AI based Situational Awareness

Emre Aksu

Nokia Technologies

FIIF Event: Artificial Intelligence in Industry

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Agenda

- Situational Awareness (SA) in industrial operations

- AI based SA in AISA project context

- Related Nokia solutions and scope in AISA project

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About Nokia Technologies / Multimedia Technologies Lab

- **25+** years of research & development on multimedia technologies
- **70+** researchers & engineers, with global recognition
- **Locations**: Tampere, Espoo, Munich, London, Dallas, San Diego

- **Research, standardization and technology development** on
  - Audio/video compression and signal processing
  - AI-based media processing and neural network compression
  - Computer vision
  - XR media systems
  - Real-time/low-delay multimedia communication systems

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Situational Awareness
Definition

Situational awareness (**SA**) is the ==**perception**== of environmental elements and events with respect to time or space, the comprehension of their ==**meaning**==, and the ==**projection**== of their future status. [1]

Why enterprises want SA:

- To become more productive and competitive
- To make better business decisions (by humans or machines)
- To have automation, where/when possible
- To reduce waste: of time, resources, material, risk, etc.

[1] Endsey Mica R. "Towards a theory of situational awareness in dynamic systems", 1995

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Situational Awareness
Automated process flow example: quality control with visual analytics

Sense

Understand



Predict

- Faulty assembly
- Correct assembly

Act

- Raise alert in real-time quality assurance system
- Assembly worker takes corrective actions

- Captured video is streamed to edge server over wireless network
- AI inference for detection & tracking is performed at the edge server
- Action is taken by a centralized business process

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AI based Situational Awareness
Industrial context (AISA scope)
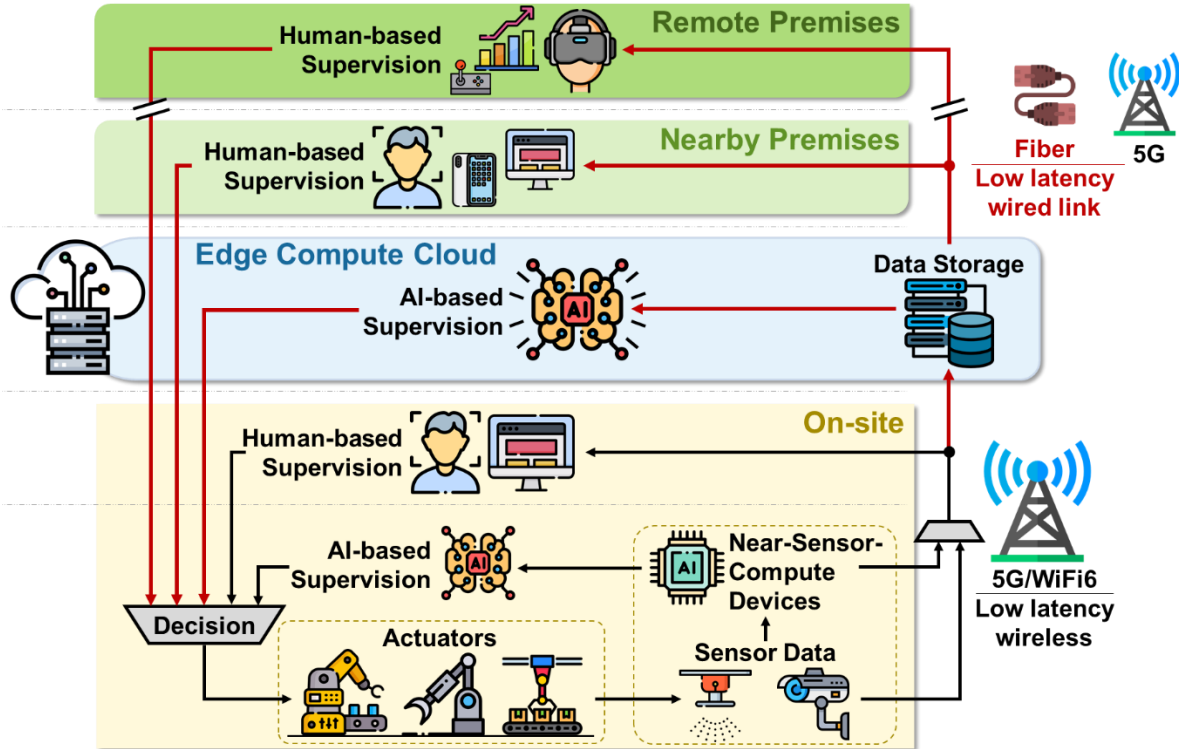
Human + machine interface / Decision making
Interfaces, near-far presence, remote-operation, interactivity

AI algorithms
AI models, training, model (re-) distribution, inference

Data processing
Data models, semantics, databases, business flow integration

Compute resources
Edge, on-premises, cloud, orchestration, time-criticality

Sensor data transmission
Media compression & transport, sensor data aggregation

Connectivity
Fast, reliable, configurable connectivity (wired/wireless)

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Examples of Nokia solutions for enabling AI based SA

Powerful 5G networks with simplified 5G operations

Industrial-grade Private Wireless

Power your digital transformation with a private 4.9G or 5G network

The Nokia Digital Automation Cloud (DAC), **Modular Private Wireless** (MPW) private wireless solutions, including Nokia user equipment and Industrial Devices.

Nokia MX Industrial Edge
Future proof mission critical OT digitalization

Simplicity of the cloud

- Edge orchestration
- Automated lifecycle management
- End-to-end service performance management

On-premises

- Nokia application ecosystem
- Partner/ISV applications
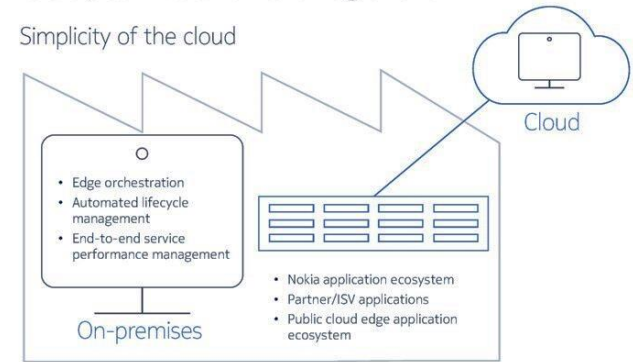- Public cloud edge application ecosystem

Cloud

- 340+ enterprise customers globally
- 370+ LTE networks for mobile operators
- 75 % of the world's LTE subscribers
- 1,300+ mission-critical networks
- Mines, airports, maritime ports, manufacturers and logistics companies

The Nokia MX Industrial Edge is a future-ready on-premises edge solution.

- Hosts AI algorithms and business applications
- edge-as-a-service model with a high-performance, resilient and secure edge architecture
- designed to meet the mission-critical needs of asset-intensive industrial environments.

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Nokia's scope in AISA project

- Efficient environment sensing with next generation cameras
  - 360-degree cameras, depth + image sensors
  - Real-time 3D point cloud and mesh generation
  - 3D semantic parsing for environment perception

- Real-time, low-delay streaming of audio/visual information
  - Bandwidth-efficient media streaming
  - Distributed media processing (edge-node-cloud)
  - Media compression for AI tasks
  - Remote presence and tele-operation

- Federated Learning
  - Multi-site/multi-node data aggregation and AI model training
  - Efficient distribution of trained model information

- Related standardization activities in MPEG, 3GPP, IETF and industry forums

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- Jukka Saarinen (jukka.saarinen@nokia.com)
- Emre Aksu (emre.aksu@nokia.com)