Integration of Traffic and Environmental data for improving green policies in the city of Bolzano
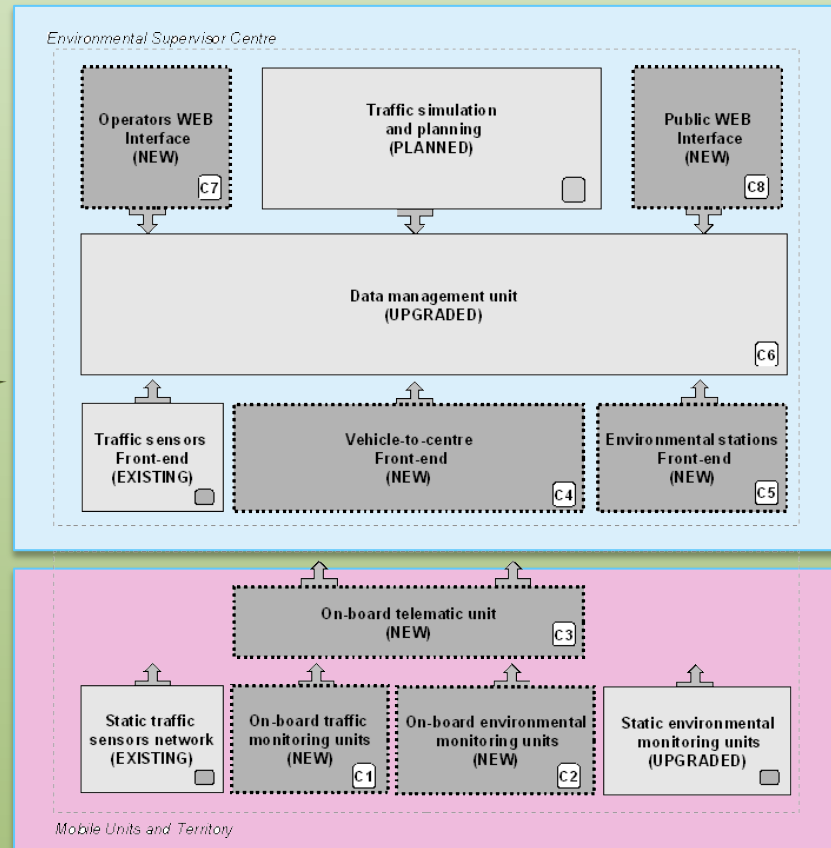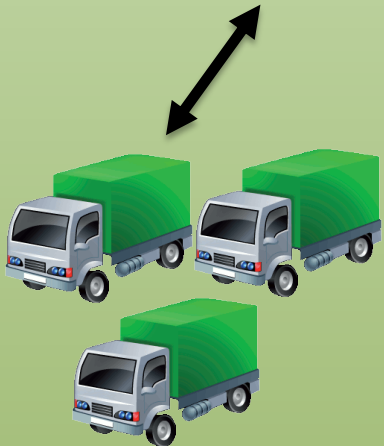
Outline

- Analysis of current situation & measurement of baseline data

- Stakeholders & users'needs

- Targeted inefficiencies

- Use case analysis

Requirements evaluation and user needs discussion

Requirements evaluation and user needs discussion

The methodology

```
Analysis of current situation &        Stakeholders          Targeted
measurement of baseline data     →     & users'needs    →    inefficiencies
```

```
INTEGREEN              ←              Use case
system concept                       analysis
```

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Requirements
identification
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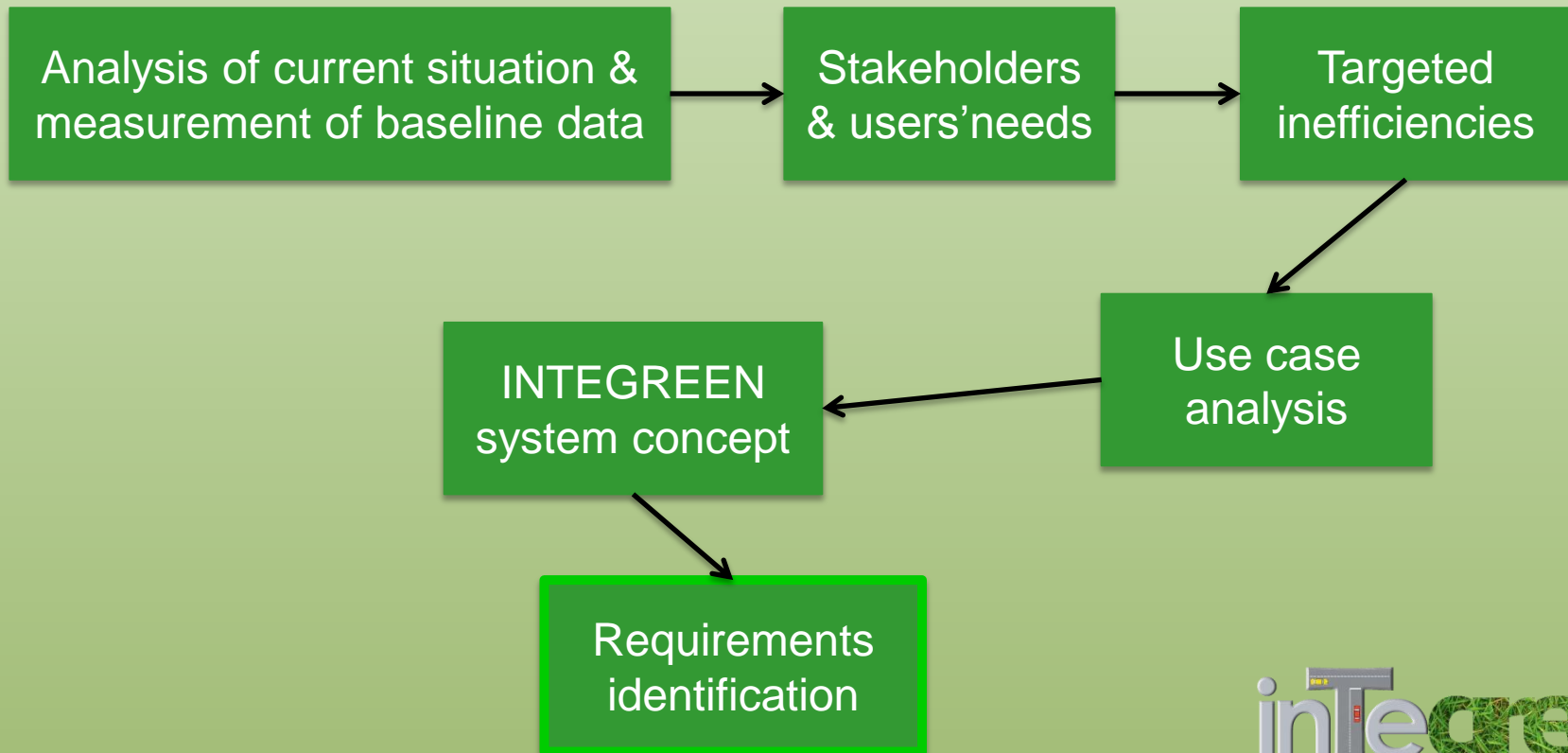
Requirements evaluation and user needs discussion

Analysis of current situation & measurement of baseline data

1. Geographical scenario and road infrastructure
2. Traffic levels and modal split
3. Air pollution levels
4. Traffic Management Centre of the city of Bolzano
5. Environmental Monitoring System in the city of Bolzano
6. Baseline data, and preliminary measurement campaign results

INTEGREEN baseline data assessment

How to empirically evaluate the urban traffic inefficiencies, and their impact on the environment?

Length: 8.8 [km]

➡ We tried to measure typical fuel consumptions through FIAT Blue&Me technology on a test city route in different conditions, in order to evaluate the impact of:
- Traffic level
- Traffic lights
- Driving style
- Navigation factor
- Travel time choice
- Meteorological conditions
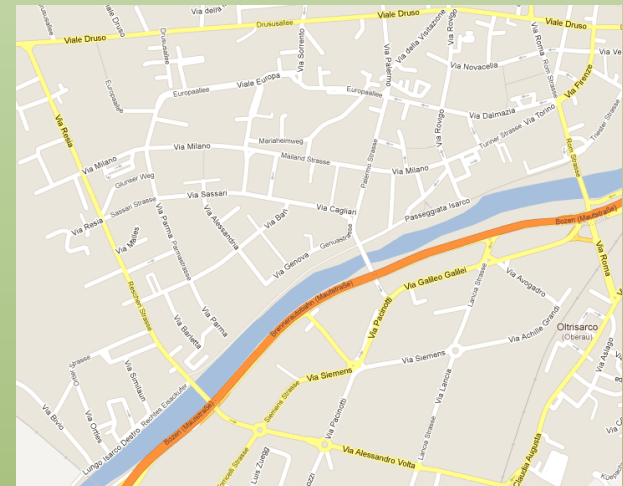
Requirements evaluation and user needs discussion

	Test n/1	Test n/2	Test n/3	Test n/4	Test n/5	Test n/6	Test n/7	Test n/8
Traffic level	HIGH	HIGH	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	HIGH
Time of the day	Morning	Morning	Midday	Afternoon	Afternoon	Afternoon	Afternoon	Evening
Driving style	"Eco-driving"	"Aggressive"	"Normal"	"Eco-driving"	"Aggressive"	"Normal"	"Normal"	"Normal"
Note	-	-	-	-	-	Navigation Factor test	Navigation Factor test	-

Two test sessions:
- n=1
  - ❑ 15/05 (morning)
  - ❑ 16/05 (afternoon)
- n=2
  - ❑ 21/05 (all day) - rainy day

Requirements evaluation and user needs discussion

INTEGREEN baseline data assessment

- The tests have allowed to get a first understanding of the contribution of the different factors of interest in the total amount of fuel consumption of typical urban trips in Bolzano.
- In certain situations (for example, high level of traffic combined with an «aggressive» driving style), these values tend to increase very significantly.
- It has been possible to have an empirical evidence of the need to combine routing information with optimal travel times indications.

Requirements evaluation and user needs discussion

INTEGREEN baseline data assessment

	Test n.1/1 (High Traffic, 8:00 AM, 15/05/2012)	Test n.2/1 (High Traffic, 8:30 AM, 15/05/2012)	Test n.2/2 (High Traffic, 8:30 AM, 21/05/2012)	Test n.1/2 (High Traffic, 8:00 AM, 21/05/2012)
Travel time (HH/MM/SS)	00.24.28	00.20.43	00.22.45	00.35.30
Fuel consumption (L)	0,604	0,764	0,620	1,180
Stop&Go	23	21	19	61
Note	Eco-driving (Peak Hour)	Aggressive mode	Eco-driving	Aggressive mode (Peak Hour)

Stakeholders and users' needs

- **User**: actor that is directly interacting with the system, in particular through a specific interface and on the base of a specific application;

- **Stakeholder**: actor that is not in direct contact with the system, but is in some way influenced by it

Stakeholders and users' needs

- **User**s
  - ❑ Local travelers
    - ❖ Motorized vehicle drivers
      - ✓ Passenger car and light truck drivers
      - ✓ Passenger collective means and heavy trucks drivers
  - ❑ Local freight transport planners
  - ❑ Road operators
    - ❖ Traffic officers
    - ❖ Traffic engineers
  - ❑ Mobile probe drivers

Stakeholders and users' needs

- **Stakeholders**
  - ❏ City Council of BZ
  - ❏ Autonomous Province of BZ
  - ❏ Service providers (e.g parking slot remote reservation)
  - ❏ Technology providers (e.g. multimodal journey planner)
  - ❏ Consumers associations
  - ❏ Driving schools and environment protection organizations
  - ❏ Passenger fleet owners

Stakeholders and users' needs

- **Local travelers**
  - ❑ «Best» (cost+time) urban travel choice depending on real-time conditions
  - ❑ Travel decision freedom
  - ❑ Pre-trip and en-route support
  - ❑ Additional information to be taken into account (e.g. parking availability, air pollution levels)
  - ❑ Reliable and up-to-date information
  - ❑ Good air quality levels in the city
  - ❑ Soft and preventive traffic-measures
  - ❑ Privacy

Requirements evaluation and user needs discussion

Stakeholders and users' needs

- **Motorized vehicle drivers**
  - ❑ Congestion avoidance
  - ❑ Intelligent travel planning (travel time + routing)
  - ❑ En-route information (e.g. at intersections)
  - ❑ «Real-time» information about traffic event

- **Passenger car drivers**
  - ❑ Presence of buses in the planned route

- **Passenger collective means and truck drivers**
  - ❑ Transport service efficiency for client satisfaction maximization

Requirements evaluation and user needs discussion

Stakeholders and users' needs

- **Local freight transport planners**
  - ❑ Quality of service & trip decisions
  - ❑ Minimization of environmental footprint and costs (customer parameter choice)
  - ❑ Driving style of drivers

- **Mobile probes drivers**
  - ❑ Transparent functioning of on-board monitoring system
    - ❖ Minimize driver distraction
    - ❖ Minimize on-board driving activities
  - ❑ Reliable & consistent on-board information

Stakeholders and users' needs

- **Road operators**
  - ❑ Time & space road capacity maximization
  - ❑ Road users safety
  - ❑ Preventive and dynamic traffic control and management
  - ❑ Air pollution monitoring and sensitive areas protection
  - ❑ Policies and levels of services based on traveller and vehicle type
  - ❑ Cooperation with other road operators

Requirements evaluation and user needs discussion

Stakeholders and users' needs

- **Traffic officers**
  - ❑ Clear and exhaustive overview of traffic (and air pollution) situation
  - ❑ Prevention and early reaction to a traffic / air pollution event
  - ❑ Real-time traffic and travel information to travelers
  - ❑ Minimization of complexity and overhead due to the novel system

- **Traffic engineers**
  - ❑ Ex-post evaluations have to be possible
  - ❑ Reduction of transit travels in residential areas
  - ❑ Prioritize sustainable mobility means in the city

Stakeholders and users' needs

- **City Council of Bolzano**
  - ❑ Maximize road safety
  - ❑ Minimize fuel consumption and emissions
  - ❑ Preserve the right to mobility
  - ❑ Quality of life in residential districts
  - ❑ Sustainable and efficient transport means have to be prioritized
  - ❑ Guarantee optimal city accessibility in any demand condition
  - ❑ Cost/benefit assessment of traffic optimization policies

Action n.2: Requirements

Stakeholders and users' needs

- **Autonomous Province of Bolzano**
  - ❑ Cooperation between municipal and regional TMC
  - ❑ Multi-modal approaches have to be further stimulated

- **Service and technology providers**
  - ❑ Traffic and mobility information distributed by TMC have to be reliable and timely-relevant.
  - ❑ It should be used by 3rd parties for creating new telematic services

Action n.2: Requirements

Stakeholders and users' needs

- **Environment protection organizations**
  - ❑ Increase the attention on environment protection in areas like Bolzano
  - ❑ Increased awareness of travelers and organizations

- **Consumers'associations**
  - ❑ Right for mobility
  - ❑ Travelers education – right information at the right time, in an easy way

Action n.2: Requirements

Targeted inefficiencies – pre/trip

Inefficiency ID	Inefficiency	Action / type of intervention	Level of relevance in terms of emission
INEF_01	Inefficient vehicle condition	Awareness-raising campaign, educational activities	Small
INEF_02	Inefficient route choice	Targeted by INTEGREEN system	Medium
INEF_03	Inefficient travel timing	Targeted by INTEGREEN system	High
INEF_04	Inefficient payload	Outside the scope of INTEGREEN	Medium
INEF_05	Inefficient modal choice	Targeted by INTEGREEN system	Medium

Action n.2: Requirements

Targeted inefficiencies – en-route

Inefficiency ID	Inefficiency	Action / type of intervention	Level of relevance in terms of emission
INEF_06	Inefficient use of electrical energy consumers	Awareness-raising campaign, educational activities	Medium
INEF_07	Inefficient routing	Targeted by INTEGREEN system	High
INEF_08	Inefficient driving	Awareness-raising campaign, educational activities	High

Action n.2: Requirements

Use case analysis

Use Case ID	Inefficiency	Pre-trip / En-route	Perspective
UC_1	**Local travelers planning eco-trip**	Pre-trip	Travelers
UC_2	**Local transport planners planning eco-trip**	Pre-trip	Local transport planner
UC_3	**En-route driver information through VMS**	En-route	Travelers
UC_4	**En-route driver information on-board demonstrator**	En-route	Mobile probe drivers
UC_5	**Traffic and environmental status assessment: INTEGRATED MONITORING**	-	TMC
UC_6	**Traffic controllers adaptive coordination: ACTUATION**	-	TMC
UC_7	**Info-mobility channels supervision: INFORMATION**	-	TMC