Models to describe, predict and optimise traffic and the environment

The ecoStrategic Model, ecoNetwork Prediction, and the ecoEmission Estimation component

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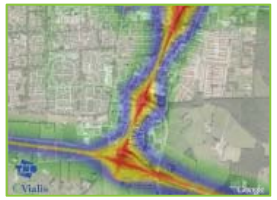
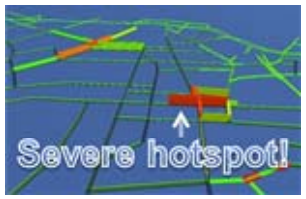
eCoMove

Cooperative Mobility Systems and Services for Energy Efficiency

SEVENTH FRAMEWORK PROGRAMME

www.ecomove-project.eu



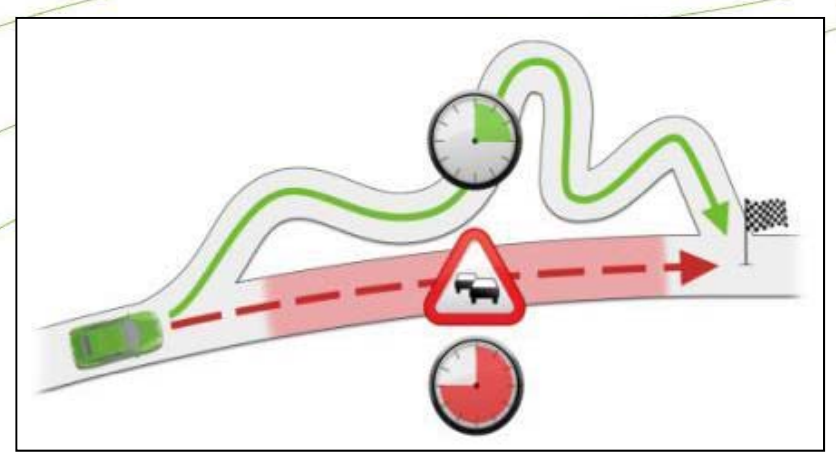



Content of the presentation

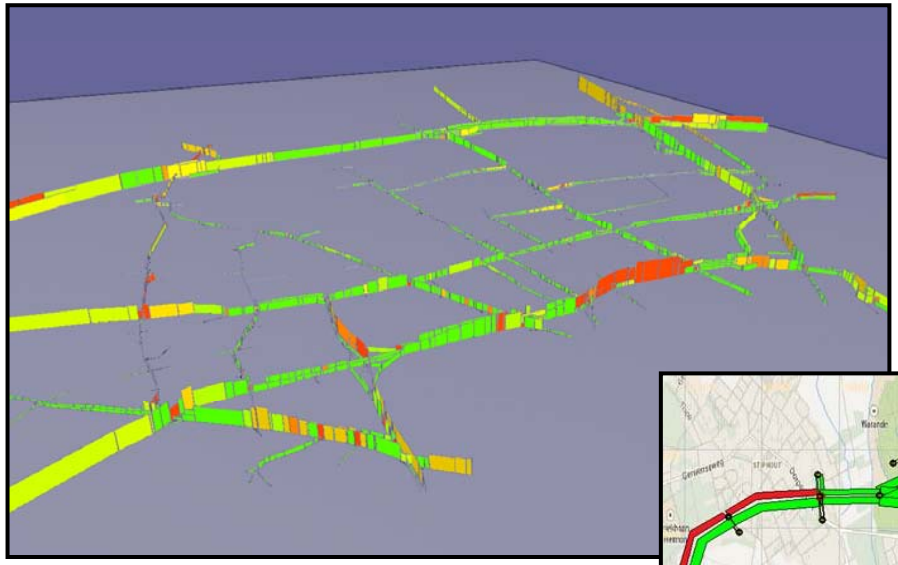
- What do we want to know about the state of traffic and the environment – and why?
- The traffic state models and the ecoEmission Estimation component
  - Purpose
  - Innovative aspects
  - Use in the eCoMove project
- Conclusions

Why these models?

- We want to help traffic make more efficient route choices
- Then we need to know where fuel consumption and emissions are high
- And whether rerouting will help reduce those

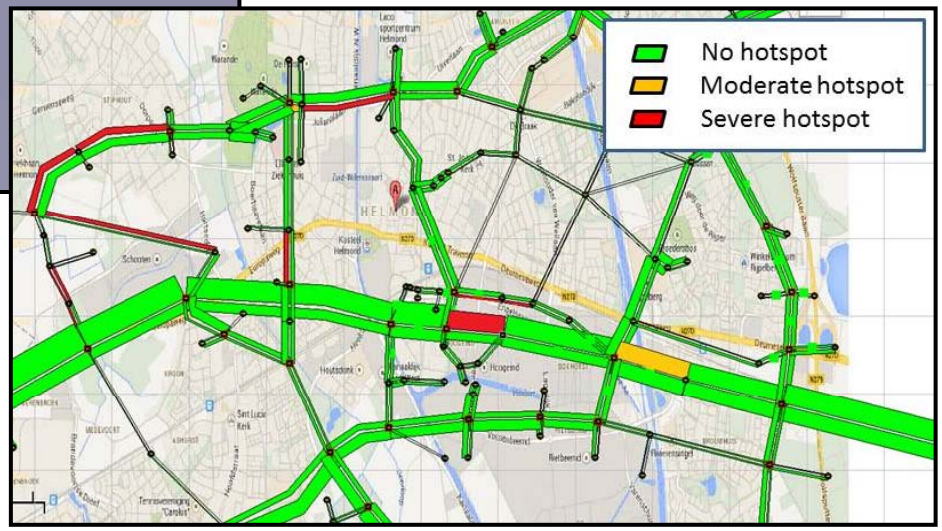


The state of the network - examples



Munich

- Green = good
- Red = bad



Helmond

Indicators for the traffic and environmental state of the network

- Traffic state
  - Speeds, flows, densities on links
  - Those indicate where high volumes and delays occur in the network
- Environmental state
  - CO_2 emissions
  - Hotspots: links where the emissions are (much) higher than they could be
    - if traffic would choose more efficient routes, in terms of traffic and/or geometry

What do the models do, roughly?

- Step 1: determine how traffic is driving currently
- Step 2: predict how traffic will drive in 15-30 minutes
- Step 3: Calculate emissions (current & predicted)
- Step 4: determine if routes chosen are efficient (identify hotspots)
- Step 5: re-route traffic so that overall, more efficient routes are driven
- Step 6: calculate effect on emissions

Traffic & environmental state models

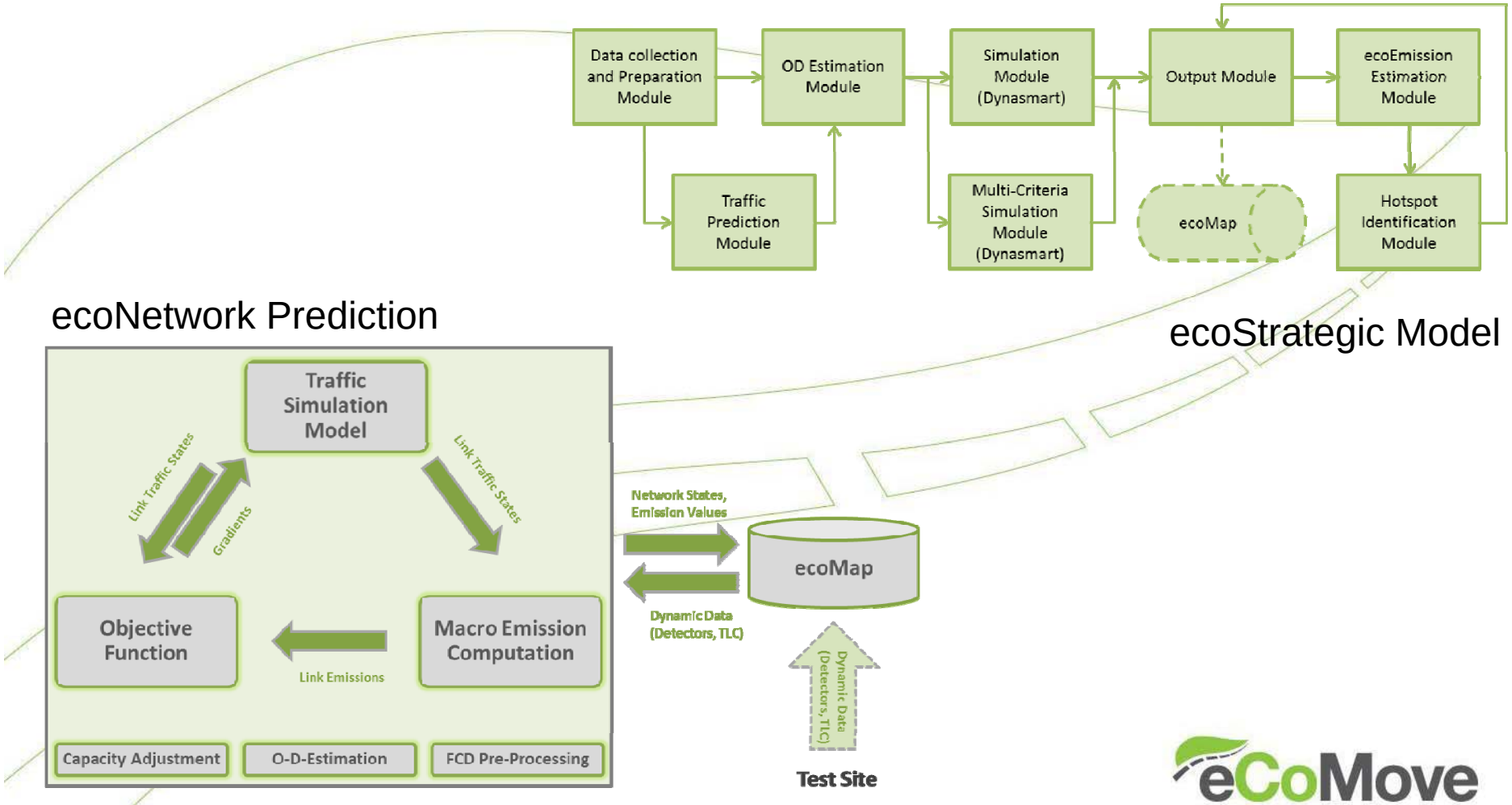
- 2 implementations in eCoMove:
  - ecoStrategic Model (Helmond, NL)
  - ecoNetwork Prediction (Munich, D)

- Both use the ecoEmission Estimation component to calculate emissions

- Innovative aspects: models cover complete network, are predictive, balance multiple policy objectives

High level structures of the models

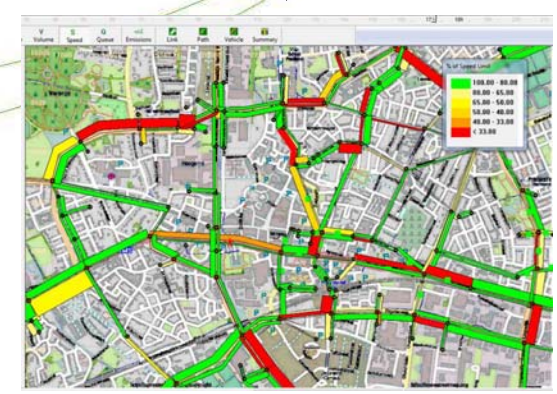
(Come see us at stand 3A for details)



Input, output

- Input:
  - Loop detector data (every 5 minutes, for observed links)
  - Network with traffic control
- Output:
  - Per link, every 5 minutes: average speed, flows, densities, CO_2 emissions, hotspot severity
  - “Views”: current, predicted, desired (optimised)

In a nutshell:



How can the state models be used?

- Traffic operators and service providers can watch the traffic and environmental state of the network

- Based on the predicted and optimised states:
  - Traffic operators may want to change their traffic management and control strategies
  - Service providers may want to present an alternative route to their customers

Important element of both implementations:

Emissions calculations

- Emissions depend on:
  - Number of vehicles
  - Composition of traffic (passenger car, truck)
  - Geometry (type of intersection, curvature)
  - Speed limit
  - Traffic conditions (free flow, congested)
- For eCoMove, an existing emission model was enhanced
  - For evaluation purpose
  - For optimisation within applications

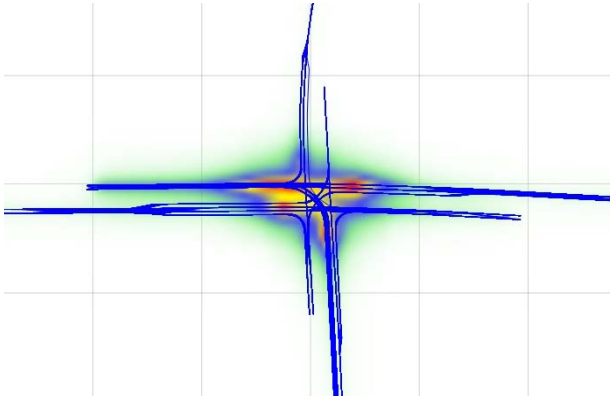
ecoEmission Estimation

- Starting point: existing version of EnViVer
  - EnViVer is based on detailed emission model VERSIT+ (TNO)
  - EnViVer = commercially available version, distributed by PTV and Vialis

- EnViVer enhancements for eCoMove
  - Slope information, vehicle fleets as desired
  - On-line version for use in optimisation
    - Micro (ecoNetwork Prediction - simulations)
    - Macro (both state models – field implementation)
  - Micro version also used with VISSIM for evaluation

ecoEmission Estimation
Micro version

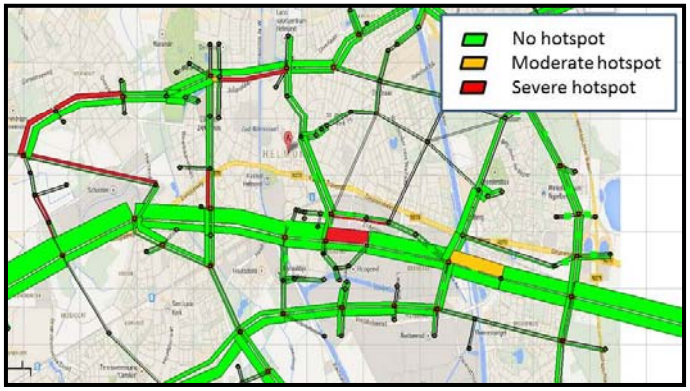
- Developed to be used for evaluation of ITS & cooperative systems
  - Specific efforts were made to ensure accuracy in highly dynamic traffic situations
- Uses high resolution speed data from individual vehicles
  - Trajectories → emissions per vehicle, total emissions in network, “heat maps”



EnViVer Micro
“heat map”
(concentrations)

ecoEmission Estimation
Macro version

- Prototype, tailor-made for eCoMove state models
- Less detailed than micro version (thus faster), but taking into account more factors than other macroscopic emission models
- Used to determine whether a link in the network can be categorised as a hotspot or not



EnViVer Macro "hotspot severity" (emissions levels compared to "bare minimum")

Conclusions

- Models to determine the state of the network will be part of future traffic management
  - Proactive, network-wide, multi-objective
- Positive impacts on overall CO_2 emissions:
  - Simulations show:
    - Networks with low or moderate traffic load: up to 6%
    - Heavily loaded networks with congestion: up to 12%
    - In case of severe incidents: up to 25%
  - Field implementations, using limited sets of real-world data show similar but smaller impacts: approx. 3%.

Thank you for your attention

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