Web mapping solutions for the development of Emission Inventory Models

Vitor Gois, Nelson Neves,
M. Freire, H. Maciel, P. Torres, J. Muxacho and Luisa Nogueira

InventAr, Lda, Portugal
&
Ithaca, Lda, Portugal.

Comissão de Coordenação e Desenvolvimento Regional de Lisboa e Vale do Tejo, Portugal.

vitorgois@mail.telepac.pt

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Overview

- Case Study overview: Air Quality in Lisbon
- Objectives of the Project
- SIMULAIR description
  - Principles
  - Interface
  - Implementation details
- Conclusions

Case Study:

Air Emission Inventory of the Region of Lisbon and Tagus Valley

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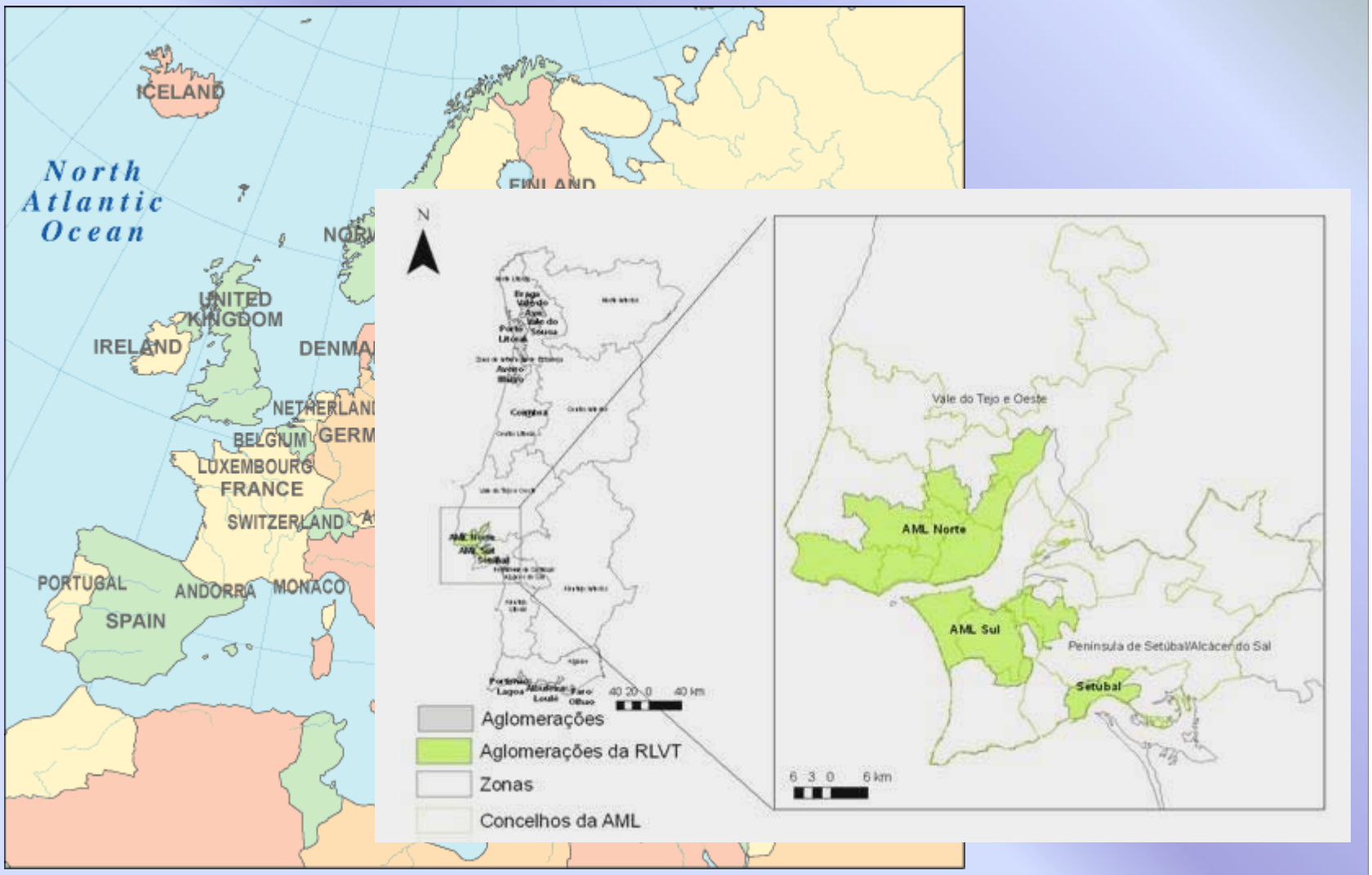
Zones and Agglomerations for Air Quality Management



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Air Quality Management in Lisbon

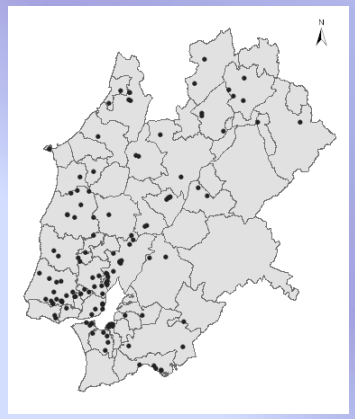
Air Quality Authority

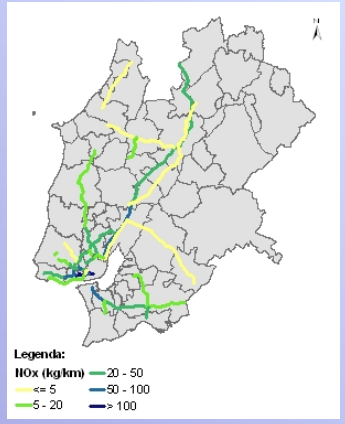
Commission for Coordination and Regional Development of Lisbon and Tagus Valley (CCDR-LVT)

Tools

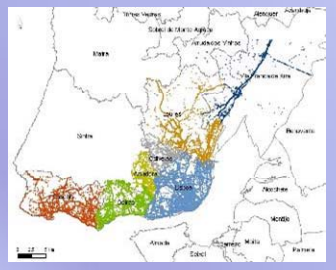
1. Monitoring survey system
   - Stationary stations
   - Extensive monitoring: period campaigns using Passive sampling (Diffusion tubes and portable PM samplers)
2. Inventory of Emissions of Air Pollutants
3. Policies and Measures
   - Plans and Programs (June, 2005, updating now)
4. Modelling tools
   - Regional level (TAPM from CSIRO)
   - National/European level (Chimere, CAMx, REM-3 under CAFE program)

Emission Inventory
Overview of Methodology



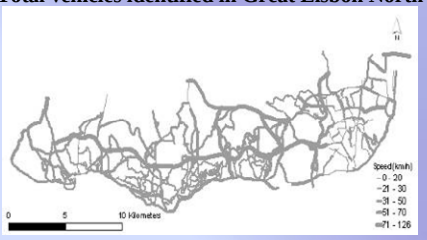


Identification of moving vehicles from aerial photography



Total vehicles identified in Great Lisbon North

Average velocity determination using GPS



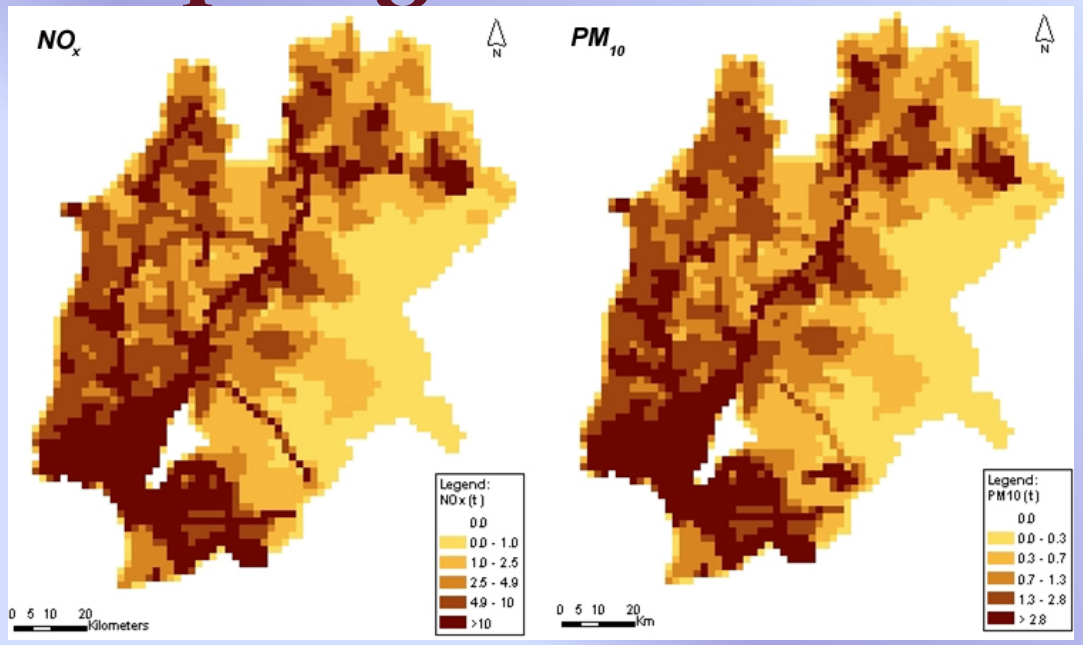
Classes of average velocities in main roads (km/hr)

Plans and Programs

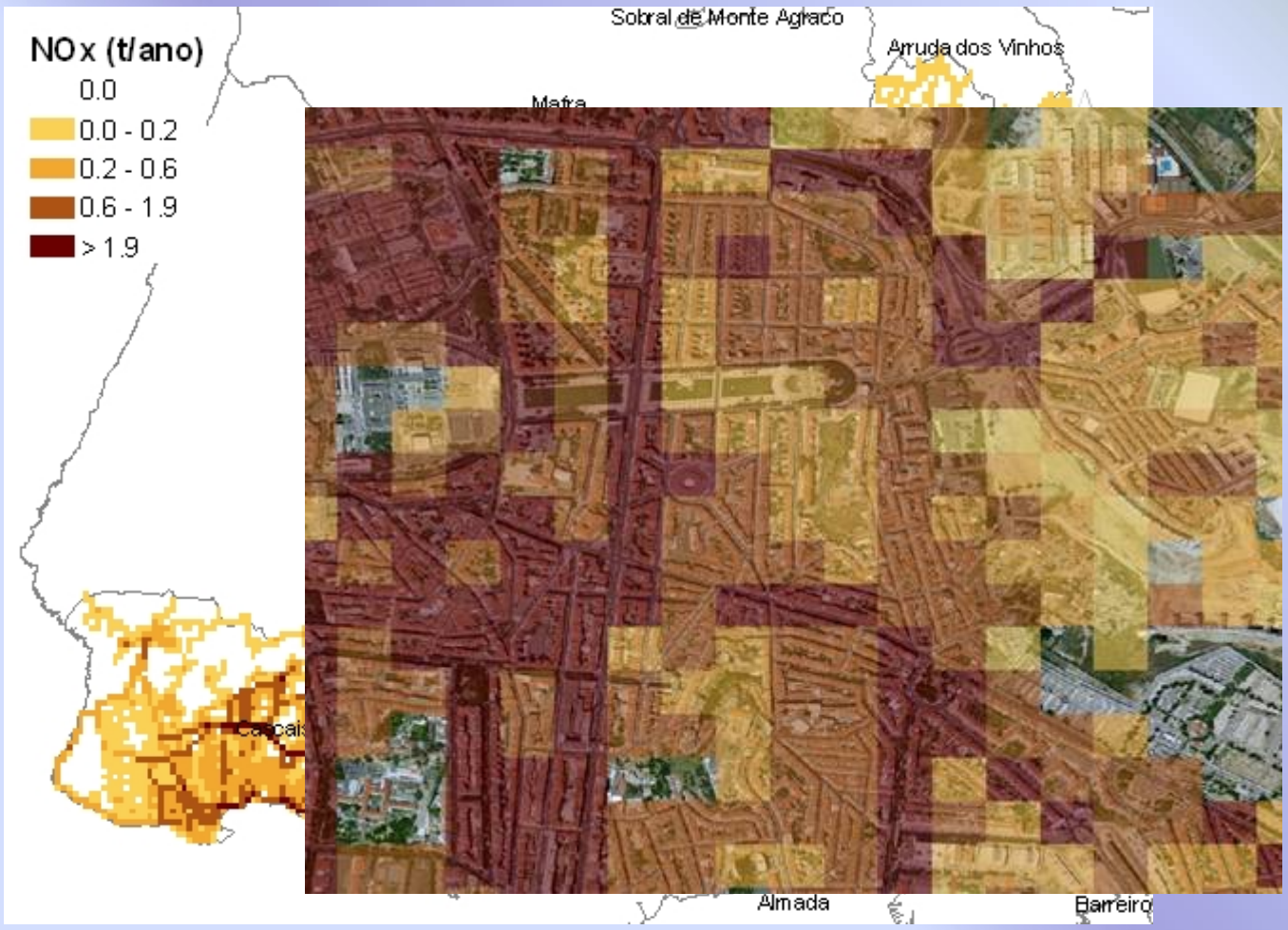
Directive 1999/30/CE of the European Union (UE)

Reduction Measure		Total PM10 reduction (t/yr)	Cost-Benefit	Relative ranking
M20a	Increase of the number of BUS corridors	2	5	1
M19	Implementation of differentiated payment schemes according to the occupation of vehicles on existing toll roads	8	1	2
M16	Implementation of Lanes of High Occupancy on Lisbon major roadways	7	3	3
M13a	Incentive to retrofitting of buses	4	8	4
M9	Parking regulations enforcement increase	3	10	5
M8	Introduction of alternate license plates	12	1	6
M6a	Retrofit plan for Buses	6	9	7
M18a	Retrofit plan for taxis	11	4	8
M17a	Taxi fleet renewal	5	12	9
M14a	Buses renewal	1	15	10
M7	Installation of particle filters systems in buses	13	7	11
M10	Introduction of a Low Emission Zones in the city of Lisbon	14	6	12
M11a	Conversion of TCR vehicles to LPG	9	13	13
MIIIa	Conversion of TCR vehicles to LNG	10	14	14
M15a	Retrofit of vehicles for solid waste collection	15	11	15
M12	Circulation tax in downtown areas	16	1	16

TAPM
Input grid to model



Level of Detail of Model Results



Inventory Model

Principles and Objectives of the System

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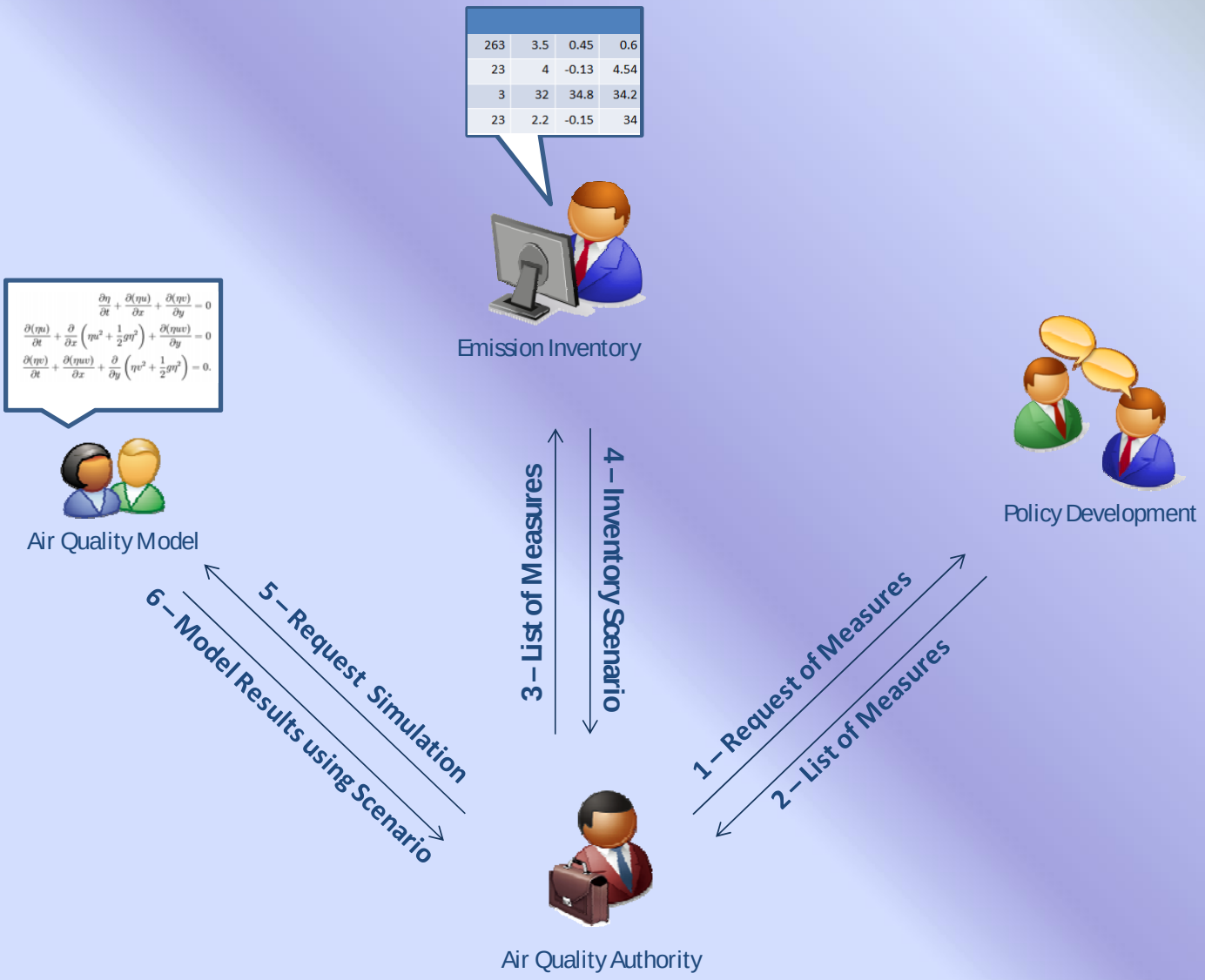
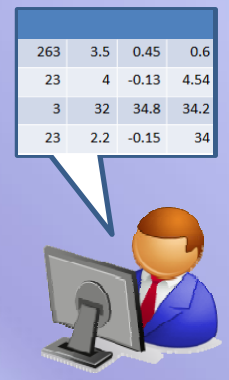
Principles of System Development

- The inventory should not be an end in itself
  - Should be a steward to models and policy developers
- Importance of the spatial placement of measures
  - Policy experts want to act on real objects
  - Need of a GIS system, but simplified
- An image of the Inventory
  - Simplification of the information provided to policy developers
  - Only an image of the inventory is sufficient
  - Focus on key variables (policy team's view)
- A pathway facilitating team communication and joint work
  - Should integrate/facilitate work of teams in different places

Enhancement of Team Work



Enhancement of Team Work



Emission Inventory

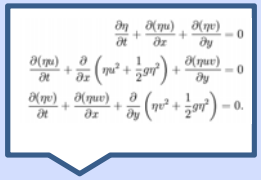
1– Inventory Simplification

Inventory Image

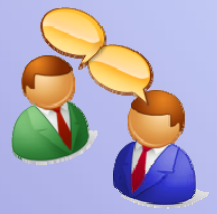
4– Export Scenario

5– Model Results

3– List of Measures



Air Quality Model



Policy Development

Air Quality Authority

2– Request of Measures

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The system should be:

- Easy to use
- Fast to navigate
- No ambiguous commands
- Intuitive to Learn
- Attractive
- Focusing on spatial objects
- Handle single objects or groups
- Low cost (Open source)
- Work at distance

The mirror image from the inventory

Source	Manipulable data	Notes
Point Sources	ID, Name and Activity code (EAC code)	The number of Large Point Source data is larger than the large point sources used as input to TAPM. Every individual unit may include more than one stack. The relation between flow variables in the stack is automatically updated by the system.
	Coordinates	
	Stack parameters: H, D, V, VF, T	
	Activity Data	
	Emission Factors	
	Emissions	
Line sources	ID, road name and sub-ling ID	Each road is made of several sub-link segments, according to changes in flow, velocity or traffic composition. User may change the fleet in absolute terms or per cent, SIMULAIR checking for 100 per cent. EF for each individual vehicle type is automatically estimated from velocity and average vehicle fleet. Velocity may vary according to vehicle type
	Coordinates	
	Total Vehicle flow	
	Composition of fleet: Heavy Vehicles, Passenger Cars, Light Duty Vehicles, 2 wheelers	
	Velocity	
	EF per pollutant and vehicle type	
Area sources	ID, Name and Activity code (EAC code)	Area boundaries are administrative boundaries and cannot be changed by the user.
	Activity Data	
	Emission Factors	
	Emissions	

SIMULAIR

Development of the Interface

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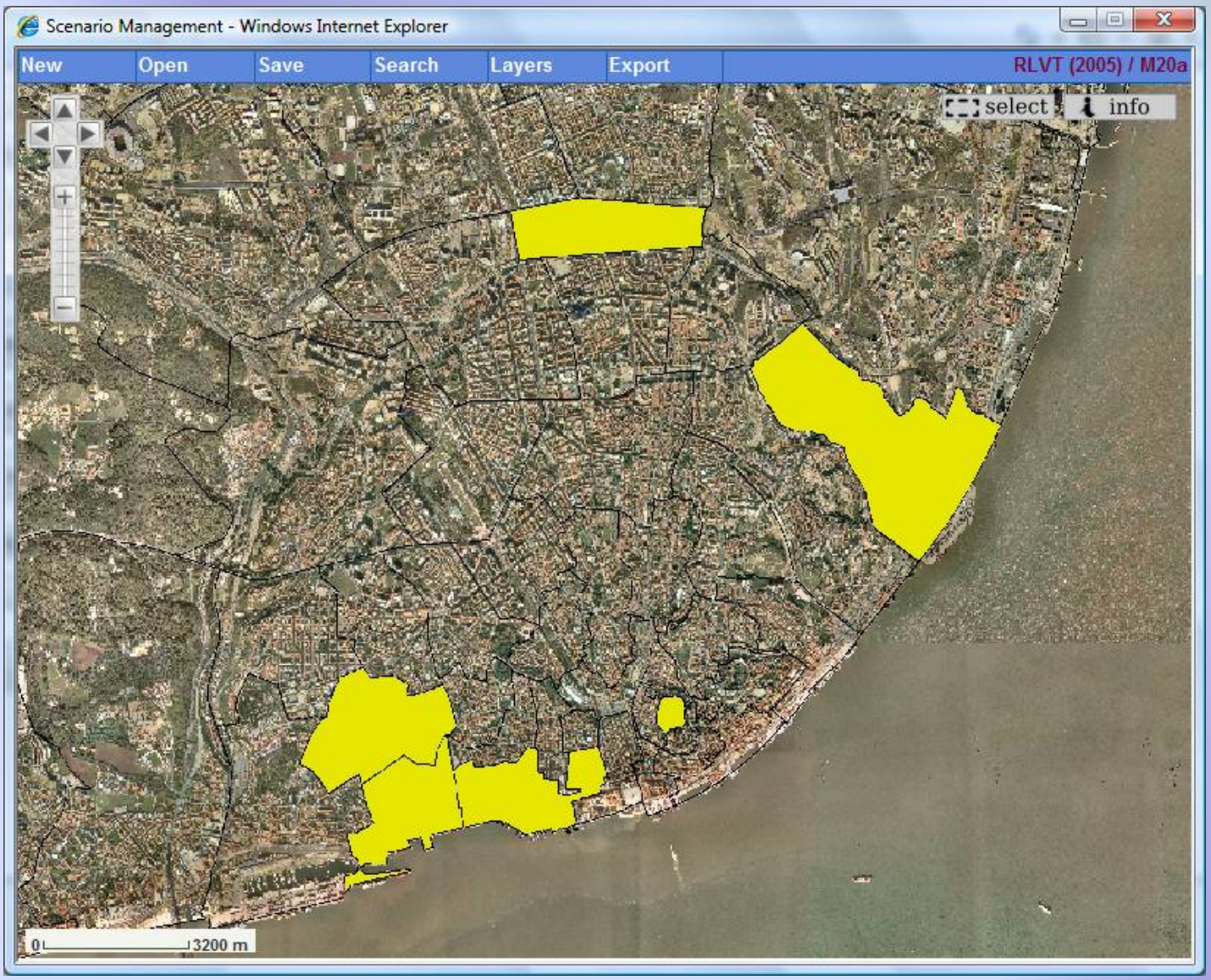
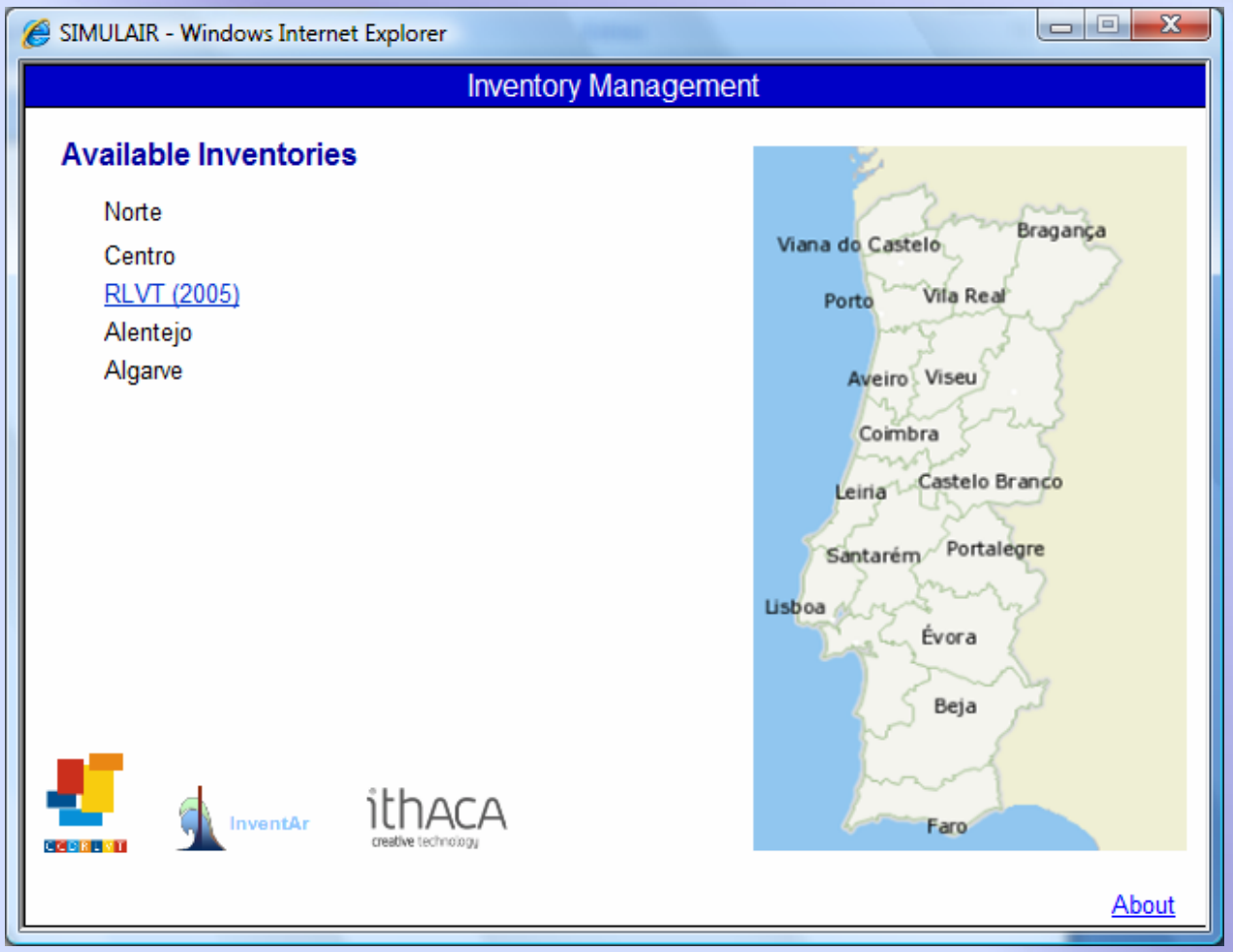
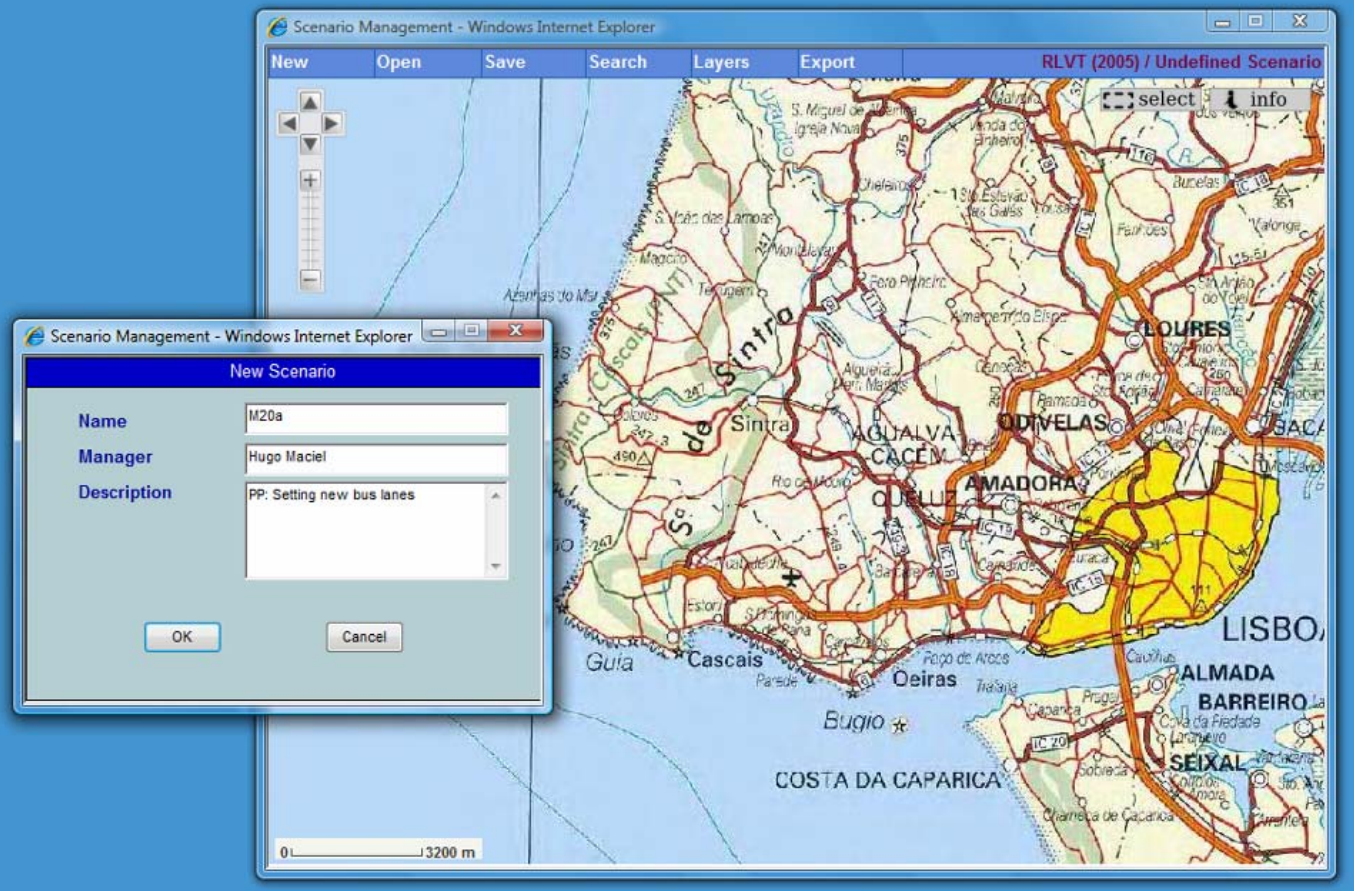
Spatial Environment



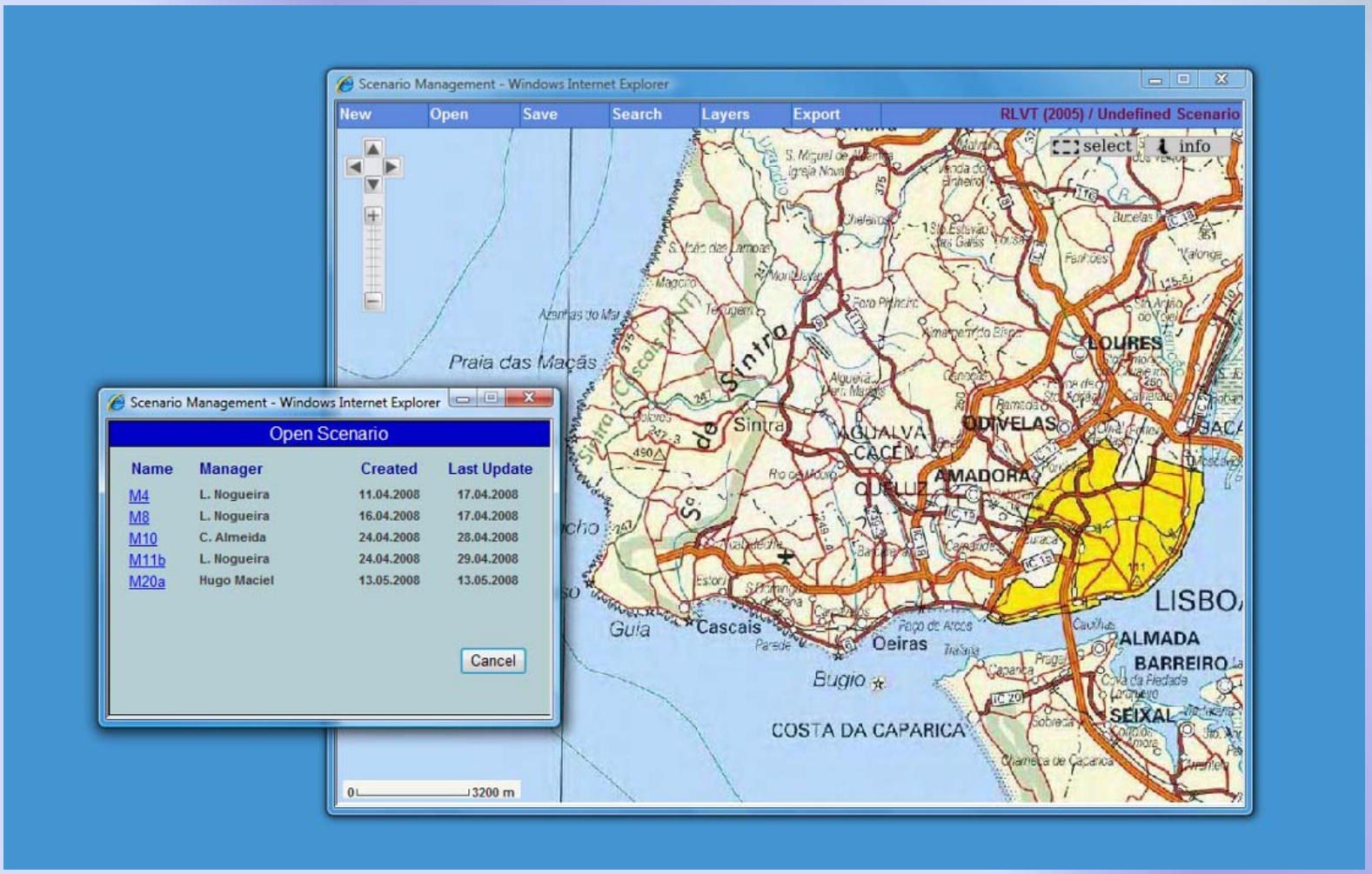
Case Definition: Inventory x Scenario



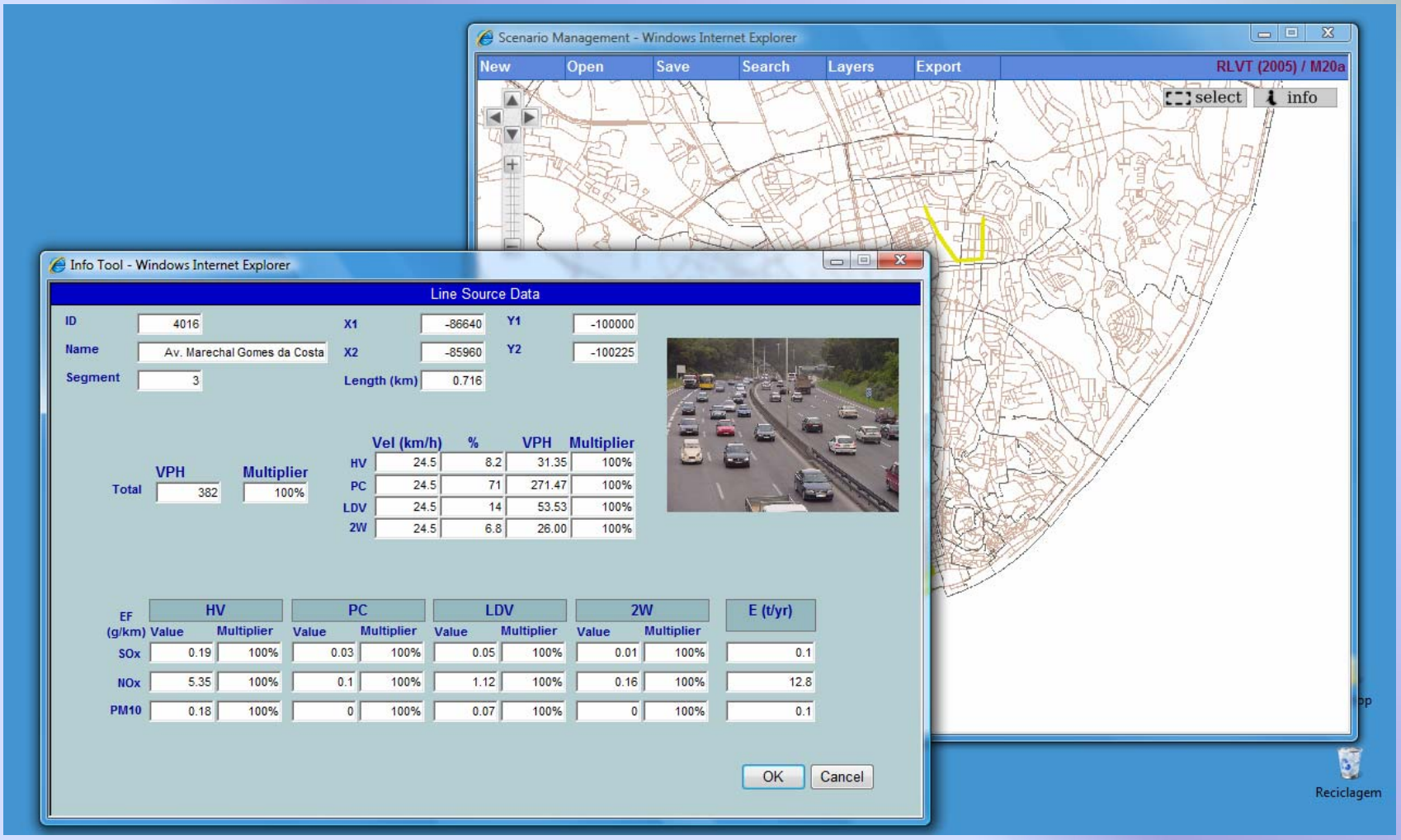
Case Definition: Inventory x Scenario



Case Definition: Inventory x Scenario



Multipliers

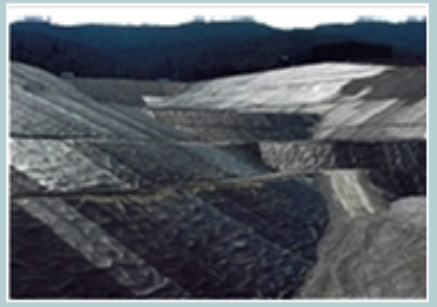


Multipliers

Info Tool - Windows Internet Explorer

Area Source Data

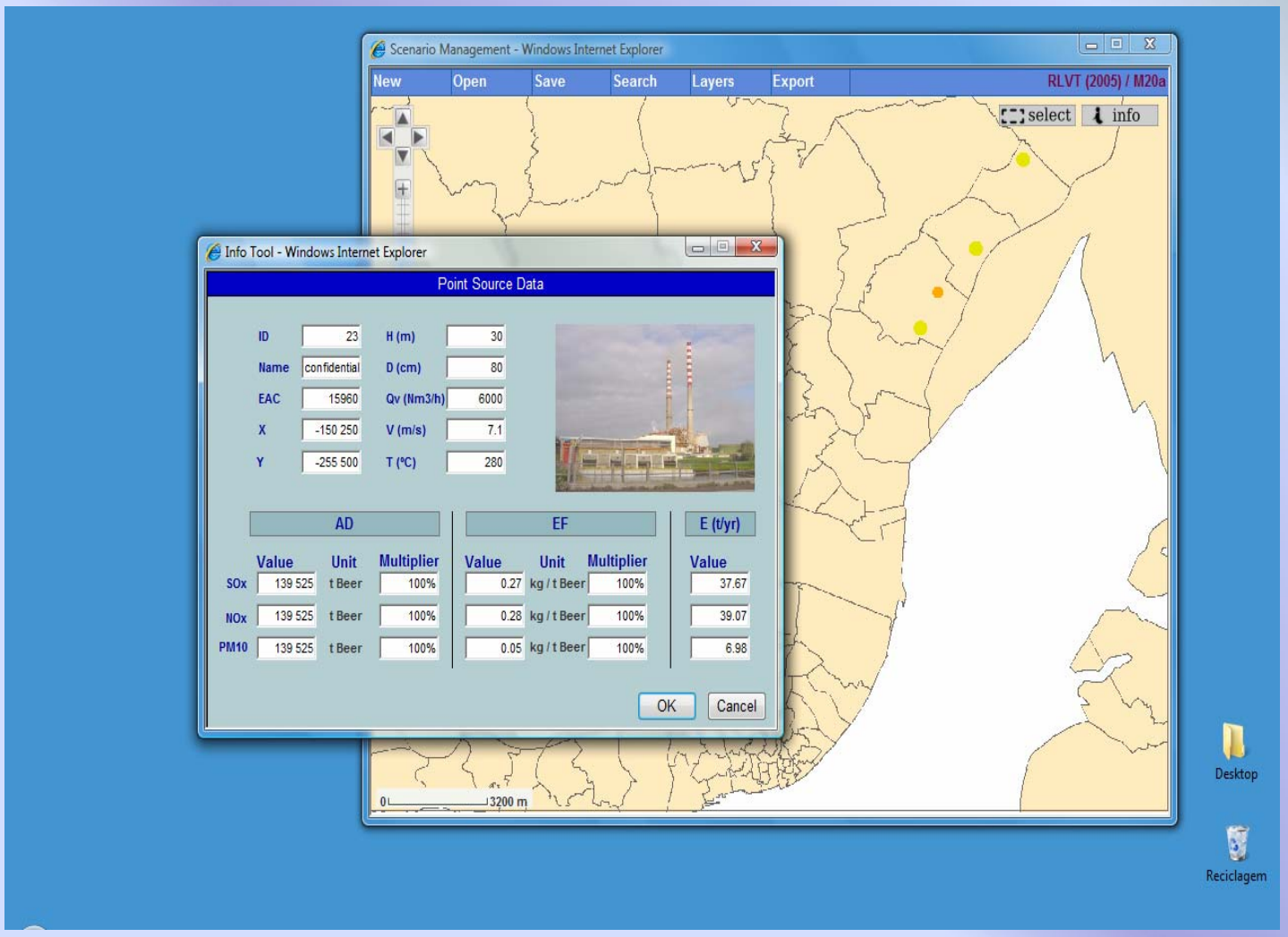
ID	809
Name	RESIOESTE
EAC	6213



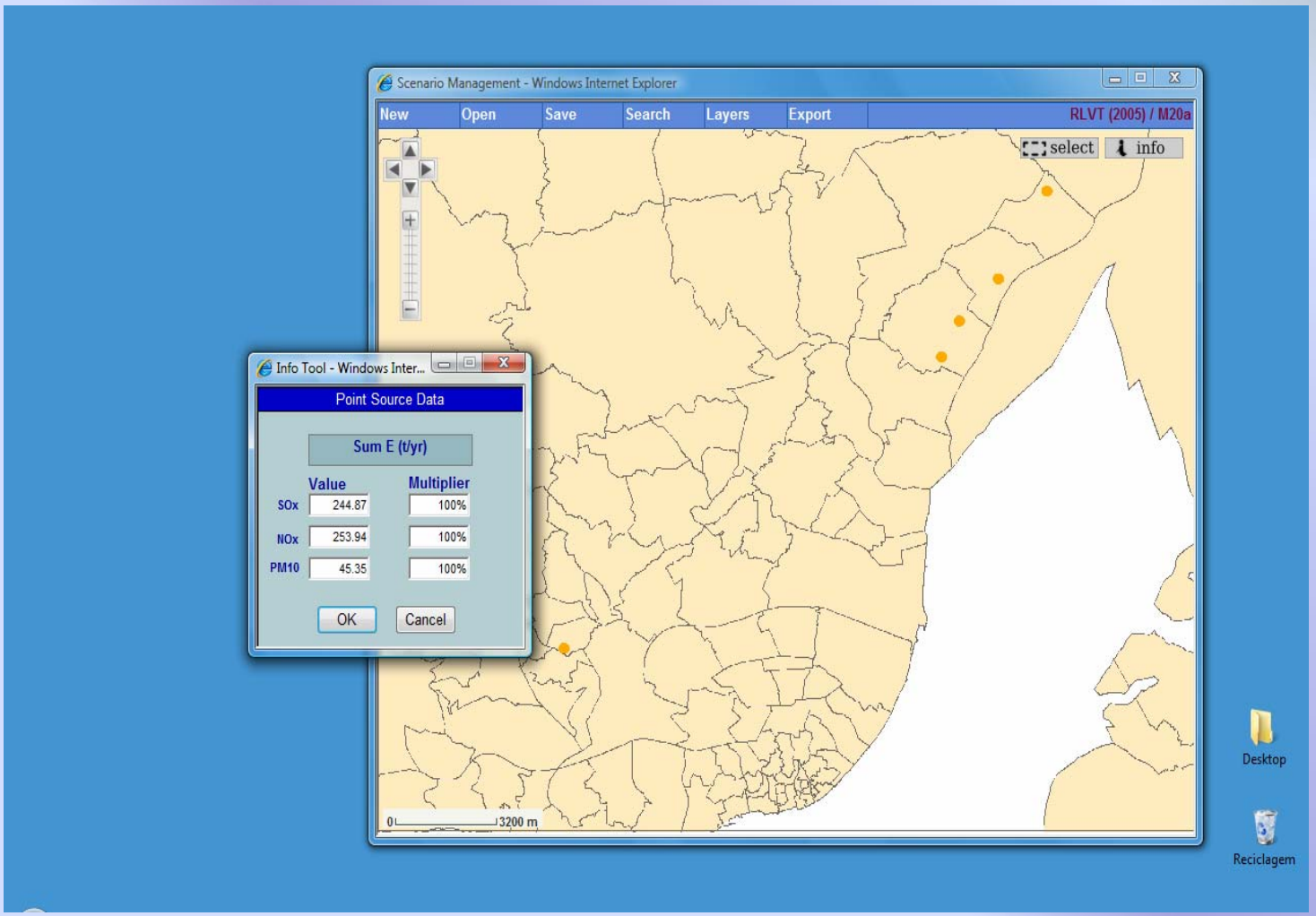
	AD			EF			E (t/yr)
	Value	Unit	Multiplier	Value	Unit	Multiplier	Value
SOx	45	ha	100%	0	kg/ha	100%	0
NOx	45	ha	100%	0	kg/ha	100%	0
PM10	45	ha	100%	12	kg/ha	100%	0.54

OK Cancel

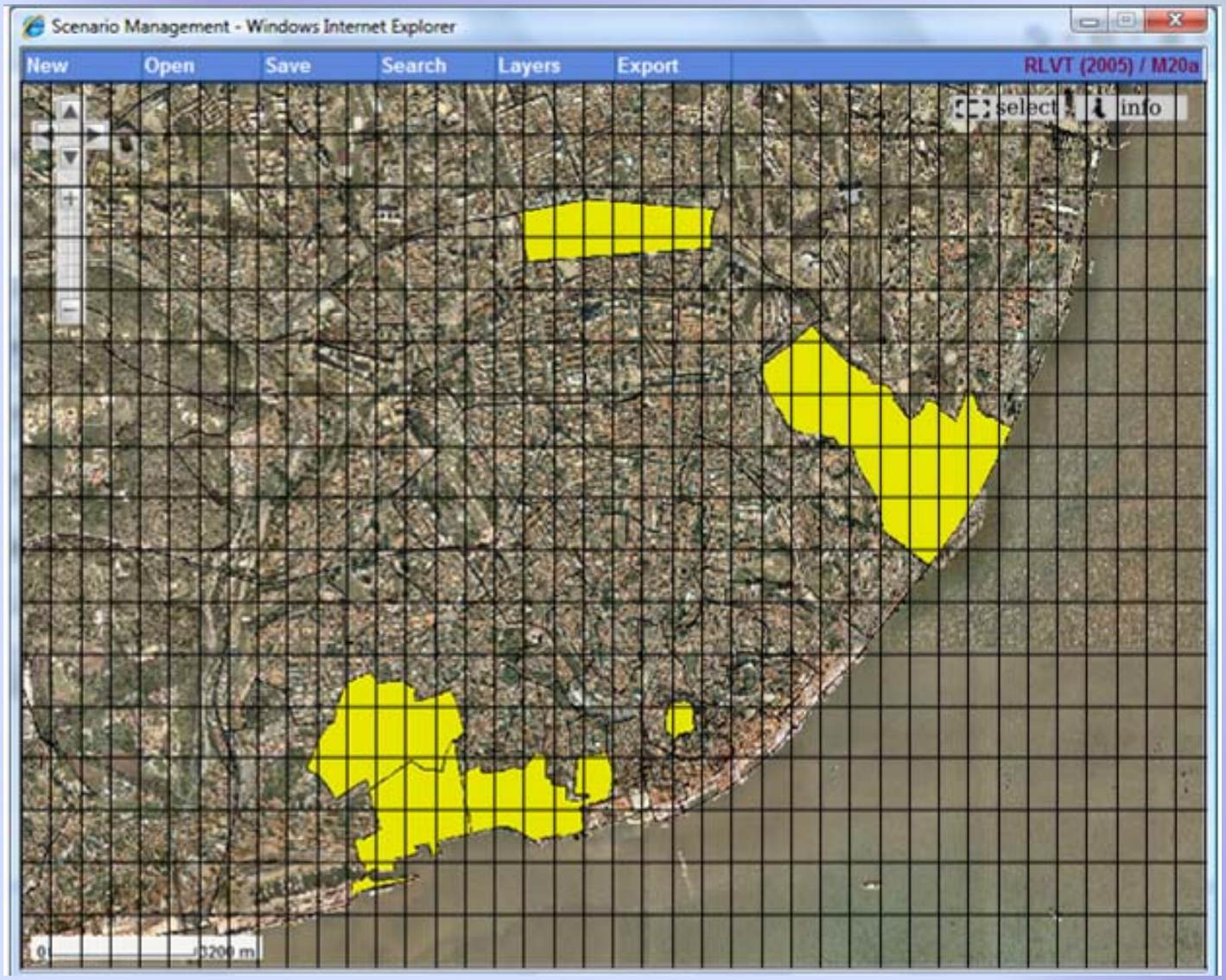
Working with groups



Working with groups



Export to model



SIMULAIR

Implementation

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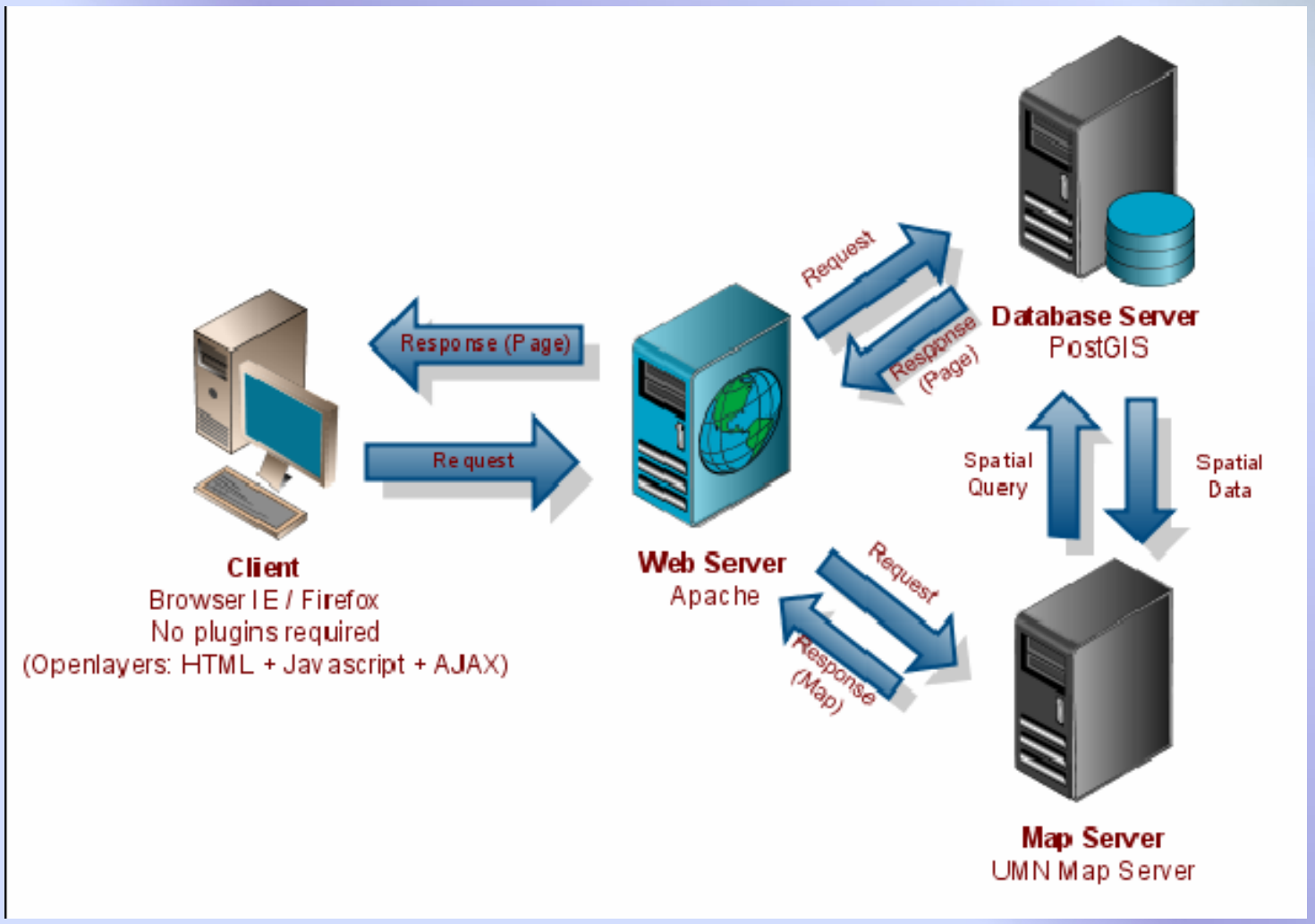
System Architecture

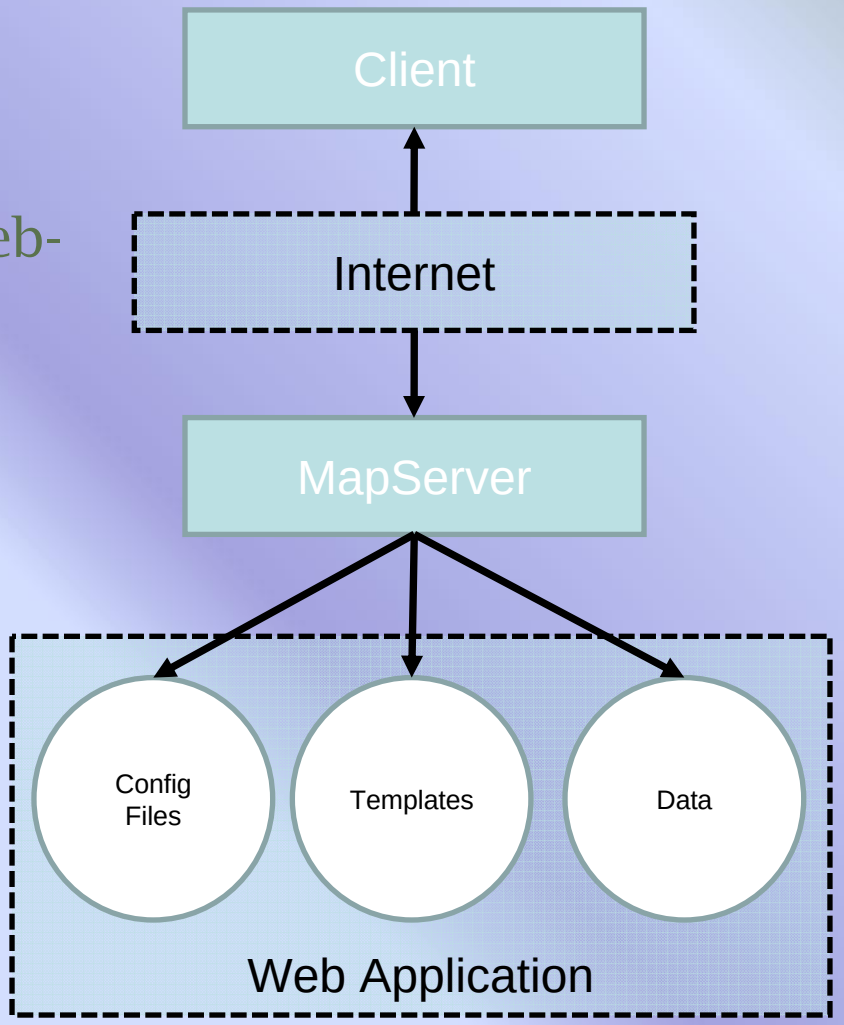


Technological Implementation Details (short summary)

Map Server

- Server-Based
- Development System for Web-Based Mapping
- Open Source
- Supports OGC Web Services Specifications

- Fast
- Extremely Configurable
- Easy-To-Use



Technological Implementation Details

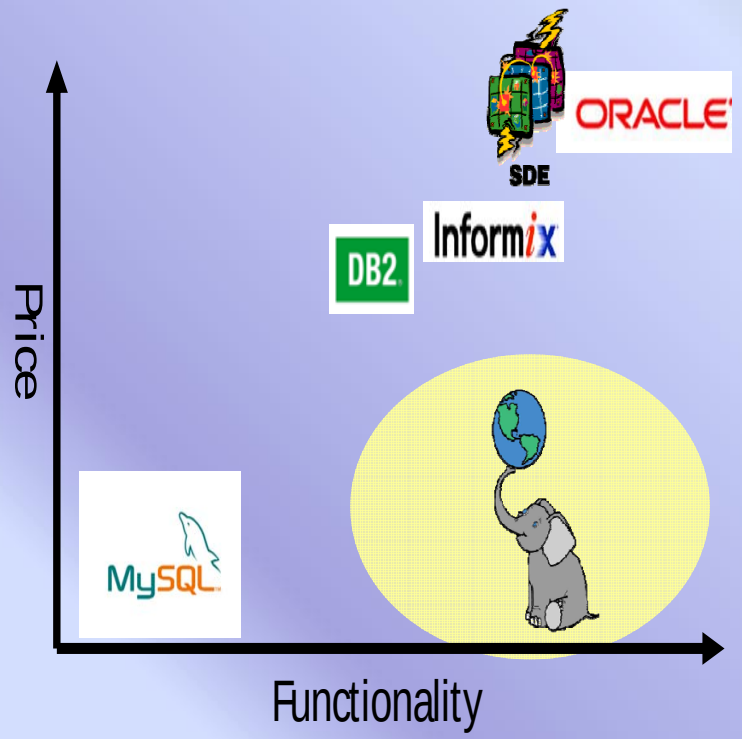
Open Layers

- Pure client-side JavaScript
- Library for web mapping applications
- Supports open standards
- Rapidly construct applications using layers from different providers of geo-referenced data
- AJAX toolkit
  - Asynchronous
  - Updates page components independently

Technological Implementation Details

Post GIS

- Open source geospatial extension for PostgreSQL
- PostgreSQL - open source relational database management system (RDBMS)
- Robust and scalable solution to a ever-increasing dataset size.



Conclusions

- There were Needs
  - for a tool to facilitate communication of the teams involved in air quality management
  - and to speed work: fast verification of outcomes of proposed measures

- Answer: SIMULAIR
  - SIMULAIR, developed for a pilot region, promotes these objectives
  - SIMULAIR is open source, general, simple, flexible, easy to learn and WWW

InventAr, Estudos e Projectos Unip Lda
Rua Sarmento Beires, 15-8ºesq
1900-410 LISBOA
PORTUGAL
+351 91 672 22 45
vitorgois@mail.telepac.pt

Ithaca, Consultoria e Desenvolvimento de Sistemas, Lda
Praceta Natália Correia, nº 9, R/C Dto,
7005-260 Évora, Portugal
+351 210 936 418
info@ithaca.pt

Thank you

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