ELEGANT

Secure and Seamless Edge-to-Cloud Analytics

1st Open Annual Workshop on Future ICT

25.05.2022

The context

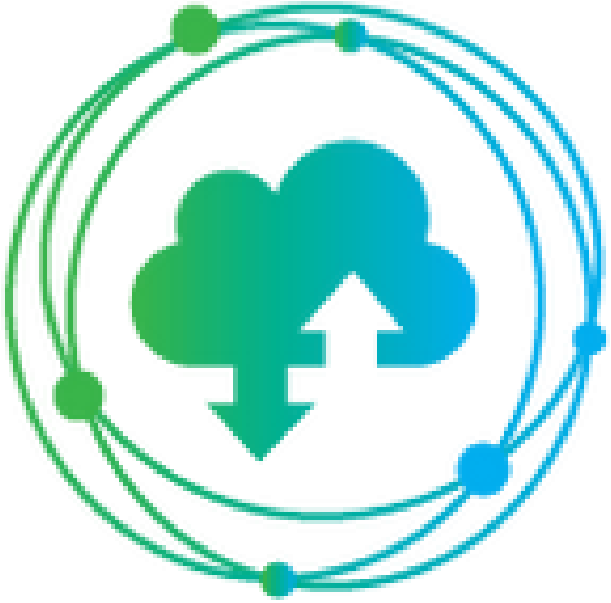
- Big Data applications process large amounts of data arriving as streams from IoT devices
- Edge processing holds the key for:
  - increased responsiveness
  - better energy efficiency
  - data privacy

The challenges

- Diversification of the programming models
- Lack of interoperability between Big Data and IoT deployments
- Lack of dynamic semantic code adaptation
- Inability of dynamic code orchestration
- Weakened security features

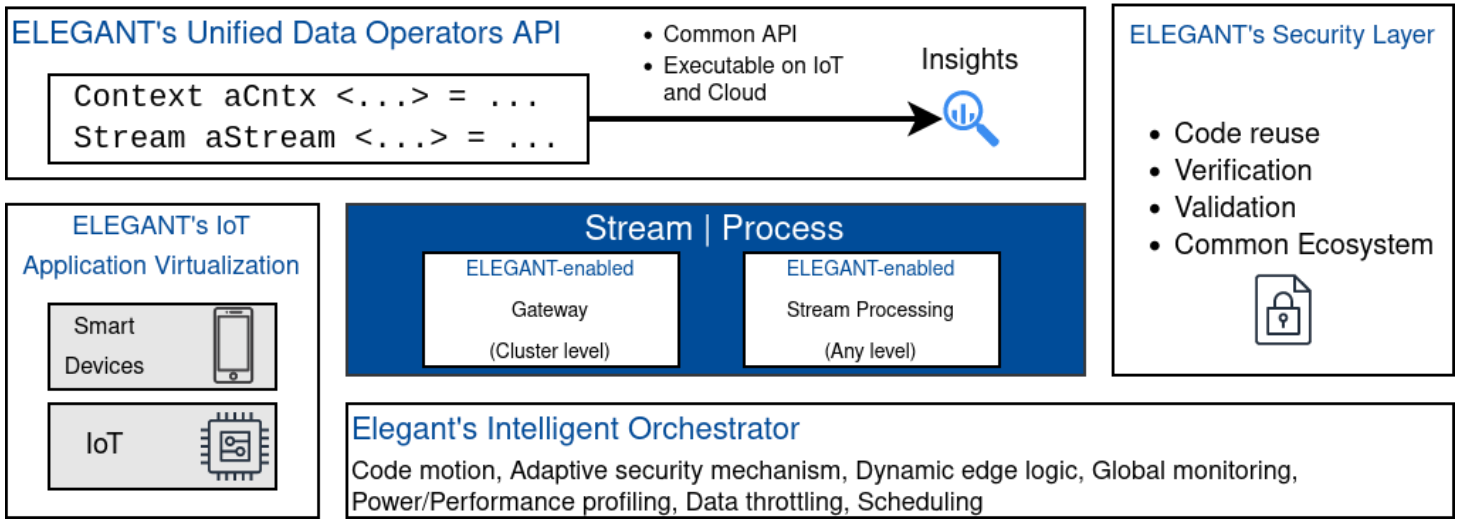
The ELEGANT vision

- Unification of IoT and Big Data programming environments
  - ➢ automatic and easy deployment of existing code from Big Data platforms to IoT devices and backwards in a self-adaptable way



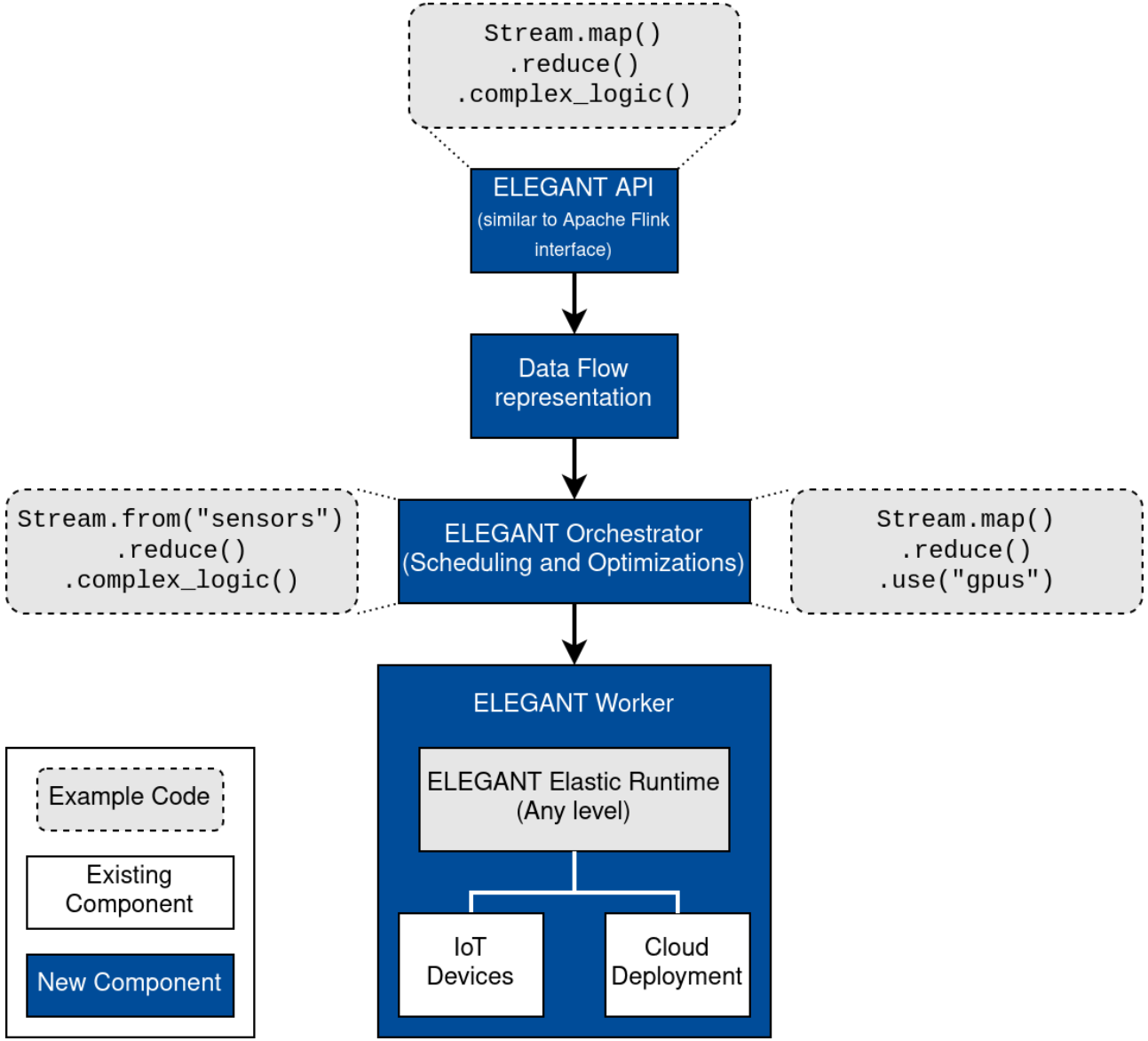
The ELEGANT objectives

- Unification of programming environments
- Dynamic Code Motion
- Intelligent resource selection and allocation
- Secure, Reliable, and Dependable code deployment



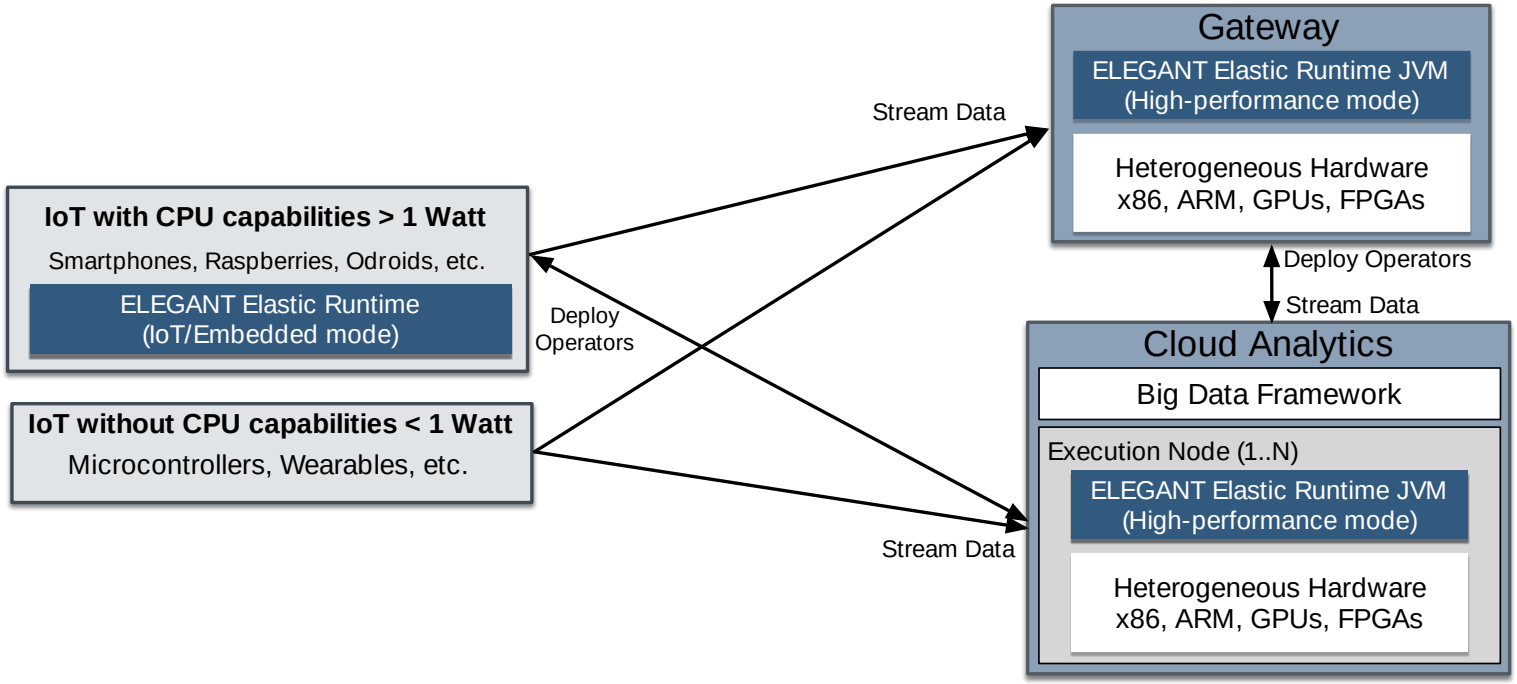
The ELEGANT components

1. Unified API for Big Data and IoT



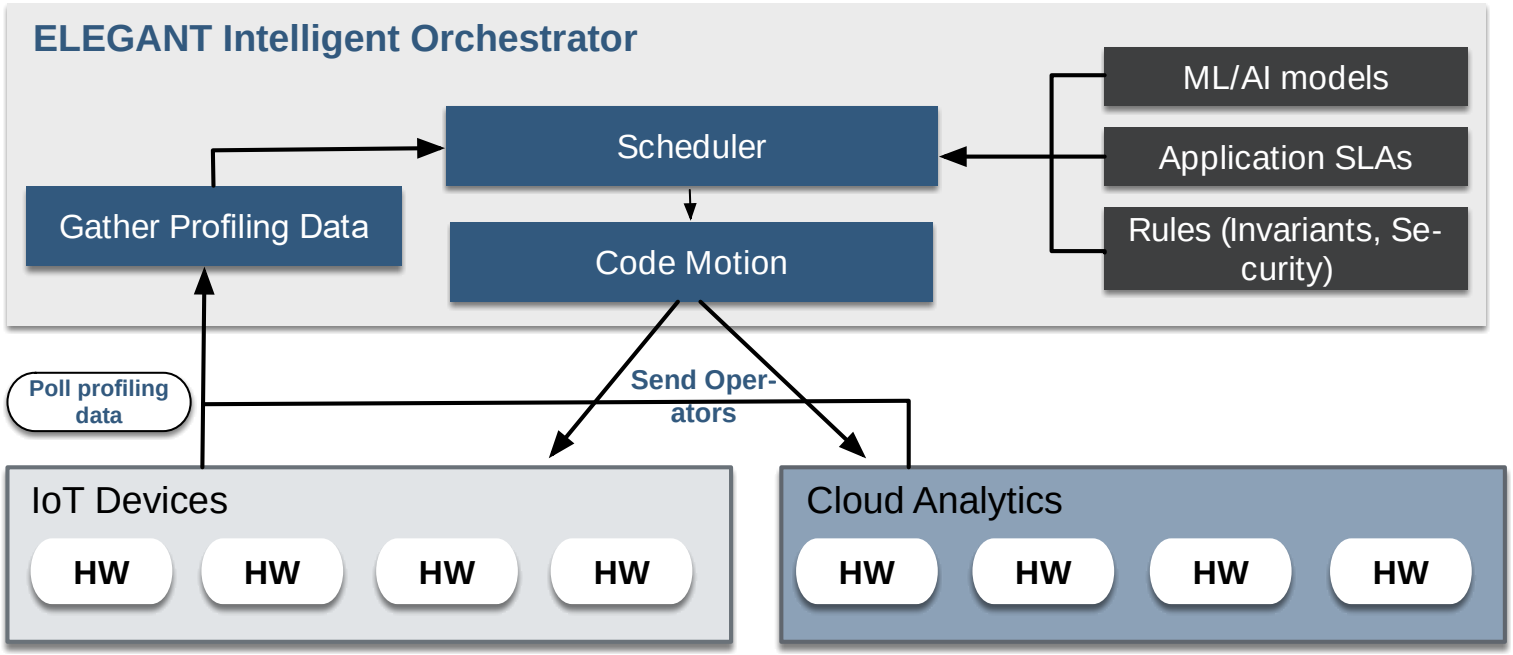
The ELEGANT components

2. High performing and energy efficient elastic scalable runtime



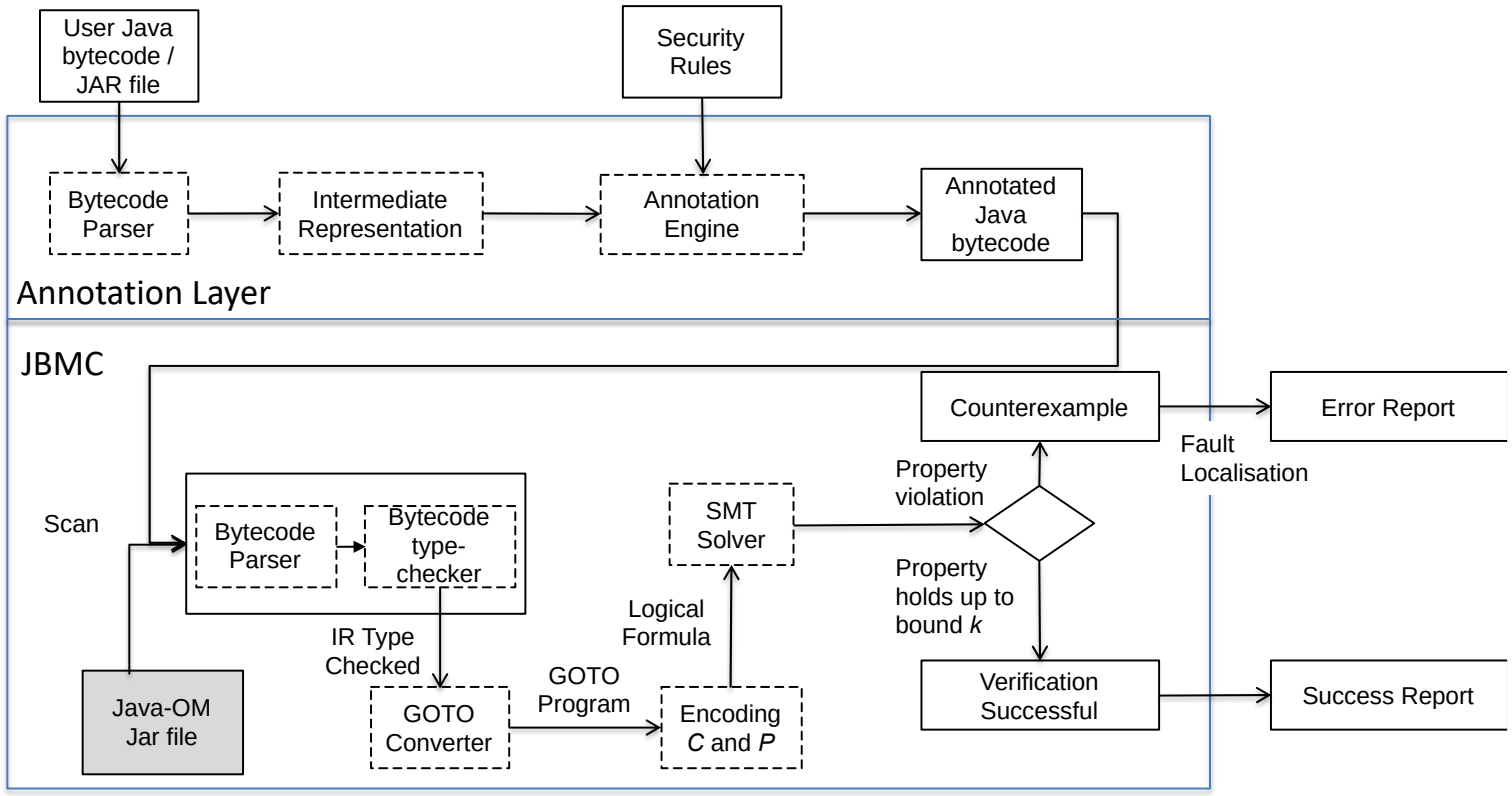
The ELEGANT components

3. Intelligent orchestration of code motion between IoT and cloud analytics



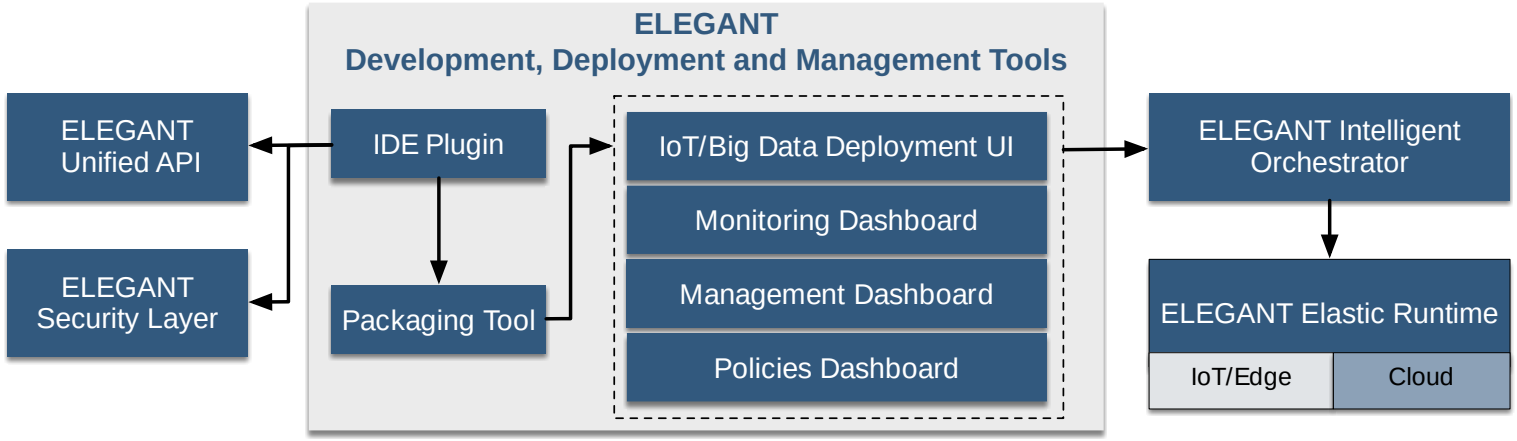
The ELEGANT components

4. Security mechanisms for code integrity and data sensitivity



The ELEGANT components

5. Tools and methodologies for development, deployment and management of applications



Some KPIs

- <5% manual code alterations after IDE tools refactored Big Data operators to IoT equivalents
- <1% code alterations for enabling the heterogeneous execution of the IoT operators
- <5% execution time in transforming operators from ELEGANT's unified API to IoT/Big Data compatible APIs
- <5 minutes of verification time to check each IoT deployed code (lazy validation techniques to avoid hurting user experience upon uploading)
- >50% reduction in resource utilization and power consumption
- >50% performance improvement in total execution time of unified platform

Use cases – Medical wearables

- Challenges:
  - Limited accuracy
  - Lack of computational power
  - Lack of interoperability
- Opportunities/Improvements:
  - Code reusability
  - Energy efficiency
  - Efficient code verification and cost reduction
  - Improved security and data integrity

Use cases – Video surveillance

- Challenges
  - Huge amount of network bandwidth is required in order to make this processing remotely.
  - Additional network delay imposed by the continuous usage of cloud resources, which can be a big disadvantage for smart systems used in monitoring critical resources.
  - Increased operational cost when using cloud resources in comparison to the usage of privately-owned resources.
  - Moving data to the cloud can cause legal implications due to privacy reasons.
  - Need to prepare against emerging threats and countermeasures associated with using cloud technologies for a video surveillance management system

- Opportunities/Improvements
  - Support for distributed processing for the security analytics features, thereby improving the resilience and reliability of the solution.
  - Scalability
  - Utilisation of edge resources
  - Reduced latency by utilizing edge resources.
  - Cost reduction with the usage of edge resources of various types and architectures

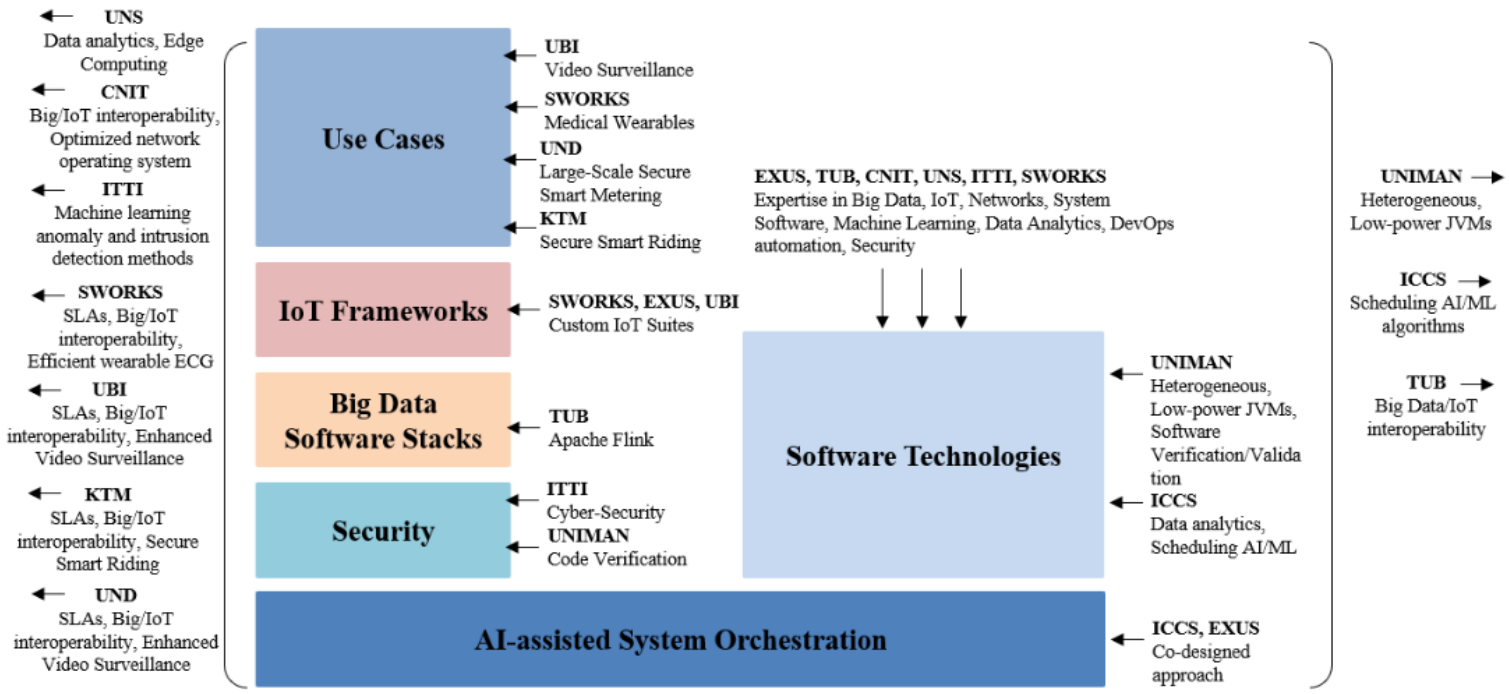
Use cases – Large-scale secure smart metering

- Challenges
  - Unstable network connectivity
  - Resource allocation
  - Security
- Opportunities/Improvements
  - Increased code reusability
  - Dynamic resource allocation
  - Security and data integrity

Use cases – Secure smart riding

- Challenges
  - Correct and dependable operation of vehicles while being able to process the vast amounts of data generated by the on-board sensors
  - Automatic software updates while managing diverse hardware and software configurations deployed on the motorbikes
  - Data privacy and secure operation of IoT connected ecosystem
- Opportunities/Improvements
  - Protection of IoT connected ecosystem against cyber-attacks to ensure the dependable execution of vehicles
  - Increased performance and energy efficiency of data analytics through dynamic code motion
  - Improved reliability and dependability

The ELEGANT consortium



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Partners

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