

Industrial Use Cases for In-Network Computing

https://www.ietf.org/id/draft-kunze-coin-industrial-use-cases-00.txt

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Industrial Networks in Times of CPS and Industry 4.0

 Networked control
Control loops at ultra low latency

Collect Process Data

High data rate

Data stream processing

s/t immediate feedback

Offline Data Analysis

- Model extraction
 - Data mining
- Machine learning
- Feedbacks new models for previous tasks





In-Network Computing in Industrial Networks



• Strategic Placement of Network Functions

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- Networked Control
 - Traffic Filters
- Data Stream (Pre-)Processing
 - Industrial Safety



• Networked Control



• Traffic Filters





P Data Stream (Pre-)Processing





- Fine Blanking
- Decoiler
 - Data Rate: 45-90 Mbps
- Lubricator
 - Data Rate: 10 Mbps
- Press
 - IR camera: 160 Mbps
 - Press control: 25 Mbps
 - Vibr. Sensor: 150 Mbps
 - 4k Cameras: 500 Mbps



- Smart Manufacturing
- Multi-Sensor Metrology
- Wide range of sensors with:
 - Different range/speed
 - Different Accuracy
- Aim for seamless switching between sensors



Industrial Safety





- **Free-Float Assembly**
- Positioning coordinated by many inputs
 - e.g. indoor coordinate system, camera, etc.
- Human in the loop detection (safety zone)
 - e.g. logical safety loop among cameras, lasers, Lidar
- Robot interaction via multiple sensors



- Arc welding robots
- Single-digit millisecond latency
- Multiple sensor sources
 - HD and infrared camera
 - Current draw of light arc
- Actuators
 - Robot positioning
 - Light arc voltage



Design/Development of network functions

- How to account for limited computational precision of networking devices?
- How to streamline the development of network functions?

Operation/Deployment of network functions

- How to coordinate, deploy and distribute the network functions?
- How to define interaction between network functions & applications?



Update industrial use cases draft

- Wording in industrial safety
- Extended section on security aspects

• Draft on transport protocol

- Implications on end-to-end principle
- Requirements
- Which protocols can be used?
- We are looking for collaboration!



Conclusion

• Different Types of Network Functions

- Networked Control
- Traffic Filters
- Data Stream (Pre-)Processing
- S Industrial Safety
- Lots of open challenges
- Next: Draft on transport protocol



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