CLASS

COORDINATING EDGE AND CLOUD
FOR BIG DATA ANALYTICS

Project Overview

WETICE 2019 – EU Project Space

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UNIMORE

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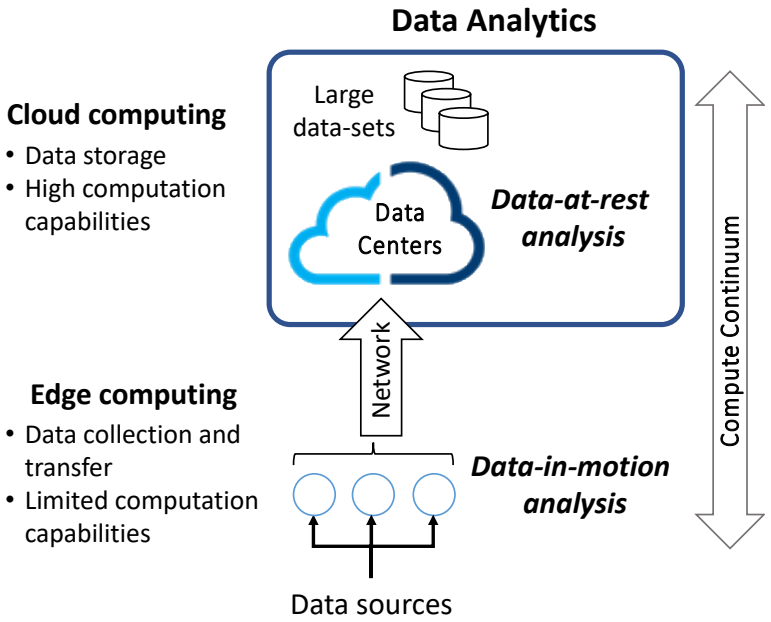
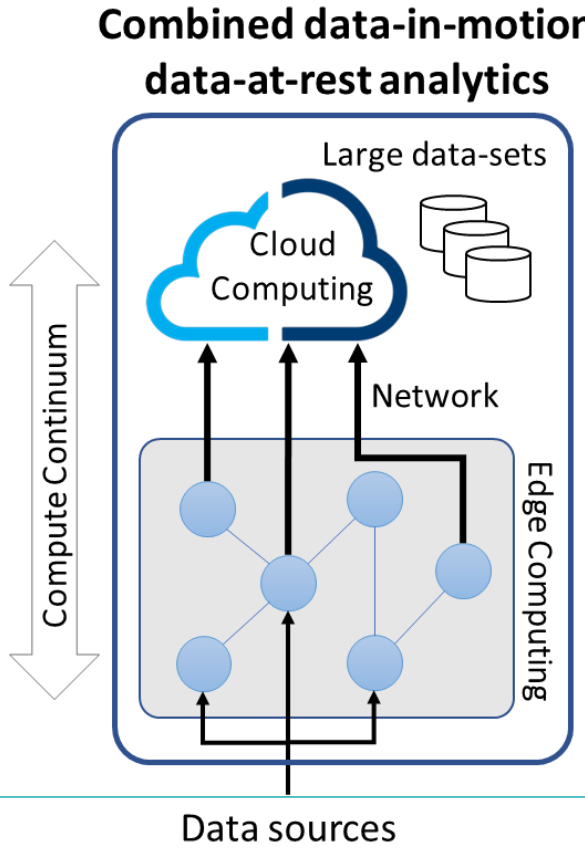
Motivation



- There is a need to devise new data analytics architectures due to
  1. The pressure of a constant increment of **volume, variety** and **velocity** of data-sets on the compute continuum
  2. The newest smart systems with **distributed data sources**, and **data analytics and real-time** requirements, e.g., smart cities
  3. New **highly parallel embedded** processor architectures increase computation capabilities of the edge

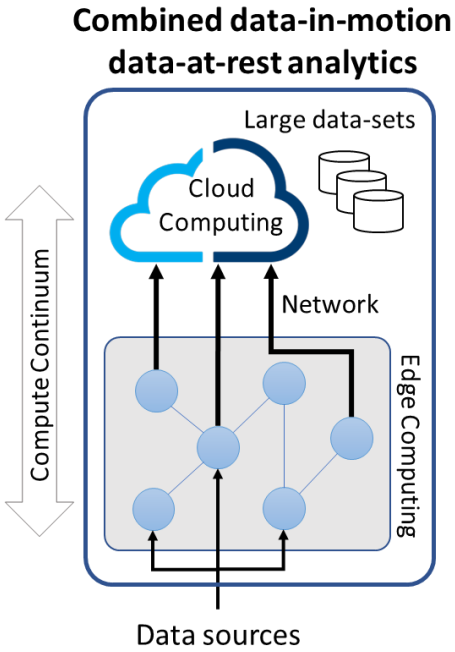
Our Vision

- The challenges of the newest smart systems can be addressed by devising a **fully distributed (fog-like) architecture in which edge and cloud computing resources are coordinated**, enabling a **combined data-in-motion and data-at-rest analytics**



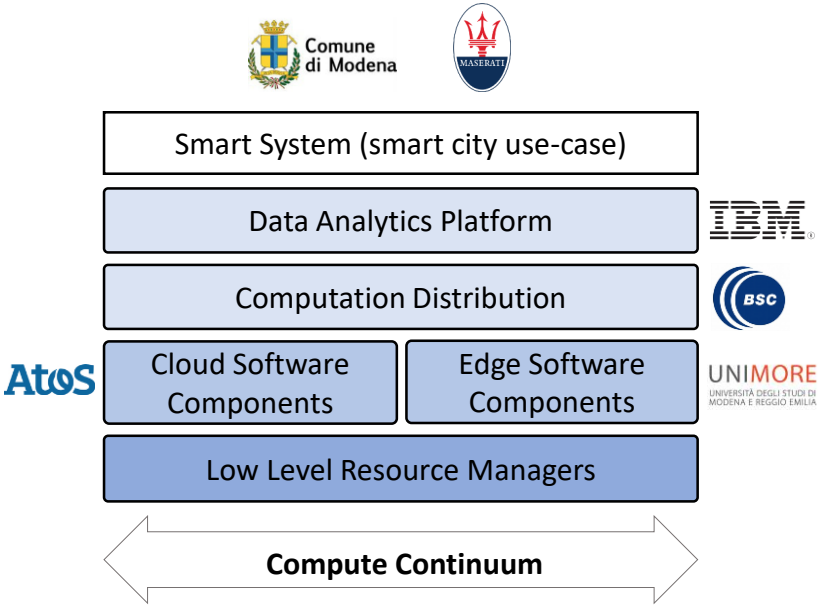
Main Contribution

- Develop a **novel software architecture** for **distributed fog-like computing architecture** capable of
  1. **Coordinate** edge and cloud computing resources
  2. **Distribute and coordinate** big-data workloads with **real-time requirements** along the compute continuum
  3. **Combine** data-in-motion and data-at-rest analytics
  4. **Increase productivity** in terms of programmability, portability/scalability and (guaranteed) performance



Software Architecture

- Integrate technologies from different **computing domains** into a single development framework
  1. Use the most advance data analytics solutions
  2. Apply **high-performance techniques** to distribute computation across edge and cloud resources
  3. Apply of **timing analysis techniques** from real-time embedded domain
  4. Use the most advanced **parallel heterogeneous** embedded platforms



Project Objectives

1. Facilitate the development and execution of *combined data-in-motion data-at-rest analytics* based on distributed computing
2. Integrate state-of-the-art big data analytic methods to *take full advantage of distributed computing*
3. Provide *real-time guarantees* on the amount of data streams that the system is capable to process to ensure the right quality of service
4. Efficiently *distribute workloads* along the continuum *reducing latency and increasing throughput* compared to cloud solutions at a *lower cost*
5. Test the envisioned software architecture on a *real-world use-case* from the smart city domain
6. To investigate the *impact of initiatives and standards* on the CLASS use-case

Smart City Use-case

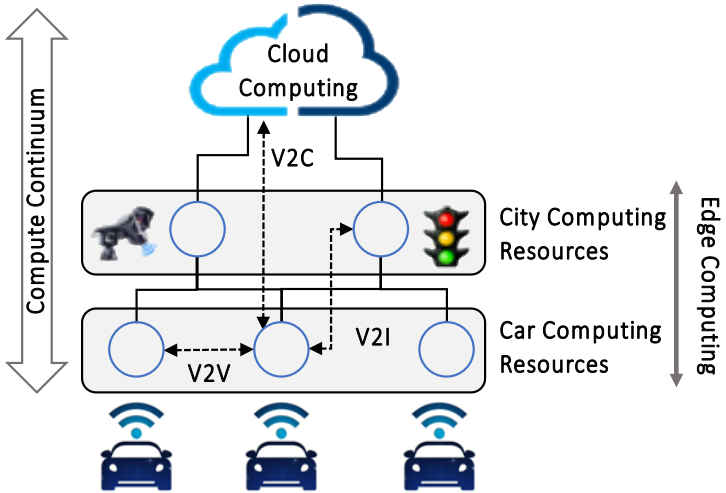
- Test and highlight the benefits of the CLASS SA
- Deployed on the *Automotive Smart Area* in the city of Modena (Italy)
  - 1 Km^2 urban area with connectivity that enables IoT devices (e.g., smart cameras, traffic scanner) to exchange information
- Three highly-connected cars equipped with
  - *Vehicle-to-infrastructure* (V2I), *vehicle-to-cloud* (V2C), *vehicle-to-vehicle* (V2V)
  - Cameras @4K, long-range and middle range radars and ultrasound sensors

Automotive Smart Area

V2V, V2I, V2C connectivity

Prototype car intended to be used

Smart City Use-case



- **Data analytics** and **real-time** requirements
- **11.4 GB/s** of heterogeneous data-sets considering 3 cars and a 1 km^2 sensing area

1. *Intelligent traffic management*, acting on traffic lights and smart road signals
   - "Green routes" for emergency vehicles
   - Traffic enhancement based on intelligent cross road management
2. *Advanced driving assistance systems*
   - Intelligent cross road management based on obstacle detection
   - Automated valet parking systems

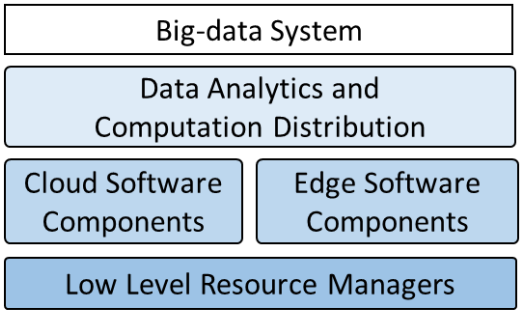
Industrial Advisory Board

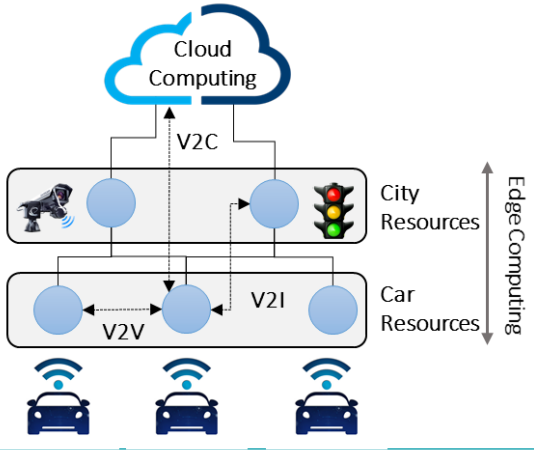
1. Monitor and provide recommendations (considering their specific requirements) on the research conducted in CLASS
2. Excellent dissemination and (potential) exploitation channel
3. Measure the interest of industries about the CLASS project

Original Members

Conclusions

1. CLASS aims to increase **productivity** on the implementation of big data systems by developing a novel SA for **distributing and coordinating** big-data workloads along the compute continuum while providing **real-time** guarantees
2. CLASS aims to **increase data analytics capabilities** by efficiently **combine** data-in-motion and data-at-rest analytics
3. CLASS aims to apply the SA to develop a distributed sensing/computing infrastructure within the Modena Automotive Smart Area for advanced urban mobility applications with **data analytics and real-time requirements**





Thanks for your attention.

Stay tuned!

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