SmartEdge

Vehicle to Infrastructure Use Case

Kari Koskinen (Conveqs Oy), kari@conveqs.fi

SMARTEDGE Project

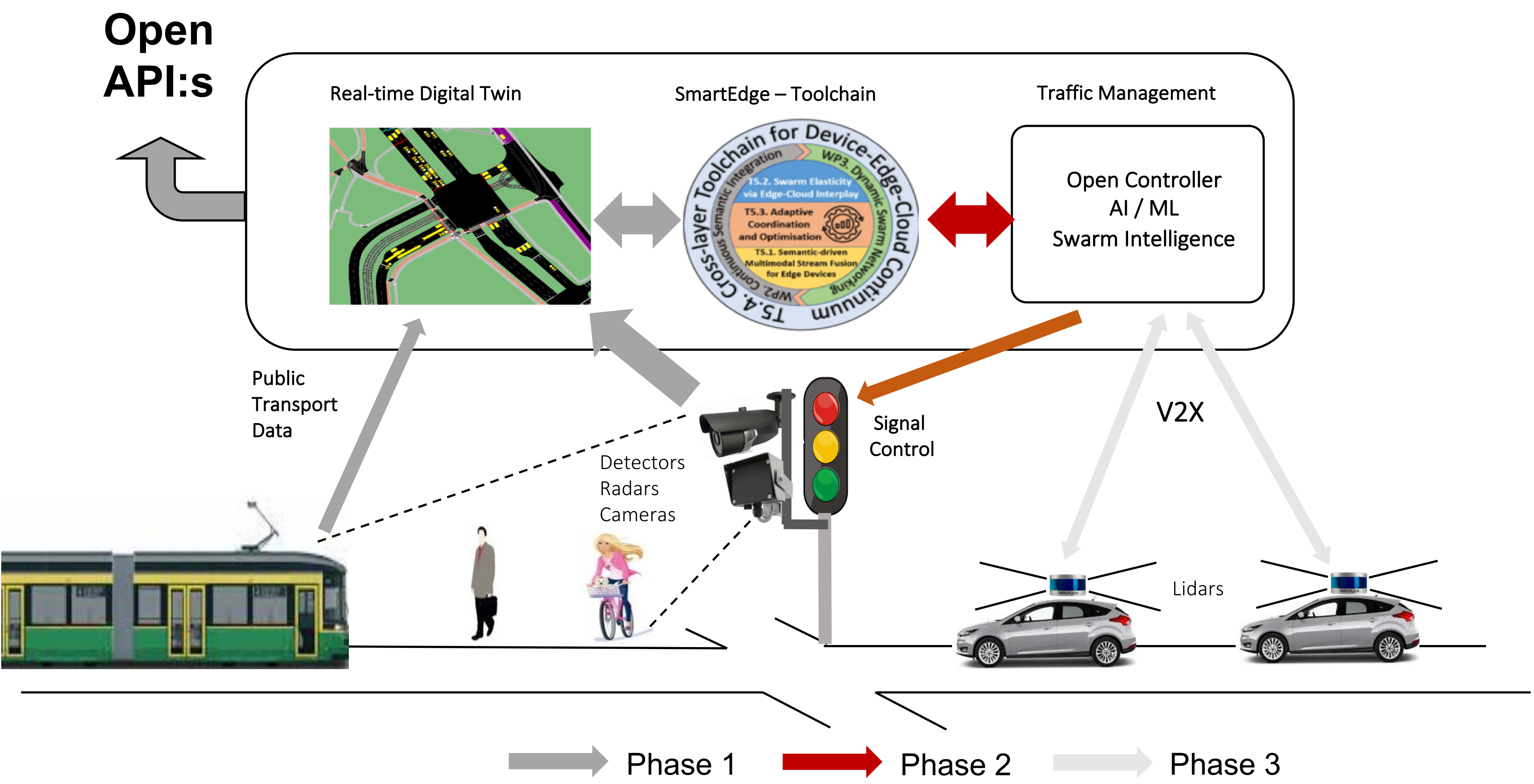
Grant No. 101092908

https://www.smart-edge.eu/

Why swarm intelligence in traffic management?

- State of the art traffic management is operating with very limited knowledge about the traffic conditions
  - Limited sensing capabilities (e.g. inductive loops)
  - Traffic controllers are monolithic and isolated in their operations
  - No semantic understanding of traffic conditions
  - Hardly any sharing of data
- Current developments in the market are promising
  - Sensing and computing equipment becomes cheaper and cheaper
  - Modeling, simulation, AI and other programming techniques are developing rapidly
  - Sensing equipment in vehicles is becoming ubiquitous
- Sharing of data swarm offer huge potential
  - Lower cost of installation (by using existing sensors in cars and infrastructure)
  - Understanding instead of individual data points

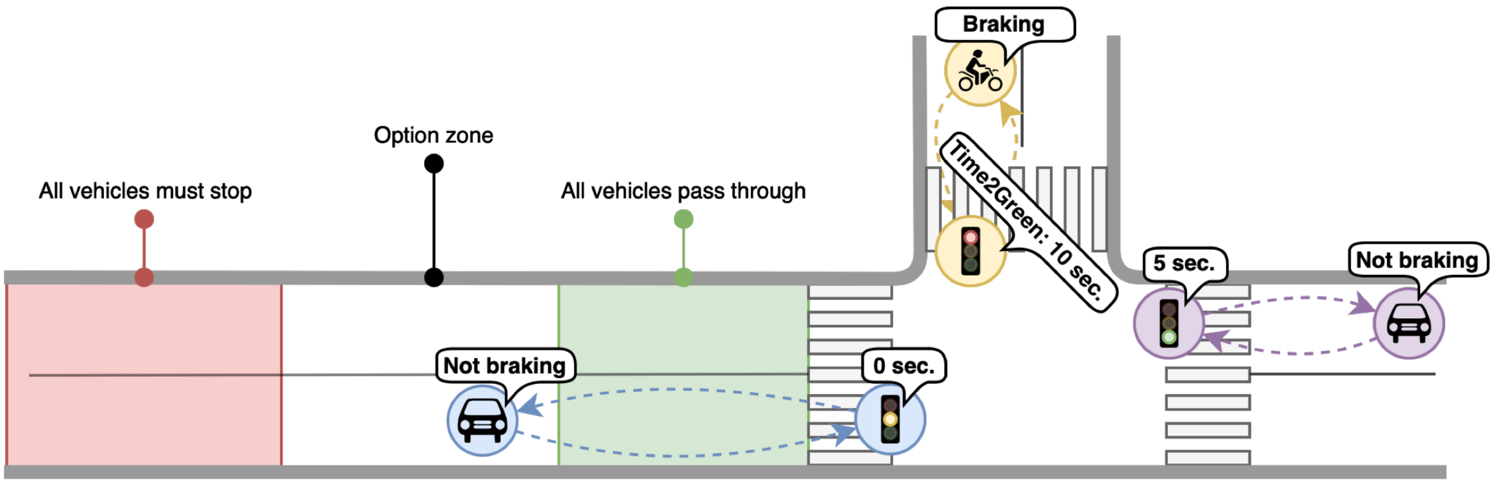
Background: SmartEdge as part of holistic traffic management



Picture: Iisakki Kosonen, Aalto University

Active option Zone management

- Goal is to implement safety functionality for traffic light operations
- This is only a simple example of functionality made possible by the connected vehicles and swarm intelligence



Technology innovation

- Semantic representation of traffic environment and conditions
  - Open Controller (an open source traffic controller developed by Conveqs and Aalto university)
  - V2X capabilities
  - Standards (WoT, SSN, SOSA, OpenXOntology, ETSI 5G, etc.)
- Sharing environment information between vehicles and infrastructure
  - Swarm formation
  - Data fusion
  - Trust networks
- Establishing two-way communication between infrastructure and road users
  - Currently only communication from infrastructure is traffic light (green or red), and single detection from vehicle to infrastructure
  - Wider array of data can be shared
- Hardware acceleration

Demonstration and field tests

- Lab tests
  - DELL infrastructure used for integration
  - Open source simulation environment (SUMO)
  - Data collected from the field infrastructure (Conveqs) and with instrumented cars (Aalto)
  - Winter 2024 - 2025
- Field tests
  - Will be carried out in Jätkäsaari test environment
  - Some 17 radars and cameras installed in the area (City of Helsinki, Conveqs)
  - Six intersections also connected to the system (Open Controller, field equipment)
  - In addition one or two instrumented vehicles will be used (Aalto)
  - Will be carried out in summer 2025

Jätkäsaari test area

Potential economic benefits

- Benefits of technologies developed in this project comes from:
  - Improved traffic flows (reduced time spent in traffic, reduced CO2 emissions)
  - Traffic safety (less accidents), and
  - Better informed decisions by the policy makers and road users
- Potential socio-economic benefits are very big, it is estimated *) that:
  - IoT solutions in centralized and adaptive traffic control can have 100 – 390 billion euros worth of socio-economic impact in 2030
  - Autonomous vehicles could capture 240 – 300 billion euros value in the same year
- Connected vehicles as well as swarm solutions are big part of any IoT solution
  - Isolation of current systems is the major problem in intelligent traffic operations
  - Most benefits can only be realized with co-operative systems capable of sharing data and resources
- However, it should be noted that most socio-economic benefits are consumer surplus

*) McKinsey: "The Internet of Things: Catching up to an accelerating opportunity", November 2021

Lead parners

- Data collection, validation and field tests
  - DELL (integration), Aalto University (Instrumented vehicles)
- Semantic representation
  - Cerfiel, Aalto University, TUB
- Swarm formation and data exchange
  - CNIT, TUB
- Open data
  - TUB, W3C, Aalto
- Computing enhancements
  - Oxford, Universite de Fribourg, TUB
- Trust Networks
  - IMC

Acknowledgment

This project is supported by the European Union's Horizon RIA research and innovation programme under grant agreement No. 101092908 (SMARTEDGE)

https://www.smart-edge.eu/