

# SWOMM

Improving efficiency of traffic through  
Intelligent Transport System (ITS)

Eugenio Morello



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# Overview

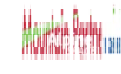
- Problem in Transport and Traffic
- A possible answer?
- How ITS works?
- Results:
  - Urban context
  - Olympic area (Turin 2006)

# The problem

- Transport and Traffic
  - Congestion
  - Global warming
  - Safety
  - Pollution



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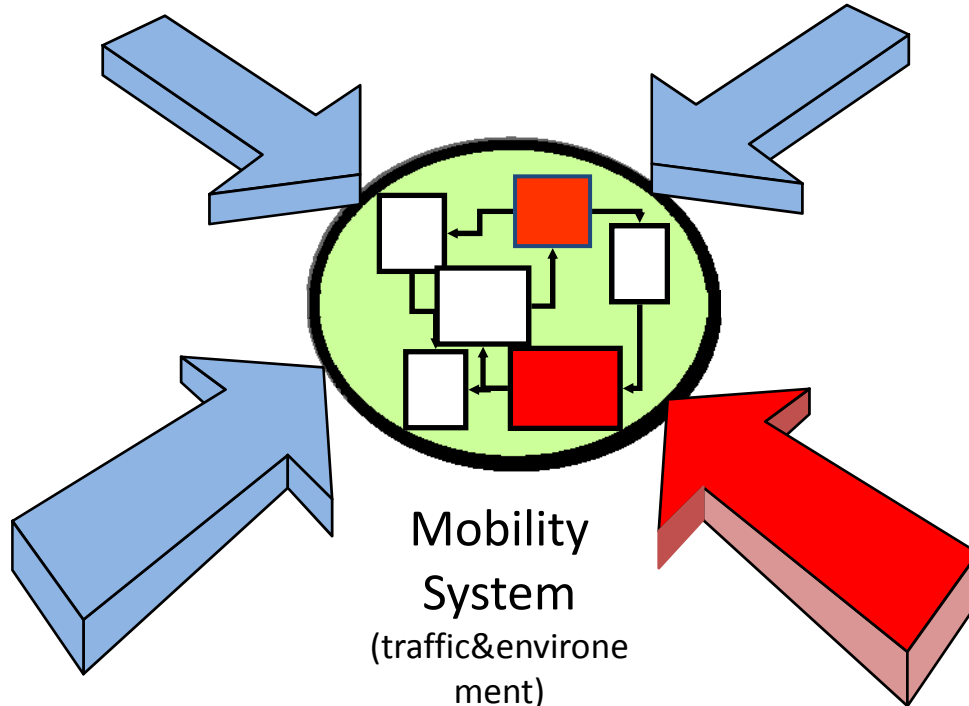
# Situation

- **Congestion:**
  - problem on 10% of the European road network; annual cost 0.9-1.5% of EU GNP
  - Forecasts of growth between 2000 and 2020: +50% road freight transport; +35% passenger transport by road
- **Global Warming (CO2 Emissions):**
  - The Road transport accounts for 72% of CO2 emissions from transport, increased by 32% from '95 to 2005
- **Safety:**
  - White Paper (2001) counts (EU-15) € 160 billion (2% of Europe's GNP) as the cost of 41.000 annual deaths and 1.7 million injured
  - fatalities decreased (-36% since 2001), but absolute numbers still impressive: 26.500 deaths in 2009
- **Pollution:**
  - There are reductions in the levels of sulphur dioxide (SO2) and carbon monoxide (CO) in ambient air, marked reductions in NOX, but exposure to particulate matter (PM) and ozone (O3) remain of major environment-related health concern

# Approach

Infrastructure

Demand Management



**INTEGRATION**

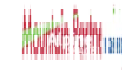
Vehicles

Mobility System  
(traffic & environment)

**ITS**

**Intelligent Transport Systems**

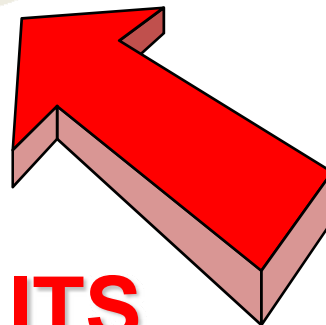
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# ITS role

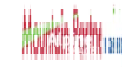
- Traffic smoothing
- traffic flows “optimal” distribution
- optimize vehicle management

- Better management of available resources by:
  - data collection (traffic, environment)
  - traffic flow regulation and control
  - distribution of information to users

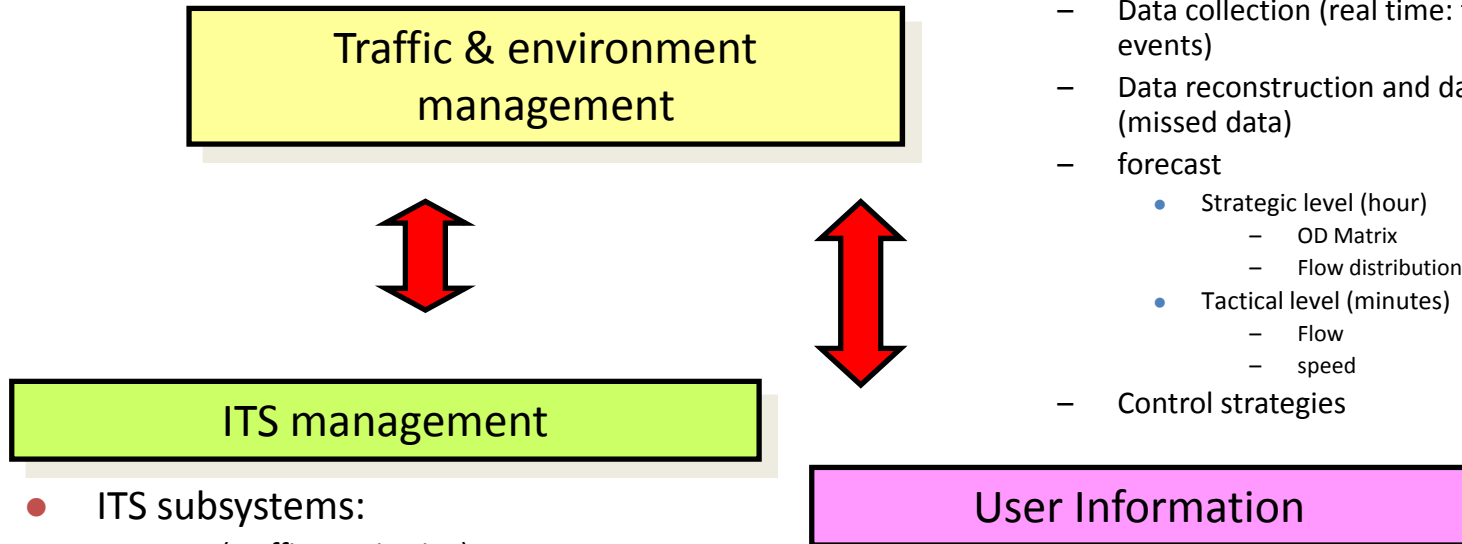


**ITS**

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# Function

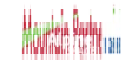


- Traffic management:
  - Data collection (historic, census)
  - Data collection (real time: traffic states, events)
  - Data reconstruction and data completion (missed data)
  - forecast
    - Strategic level (hour)
      - OD Matrix
      - Flow distribution
    - Tactical level (minutes)
      - Flow
      - speed
  - Control strategies

- ITS subsystems:
  - RT (Traffic monitoring)
  - EM (environment monitoring and meteo)
  - CCTV (video surveillance)
  - AID (Automatic Incident Detection)
  - RM (Ramp metering)
  - VMS (Variable Message Sign)
    - LCS (Lane Control Sign)
    - TXT (textual information + pictogram)
    - VDS (direction and rerouting)
  - MIM (Multiagency Incident Management)
  - Fleet management

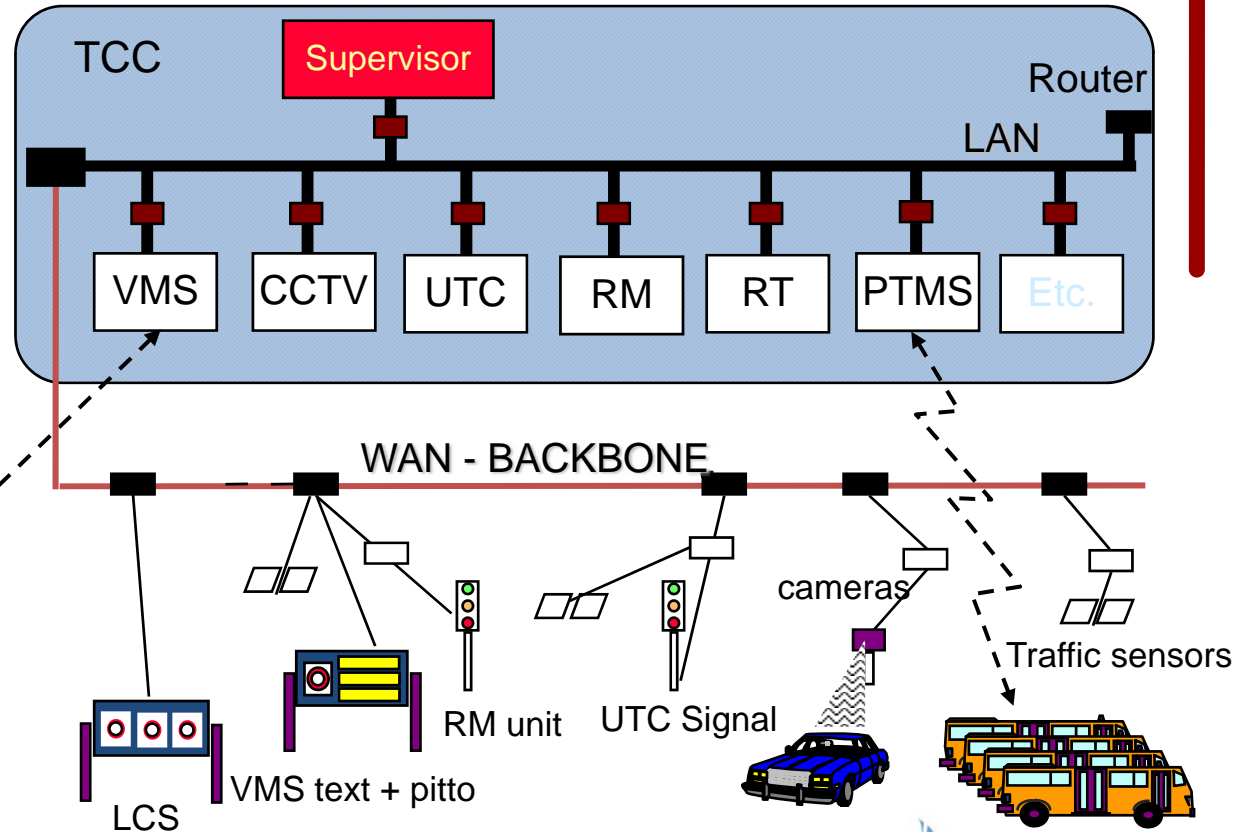
- Infomobility:
  - Web portals
  - TELETXT
  - Personalized information
    - Dynamic Navigator
    - PDA
    - 3G telephon

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# ITS - Suitable architecture

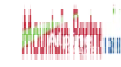
- A collection of independent and autonomous systems
- A city network for data exchange
- sharing of interfaces (data dictionary and Location referencing system
- A higher function of "supervision"



# ITS - supervisor

- Supervisor is in charge of:
- real time traffic monitoring
  - Collect traffic measures from sensors (fixed, mobile)
  - events management (offer & demand)
  - Traffic data completion (using traffic models)
- define the optimal/feasible traffic distribution
  - Traffic forecast
  - tactic level, horizon 5'-30'
  - Strategic level horizon 1h
- traffic control
  - Rerouting (direction and path to be followed)
  - target speed

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# ITS - supervisor

- **Supervisor** is based on “integration basic principles” (QUARTET UE project)
  - **Cooperative Traffic Monitoring** (traffic data fusion and completion)
  - **Feasible Equilibrium** (on line traffic models: Assignment and OD Matrix estimation)
  - **Equilibrium Keeping Control** (closed loop feedback control)

# ITS - supervisor

- **Supervisor concept:**

Town Supervisor Strategy based on :

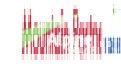
*LINK PROTECTION* concept

*EQUIVALENT DENSITY* concept

*REROUTING STRATEGIES*

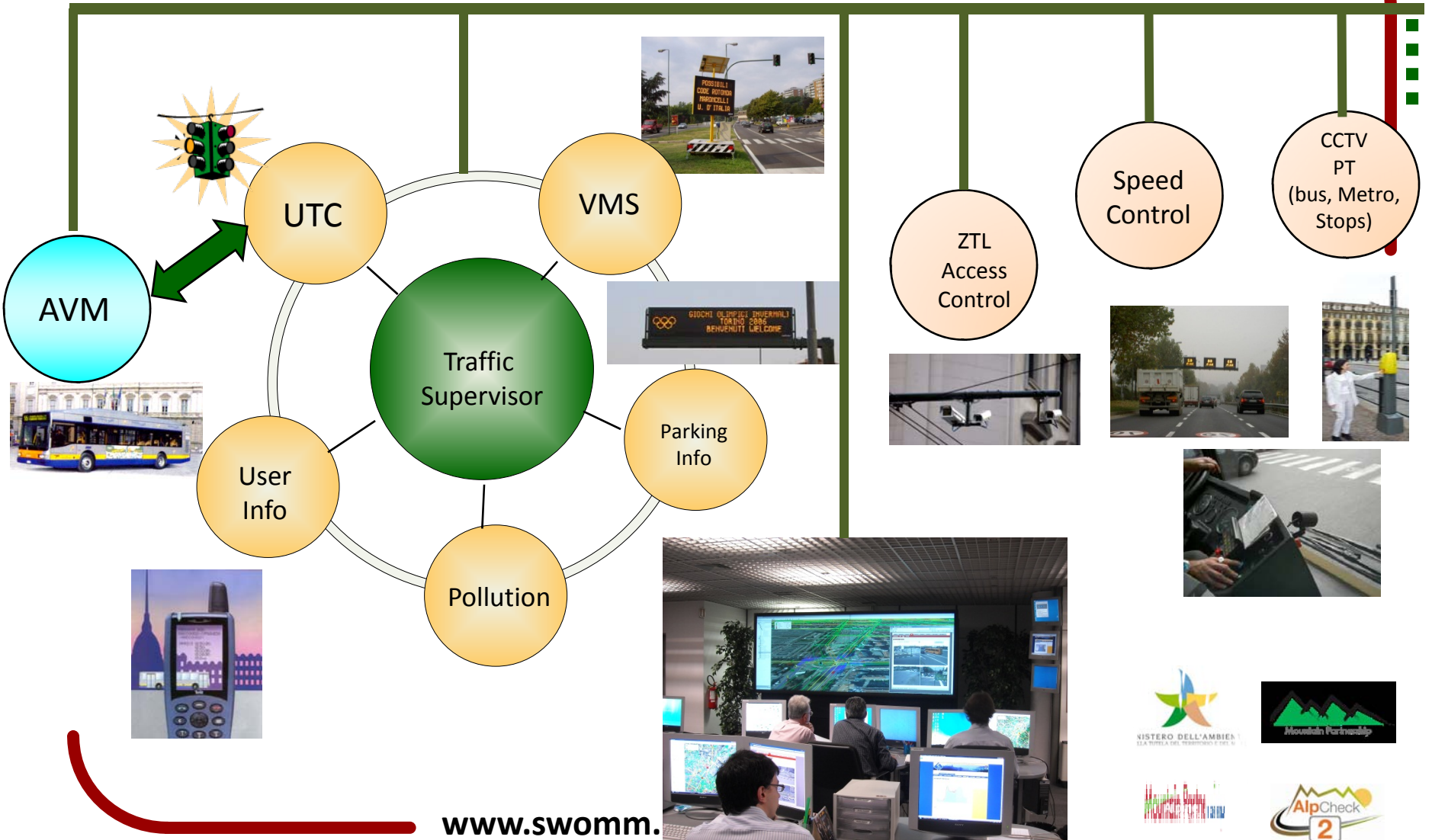


“A link has to be PROTECTED when the observed EQUIVALENT DENSITY is greater than the desired density defined as output of FEASIBLE EQUILIBRIUM”





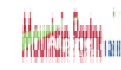
# 5T – Integrated System



# 5T – Integrated System

- Before the Olympic Games, the 5T company monitors, controls and integrates:
  - 200 centralised junctions in the city (1900 traffic sensors)
  - 50 urban VMSs
  - 200 bus stop displays
  - 1.300 equipped Public Transport vehicles (trams and buses)
  - 60 cameras at intersections for video-surveillance
  - pollution monitoring stations
  - 20 city parkings for availability monitoring
  - video-surveillance systems (on buses and at the bus stops)
  - all the accesses to the traffic limited zone in the city centre
- For the Olympic Games it is decided to expand the existing 5T system, in terms of:
  - 107 VMS – along the Motorways and the urban, national and departmental roads
  - 108 traffic detectors – along the Motorways and the urban, national and departmental roads
  - 31 cameras for surveillance - along the Motorways
  - 10 additional parking areas – urban and mountain area
- The new Traffic Operation Centre covers not only the city but also the mountain area and the connecting road-network.

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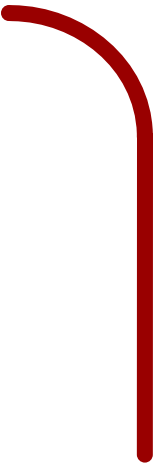
# 5T -results

- Field test after one year of operation of the system (urban context)
  - Reduction in travel time (in car) -17%
  - Reduction in travel time (on PT) -15%
  - Reduction in travel time (OD) -21%
  - Reduction in pollution -8%
  - Increase in PT use +3%



# conclusion

- Several examples in many towns/region in Europe, USA, Japan have demonstrated that ITS can improve traffic condition in a very significant way.
- UE Action Plan and Directive
  - Intelligent Transport Systems (ITS) can significantly contribute to a cleaner, safer and more efficient transport system. A new legal framework ( Directive 2010/40/EU) was adopted on 7 July 2010 to accelerate the deployment of these innovative transport technologies across Europe. This Directive is an important instrument for the coordinated implementation of ITS in Europe. **It aims to establish interoperable and seamless ITS services while leaving Member States the freedom to decide which systems to invest in.**



Thank You for the attention



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