The Integrated Wireless and Traffic Platform for Real-Time Road Traffic Management Solutions

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- Distributed Traffic Jam Detection

- Travel Time Estimation based on (Extended) Floating Car Data

- Contextual Bus Lane Management
  (e.g. for electric vehicles)

- Limited Access Control
  (e.g. road closure)

- Regulatory and Contextual Speed Limit Information
  (e.g. green light speed advice)

- Traffic Light Adaptation
 (e.g. based on queue length)

- etc.

iTETRiS

Problems:

- Local-scope geographic analyses shift problem to adjacent uninspected areas

- Short-term analyses shift problem to a later point in time

> → Large-scale (whole city-area), long-term (1-2 hours) analyses are required

- Field-operational tests are too expensive and not reproducible
- Theoretical analyses use abstractions which reduce accuracy

→ Large-scale long-term **simulations** are required
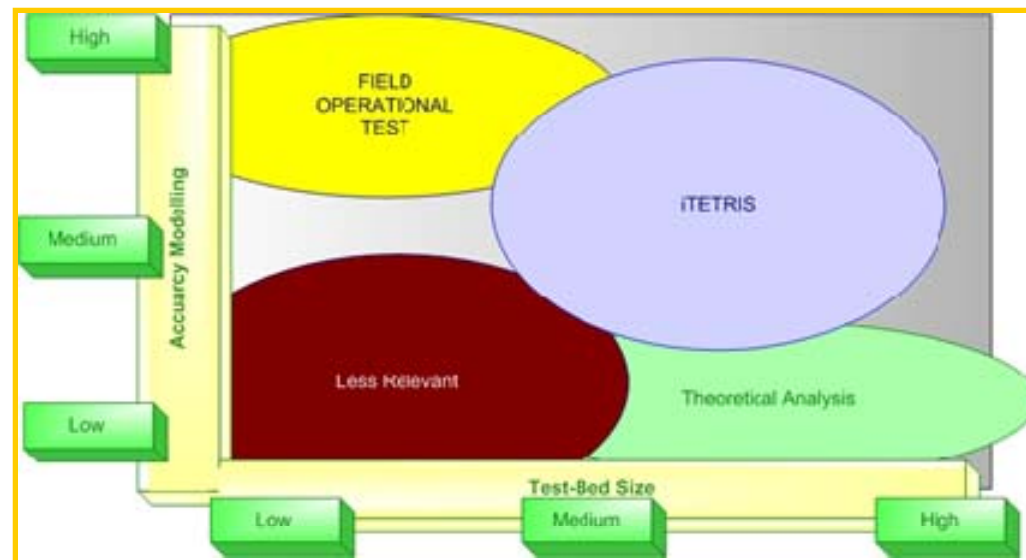
iTETRIS targets large-scale long-term evaluations of performance and effect of V2X communications for traffic management.

- Development of a holistic closed-loop simulation environment
- Development of general traffic management strategies
- Development of data distribution strategies for V2V+V2I communications
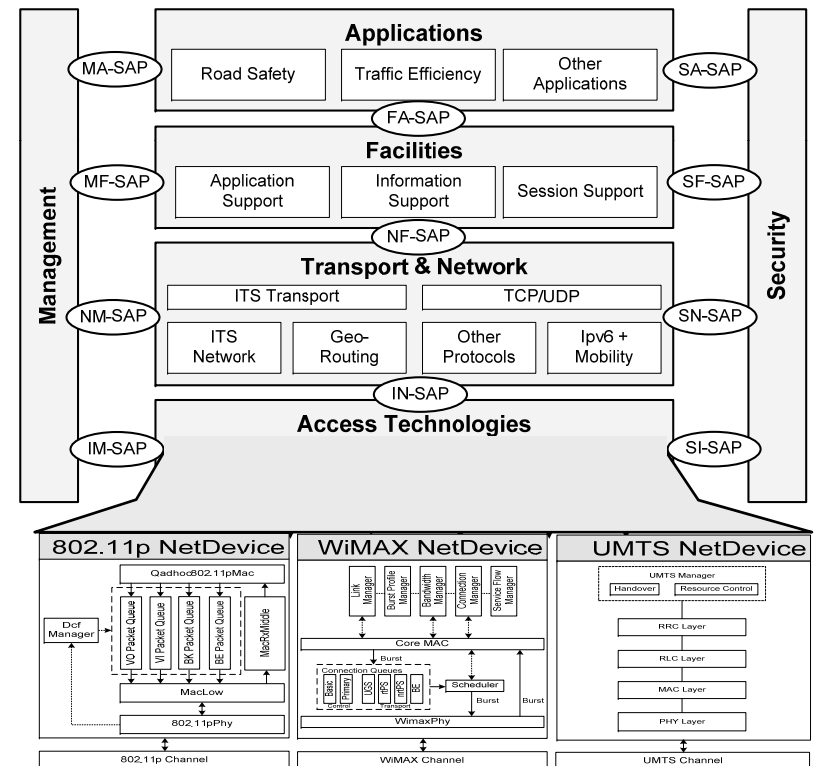- Evaluations with realistic traffic flows

Partners

Peek Traffic B.V. (The Netherlands)

CBT Comunicacion & Multimedia (Spain)

City of Bologna (Italy)

German Aerospace Center – DLR (Germany)

Hitachi Europe SAS (France)

Innovalia Association (Spain)

Eurecom (France)

Thales Communications (France)

Universidad Miguel Hernandez (Spain)

Project details

- Duration: 30 months (07/2008 – 12/2010)
- Budget/EC Funding: 4.42 M€ / 2.96 M€
- Website: www.ict-itetris.eu
- Contact: Thales Communications
  coordinator@ict-itetris.eu

ITS standards compliance

- ■ ITS architectures
  - ● Use the open architectures defined in COMeSafety and ETSI TC ITS as basic reference

- ■ Compliant implementations
  - ● IEEE 802.11p, ETSI TC ITS (5GA)
  - ● UMTS, WiMAX and DVB-H

- ■ Contributions
 - ● Provide inputs to C2C-CC WG and ETSI TC ITS

iTETRIS

- **Microscopic open-source traffic simulator SUMO** (http://sumo.sourceforge.net)

- Simulation of realistic traffic flows with multiple vehicle classes (cars, busses, electric vehicles, etc.)

- SUMO allows simulation of up to 500 000 vehicles in real-time

- iTETRIS extensions:

  - Emission modeling: CO_2, NO_x, particles, noise, fuel consumption, etc.

 - Adaptive Vehicle Rerouting/ Traffic Light Control: closed-loop simulations

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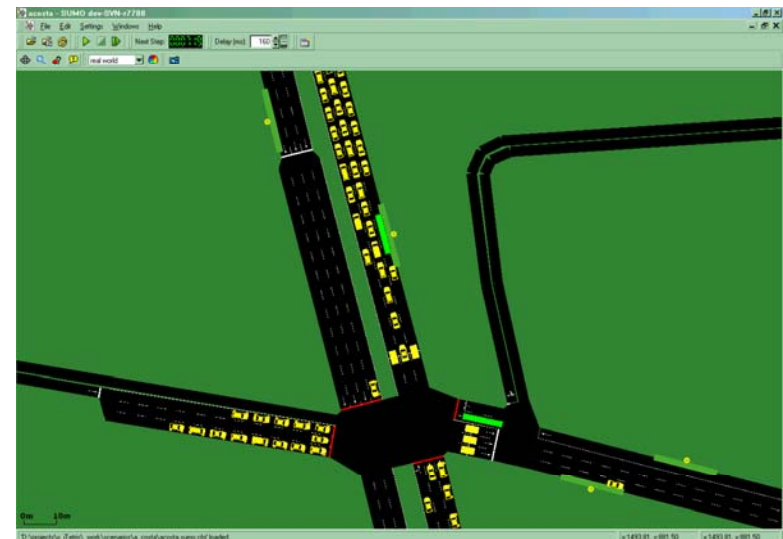
- Discrete-event network simulator **ns-3** (http://www.nsnam.org/)

- Free and open-source software project

- Good scalability, modularity and multi-technology support (ns-2 not capable of simulating more than 8000 nodes)

- Ongoing NSF funded project

- iTETRIS optimizations:
  - More effective interfering packet list management
  - Interference range reduction
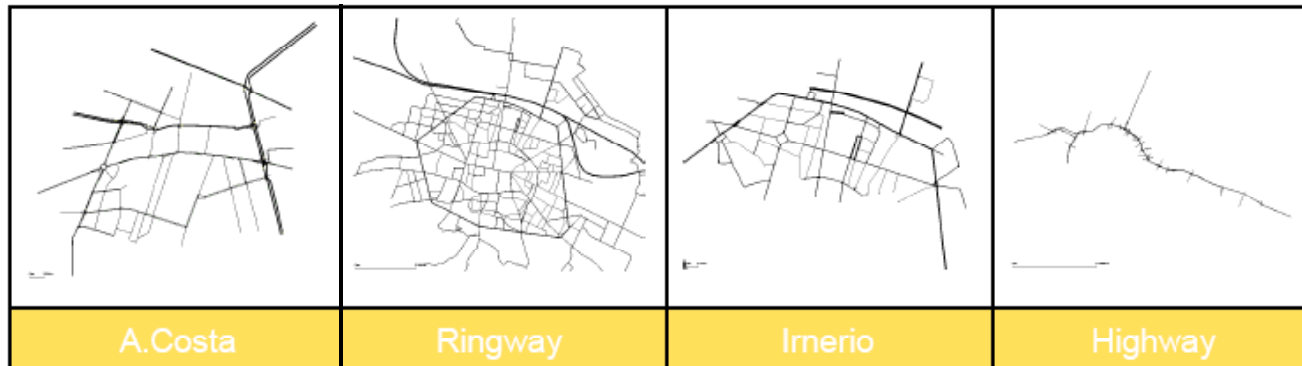 - Packet rate reduction

- **Synchronizes the individual simulators in time and space**

- **Integrates information-related facility layer components**

- **Provides interfaces to applications to:**

  - Retrieve information from ns-3 (e.g. CAM, DENM) and SUMO (e.g. ego vehicle position, traffic light status)

  - Control ns-3 (e.g. send DENM) and SUMO (e.g. vehicle rerouting)

Applications

iCS

ns-3

SUMO

EMILIA - ROMAGNA
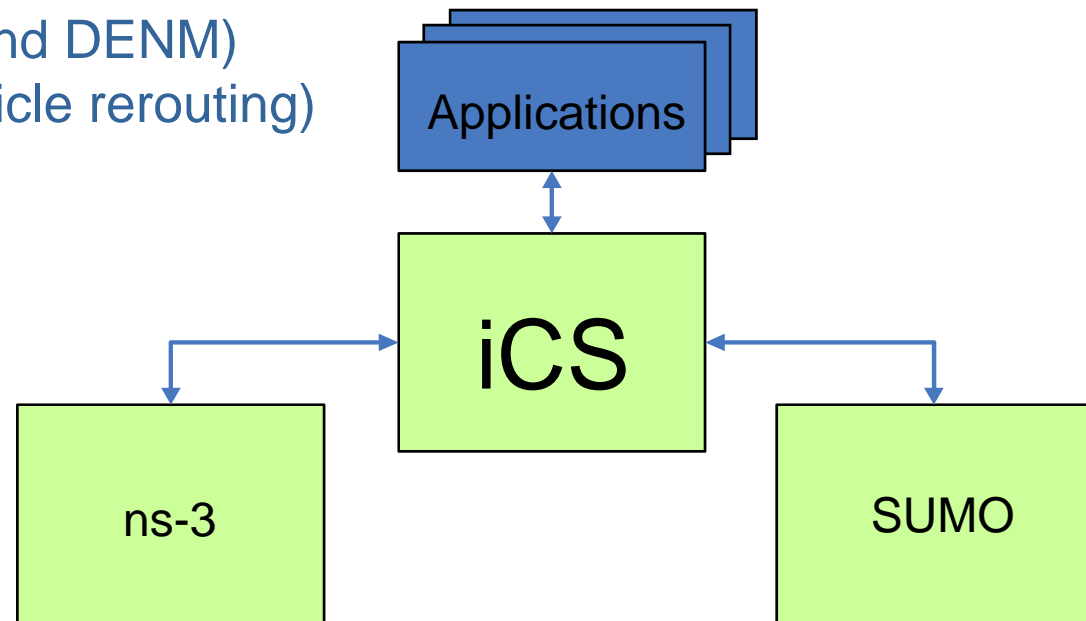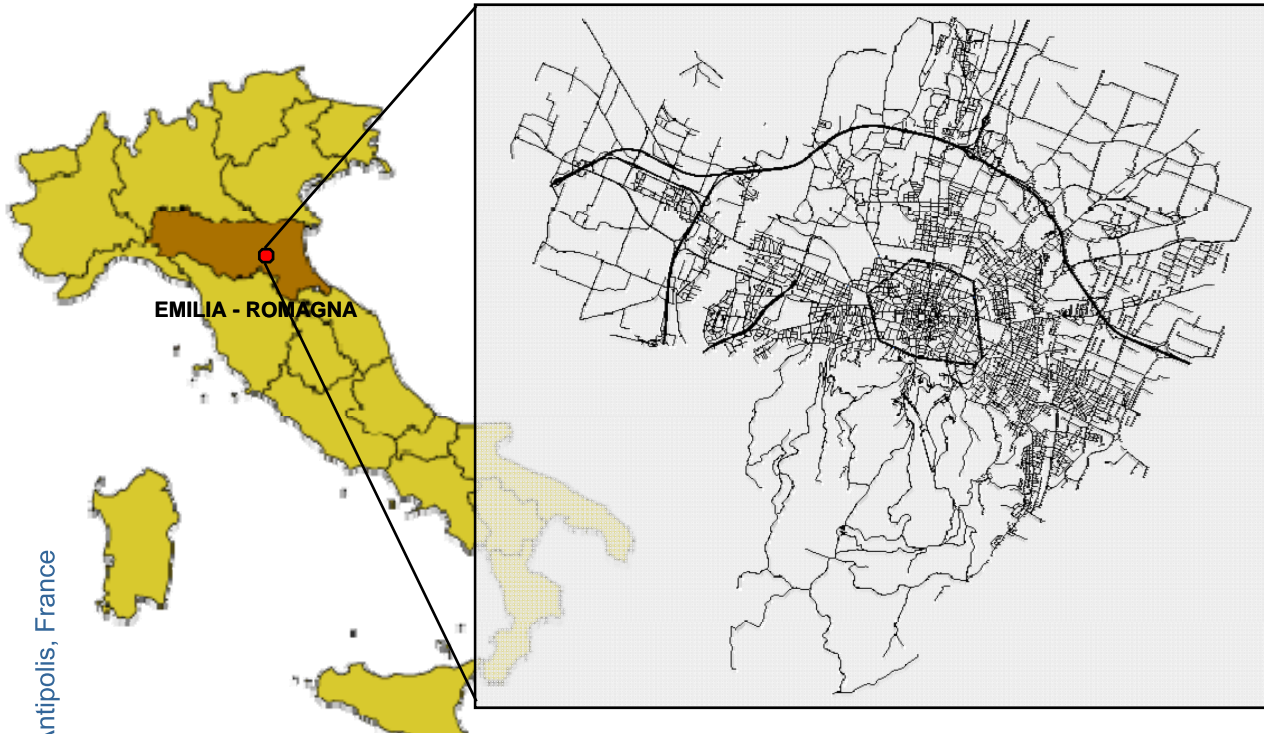
- City of Bologna
- ~373.000 inhabitants
- ~170 controlled intersections
- ~1000 induction loops
- Realistic traffic flows from OD-matrices and induction loop data

| A.Costa | Ringway | Irnerio | Highway |

Pasubio – A. Costa

Problems:

- Events such as a football match or a concert
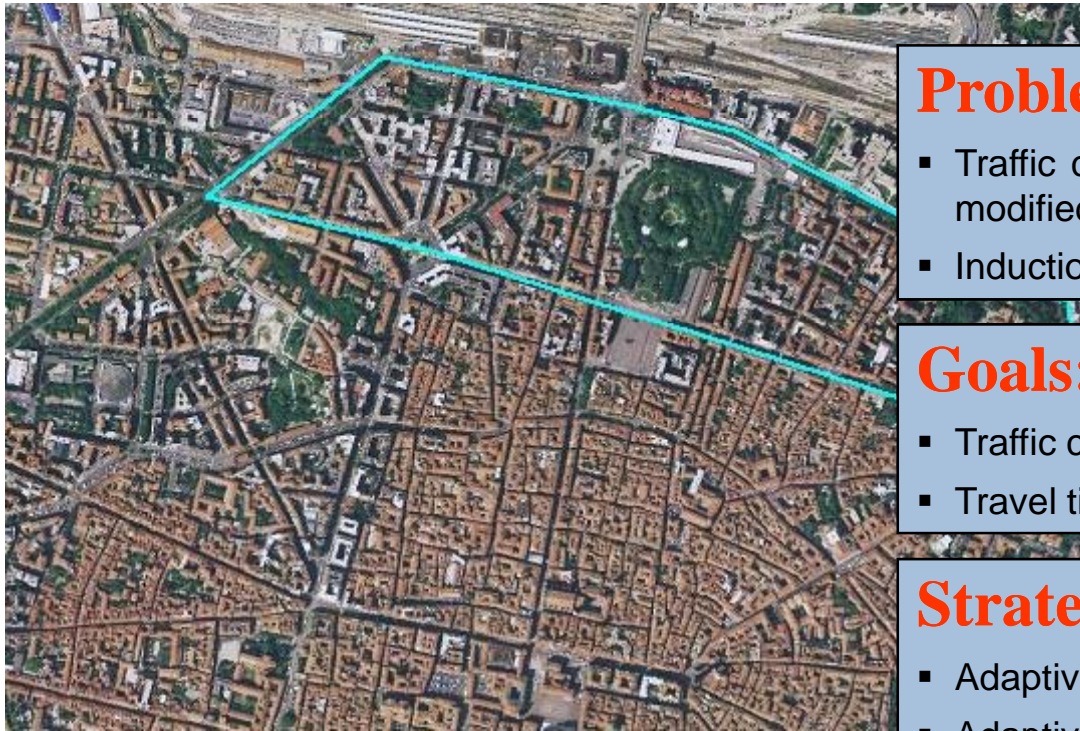- Reachability of the hospital

Goals:

- To manage the traffic in an area that offers few alternative routes
- Emergency vehicle priority

Strategies:

- Adaptive Traffic Light Control
- Adaptive Rerouting
- Regulatory and contextual speed limit information
- Bus lanes management
- Limited Access

Irnerio - Open Market Fair

Problems:

- Traffic condition analysis when road traffic is modified due to open market fair
- Induction loop malfunctioning or road yards

Goals:

- Traffic congestion detection in real time
- Travel time estimation

Strategies:

- Adaptive Traffic Light Control
- Adaptive Rerouting
- Regulatory and contextual speed limit information
- Bus lanes management
- Limited Access

Inner city ring-way

Problems:

- Traffic condition analysis
- Induction loop malfunctioning or road yards

Goals:

- Traffic congestion detection in real time
- Travel time estimation

Strategies:

- Adaptive Traffic Light Control
- Adaptive Rerouting by covering the ring way clockwise or anti-clockwise
- Regulatory and contextual speed limit information
- Bus lanes management
- Limited Access

Orbital + Highway

Problems:

- Orbital (free) and Highway (toll)
- Multiple exits to the city center

Goals:

- Travel time reduction
- Optimization of the orbital congestion
- Travel time estimation

Strategies:

- Adaptive Rerouting
- Regulatory and contextual speed limit information

Data Dissemination for V2V/V2I communications

- Development of next generation reliable & contextually dynamic vehicular communication protocols for V2V+V2I

- Delay- and Disruption-Tolerant Networks (DTN) with store-and-forward functionality over multiple radio access technologies

- Geo-unicast, geo-anycast and geo-broadcast communication protocols
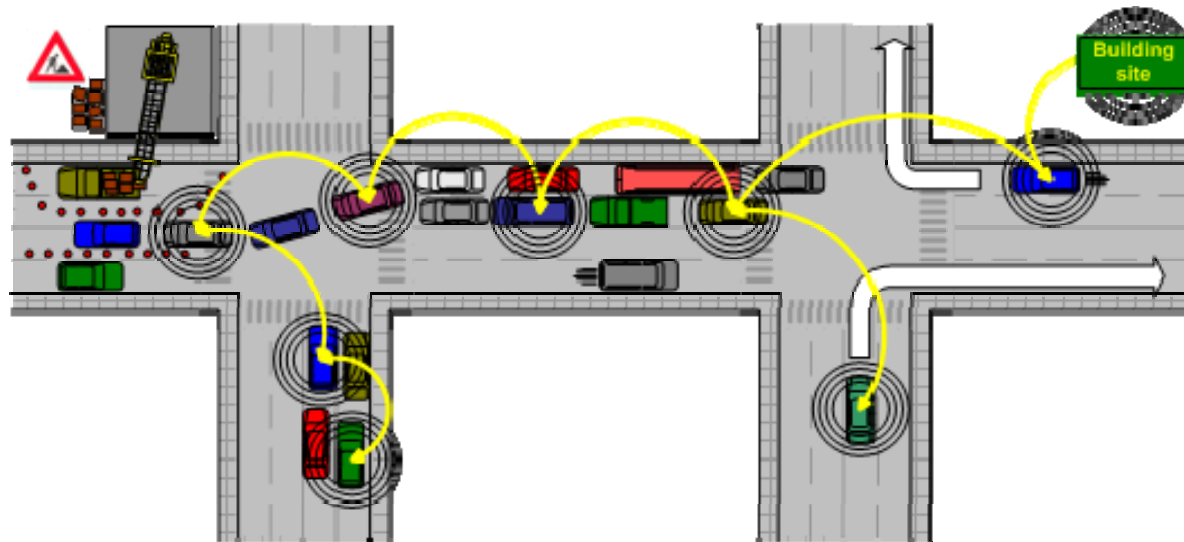
- Provide contributions to C2C-CC (SIM WG) and TC ITS for protocols and ITS simulation framework definition

- Could help the future FOTs for planning in their preliminary phase

- Provide road authorities with a tool to

  - Evaluate potential exploitation of cooperative V2X communications

  - Provide input to smart policy strategies creation through simulated traffic control policy evaluation, eg. based on pollution traces

- Extend the SUMO or ns3 simulator to cover new emerging use cases and scenarios, or even replace either of them with another simulator, as interoperability is a key objective of the development of the iCS.

Future usage of the iTETRIS platform:

- Performance evaluations of communication protocols

- Evaluation of the effect of traffic management applications

- Simple integration of novel applications and scenarios

- Open to future enhancements (open-source)

Feel free to visit our website http://www.ict-itetris.eu or contact one of the project members directly

Thank you for your attention!
Questions?

www.ict-itetris.eu