Tomorrow's Elastic Adaptive Mobility

Towards Collaborative Mobility:
Elastic Transport Infrastructure & Research Challenges

20th ITS World Congress
Angelos Amditis, ICCS
Tokyo, October 15th, 2013

20th ITS WORLD CONGRESS TOKYO 2013

This project is co-funded by the European Union

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Concept – TEAM Collaborative network

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Objectives (1/2)

- **Elastic traffic infrastructures** - let infrastructures start to be flexible and change based on citizens' or cities' demand and interactions with them.
- Provide **"on demand" services** for mobility to offer a maximum of flexibility in the usage of different transport modes (multi-modal mobility) and easy access modalities allowing an affordable and environmental friendly mobility.
- Development of **collaborative applications** which are focusing on the infrastructure side targeting mainly the enhancement of energy efficiency and environmental friendly mobility, without neglecting also the safety and comfort benefits, taking into account basic system components from EMPOWER.

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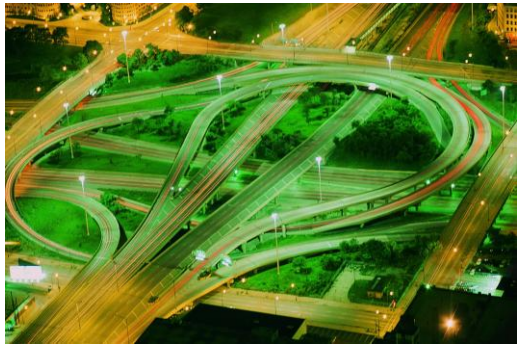
Objectives (2/2)

- Make flexible use of available mobility facilities (i.e. road lanes, parking places etc.) by making a **sustainable dynamic planning**.
- Provision of **cooperative control sensing and optimization algorithms** which are able to:

  - *evaluate mobility decisions or behaviour* in regard to other stakeholder's needs and behaviour,

  - *orchestrate different user alternatives* in a way, that they are adjusted to increase traffic efficiency and optimize mobility.



- Development of a set of **enablers** (i.e. data, aggregated data, algorithms or tools) which together with the horizontal technologies and subsystems to be developed at the EMPOWER sub-project will be the key components used by the TEAM applications.

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Applications – Outcome of stakeholders survey

- Collaborative pro-active urban/inter-urban monitoring and ad-hoc control (CMC)
- Collaborative co-modal route planning (COPLAN)
- Co-modal coaching with support from virtual/avatar users (CCA)
- Collaborative smart intersection for intelligent priorities (CSI)
- Collaborative public transport optimization (CPTO)
- Dynamic collaborative corridors (DC)

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Stakeholders preferences and constraints

Stakeholder	Preferences and constraints / Main targets
Users	Egoists: fastest, smoothest, most convenient route • Congestion avoidance • Improved bus services • En-trip information • Decision support etc. They don't want to be monitored by the "system"
Road operators	• Safety (human and cost reasons) • Sustainability of the road infrastructure
Public transport operators	Maximise quality of service and minimise their costs (conflicting) • Priority scheduling / Green wave • Dynamic bus lines, bus lines synchronisation etc.
Local authorities	Focused on their residents' preferences • Congestion reduction • Modal split • Access control

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Stakeholders preferences and constraints

Stakeholder	Preferences and constraints / Main targets
Traffic management centres	Efficiently manage the traffic to keep other stakeholders satisfied • Current traffic state & forecast, historic data • Reaction to incidents • Flow maximisation • Provide data to third party companies
Automotive OEMs and suppliers	Real-time (traffic) information to the driver – competitive advantage • Equipment for gathering (traffic) information, providing this information to the TMC and receiving traffic information gathered by others
Others	Logistics providers: interested in post processed data from the TMCs for providing good services to their customers Emergency vehicles: they want to be as fast as possible while disregarding all constraints and preferences of all other stakeholders

Users, stakeholders, and use cases

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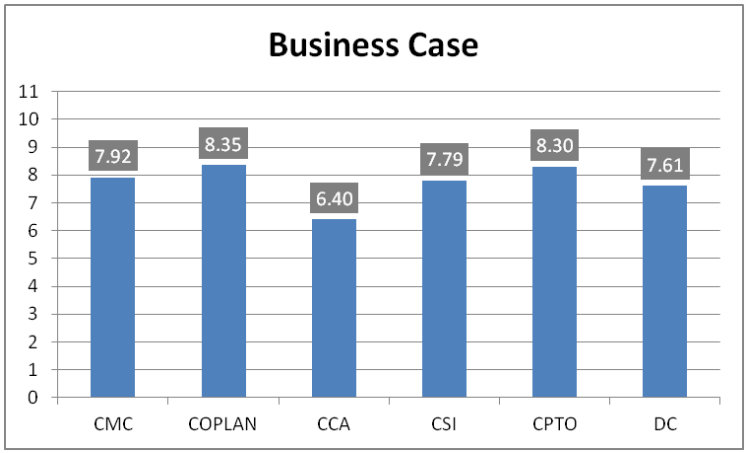
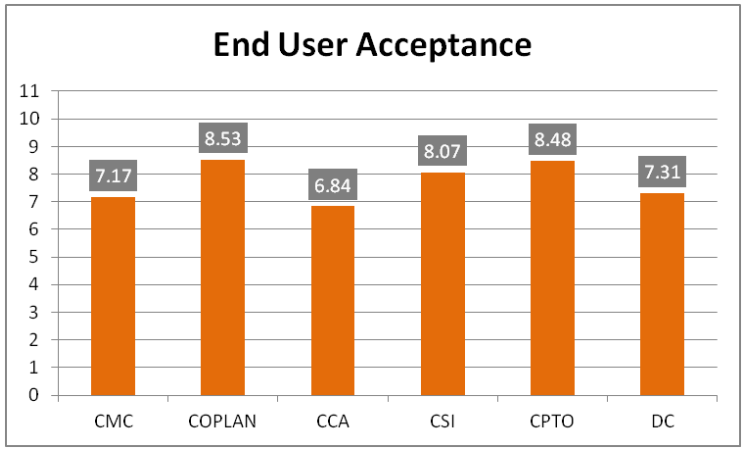
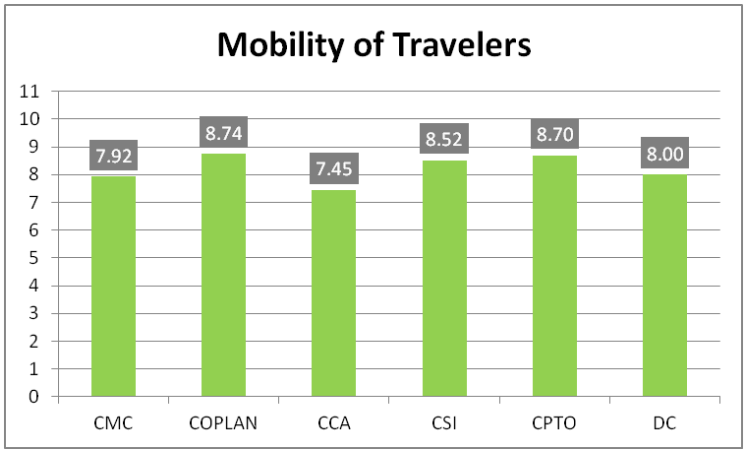
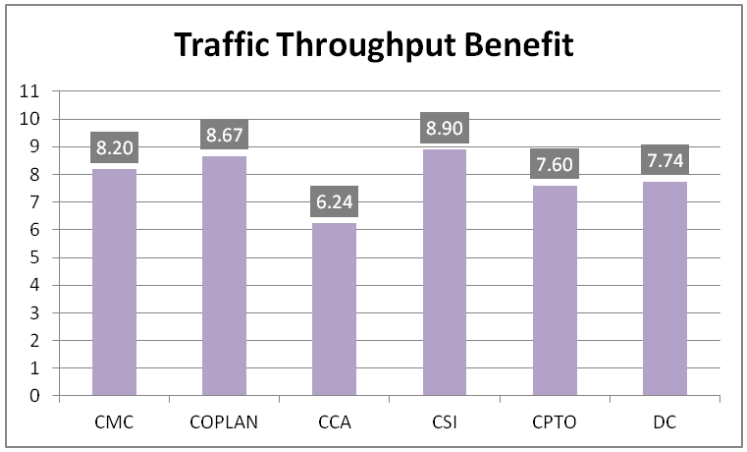
Stakeholder survey









Users, stakeholders, and use cases

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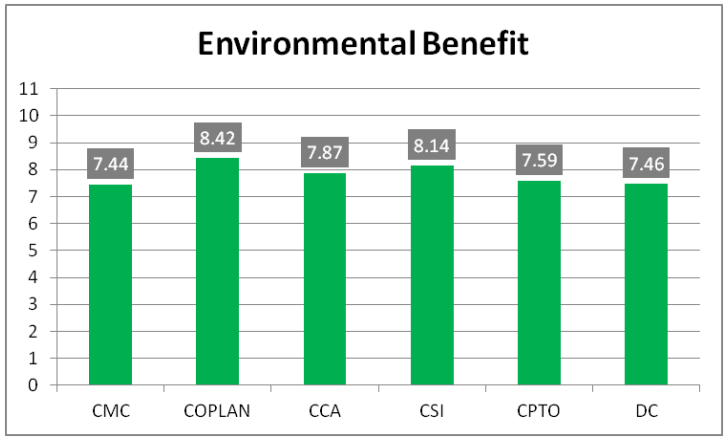
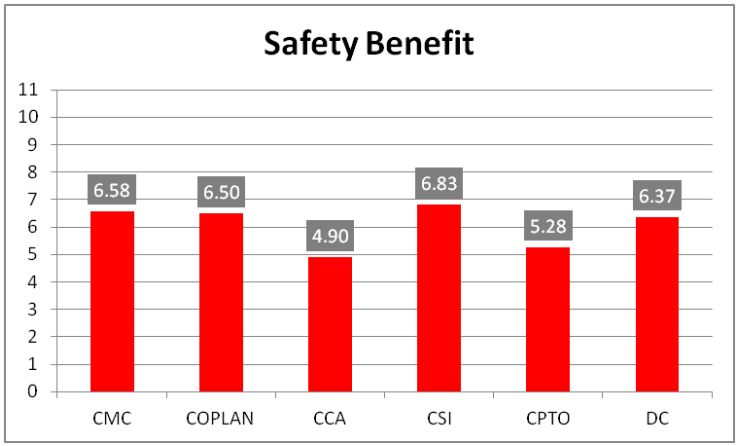
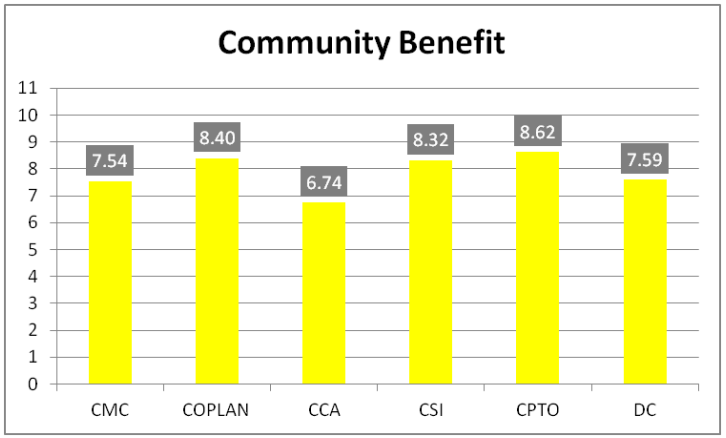
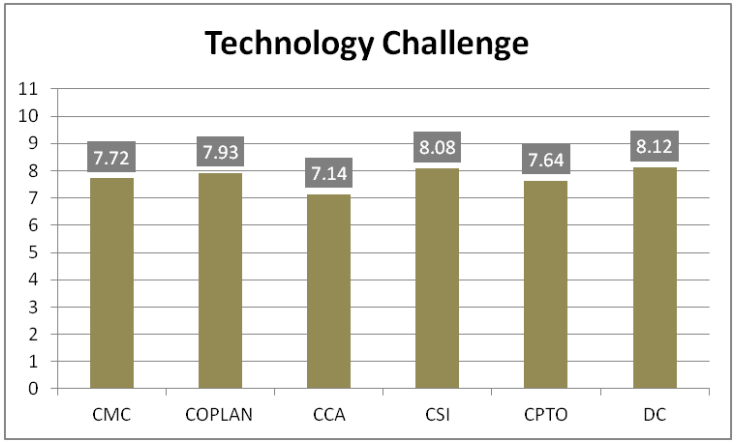
Stakeholder survey









Research Challenges

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Technical related challenges

- Mobile communications convergence for ITS
  - 802.11p
  - LTE
- Local Dynamic Map++ (LDM++) and Data cloud
  - Flexible/layered mobility information management
  - Local level (e.g. vehicle/mobile) & system level (e.g. cloud) real-time operation
- Increased position accuracy (cooperative GPS)
  - Exchange of raw GNSS data
  - Different communication protocols & technologies
- Privacy and security

Research Challenges

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Collaborative optimisation & control algorithms

- Designed for large scale systems exploiting infrastructure information and mobile data
- **Key innovations:**
  - Considering all road users and their interactions (not only the needs of an individual driver or traveller)
  - Regulate the system in a decentralized best-effort manner
  - Elastically respond to the changing needs of the participating actors
- Different **algorithmic approaches** under examination:
  - Game theory
  - Control theory
  - Optimisation
  - AI/Machine learning

Conclusion & outlook

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Conclusion

- Elastic infrastructure – A key concept for addressing transport problems of modern cities
- Promising results from the stakeholders survey for future deployment and exploitation
- Innovative applications selected (stakeholders survey)
- Several research challenges to be addressed: *technology* related & *algorithms* related (optimisation & control)

Outlook

- Design & architecture of elastic transport infrastructure
- Implementation and integration

Consortium

TEAM
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Automotive

BMW GROUP Research and Technology
CRF CENTRO RICERCHE FIAT
VOLVO

ICT

COSMOTE our world is you
DELPHI
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here
intel Intel Mobile Communications
TELECOM ITALIA
RE:Lab
NXP
NEC

Infra-structure

TORINO Tecnologie Telematiche Trasporti Traffico
infotrip
RAMBØLL
swarco SWARCO MIZAR S.p.A.
e-trikala
swarco SWARCO TRAFFIC SYSTEMS GMBH

Research

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ELIOS
VTT
NATIONAL UNIVERSITY OF IRELAND MAYNOOTH

Other

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This project is co-funded by the European Union

Thank you!

Dr. Angelos Amditis

Research Director

ICCS

Contact

9 Iroon Polytechniou str,

Polytechnic Campus, Athens, GR-15773

Phone: +30 210 7722398

Fax: +30 210 7722291

Email: a.amditis@iccs.gr

Website: http://i-sense.iccs.gr/

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