iTETRIS Newsletter

June 2009

Welcome to the second issue of the iTETRIS (www.ict-itetris.eu) newsletter. This project supported by FP7 Cooperation Work Programme ICT is engineering an integrated wireless and traffic simulation platform for real-time road traffic management solutions. This second issue of the iTETRIS newsletter focuses on three key aspects. Firstly, road traffic scenarios, which are of particular relevance to road authorities requirements. Secondly, the specification of the use cases selected to reveal the functionality that has to be supported by iTETRIS platform. Thirdly, the description of the ETSI standards compliant simulation architecture.

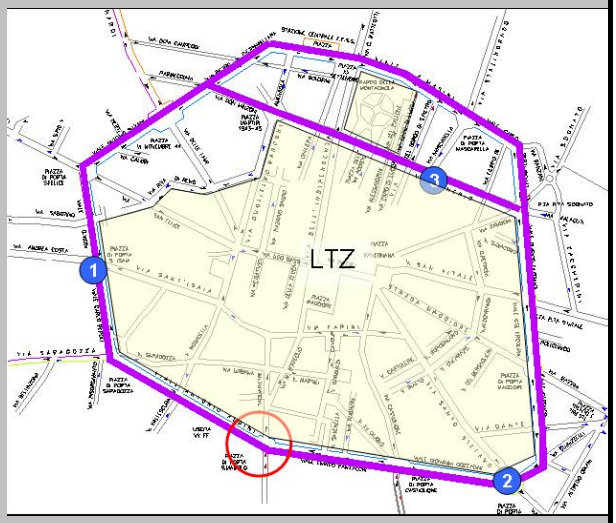
iTETRIS Scenarios, Use Cases and Large Scale Simulation Architecture

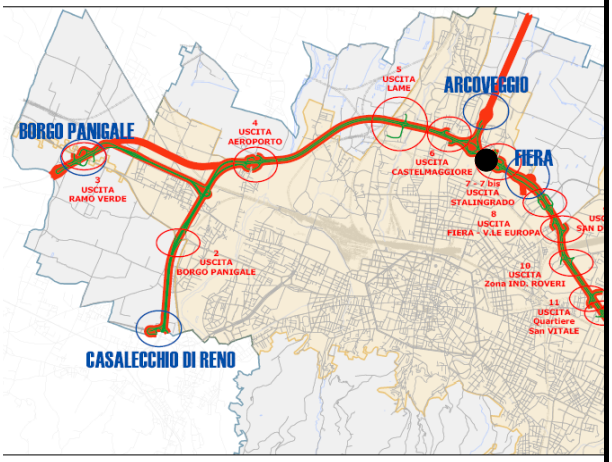
iTETRIS' vision is to create a global, sustainable, open vehicular communication and large-scale simulation platform for Cooperative ITS performance evaluation. iTETRIS has now defined a rich set of realistic traffic conditions, use cases and a simulation architecture fully aligned with ETSI TR 102 638 V1.1.1 June 2009 standard, which ensures that crucial technical capabilities for successful Cooperative ITS deployment could be analysed with unprecedented accuracy in the near future.

Scenarios

iTETRIS has been working on the identification of a number of scenarios that could serve as a benchmark to showcase effectiveness and impact of particular cooperative road safety and cooperative traffic efficiency solutions. The scenarios have addressed specific events and situations in the city of Bologna that can be easily transferred to other European cities, which would experience similar conditions. 3 scenarios have been considered and different traffic conditions have been identified as particularly relevant in the context of road traffic management.

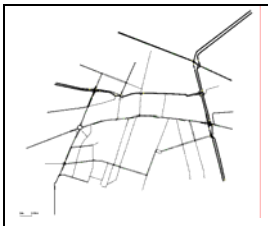
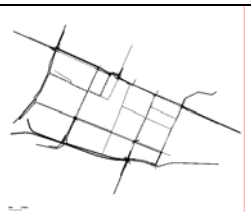
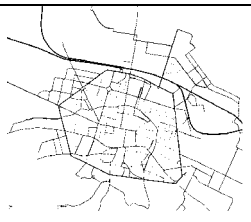
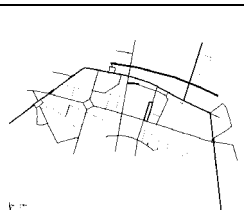
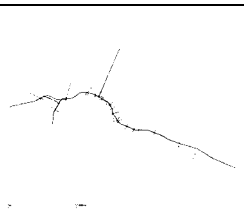
Number	Title	Description	Picture
SC1	**Pasubio / A. Costa** City Stadium	The first case study aims to analyse the impacts on the mobility of a big event such as a football match or a concert. The area is not far from the city-centre and is characterised by many point of interests: the stadium, where the Bologna FC plays and live-concerts take place; the cemetery; the Hospital. The goal is to manage the traffic in an area that offers **few alternative routes**, where the stadium generates a significant increase traffic flow that affects adjacent areas of Bologna traffic network.	

		Bologna is surrounded by an inner city ring-way, which draw a line between the Bologna-centre and the remaining urban city. The **ring-way** is **equipped** with **plenty** of **traffic lights and detection loops**. It can be **crossed clockwise or anti-clockwise** and as all the traffic-lights are connected each other, for this case-study a traffic management system should be able to help the vehicles in finding the optimal route, the one that minimise travel times, and should be able to compensate malfunctioning of an induction loop.	
SC2	**Open Market Fair** / Irnerio	As the area within the Ringway is a **Limited Traffic Zone (LTZ)**, only few vehicles are allowed to come in, the ring-way is the only way for vehicles to cross the city. The scenario also includes **Via Irnerio**, a street that represents a **shortcut connection** to the ringway, with no traffic restriction for private vehicles. The junctions most involved in traffic congestion during the day of the **open market** are indicated in the following picture. **Congestion** in the junction numbered **1** is due to the huge amount of **pedestrian crossing the cross-walking**. As regard the junction number **2** there are problems owing to the increased number of **vehicles turning left** in order to **reach** the **underground car park**.	
SC3	**Ring way** / Irnerio	This scenario extends the previous contexts and covers 3 additional traffic conditions • **Traffic congestion** is defined at a junction (in the red circle). What will be the quicker route from point 1 to point 2? • The **malfunctioning of induction loops** has been taken into account. In this, case how a malfunctioning be identified at the soonest? Once a loop failure is confirmed, what shall a traffic management system do? • The condition number 3 takes into account the case of a **localised problem** that occur in a specific point of the network, such as the presence of a **road yard**, or a mere **lane closure** (point 3 in the following picture).	

SC4	**Highway/ Orbital**	**Bologna** is situated in the heart of the middle-north of Italy and it is an important **node** for the network **connecting the north to the south**. The orbital runs beside the highway. In the picture to the right the Highway is represented in red; the Orbital is green - coloured; highway's exits are indicated in a blue circle, whereas Orbital's exits are in red., Since **4 out of the 5 highway exits are connected directly to the orbital,** it is often chosen by the drivers as an alternative route to the highway. In the case of congestion in the highway, the traffic management system of the highway suggests the drivers to leave the highway and take the orbital. In the same way, in the case of traffic jams in the Orbital, vehicles can leave the Orbital for the Highway. The **strategy** to pursue is essentially to suggest routes (exits) that **minimise vehicles' travel time.** The strategy should be activated **suggesting** some vehicles to choose another **exit** from the one they were going to take using a **longer way but less congested**.	

iTETRIS Scenarios and Traffic Conditions(© iTETRIS Consortium)

Based on a set of descriptions given in VISUM, Vissim, and ArcView shapefile format, the described areas were translated into descriptions for the open source traffic simulation platform **SUMO**, yielding in a very **rich** set of **traffic conditions** for studying **Cooperative ITS solutions at city-level** within the iTETRIS project.

				
A.Costa	Pasubio	Ringway	Irnerio	Highway

SUMO road network models used in iTetris evaluation scenario (© iTETRIS Consortium)

Use Cases

The set of scenarios above depict both representative situations for traffic congestion situations and different traffic dynamics. Furthermore, the scenarios also permit that Intelligent Re-routing, Advanced Driving Assistance Systems (ADAS) and advanced Traffic Light Control (TLC) algorithms could be proposed relying on advanced communication features.

iTETRIS vision is to create a global, sustainable and open vehicular communication and traffic simulation platform designed to facilitate a large scale, accurate and multidimensional evaluation of cooperative ICT solutions for mobility management. So it is very important that iTETRIS is capable of simulating the largest possible set of Cooperative ITS solutions in an effective manner. This implies that use cases should be complete enough to reveal current and future blocks needed to implement and simulate sophisticated algorithms. Hence, the use cases are defined so that coverage of technical capability requirements is ensured thereby leveraging the assessment of the largest possible amalgam of Cooperative ITS traffic management strategies. Use Cases are therefore designed to ensure completeness in the iTETRIS specification.

The Use Cases have been defined so that strategies for both traffic estimation conditions and traffic management could be addressed and identified.

	Use Case	Description
Traffic Condition Estimation Strategies	UC1 – Traffic Congestion detection	UC1 aims at detecting traffic congestion situations in a distributed manner, i.e. without making use of the communication infrastructure – ITS Roadside Station. Periodic message Exchange between vehicles is used to create accurate representation of traffic context and through advanced algorithms traffic congestion conditions could be extracted.
	UC2 – Travelling time Estimation	The objective of UC2 is to estimate through centralised means the transit times of each street or segment of interest in a scenario. Each ITS Roadside Station collects data through V2I communications and sends it to the Traffic Management Centre (TMC) for operation of the traffic
Traffic Management Strategies	UC3 – Public Transport Lane Management	V2I communications will be employed in UC3 to detect, in a centralised manner, congestion situations and allow temporally the use of public transport lanes to private vehicles.
	UC4 – Restricted Access to Prioritised Vehicles	UC4 aims at the evaluation of traffic management strategies that would allow access to city centre street to vehicles with high occupancy and/or low emission vehicles, e.g. electric cars
	UC5 – Optimum route recommendation	UC5 is one of the use cases devoted to demonstrate the improvement of traffic efficiency. Vehicles request the Traffic Management Centre (TMC) the best possible route for their destination. The TMC provides personalised optimum routes. As a function of the information gathered through V2V-I2V communications, each vehicle decides the best possible route in a distributed manner.
	UC6 – Maximum speed limit information and dynamic traffic light adaptation	UC6 covers the management of crossing operated by traffic light control algorithms. As a first approach through I2V each vehicles receives information about the recommended speed to adopt in order to optimise the probability to get green traffic lights on the selected path. As a possible enhancement the project will evaluate how the traffic light control algorithm could also adapt to the varying traffic congestion situations.

	UC7 – Emergency Vehicle Prioritisation	V2I communications will permit in UC7 that vehicles inform the ITS Roadside Station that an emergency vehicle is approaching. Traffic lights will change their phases so that the flow of the emergency vehicle could be prioritised. Public vehicles could also be informed about such event and they could cooperate to improve the progress of the vehicle in the middle of the traffic.
	UC8 - Event Based Traffic Condition Notification	Upon detecting an abnormal traffic event (e.g. traffic jam occurrence or detection of travel times being considerably longer than the expected values) through the analysis of the current traffic condition estimates, vehicles driving in certain area will receive traffic indications to avoid the anomalous traffic situation. The traffic condition estimates are obtained from UC1 and UC2.
	UC9 - Traffic Light Adaptation by Traffic Management Centre	In UC1 and UC2 information is collected about travel times and traffic jams. That information is only disseminated to the road users in those strategies. In this strategy, however, the same information will be propagated to the traffic management centre as well. There it will be combined with queue information from the traffic light controllers to influence the traffic light programs.

With such Use Case implementation iTETRIS will allow the evaluation, among others, of the following technical capabilities at a system level:

Capability Type	Technical Capability
Radio Communication Capabilities	The radio communication single hop coverage (distance, area)
	The radio communication frequency channels being used (for interoperability purpose)
	The available bandwidth and bit transfer rate
	The radio communication channel robustness which can be characterized by its packet error rate
	The contribution of the road infrastructure to compensate for signal propagation difficulties in areas populated by radio obstacles (trees, buildings, etc.)
Network Communication Capabilities:	Broadcasting capabilities
	Multicasting capabilities
	Ad-hoc networking capabilities
	Geo-casting capabilities
	Uni-casting capabilities
	Congestion control capabilities
	Messages priorities management capabilities
	Channels/connectivity management capabilities
	Capability to gain at least one IPv6 globally valid address for Internet - based applications
	Transparent management of changes in the point-of-attachment to the Internet for all the involved in-vehicle devices

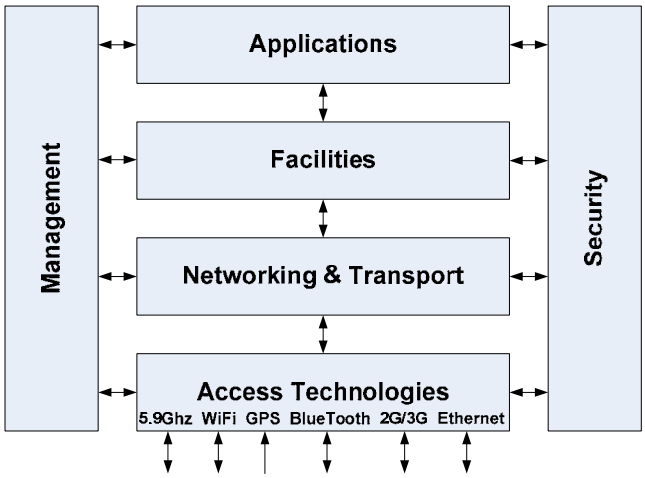
ETSI compliant Cooperative ITS Simulation Architecture

iTETRIS has set to objective to define the large-scale simulation architecture for Cooperative ITS that is compliant with ETSI ITS Communication Architecture. The following qualities are wished for the iTETRIS simulation architecture:

- Interoperability and Sustainability.
- Performance and Scalability.
- Extensibility and Maintainability.

- Usability
- Implementation Effort and Testing

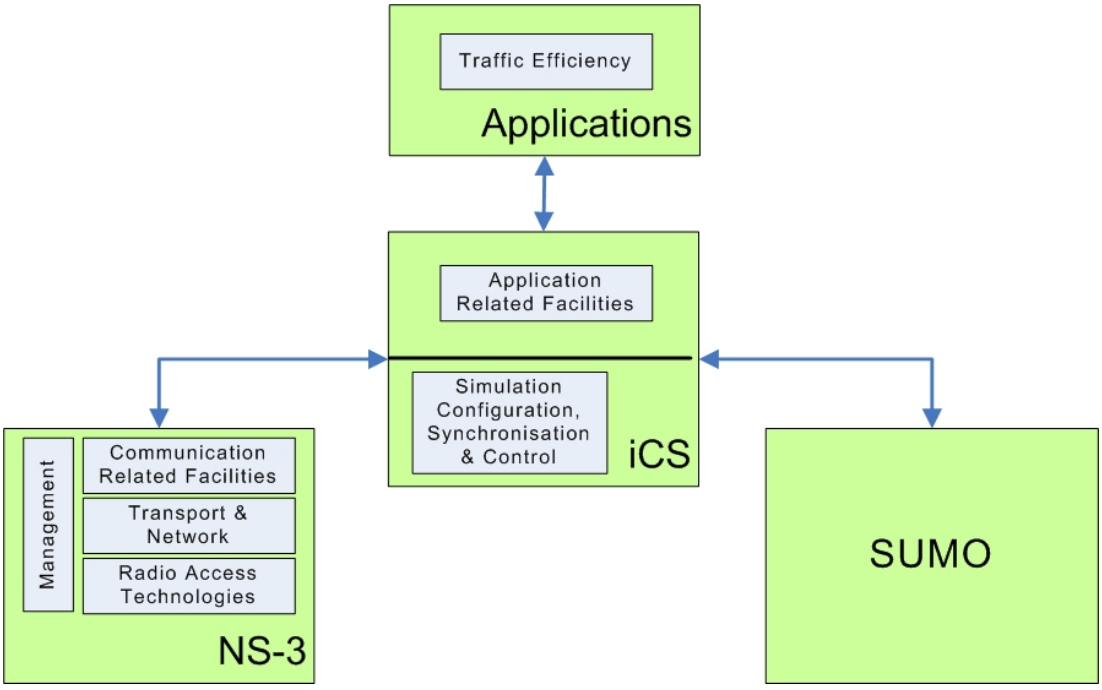
In order to ensure the **compliance** of the **iTETRIS platform** with the **major international and research standardisation efforts** in Cooperative ITS systems, the platform is developed following the **ETSI TR 102 638 V1.1.1** standard published in **June 2009**. The high-level architecture is illustrated below



iTETRIS Simulation Architecture (© iTETRIS Consortium

The proposed architecture considers three different subsystems (ITS Roadside Station, ITS Vehicular Station and ITS Service Centre) that can communicate over a wide range of wireless or wired communication media, and that allows for both direct ad-hoc V2V and V2I communications. It is important to note that this architecture has many similarities with the CALM (Continuous Air interface for Long and Medium range) architecture developed under the ISO TC 204 WG16. In particular, the new architecture maintains the CALM objective to allow for seamless communications over multiple communications technologies.

iTETRIS has mapped such high-level architecture in the following 3-Block simulation architecture. The 3-nlock architecture is the simulation architecture providing best-of-breed performance optimally balancing the desired simulation features with Cooperative ITS International Standard alignment.



iTETRIS Simulation Architecture (© iTETRIS Consortium

iTETRIS – Where to find us

The latest developments regarding the iTETRIS project will be presented at the following events. If you are interested in our research please do not hesitate to contact our research team.

ITS World Congress 2009, 22nd to 25th September 2009. Stockholm (Sweden)
iTETRIS: scenarios for simulation of real-time road traffic management solutions over integrated wireless communication and traffic platform
http://www.itsworldcongress.com/
Session: TS100
Session Title: Traffic management congestion
Date: 24 Sep 2009
Time: 16:00–17:30

iTETRIS Workshop @ ITST 2009, 21st October 2009. Lille (France)
http://itst2009.inrets.fr/
Date: 21 Oct 2009
Time: 14:00–18:30

Car2Car Forum 2009, 3rd to 4th November 2009. Wolfsburg (Germany)
http://www.car-to-car.org/index.php?id=96
iTETRIS: Large Scale Simulation Platform for Cooperative ITS. Scenarios, Architecture and First Performances.
Session: Plenary Session C2C-CC Related Projects I
Date: 03 Nov. 2009
Time: 13:00-14:15

2009 Annual Polis Conference, 10th to 11th December 2009. Brussels (Belgium)
http://www.polis-online.org/
Investigating the Efficiency of ITS Cooperative Systems for a Better Use of Urban Transport Infrastructures: The iTETRIS Simulation Platform.
Date: To be determined

iTETRIS Information

Project Duration:
July 2008 – December 2010

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