientificamerican.com/article/people-differ-widely-in-their-understanding-of-even-a-simple-concept-such-as-the-word-penguin1/>

**Industry is inherently
complex**

Industrial AI

- Industrial AI interacts with **physical systems**
- It requires **consistent data flows**, robust pipelines, safety validation, and integration with existing OT/IT systems.
- Adoption challenges are **rarely technical**: they are legal, economical, organisational, and procedural.



Why Industrial AI is “different”

Industrial systems operate under strict constraints that shape every AI decision:

- **Safety-critical environments.** Failure has physical consequences for people, equipment, or production continuity.
- **Reliability and uptime requirements.** Systems must work *every time*, not “on average.”
- **Regulated and audited processes.** Traceability, explainability, and documentation are mandatory.
- **High cost of errors.** Downtime, scrapped material, or process instability are expensive and often unacceptable.
- **Long equipment lifecycles.** AI must integrate with legacy systems designed decades ago.

**AI is an organisational
question**

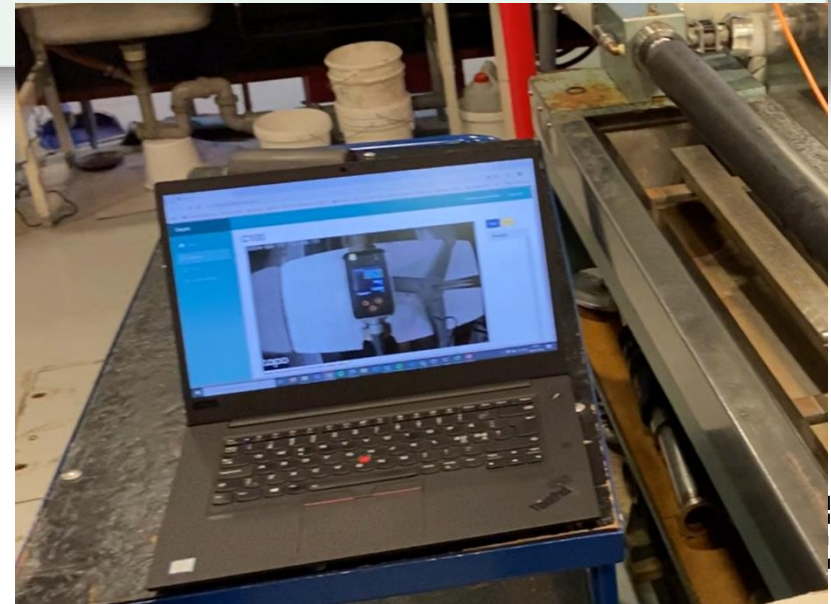
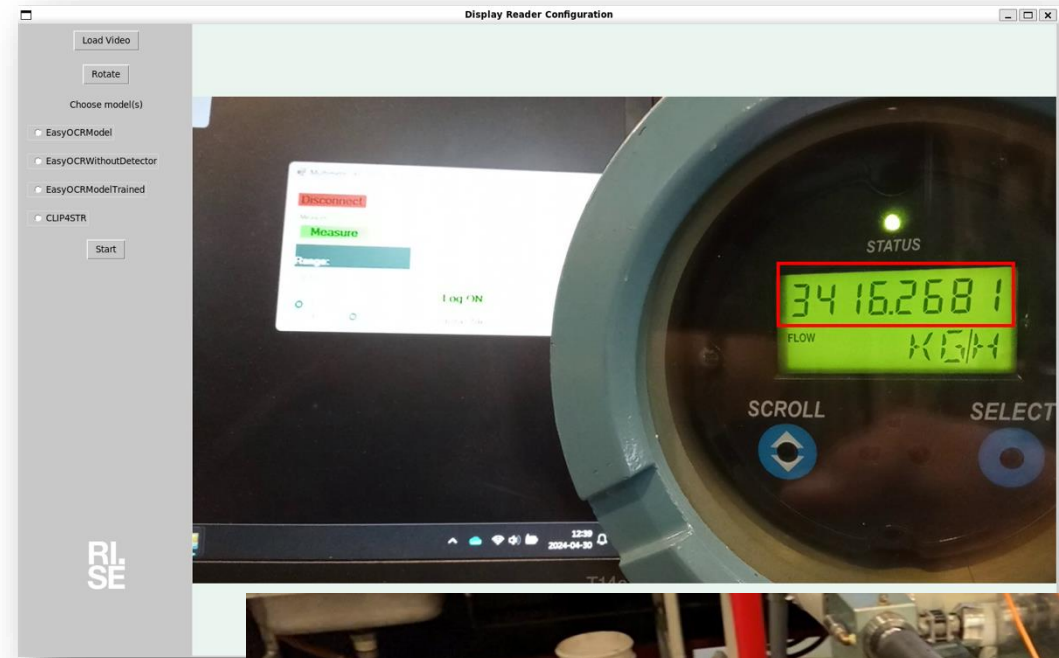
Industrial data

- Sensor data (temperature, pressure, vibration, machine status)
- Process data (production rate, cycle time, batch parameters)
- Quality data (defect detection results, surface quality, product test results)
- Maintenance data (service reports, spare parts records)
- Tacit knowledge (postits)



Industrial data

- Data is not centralized
- Data is missing
- Data ownership may vary across a factory



Scanner 7 Errors Service Scanner Data 3D

Length 520.2 cm

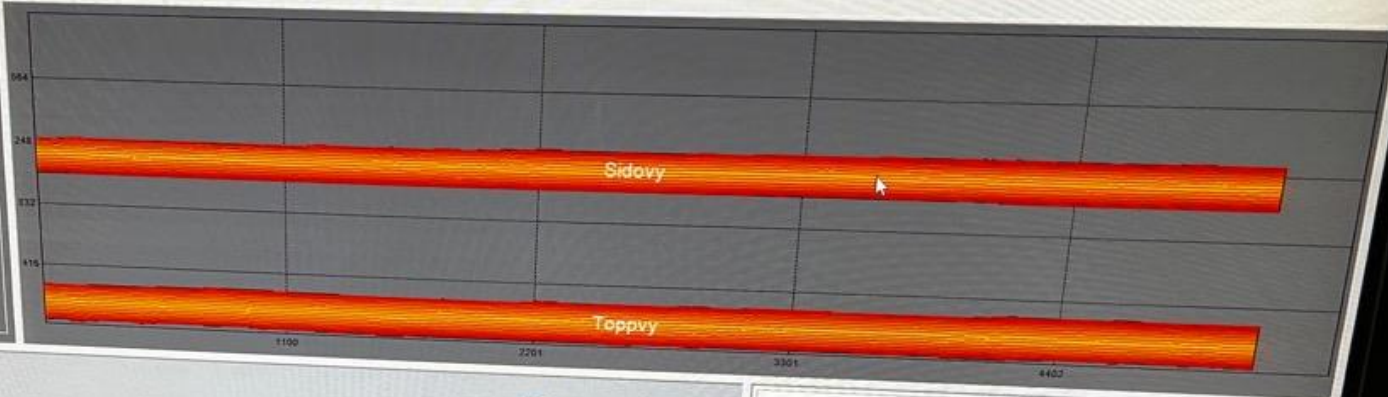
	D	D1	D2	Position
Top	245 mm	234	254 mm	330 mm
Butt	285 mm	285	277 mm	4630 mm
Mid	26.7 cm	254	272 mm	2650 mm

Volume 0.245 m³ VMF-volym

Taper 9 mm/m

Orientation Topp forst

Curvature 2 mm/m



Tracking Info

Id	TrackId	Position	Status	3D	EI	SI	TS	AT	TL	IIS	IA
46682	5993	84717	167								
46683	5994	88913	167								
46684	5995	83330	167								

System OK
Chain Running (0 min)

Status	Sensor	Framerate [fps]
	DShape 1/1	
	DShape 1/2	561
	DShape 2/1	562
	DShape 2/2	
	DShape 3/1	
	DShape 3/2	
	DShape 4/1	
	DShape 4/2	



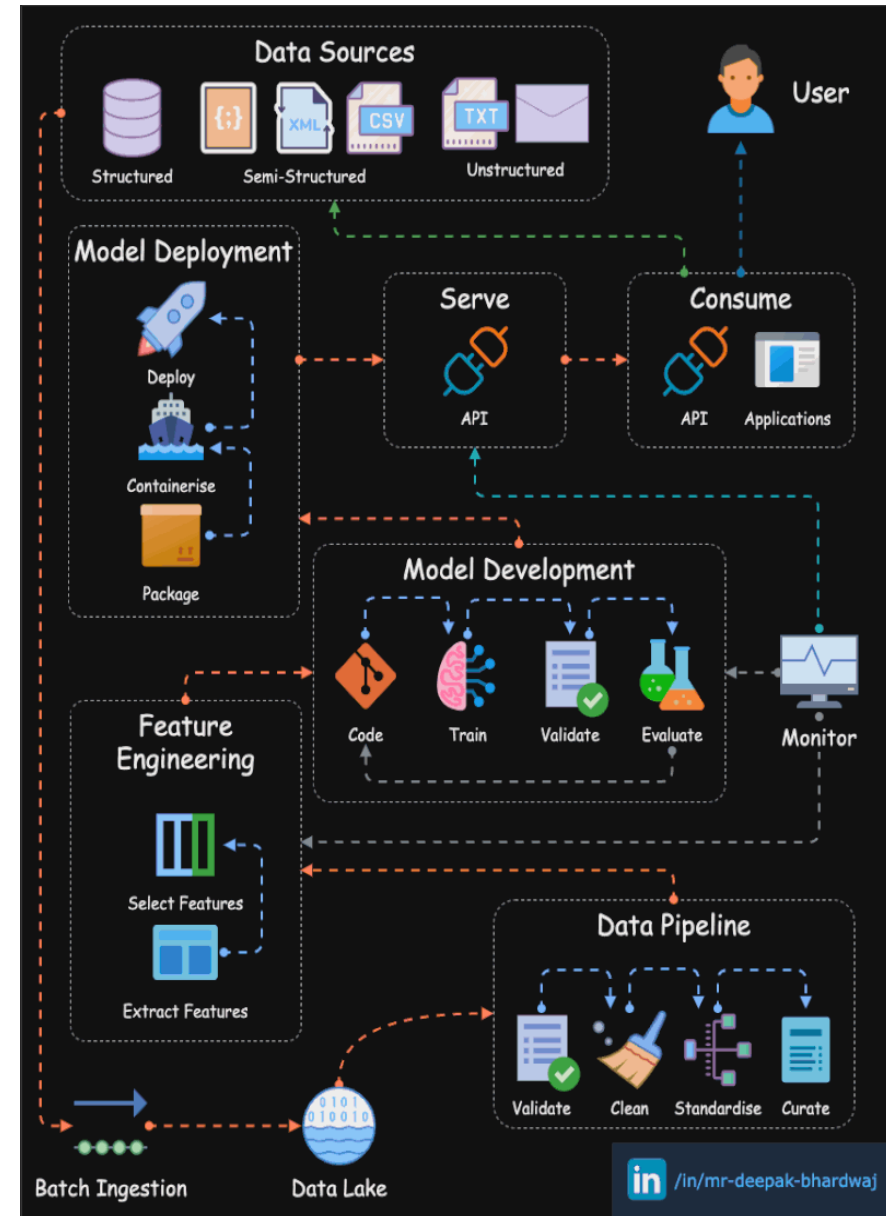
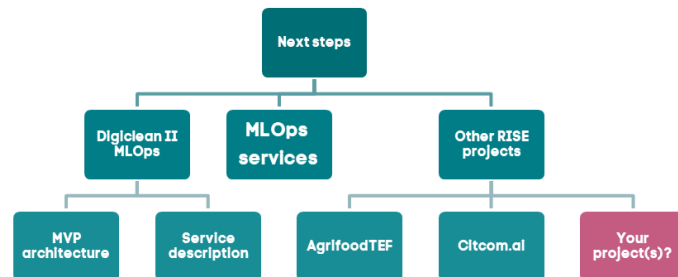
Session list

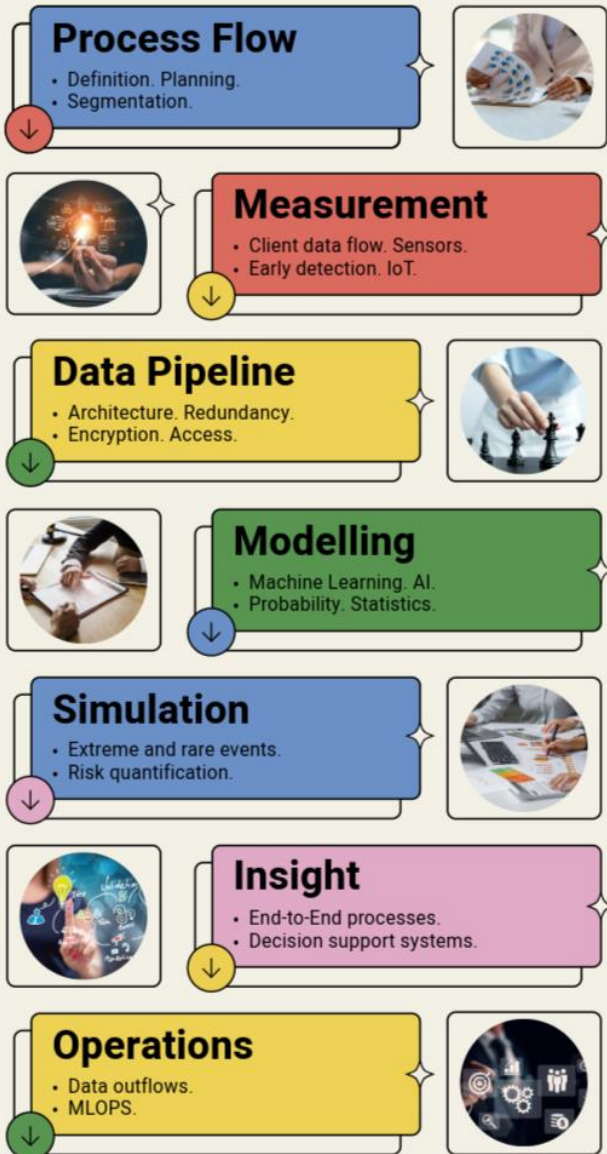
Kerth Svensson (157 663 955)
Ricardo Pignata (1 349 723 7)

www.teamviewer.com

Data Pipelines

- **What:** Cleaning, organizing, and preparing raw data for analysis. This stage includes handling large volumes of unstructured or semi-structured data.
- **How:** Tools and systems for data preprocessing, such as data cleaning algorithms, format standardization, and real-time data filtering to ensure high-quality data ready for analysis and ML.
- **R&D focus:** Automating data cleansing processes with AI techniques, detecting anomalies in data streams, and optimizing data pipelines for large datasets.





From Sensor to Insight

- Process flow – DesignOps
- Data collection from multiple sensors/modalities
- Processing the data: AI/ML ready
- Model development and scaling
- Prediction, decision & automation
- Scaling & MLOps (Deployment)

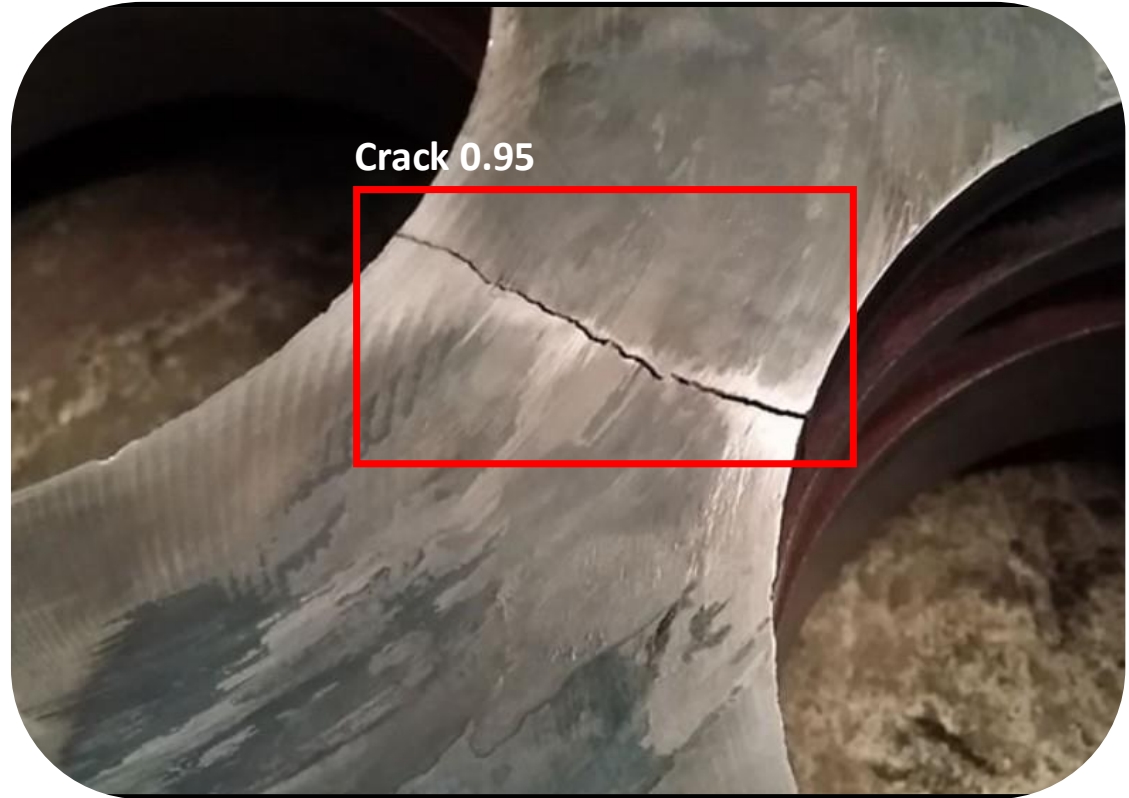
Industrial applications today



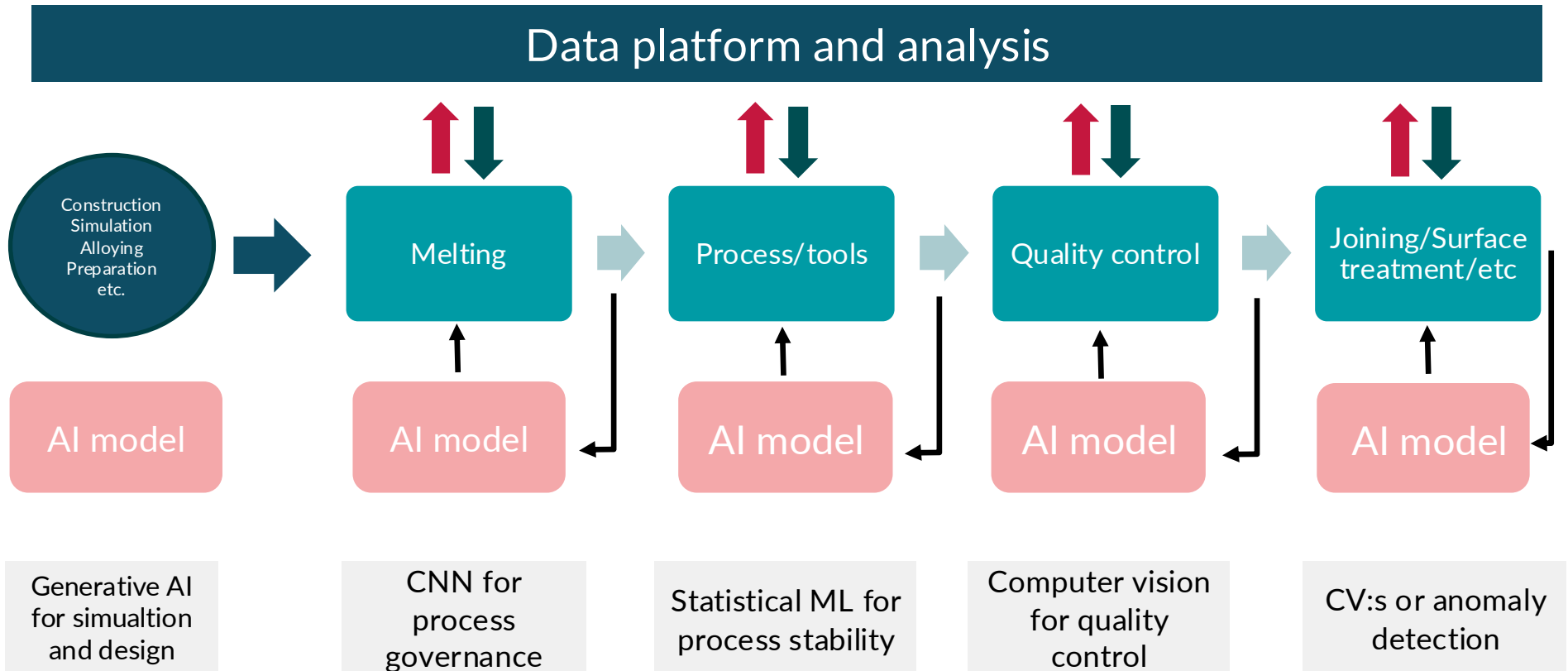
Predictive maintenance



Quality control

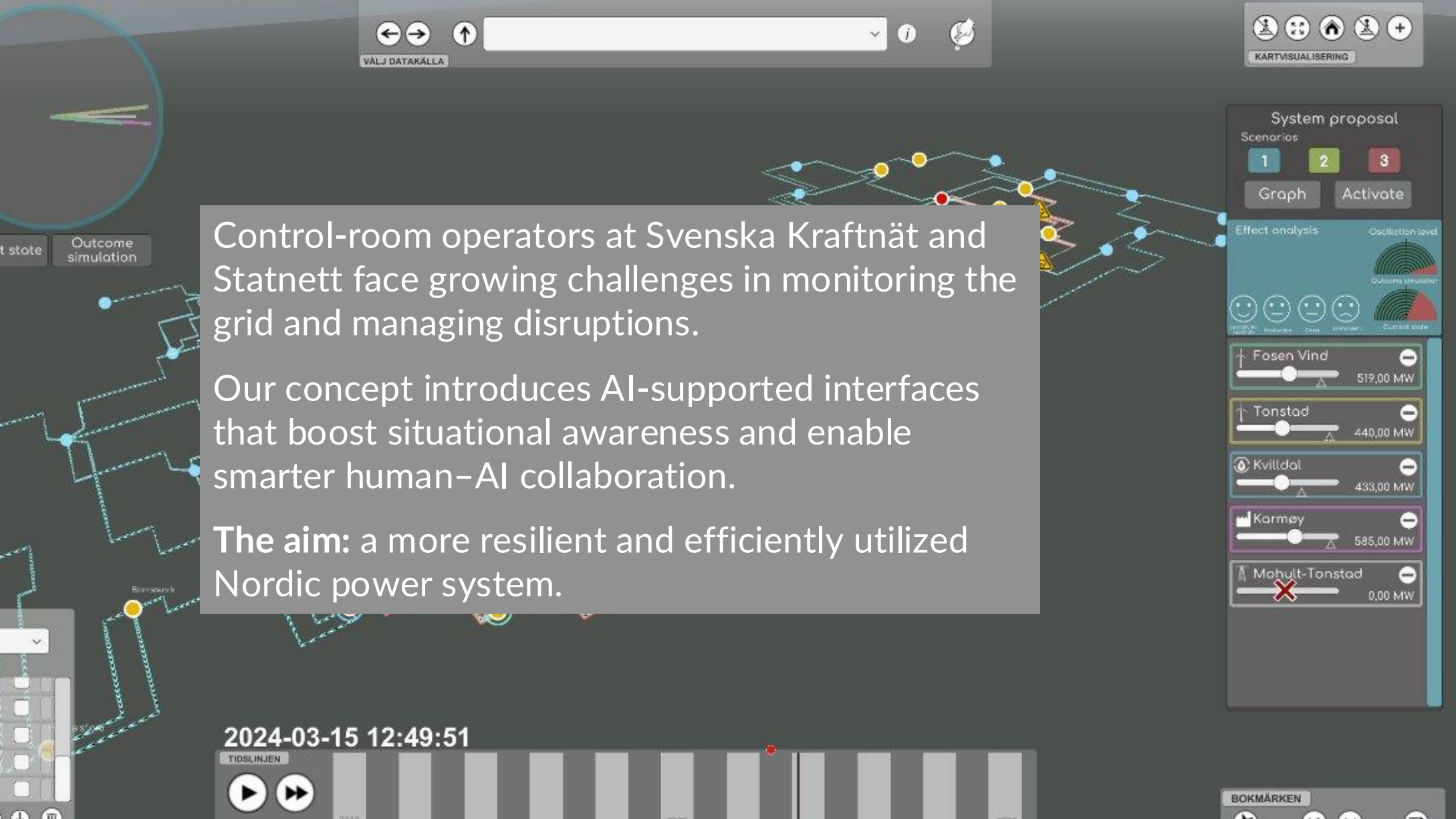


AI for process governance





There is a need to understand the **role of technology** and how to make the most of these developments in order to create value and promote sustainability.

The background image is a screenshot of a complex power system simulation interface. It features a dark grey background with a network diagram of power lines and nodes. Nodes are represented by colored circles (blue, yellow, red) and lines are dashed or solid in various colors. On the left, there's a circular inset showing a zoomed-in view of a specific part of the network. At the top, there are navigation controls including arrows and a search bar. On the right, there's a sidebar with various controls and status indicators. At the bottom, there's a timeline and a status bar.

Control-room operators at Svenska Kraftnät and Statnett face growing challenges in monitoring the grid and managing disruptions.

Our concept introduces AI-supported interfaces that boost situational awareness and enable smarter human-AI collaboration.

The aim: a more resilient and efficiently utilized Nordic power system.

System proposal

Scenarios

1 2 3

Graph Activate

Effect analysis

Oscillation level

Outcome simulator

Current state

Fosen Vind 519,00 MW

Tonstad 440,00 MW

Kvittdal 433,00 MW

Karmøy 585,00 MW

Mohult-Tonstad 0,00 MW

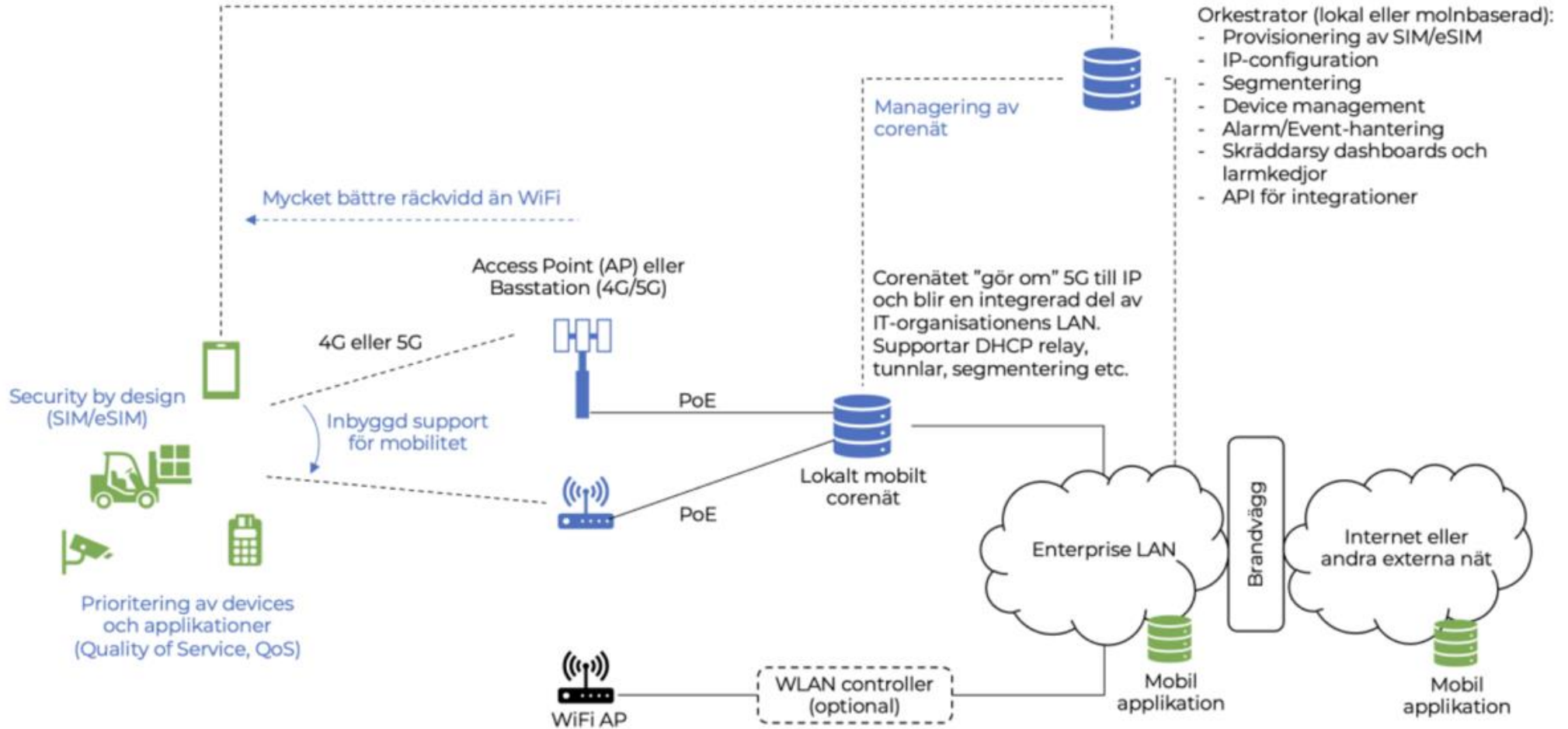
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TIDSLINJEN

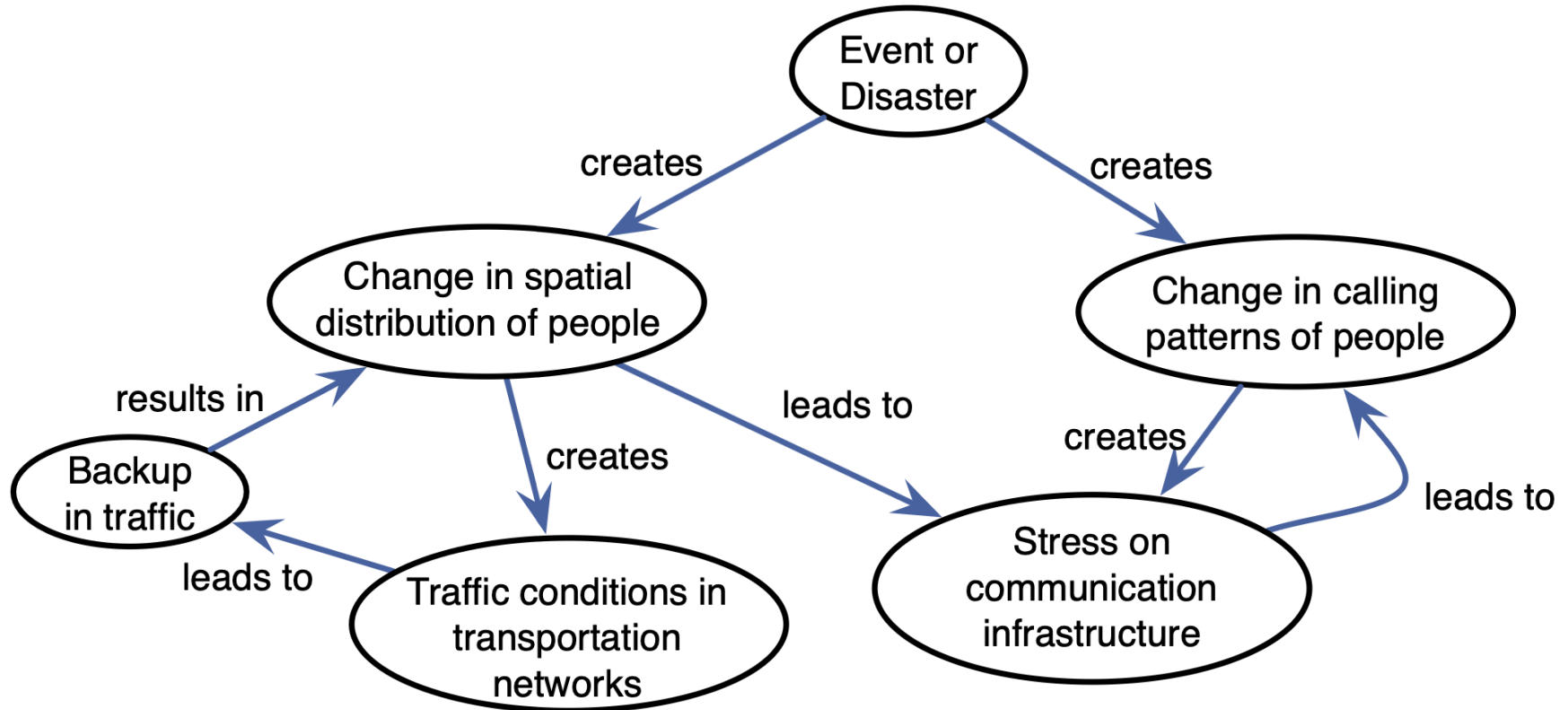


BOKMÄRKEN

5G network in factory (principle)



Connected Factory => Cascading Failures



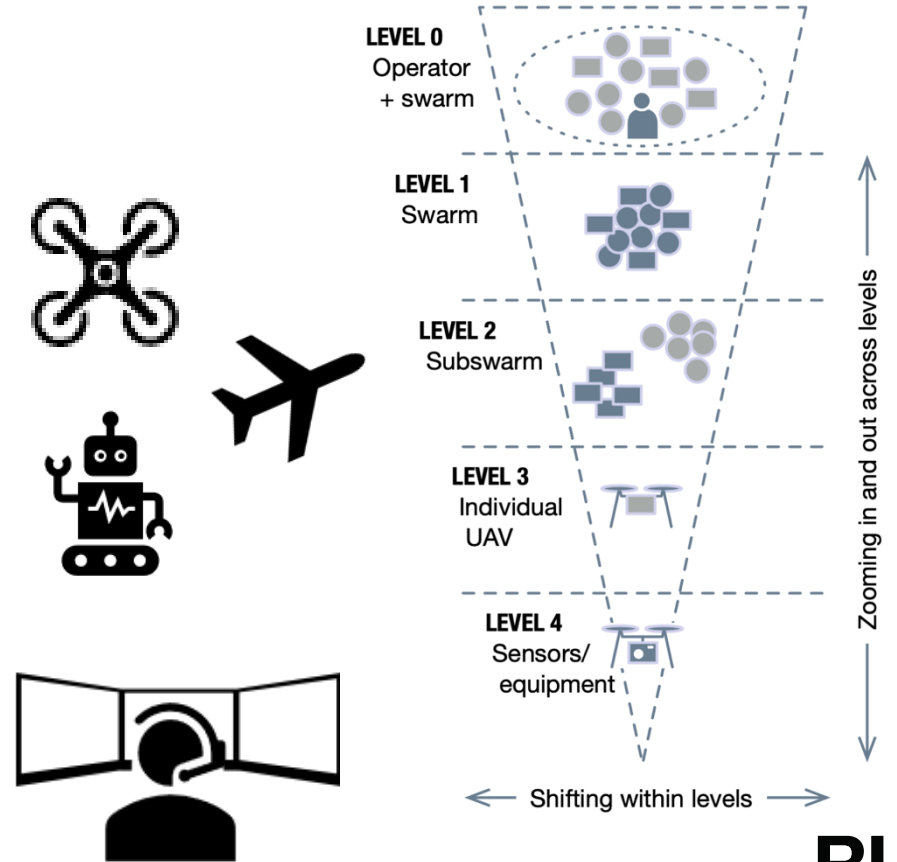
Monitor and control autonomous systems

System of Systems

- Different interacting and autonomous systems operate within the same domain.
- HMI

Control Levels

- Individual units
- Groups and sub-groups of units
- Task level – monitoring and control





Technical capabilities for next-gen CPS

- Edge-AI
- Digital twins
- Robustness, safety, security, standards
- Data handling and interoperability



System-level capabilities

- Multidisciplinary collaboration
- Infrastructure and test beds
- Modelling and data driven methods
- Ethical and regulatory aspects
- Business models



- 
- Industrial AI $\neq$ office AI — it must be safe, reliable, and robust.
 - Data quality and process integration matter more than algorithms.
 - Human oversight remains essential in all realistic industrial deployments.
 - Automation follows maturity, not ambition. Autonomy requires trust.
 - The value of AI comes from stability, predictability, and operational relevance.



Thanks!

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