Big Data Analytics for Smart Cities
The H2020 CLASS Project

Eduardo Quiñones (BSC)
{eduardo.quinones@bsc.es}

New Platforms for Future Cars: Current and Emerging Trends Workshop
23/03/2018 - Dresden (Germany)
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

Cloud computing
- Data storage
- High computation capabilities

Edge computing
- Data collection and transfer
- Limited computation capabilities

Data Analytics
- Data-at-rest analysis
- Data-in-motion analysis

Data sources
- Limited data-sets

Compute Continuum
Our Vision

The challenges of the newest smart systems can be addressed by devising a fully distributed 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 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

- **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
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
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

- **Data analytics** and **real-time** requirements
- **11.4 GB/s** of heterogeneous data-sets considering 3 cars and a 1 km² sensing area
Knowledge Base

- Application use-cases are based on **sensor fusion**
  disperse city/vehicle data sources
  - Consistent view of the city among all involved actors
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!

Twitter: @EU_CLAASS
LinkedIn: http://bit.ly/CLASS-project

www.class-project.eu