

Trends and news in connected and automatic driving in Finland

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TRAFICON



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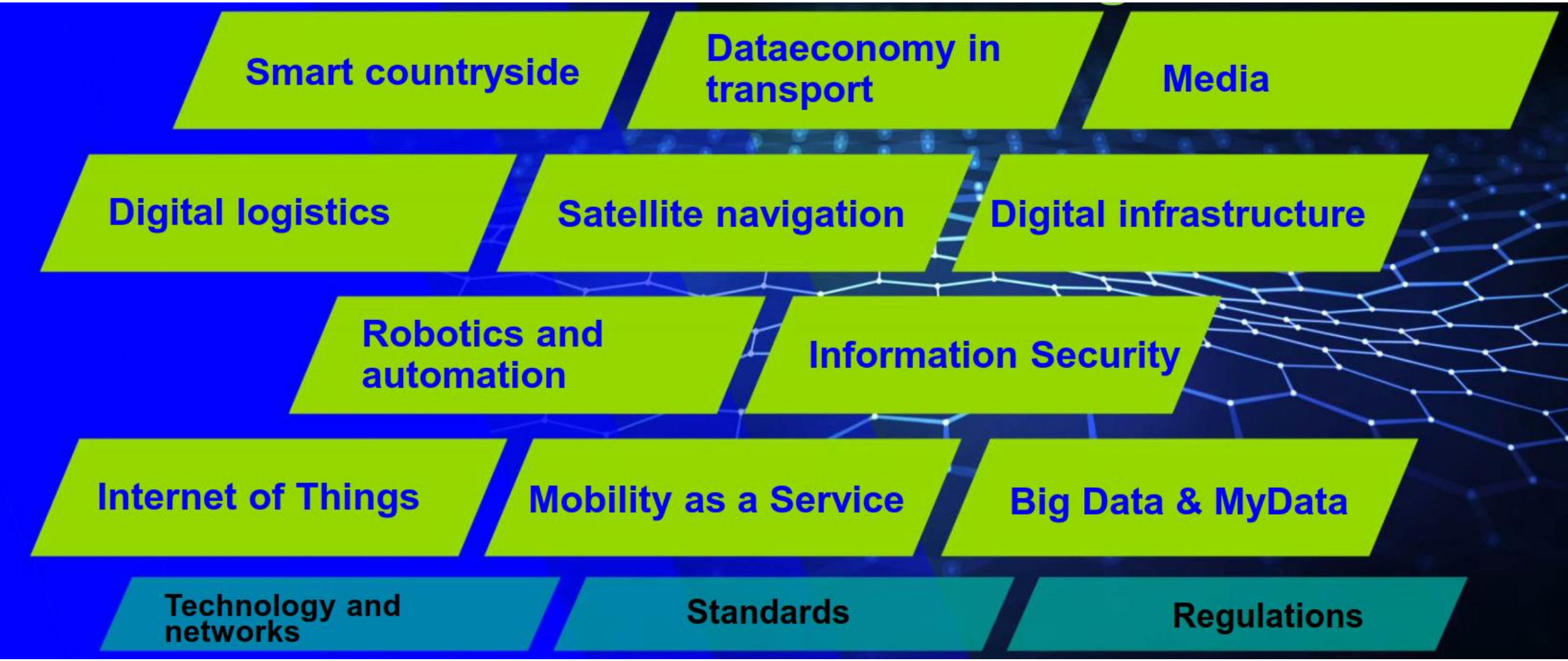
Governmental flagship project – Growth of digital business



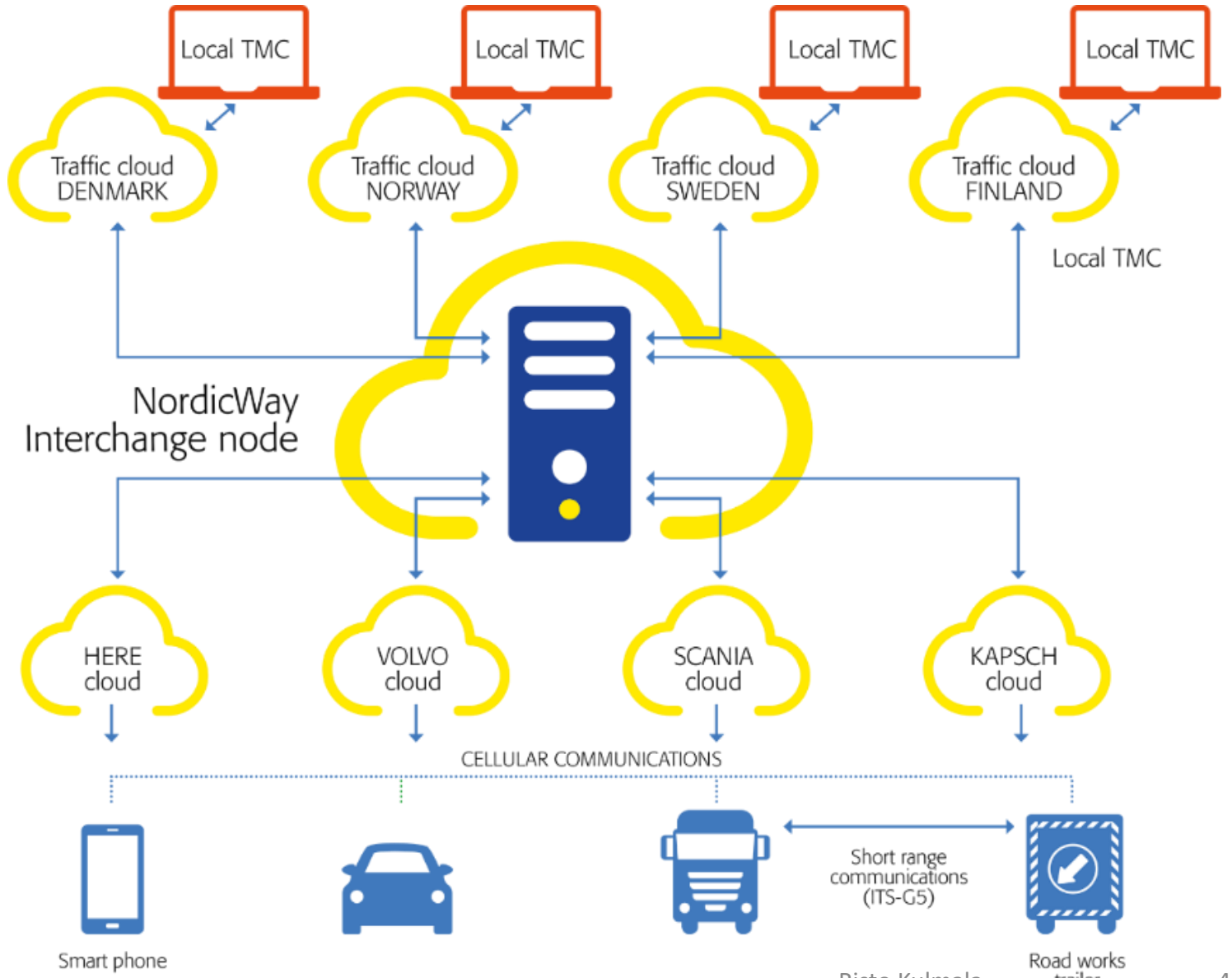
Connected and cooperative

- Long public-road network
- Low population density, low traffic volumes
- Good 3G/LTE network coverage
- High level of and ambitions for road safety
- ITS Directive Priority action c) safety-related traffic information
- Incidents often main origin of congestion

- High-potential for Day1 C-ITS hazard warning services utilising already existing cellular networks

Solution: NordicWay interchange node

Real-time sharing of safety related data via cellural networks by incorporating a ”neutral server”



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It works!

SCANIA

KAPSCH

VOLVO

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More services

Pilot deployment of additional services 2018-2020

Day 1 C-ITS services list	NordicWay
Hazardous location notifications:	
Slow or stationary vehicle(s) & traffic ahead warning;	NW2
Road works warning	OK
Weather conditions	OK
Emergency vehicle approaching	NW2
Other hazards	OK
Signage applications:	
In-vehicle signage	NW2
In-vehicle speed limits	NW2
Signal violation / intersection safety	NW2
Traffic signal priority request by designated vehicles	NW2
Green light optimal speed advisory	NW2
Probe vehicle data	OK
Day 1.5 C-ITS services list	
Traffic information & smart routing	NW2

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Automated driving – regulations

- New traffic act approved in August 2018 (into force in 2020)
- No necessity to have a human driver to be inside the vehicle anymore. The new regulation specifically allows automatic vehicles to drive under remote control.
- Traffic control devices shall provide information in digital form in the future.
  - e.g. traffic lights, traffic signs, road markings
- For type approved automated vehicles there is no need for special permissions after 2020

MINISTRY OF TRANSPORT AND COMMUNICATIONS

Automated driving – policy

- All modes of transport: Air – Maritime – Rail – Road
- Robots on land, in water and in the air – Promoting intelligent automation in transport services; Publications of the Ministry of Transport and Communications 7/2015
  - Regulation-oriented
- A roadmap for developing automation and robotics in transport sector 2017-2019; Publications of the Ministry of Transport and Communications 10/2017
  - Intelligent automation and robotics for service development
  - Utilisation of data and traffic management for automation
  - Development of physical and digital infrastructure

Automated driving – measures

- Intelligent automation and robotics for service development
  - International cooperation
  - Testing
  - Ethics, accessibility, privacy
- Utilisation of data and traffic management for automation
  - Data needs and quality requirements
  - Increase of open and real-time data
  - C-ITS data sharing and exchange
- Development of physical and digital infrastructure
  - 5G deployment
  - Precise positioning
  - Digital transport infrastructure

Registration for auction of 5G frequencies is now open

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The Finnish Government issued on 11 July an invitation to apply for electronic communications licences for the purpose of providing telecommunications services within the 3.5 GHz spectrum (3410–3800 MHz). The spectrum can be used for wireless broadband nationwide in mainland Finland from the beginning of 2019, and it is well suited for the construction of the first 5G networks in Finland.

Automated driving – action plan

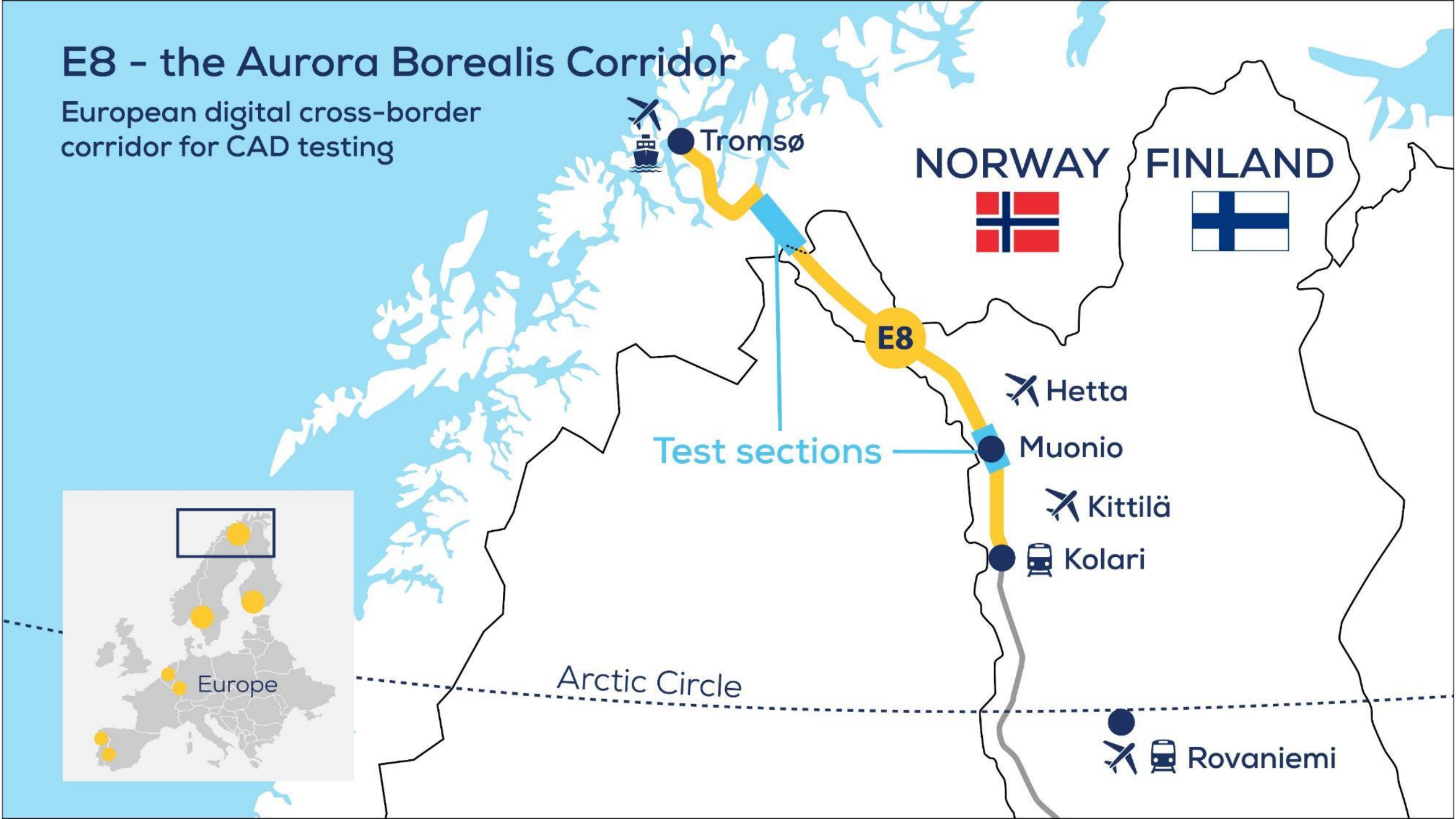
- Road vehicle automation, SAE levels 3-4
- Focus in actions required by public sector
- Action Plan 2016-2020
  - Infrastructure
  - Road
  - Services
  - Vehicle
  - Driver
- http://www2.liikennevirasto.fi/julkaisut/pdf8/lts_2016-19eng_road_transport_web.pdf
- A new action plan to be prepared in 2019

Automated driving – testing

1. Winter testing in Northern Finland
   - Arctic Challenge pilots
   - Aurora E8-highway: intelligent infrastructure testing environment
2. Urban testing facilities
   - Tampere
   - Developing testing tools & requirements for AVs
3. Automated electric buses/shuttles
   - Helsinki, Espoo, Tampere
   - Automated last-mile solutions & innovation platform
4. All open roads
   - National legislation allows for automated vehicles
   - Trafi can grant test plate certificates (valid 1 year at a time) http://www.trafi.fi/en/road/registration/test_plate_certificate

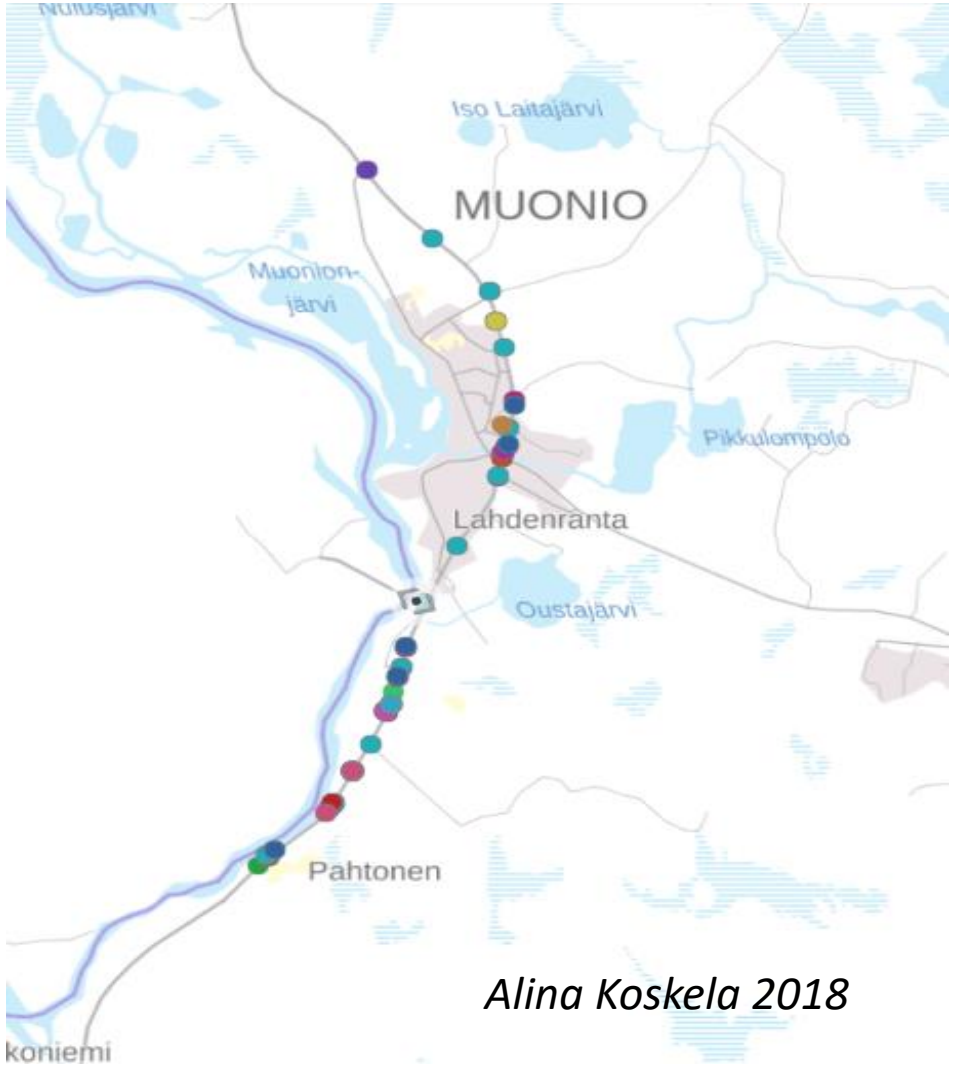
E8 - the Aurora Borealis Corridor

European digital cross-border corridor for CAD testing



Arctic Challenge 2017-2019

- Project examining opportunities in road transport automation and intelligent infrastructure and their performance in snowy and icy conditions
- Based on the Road Transport Automation Road Map and Action Plan 2016–2020
- Public sector funding from FTA, Trafi & EU
- Location: main road 21 (E8) in Fell Lapland
- 10 km test section: Electricity and fibre optics with connection access every 300 m, equipment cabinets every 900 m, 4G – pre-5G, 3 GNSS land stations, HD map, control room facilities, fixed stands for beacons/poles/ landmarks, …



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Arctic Challenge 2017-2019

- Specific research questions
  - the type, location and characteristics of the landmarks, such as delineators and posts + sensor reflectors, or snow poles and plot access marks that could support automated driving
  - accurate positioning of vehicles in arctic latitudes and on roads covered with snow and/or ice;
  - remote control of vehicles using cellular communications in good and adverse road weather conditions
  - back-office systems and related interfaces to provide extended electronic horizon to automated vehicles via cellular communications

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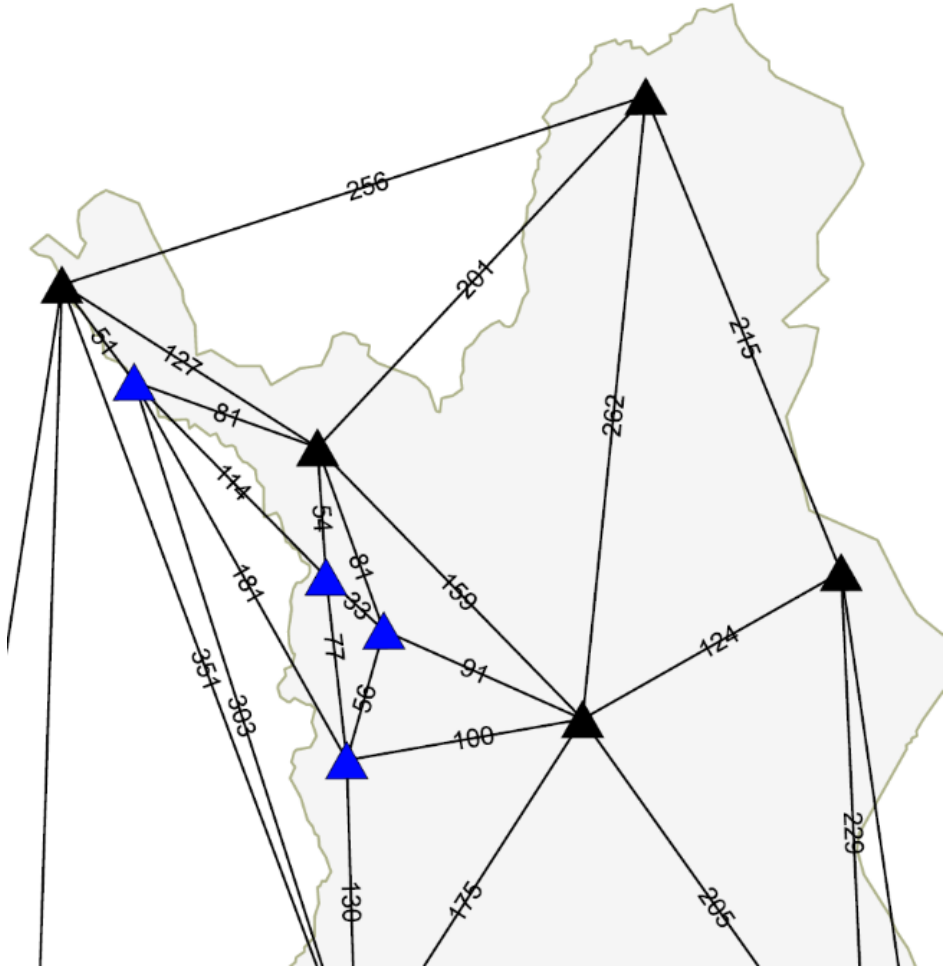
Arctic Challenge – 1st results

- Northern latitudes have special problems with satellite positioning
- GPS positioning complemented with Real-time kinematic (RTK) land reference stations
- <7 cm positioning accuracy



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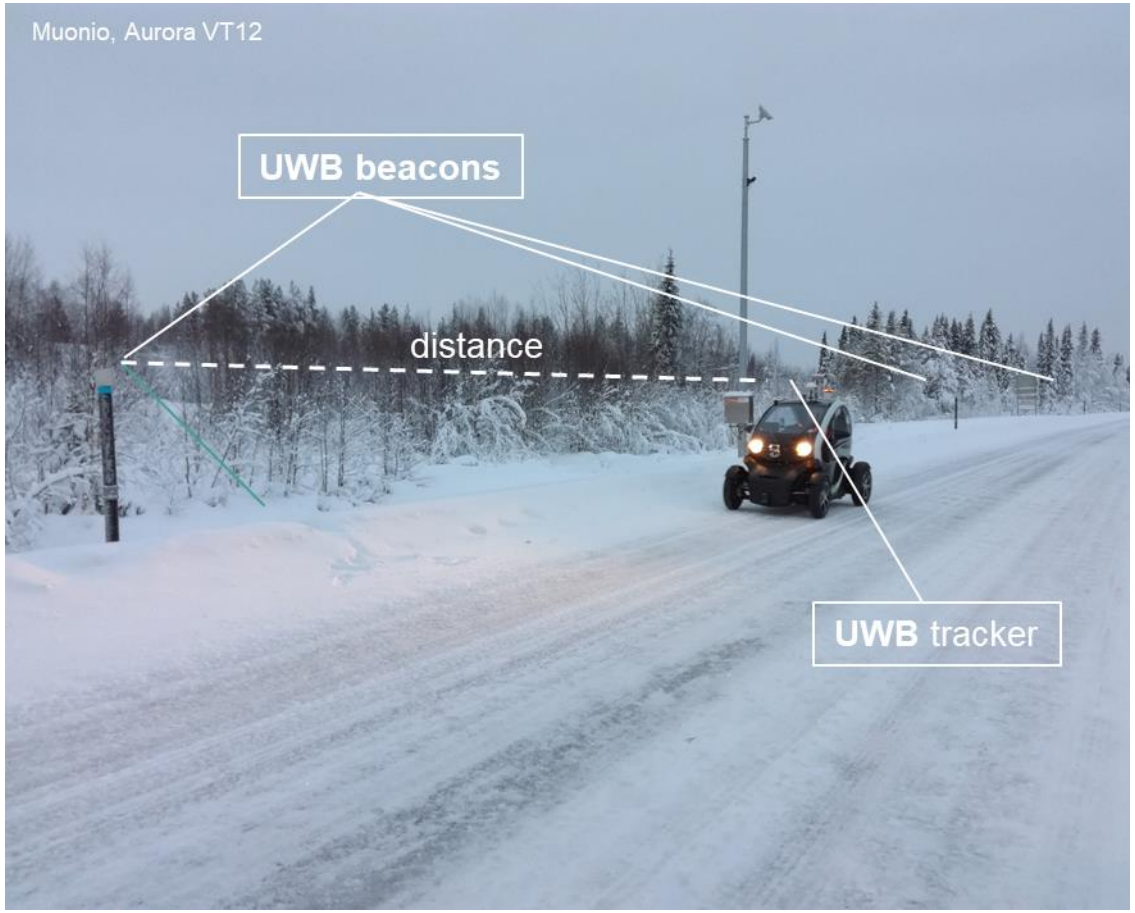
Arctic Challenge – 1st results

- **UWB beacons for automated vehicle positioning**
- Measurement accuracy well within a few centimeters in real winter road conditions across a wide range of distances.
- UWB distance measurement performance is sufficient for navigation along the road.
- From 100.000+ measurements, the distance error is approximately normally distributed with a standard deviation of 27mm
- The deviation is smaller with faster data rates (22m with 6.8Mbps vs. 33mm with 110kbps).
- Error is independent of distance.
- Weather does not affect for UWB range or accuracy based on these tests
- At higher speeds (>55km/h) positioning accuracy is getting worse with current test setup



Sharpeye, Alina Koskela 2018

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Arctic Challenge – 1st results

Martti, the robot car developed by VTT Technical Research Centre of Finland, is the first automated car to have driven fully autonomously on a real snow-covered road. On top of that, it also succeeded in making a new speed record of 40 km/h on the Aurora E8 intelligent road in Muonio, probably setting a new unofficial world record as well.

VTT 2017

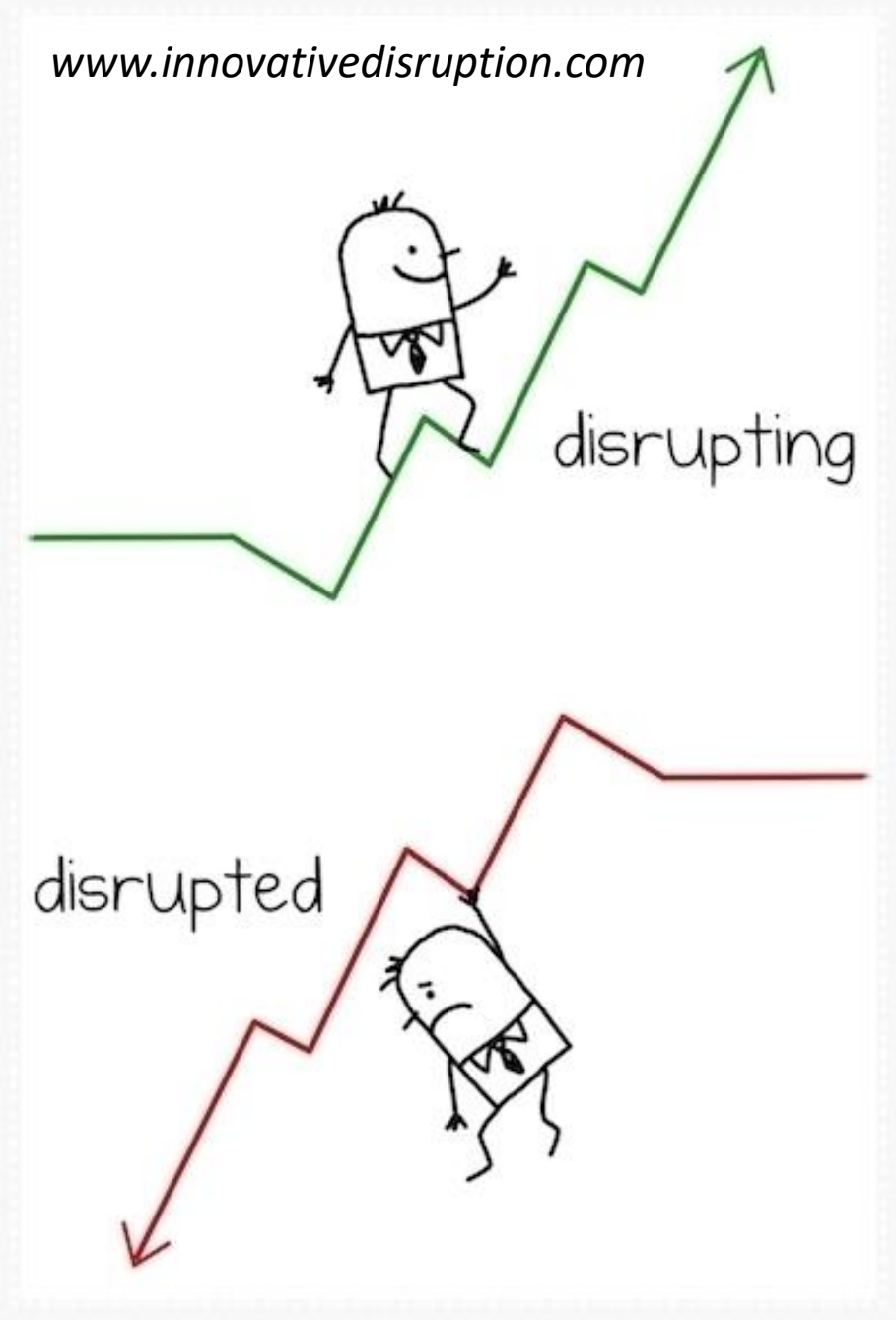
Infra Challenge – also Aurora

- How should roads be instrumented to support proactive maintenance, intelligent infrastructure asset management and connected and automated driving?
- How can maintenance processes be automated? What kind of maintenance do connected and automated vehicles require?
- How automated data acquisition processes could be utilised to support pavement management and daily maintenance (crowd sourcing)?
- How connected and automated driving will affect road wear

Alina Koskela 2018

Final remarks

- Strong policy support for development and roll-out of automated driving
- Liberal regulatory environment for L3-L4 automated vehicle testing and also driving
- Open data, very good LTE road network coverage
- Cellular C-ITS is the way to go
- Small country, small markets
- R&D organisations and small companies build up automated vehicles of their own
- R&D focus
  - Adverse weather and especially winter conditions
  - Digital and physical infrastructure
  - Shared and public transport



Questions?