Testing and deploying new solutions through collaboration

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VTT & Transport

Place for a photo
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VTT Technical Research Centre of Finland Ltd

VTT Technical Research Centre of Finland Ltd is the leading research and technology company in the Nordic countries. We provide expert services for our domestic and international customers and partners, and for both private and public sectors.

We develop new smart technologies, profitable solutions and innovative services. We cooperate with our customers to produce technology for business and build success and well-being for the benefit of society.

VTT is part of Finland's innovation system and operates under the mandate of the Ministry of Employment and the Economy.
VTT’s status as performer of R&D work
VTT’s spearhead programme *TransSmart* is a collaboration platform for the development of smooth-running, cost-efficient and environmentally friendly transport systems.

- Public sector
- Private sector
- Research organisations
TRANSSMART THEMES AND CONTENTS

- Biofuels for transport
- Low-carbon fuels
- Infrastructure for EVs & FCVs
- EV fast charging & grid effects
- Energy storage for vehicles
- Efficient use of vehicles
- Vehicle technology
- Hybrids, EVs & FCVs
- Focus on commercial vehicles and mobile machinery
- Ship propulsion

- Smart cooperative systems and services
- Business ecosystems, business models and foresight
- Advanced multimodal transport management systems and services
- Service concepts, testing and technology platform demonstrations
- Transport system foresight
- Systemic policies and impact assessment
- User values, demands, intentions and acceptance
- Stakeholder networks, communities and their management

Low carbon energy
Advanced vehicles
Smart transport services
Transport system

Megatrends, user demands, business opportunities, policy support, foresight
What’s going on

Place for a photo
(no lines around photo)
Acronym of the day

SECAY

…or ACES, CAVES or however you want to scramble the letters…
- UberPOOL

- Car Sharing
  - “…one-way carsharing is almost certainly reducing VMT overall…”

- Sharing and new services provide options and reduce the need to own (at least a second) car

Source: Uber @ SITCE 2016
Cars getting there…
… (smart) mobile phones already there.
NordicWay / connected driving

- Deployment of C-ITS (Cooperative ITS) utilising cellular networks
- Extended to corridor between Finland, Sweden, Norway and Denmark
- Highway and inter-urban connected driving

C-ITS trial applications

- hazardous location warnings (slippery road, adverse weather)
- road works warning
- probe vehicle data
How do we change things?
Killer Apps

- Widely deployed services to enable other solutions, e.g.
  - Grab, Uber, Waze, ... → FCD data, traffic management
  - Electronic Toll Service → eTag for other purposes

- User acceptance (value for the user) and good business case needed...
  - GPS tracking of citizens?
...as well as acceptance by authorities

In January 2012, a law was passed in France to forbid the ownership or use of all systems which indicate the presence of speed cameras

By Nick Trend
22 JUNE 2012 • 12:00AM

Changing/nudged/incentivizing user behaviour
If the conditions are right…

“…the most cited reports put Oulu’s overall bicycle modal share at around 22% (32% in summer, 12% in winter)…”

In Oulu, Finland, cycling in the snow is seen as unremarkable. Photograph: Anders Swanson

Rewarding scrapping of old cars

- Test: 1500€ discount on a new car when scrapping an old one
  - 1000€ (gov) + 500€ (industry)

- Results:
  - 8000 new vehicles with lower emissions (replacing avg. 19yo cars)
    - -8 M€ cost for government
    - +17 M€ vehicle taxes and +16,5 M€ VAT from what would not have been bought otherwise (60% of total)
  = +25,5 M€ + reduced emissions and safety improvements

http://www.trafi.fi/liikennelabra/kokeilut/romutuspalkkiokokeilu
Public Transport as realistic alternative

http://mak.hsl.fi/
Changing user behaviour

- Even the simple things like…

Free internet connectivity abroad

USB charging for bus passengers

Gamification

Image: http://www.pokemongo.com/
Developing and implementing smart systems and services

- Wider take-up of new solutions requires them to first be tested and proven – **pilots, tests and demonstrations!**

Traffic Lab – Finland is a traffic lab

Helsinki is a hotspot for integrating smart and clean solutions into the city structure

Aurora to become the first Arctic testing ecosystem for intelligent transport
Case: Electric buses and open innovation
Steps towards an electric bus system (HRT)

"Vehicles" (ECV)
- Components
- Powertrain
- Single vehicles

"System" (ECV)
- Systemic view
- Charging technology
- Operation concepts
- A few vehicles

HRT timeline: 2012 → 2014
"Vehicles": ECV-eBus project

- The aim is to find out usability of electric buses in commercial transport
- Field study and laboratory research
  - Electric bus test line 11 Tapiola-Friisilänaukio
  - Four commercial eBuses in operation
  - Vehicle technology analysis
    - Full-size VTT-owned electric bus prototype as a development platform
  - Battery laboratory
    - Climatic chambers for components
  - Simulation tools
- Challenging weather conditions
- Part of Tekes EVE programme
  - A major section of ECV national R&D network (Electric Commercial Vehicles)

The prototype bus became so good it was operating one week in commercial passenger traffic in 5/2014
“System”: eBusSystem – the Espoo demonstration

The transport system
How do electric buses fit into the public transport system?
- Ministry of Transport
- Helsinki Region Transport
  - City of Espoo
  - Veolia, Aalto University

The vehicle
How do electric buses perform?
- Veolia, VTT
- Bus manufacturers (BYD, Caetano, Ebusco, VDL)
- Component manufacturers (Visedo, Tamware, Vacon)
- Transport Safety Agency

The energy supply
How can electric buses be charged and how is the grid affected?
- Smart grid, grid services and smart bus depot
- Utilities (Fortum), Siemens, charger manufacturers
- Rail traffic synergy, cities
  - VTT, TUT, LUT

Public sector
Private sector
Bus operator
Research
Steps towards an electric bus system (HRT)

- "Vehicles" (ECV)
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  - Powertrain
  - Single vehicles

- "System" (ECV)
  - Systemic view
  - Charging technology
  - Operation concepts
  - A few vehicles

- Commercial electric bus operation
  - Normal commercial procurement
  - Value chains and service providers established
  - Several bus operators active
  - Charging infrastructure available

HRT timeline: 2012 2014 2016 2016/2017? →
Estimated effect on emissions by 2025 (compared to 2010): reduction of NOₓ (-92%), PM (-95%), CO₂ (-90%)

- For conventional buses, biofuels are phased in and constitute 100% from 2020 onwards
Transition to operation

- Challenges and worries for investment decisions (operators, PTAs, cities)
  - Operators’ investment in electric buses
  - Reliability of new technologies
  - Infrastructure required for electric buses

Beginning requires sharing of risks and resources – innovative procurement
Steps towards an electric bus system (HRT)

- **"Vehicles" (ECV)**
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- **Pre-Commercial Procurement (ePELI)**
  - Market dialogue: building the business ecosystem
  - PCP with operators
  - Small fleet & charging infrastructure
  - Innovation platform

- **Commercial electric bus operation**
  - Normal commercial procurement
  - Value chains and service providers established
  - Several bus operators active
  - Charging infrastructure available

**HRT timeline:**
- 2012
- 2014
- 2016
- 2016/2017?
Seamless travel and user experience

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- Components
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Vehicle systems

ICT, sensors

Innovation platform
PCP (ePELI)

Market dialogue: building the business ecosystem
- PCP with operators
- Small fleet & charging infrastructure
- Innovation platform

Fleet management

Traveller services

Commercial electric bus operation
- Normal commercial procurement
- Value chains and service providers established
- Several bus operators active
- Charging infrastructure available

HRT timeline:
- 2012
- 2014
- 2016
- 2016/2017?
Innovative electric buses serve as a test platform in real use environment. Service and technology developers and providers are welcome to develop and test their solutions.

Real context and references – co-development and business ecosystem

Contact: info@LivingLabBus.fi
THE GOAL

Enabling and supporting faster development of mobility services through a concrete, open test environment in a real public transport context.
User Expectations and Efficiency

Services
- Seamless travel
- Co-development
- Business

User Experience
- Ease of use
- Comfort
- Interactivity

Technology
- Economic efficiency
- Emissions
- Safety

Mobility services based on user needs with enabling technology
EXAMPLE: SEAMLESS INFORMATION

Beacon context metadata repository

1. beacon signal 1234 found
2. what is beacon 1234?
3. beacon 1234 is bus stop at x,y,z, ...
4. beacon signal 2345 found
5. what is beacon 2345?
6. beacon 2345 is a bus number 18,...
7. beacon 3456 found, strength = 23db
8. beacon 4567 found strength = 32db
9. what are beacons 3456 and 4567?
10. beacon is inside bus 8, back wall, h=2m,...
EXAMPLE: GREEN-DRIVING APPLICATION

+ Safety
+ Comfort
+ Timeliness

Table 1 Impact of application use on fuel consumption (l/100 km), summertime, novel users

<table>
<thead>
<tr>
<th>Traffic condition</th>
<th>System use</th>
<th>Fuel consumption and change per speed limit area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>30 km/h</td>
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<tr>
<td>day time</td>
<td>without</td>
<td>42.5</td>
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<td>39.9</td>
</tr>
<tr>
<td></td>
<td>impact</td>
<td>8.9%</td>
</tr>
</tbody>
</table>

Statistically significant results marked ** = \( P < 0.05 \) and * = \( P < 0.10 \), negative changes in yellow and positive in orange
Sample size 66–249 per speed limit area, traffic condition and system use combination

Real time friction monitoring and analysis during normal driving in thousands of heavy vehicles.

In vehicle detection of slippery road section. Instant warning to the driver.

EXAMPLE: SLIPPERINESS DETECTION

- Data from vehicle's databus (CAN).
- Localisation of a slippery road section.

Service provider

Road authority

Real time map of slipperiness of roads (available for road users).

Maintenance register

Road maintenance vehicle

Warning to the approaching vehicles

Real time friction monitoring and analysis during normal driving in thousands of heavy vehicles.
Collaboration and convergence
Policies & Regulation

- Flexible policies to support thinking outside the box and testing – while still ensuring fairness

From Regulating Uber to Subsidizing It

By Jared Meyer | March 23, 2016 | 10:49 AM EDT

On March 21, the Orlando suburb Altamonte Springs is starting a pilot program that pays for part of riders’ Uber fares. This misguided year-long initiative has a budget of $500,000 and will cover 20 percent of each fare for rides within the city’s limits and 25 percent of each fare for rides that start or end at mass transit stations.

Black Market Ride-Sharing Explodes In Austin After Voters Drive Out Uber And Lyft

Now that Uber and Lyft have pulled out of Austin due to onerous new city regulations, drivers and riders are turning to black market ride-sharing.

http://www.cnsnews.com/commentary/jared-meyer/regulating-uber-subsidizing-it

http://thefederalist.com/2016/05/23/black-market-ride-sharing-uber-lyft/
Policies & Regulation

- Pre-empting or adjusting to new solutions?

- Pathways and accessibility
Policies & Regulation

Testing automated vehicles in Finland

Testing of automated vehicles (SAE levels 0–5) is possible in road traffic in Finland using a test plate certificate.

In testing automated vehicles, the vehicle must have driver either inside or outside the vehicle.

In liability issues, the driver is the person who makes decisions on the movement of the vehicle.

http://www.trafi.fi/en/road/automated_vehicle_trials
It’s not just about us…

- Smart systems and cities need to collaborate across sectors
  - Transport
    - Resilience, management, …
  - Energy
    - Smart grids, charging, …
  - Information & Communications
    - Security, privacy, IoT, …
  - Land use planning
    - Parking, …
  - …
Mobility as a Service
Mobility-as-a-Service operators (big & small),
Multiple customized services
All Transport modes with single User Interface, Internet of traffic.

Integrated online services and interfaces
Online services platform: Open Data, Interfaces and APIs, Cloud Services, Internet of Things

Intelligent traffic infrastructure
Traffic management systems
Digital ticketing, routing services
Seamless connectivity

Telecommunications and information infrastructure
Mobile data networks 4G/5G
Static networks enabling international interoperability, broadband for all

Core infrastructure
Roads, rails, airports and ports.
Growth Corridors

Source: ITS Finland, 2016
FOCUS AREAS

Smart infra
- Transport infrastructure
- Digital infrastructure
- Energy infrastructure

Energy and vehicles
- Bio- and low-carbon fuels
- Efficient vehicle use and technology
- Electric and fuel cell vehicle
- Hybrid power

Information and transport services
- Interoperable services
- Different users and needs
- Automation & C-ITS
- Traffic optimisation

Transport system - Goals:
- Environmentally friendly
- Serving and intelligent
- Interoperable
- Resource efficient
- Resilient and safe

Line of Actions, R&D support:
- Decision making support & Helpdesk
- Impact assessment and forecasting
- User values, needs and acceptability
- Service concepts
- Test environments
- Verification and validation
- Technology and system development
- Co-development and ecosystems