Report of the ITEA customer workshop on Smart Mobility

For the fifth time, ITEA has put the customer in the spotlight during the ITEA international customer workshop. The workshop took place on 12-13 June – during the Kista Mobility Week – and was hosted by Ericsson, for which we are very grateful. This year's focus was Smart Mobility and, with over 50 participants, it was the biggest workshop that we've organised so far. This clearly shows the importance and relevance of the topic of Smart Mobility.

The following companies took part:

Customers	Industry	SMEs
Airbus / EIP-SCC	Airbus	Applanix Corporation
Bosch Corporate Mobility Management	Bombardier	Bumbee Labs
Drive Sweden	Bosch	Carmenta
Ford Otosan	Ericsson	ESI ITI
Nordhessen region	Thales Digital Factory	Esri Canada
Stockholm city	Tofaş	Eteration
Tampere city	Turkcell Technology	Fortran Traffic Systems Limited
Trafikverket	Volvo Group Connected Solutions	Geotab
Transdev Group		Honk Mobile Inc
Turku city		International Road Dynamics Inc
UAV-Dach		Navya
Urban ICT Arena - Kista		Solace Corporation
Volvo Cars		Technolution
		Thorsis
Contributors		TMOB
Eyüpsultan Municipality – Istanbul		ViNotion
Göteborg		Visy
Transport for London		

Customers' Smart Mobility challenges

After a short welcome address and explanation, everybody was invited to check out the demos from the Kista Mobility Week, showing autonomous vehicles, connected (and remote) driving, emergency drone cases and remote, on-board diagnosis for ambulances. Afterwards, a set of customers presented their most urgent Smart Mobility challenges and Philippe Letellier presented the 16 SMEs that attended the workshop. During the breaks and the networking dinner at the end of the day, the participants had the opportunity for one-on-one discussions to get to know each other and to better understand the customer's problems and the potential of the large and small industries' technologies.

We say a big thank you to all customers for sharing their challenges with us. We have created a synthesis of these challenges, which were notably rich and diverse:

1. **Mobility as a Service (MaaS) challenges:**
   - The multiplication of different means of transport leads to a demand for Mobility as a Service (MaaS). MaaS changes the value chain and increases its complexity. MaaS requires coverage for all means of transport, a common payment solution and a travel planner.
   - MaaS must ensure a balance of all of a city's macro-needs:
     - Energy and carbon optimisation: understanding the potential role of MaaS in achieving a 70% reduction in CO_2 emissions by 2030 without a sharp reduction in accessibility for the population. Cities are aiming to be carbon-neutral by 2029, with all possible traffic electrified.
     - Reducing pollution in general: problematic air quality management, noise reduction.
     - Fluidity across the city: efficient land use, intelligent traffic, 66% of traffic to become sustainable (mass transit, cycling, walking), walking and cycling to be the main modes of transport near city centres.
     - Reducing accidents (number and severity).
     - More accessibility for elderly or impaired people.
     - How can we create public transport in very sparsely populated areas? Trips by car will stay an important mode of transport, especially considering the existence of so-called 'mobility deserts' that are under-served by other modes of transport.
     - Dealing with reduced mobility levels in rural areas through decreased public transport and demographic change.
   - The promises of MaaS include:
     - Lower mobility budgets for end users.
     - Optimisation of investments and operations.
     - Productivity and efficiency improvements.
     - The ability to orient mobility usages.
     - Contributions to mobility for all.
     - A direct link with citizens.
     - Reduction of acquisition costs.
     - Optimisation of the offer through personalisation.
   - How can we instrument the full system through massive, real-life data acquisition? How can we extract behaviour models from the acquired data? Cities have a dual challenge of integrity and privacy.
   - The push to send the maximum amount of meaningful data to the lower levels of the organisation to allow quicker and more efficient decisions.
   - Infrastructure costs must go down.
   - How can we propose individualising journeys for London when there are 4.5 million passengers per day, while also covering different needs (wheelchairs, older persons with mobility difficulties, etc.).
   - Urban mobility management leads to the setting up of a digital twin of the city. It's not easy to build a multi-tenant digital twin, and suppliers are not delivering adequate tools and data.
   - The MaaS market can be public-only, market-based or a mixture of both. The challenge of MaaS multi-criteria optimisation applies to end users but also to cities.
   - Political demand to have an open MaaS offer.
   - Value chain stakeholders' collaborations, roles and role distributions are a challenge.

2. Business models

- Creating sustainable business models is a challenge. How can we uphold a margin with open data? Perhaps because it opens the door of hundreds of different services, all exploiting the same data? What is the role of open data and the data economy (scalability)?
- How can we maintain a cost-effective single-fare traffic system?
- Urban mobility appears to be a complex value chain.
- Challenges exist regarding supportive regulations, such as tax legislation (benefit taxation, tax rules for the sharing economy, rental car legislation, etc.).
- Loyalty programmes.

3. Specific challenges

Mobility is freedom → reduced mobility is a cutback of freedom → need for a system which increases the level of mobility with reduced or consistent costs.

Mobility industry:

- The mobility industry is being challenged by new technologies (e-mobility + connected cars) and consumer trends (sharing economy + ecological awareness).
- Autonomous vehicles are intended to be a big change in the full value chain, ranging from OEMs to e-commerce for car manufacturers.

General issues:

- Time to market is key: what, when, how?
- Reaching the right system effects.
- Collaborations between vehicles, infrastructure, services and cities.

Implementation case1: Turku

- How do we cross a river in an efficient way without a bridge or tunnel?
- Autonomous ferries need to be (nearly) as reliable as bridges – about 7/20 operation, in basically all weather and icing conditions. They need to:
    - be very fast in their operations: crossing time of one minute, docking time of max. two minutes per end;
    - be completely accessible for wheelchairs, the elderly, etc.;
    - be safe, even for children traveling alone;
    - be emissions-free (electrified);
    - be cost-effective: personnel may be 60-80% of operating costs, especially when working weekends and nights;
    - be operational in arctic weather (fog, snow, freezing rain, ice): electric motors may be insufficient;
    - address crowd-control issues: how do we design the ferry and pier so that no overloading can occur?
    - address legal and safety issues.

Implementation case 2: Optimisation of parking

- The growth in parking demand is outpacing the growth in supply.
- Parking areas remain with free spots
- Increasing revenue will be key to driving asset growth.
- Requires a wide-ranging inventory and many transaction types (aggregate of all types of parking inventory – private, municipal, college & university, airport and hospital; aggregate of all types of parking transactions – daily, monthly, transient and long-term).

Implementation case 3: Topography, geography, history, …

- Sloped topography is a challenge for mobility.
- Historical environments often feature narrow streets, which is a challenge for mobility. For historical areas, tourist management is a challenge.

Implementation case 4: 3rd dimension and drones:

- Smart Mobility in Smart Cities means: WALK, RIDE, DRIVE, FLY. Urban traffic is entering a new phase with the introduction of drones. The deployment of drones requires public & private support, ground & air synergies and co-creation with citizens.
- The transportation of blood and pathologic samples: reduced transportation times can save lives and increase public acceptance of drones.

Other cases:

- Rubbish disposal is a specific case: the challenge is to eliminate human waste and to optimise street usage, noises and smells.
- Increasing safety by greater automation for transport agency workers, who are sent to unsafe zones to work (dig in a tunnel, maintenance on the line)

4. Internal challenges for cities:

- Cities' populations are projected to grow.
- Urban mobility is only one part of city-wide networks.
- Smart mobility requires digital infrastructure, new business models and services, societal development and planning and some policies and regulations.
- City planning uses a lot of different simulations and visualisations, with GIS at the heart of the game. Visualisation is important and targets technicians, politicians and citizens; interoperability between simulators and visualisation tools remains a challenge. Cities are interested in sound and air quality simulators. How can massive, multi-agent simulators provide more detailed simulations? There is a clear interest in security situation simulation.
- Technological developments are fast and have a short lifecycle, which places great demands on flexibility in planning. The issues of identification and personal confidentiality are constantly being updated and may affect the possibilities for collecting and providing data.
- How can we build trust in the long term? Data sharing, taking into account social security and integrity, is a prerequisite for development.
- The challenge for cities relates to organisation: who decides what and when? Politicians can change every four years.

Brainstorming sessions

After this first day, in which the challenges and painpoints for cities were gathered, the second day was dedicated to a large, open brainstorm between customers and industry. This analysed the potential room for solutions and identified some areas which deserve R&D projects, targeting impact on the market as we are so used to doing at ITEA.

This brainstorm was organised in three parallel sessions:

- **Session I - System of Systems,** chaired by Philippe Letellier
  - System of systems
  - MaaS optimisation
  - Validity, retention
  - UX consistency across the system
  - Resources optimisation (streets, etc.)
  - Safer streets

  - Less emissions
  - Reducing CO_2 production by transport without reducing accessibility too much
  - Data orientation
  - Extending sensors vision through a system view for autonomous cars

- **Session II - Rules, Legal Aspects and Business Models,** chaired by Erik Rodenbach
  - Multi-tenant business models
  - Rules to follow to allow different vehicles to share the same resources
  - Value chains: why collaboration is hard to do and how to do it well
  - Time to market
  - Legal aspects
  - How to share data with each stakeholder in a safe way
  - Standardisation of data
  - Clearance payments
  - Assessment tools for the system
  - How to create trust regarding the quality of services
  - Upscaling experiments
  - On-demand, end-to-end transportation
  - Public-private interface

- **Session III - Different Vehicles and USPs,** chaired by Maria Rimini-Döring
  - USP of the different means of transport
  - Increasing the number of travellers per vehicle
  - Less capital per km
  - Low emissions
  - Transport efficiency
  - Transport quality
  - Societal goals regarding the environment
  - Safety
  - Resource utilisation
  - Acceptability
  - Costs of certification
  - System security certification
  - Infrastructure surveillance

Main results from the brainstorming session

Session I: Systems of Systems

Six topics of interest have been selected:

A. Open MaaS platform
B. Autonomous vessels
C. Traffic control & safety
D. Organisation of the logistics
E. Drones
F. Energy

A. Open Maas platform

This topic will require to cover:

- Data storage
- Operational models
- Quality
- Governance models

- Evolutionary development
- Public API
- Misuse management
- Business models
- Billing models
- Data trading

Two topics revealed a lack of consensus when it came to optimisation. The existing MaaS are focused on optimisation in the interests of the user. But the interests of individuals can be the opposite of the collective interests of society (e.g. pushing cars to use the 30 km/h zone in front of schools because the rest of the city is overloaded). To solve this question, we propose a multi-criteria optimisation engine which can take into account the interests of users on one side and the interests of society on the other, with a balance to be defined. The second point regarding this optimisation engine is the development of a transport policy editor and engine to describe the transport policy, which is a translation of the global interests of a society. This transport policy editor could be used, for example, by cities to keep an impact on the realities of urban mobility. The transport policy engine will then interact with the optimisation engine to find an adequate balance between individual interests and the collective interest.

The unsolved question from this workshop is: do we have to integrate an optimisation engine into the platform, or should we leave it as a service with private competition?
The negative side of things, named by some cities, is:

- It is not the role of cities to be paternalist and to force individuals to behave in a certain way.
- They prefer to leave more freedom and to react when a problem arises to force the operators to overcome the drawback.

The positive side is:

- If we don't propose a solution to take into account the collective interest, there is no chance that it will be taken into account.
- If few digital solutions are deployed massively worldwide, focusing only on individual interests, there will be no way back. It will not be possible to solve issues at the level of a city, and the associated data will be kept by some private interest in order to generate business. We therefore need to have an open alternative.
- With such a solution, each city can define the balance between the two kinds of interests at the desired level (the limit being to be fully aligned to individual interests as the existing solutions).
- Furthermore, the transport policy engine can be interfaced with different MaaS solutions to keep the competition

This non-decision will have to be analysed in more detail in a potential project.

The interested companies to push this topic towards an ITEA proposal are: IRD, Thales, ESRI Canada, Ford Otosan, Bombardier, Volvo Car Group, Solace Corp, Thorsis, Fortran Traffic Systems Limited, Bosch, Eteration, Tofaş, City of Tampere and Nordhessen. **Thales** is the leader in terms of preparing a potential proposal.

B. Autonomous Vessels

This topic will require to cover:

- Consistent positioning
- Sensors fusion
- Recognition of surroundings in order to create a bubble of security
- Underwater perception for accident situations and for extremely icy weather conditions
- Access control
- Navigation
- Surrounding interactions as problems can't be reduced to the vessels themselves; they must interact with infrastructure

- Real-time connectivity
- Monitor, Command & Control Centre
- Cybersecurity as such infrastructure will quickly become a target for hackers
- Safety and reliability
- Certification, IMO regulation

The interested companies to push this topic towards an ITEA proposal are: Applanix, ViNotion, ESI ITI, Carmenta, Visy, Solace Corp, Volvo Group Connected Solutions, City of Turku, OneSea Ecosystem, Navya, Ford Otosan, Bumbee Labs, Fortran Traffic Systems Limited, Bosch, TMOB, Turkcell. **City of Turku** is the leader in terms of preparing a potential proposal.

C. Traffic control & safety

This topic is intended to cover:

- The handling of multi-type users (cars, pedestrians, bicycles, etc.) using the same resources
- Future traffic control in the context of autonomous vehicles
- Managing the transition phase
- Autonomous roadside units
- Sensors deployment for situational awareness
- Standardisation
- Warning alert systems
- Command & Control Centre

The interested companies to push this topic towards an ITEA proposal are: Carmenta, Thorsis, ViNotion, Bombardier, Turkcell, Volvo Cars, Trafikverket, Nordhessen, City of Tampere, Solace Corp, TMob, Fortran Traffic Systems Limited, Bumbee Labs, Urban ICT Arena, Navya, Bosch, Tofaş and Drive Sweden. **Carmenta** is the leader in terms of preparing a potential proposal.

D. Organisation of the logistics

The aim is to enhance logistical efficiency in cities and to reduce the impact on future green cities. This topic is intended to cover:

- Multi-operator, autonomous logistic centres at the edges of cities
- Green last-mile delivery
- Rubbish management
- Transport policy tools

The interested companies to push this topic towards an ITEA proposal are: Nordhessen, Ford Otosan, Visy, TMob and Volvo Group Connected Solutions. **Ford Otosan** is the leader in terms of preparing a potential proposal.

E. Drones

Drones have multiple usages in urban mobility. This topic is intended to cover:

- Inspections of infrastructure
- Inspections and interventions regarding accidents
- Data collection for different kinds of cartography
- Freight transport
- Passenger transport
- Sensor recognition on the drone
- The challenge of noise reduction in order for drones to be acceptable in cities
- The required regulations
- Autonomous flights as the ultimate goal for ensuring economical sustainability

The interested companies to push this topic towards an ITEA proposal are: Nordhessen, Trafikverket, City of Tampere, Thorsis, Airbus, ViNotion, Solace Corp, Bombardier, ESI ITI, Urban ICT Arena and Volvo Group Connected Solutions. **Urban ICT Arena** is the leader in terms of preparing a potential proposal.

F. Energy

Energy optimisation is at the heart of urban mobility. This topic is intended to cover:

- Smart charging
- The integration of Smart Grid & Transport systems in order to take advantage of the potential for global battery sizes (deployed by transport systems) to master non-continuous renewable energy
- Microgrids
- Trusted incentive models for bi-directional charging

The interested companies to push this topic towards an ITEA proposal are: Trafikverket, Bombardier, Volvo Car Group and Kassel Fraunhofer IEE Institute
Bombardier is the leader in terms of preparing a potential proposal.

Session II - Rules, Legal Aspects and Business Models

Session II focused its discussions on a set of problems:

- Standardisation is needed for the sharing of data and protocols. There are too many proprietary solutions for interfacing, e.g. in cars. Standardisation is needed to create open systems between different modalities and between different systems and platforms.
- Data ownership: public transport data is now open. In aeroplane systems, there is some resistance against providing this data to everyone in order to generate business from it. Data categorisation (open data, private data, etc.) is needed to identify the different types of data.
- Policy measures are required. If we leave it to the market, it is not clear if the public will accept it. Grey zones need to be identified in order to avoid activities which are on the border of legality. How can we further support disruptive inventions like Uber? Taxing new initiatives, like Uber, is difficult in several countries.
- Traditional businesses are working in closed boxes and struggle with the creation and complexity of new, open systems. How can we develop new business models to make MaaS acceptable for all actors? Currently, these systems normally work regionally. A framework for roaming is required.
- E-commerce generates huge logistics and puts a heavy load on traffic. How can we make this more sustainable? There is currently too much emphasis on lorries and aeroplanes and less on trains.
- Transport is currently the only sector that is not reducing its energy consumption. Lorries are not efficient. Lorry ownership regulations (family businesses with a few lorries) now only allow the use of a lorry for a maximum of 11 hours per day. There is currently a large shortage of drivers; this work needs to be made more attractive and new models are required.
- The use of smart cars will have an impact on maintenance. If there are different stakeholders, how can we share a location and the corresponding data?

Some potential solutions have been analysed, covering:

- The downloading of data via a subscription model (similar to Spotify, for example).
- Advising on different travel routes to better regulate traffic.
- Different business models for MaaS.
- Creating a roaming-like model for MaaS.
- Control towers for controlling multi-modal traffic in dense areas; providing predictive advice for travelling.

This led to two ideas for potential proposals:

1. **Control Towers**
   These control towers will target different purposes (land-based traffic), each involving several use cases that include different transversal areas:
   - Standardisation
   - Data categorization
   - Sustainable and successful business models

   The interested companies to push this topic towards an ITEA proposal are: Volvo Group Connected Solutions, Drive Sweden, Bombardier, Tofaş and Ericsson. **Drive Sweden** is the leader in terms of preparing a potential proposal.

2. **Urban Logistics**
   One challenge is to match freight exchange (shippers, carriers, etc.). This idea has been merged with the logistical topic of Session I,

Session III - Different Vehicles and USPs

In this session, we first created a long list of the means of transport operating within cities and the discussion was then focussed on the ones being somehow more exotic or less in focus, marked in bold here below:

- **Walking/augmented walking ('walking belts')**
- Privately-owned cars
- Taxis
- Car sharing
- **Autonomous shuttles**
- Bicycles/eBikes
- E-scooters
- Motorcycles
- Buses
- Metros/trams/trains
- Drones
- Water transport (short)
- **Autonomous water transport**
- Water transport (long distance, >500m)
- Lorries
- Cable cars/funiculars
- Escalators
- Lifts

1. **Walking/augmented walking ('walking belts')**

The Unique Selling Propositions (USPs) of walking are:

- Health benefits
- Availability anytime, no preparation
- Free of charge
- Augmented walking for the disabled/the elderly/children/strollers (velocity, steepness, etc.) – also useful for sightseeing
- (Services for inclusive mobility)

Nevertheless, it also has some drawbacks:

- Slow and sweaty
- Weather exposure
- Distance is limited
- Luggage/load
- Health limitations

- Safety and security
- Lack of places for walking (e.g. in industrial zones)
- Air pollution exposure

2. Autonomous water transport

Non-autonomous ferry costs are currently €1 to 2 M. An unmanned solution will drastically reduce the operational costs: -60 to 80% of costs (five people + one replacement) = €500 k/year. Nevertheless, the context requires zero tolerance for injuries.

The Unique Selling Propositions (USPs) of autonomous water transport are:

- Point-to-point river crossing
- Replacement for bridges
- Quick to place, little pier infrastructure
- Almost no need to change city structure
- Nice tourist attraction

A challenge remains that no solution is currently available for bad weather conditions.

3. Autonomous shuttles (15 people)

The special case of autonomous shuttles has been discussed at length.

The USPs appear to be:

- Designed for the first and last mile: the most expensive part of the trip for cities (infrastructure) and passengers (personal costs).
- Technical and legal acceptance across the ecosystems as a whole (passengers, other traffic users, supervisors, cities, etc.).
- Infrastructure-free solution, but some infrastructure features can help (smart traffic lights).
- Part of city planning.

Nevertheless, this means of transport is subject to some drawbacks:

- Some components are not “certified” for temperatures under -12°C, heavy snow, rain… are a limitation while darkness is not a problem;
- A speed limit of under 25 km/h for safety reasons.
- Remote piloting is a bigger challenge (communication needed at high rate; Control system with no delay);
- The risk of cybersecurity attacks.
- People challenging the behaviour (trying to stop it).
- 5G reliability.

These two topics, autonomous ferries and autonomous shuttles, have been combined and this has led to a set of research challenges:

- Acceptance/accessibility/cybersecurity: addressing the prevention of hijacking, geo-fencing.
- Crowd control (movement of people in, out and on the vehicle).
- Well-designed interactions between the vehicle and passengers: information on emergencies.
- Interaction rules for other traffic; information regarding people in the area.
- Risk management (against extreme accidents).
- Impact on city planning.
- Changing the mindset of people and companies (associates in industrial zones, e.g. Lyon), less doubling of infrastructure (restaurants, shops, etc.).
- Winter conditions (snow, rain, ice storms) in the current operational domain of the shuttles: coping strategies.
- Evaluation of sensor quality: naval vs automotive (also incl. price).

It would be interesting to investigate the design of possible connections between two autonomous means of transportation (from the ferry onto the shuttle).

The interested companies to push this topic towards an ITEA proposal are: Turku City, Navya, Ford-Otosan, Bumbee Labs, Fortran Traffic Systems Limited, Bosch, Turkcell Technology and Tmob. **Turku City** is the leader in terms of preparing a potential proposal.

This topic has been merged with the autonomous vessels topic of session I under the lead of city of Turku.

You are invited to use this valuable input and to create or join a customer-oriented idea for a project proposal in ITEA 3 Call 6. We look forward to discovering your unique solutions!