Towards a Predictable and Cognitive Edge-Cloud Architecture for Industrial Systems

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Motivation

- Edge-cloud computing became an integral part of many Cyber-Physical Systems (CPSs)
- Several new requirements:
  - Adaptivity
  - Timing predictability
  - cognitivity

Motivation

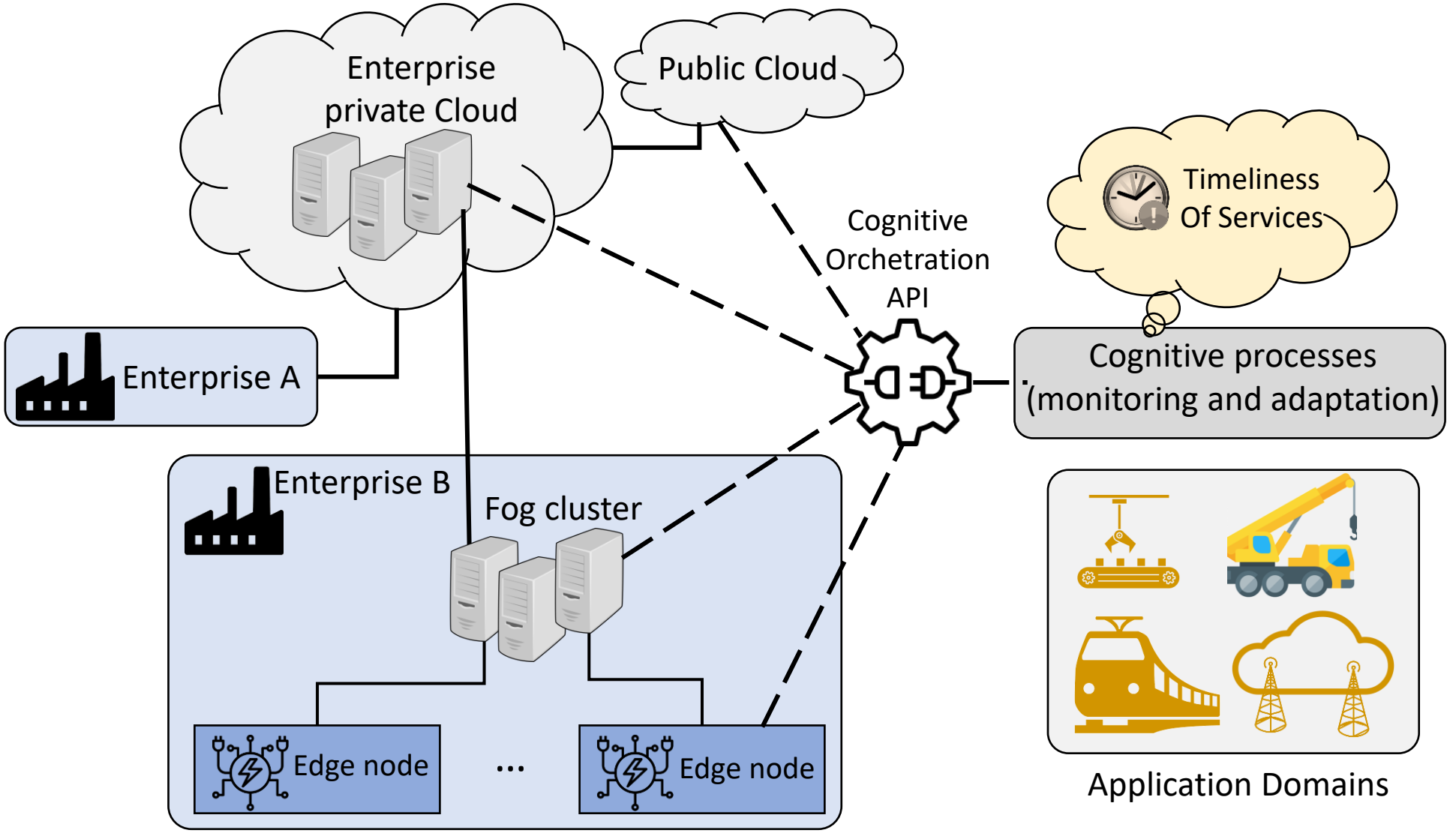
- Congitivity and adaptivity:
  - Monitor the environment
  - Intelligently perceive the situation
  - Autonomously adapt the overall utilisation of resources

- Timing predictability:
  - Prove and demonstrate that the system meets all timing requirements

Contributions

- To meet these requirements
- We propose a novel architecture
- Predictable and cognitive edge-cloud computing architecture for CPS systems

Architecture



Architecture

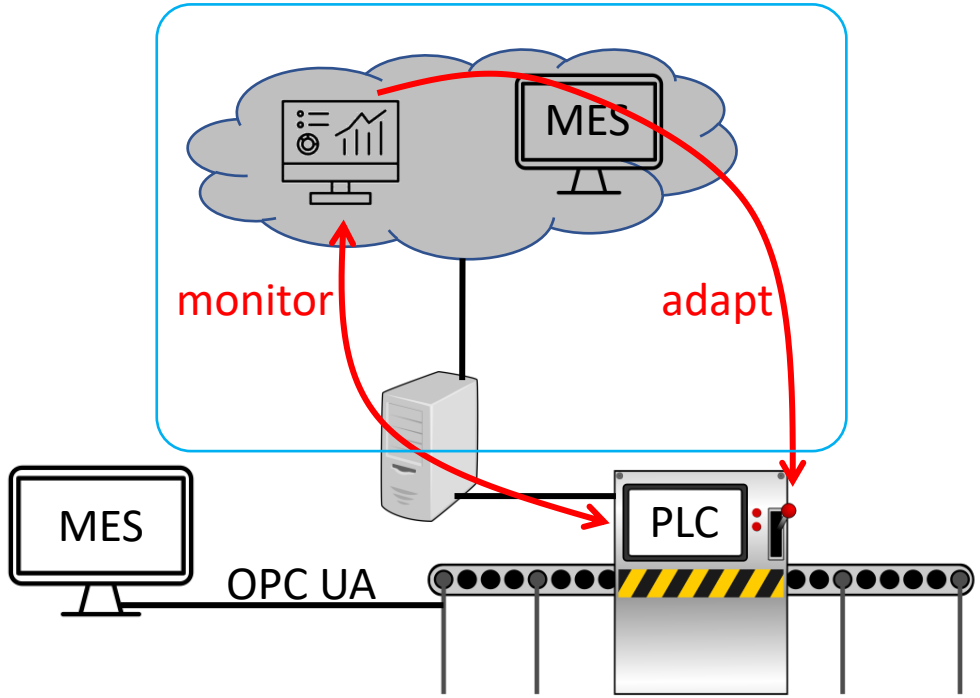
- The main goals of the proposed architecture:
  - To develop a multi-layer edge-cloud computing architecture with an intelligent cognitive capacity to adapt the system autonomously during run-time
  - To adopt suitable AI- and ML-based techniques to perform run-time monitoring, intelligent perception, and adaptation of the multi-layer edge-cloud computing architecture
  - To develop techniques to verify the timing predictability of the system, in terms of computation and communication, during offline and run-time of the system

Primary plan

- Predictable run-time environment and communication
- Cognitive Orchestration API
- Cognitive Capacity: Monitoring and Dynamic Adaptation
- Support for Timing Predictability

A use case

- Automation use case
- Manufacturing Execution System (MES) deploys changes in the system
- Via the proposed architecture, the changes will be dynamic and autonomous based on the monitored situation



Future plan

- We proposed a novel edge-cloud computing architecture

- Main plan is to develop accompanying techniques:
  - Predictable run-time environment
  - Cognitive orchestration API
  - Cognitive capacity (adaptation and monitoring techniques)
  - Online timing verification techniques

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