

# The development of autonomous road maintenance

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# Road maintenance development

Mechanization

*"From horses to machine"*

Trucks and equipment

*"Cost efficiency"*

Control system and data  
collection

*"Automation"*

Cloud services, AI,  
robotics

*"Autonomous road  
management"*



1950

1990

2000

2010

2020

# Development of autonomous road management



Autonomous  
Road  
Maintenance  
Vehicle

Autonomous  
machines

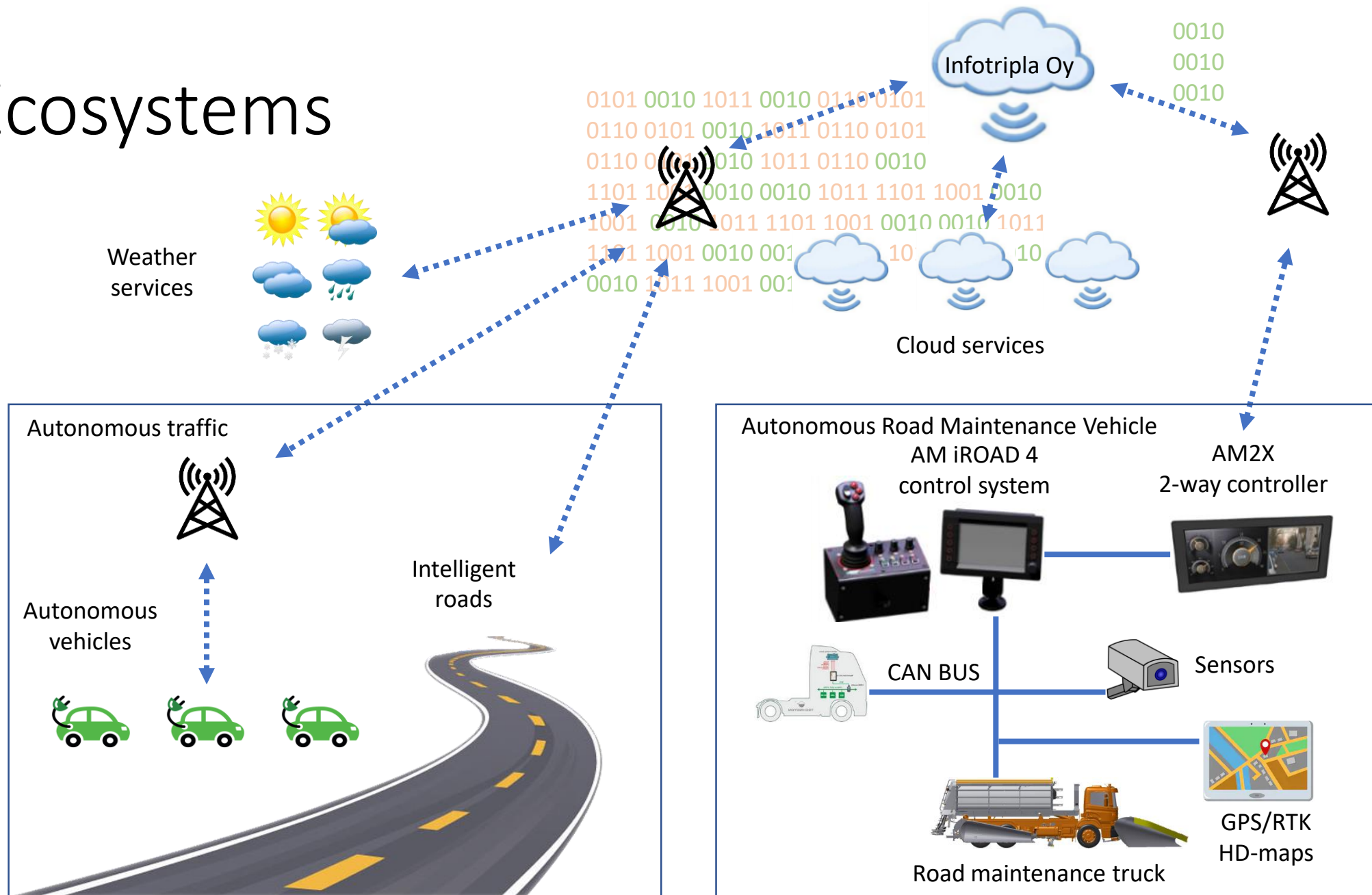
Intelligent roads  
and background  
systems

Autonomous  
vehicles and  
transport

Machines  
automation



# Ecosystems





# Semi autonomous road maintenance truck

- Semi-automatic road maintenance truck tested in Muonio on Aurora road as part of Infra Challenge (2018)
- Controlled the working width of the side plow following shape of the road marking and bus stop
- Snow jet control at road signs
- Obstacle detection with sensors, side plow collision automation
- Automatic spreading width and spread amount control via cloud service
- Utilizing high definition map and precision positioning to identify road markings, ramps, traffic signs etc.



# Semi autonomous road maintenance truck



1. Side Plough AM SHJ 212 with snow jet control and working width detection
2. Front Plough AM 4600 LPC Silent Highway Plough with Flexible Blades
3. Automatic Spreader **AM 5000 Combi**
4. Two Way **AM2X** control system with data communication to cloud services
5. Data collection device **AM Telemetry**
6. Positioning Devices GPS/RTK
7. Observation Sensors **Radar, Thermal Camera and 3D-camera**



# Sensors

## 1. Radar

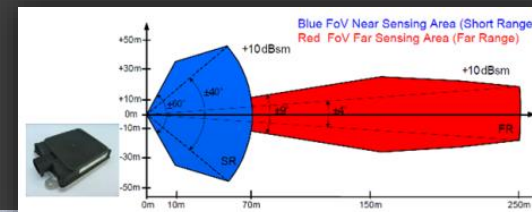
- Metal-containing objects are detected regardless of the conditions
- Detects objects in snow fall and inside the snowbank
- Works in all weather and light conditions
- Does not detect person / items that do not contain metal
- Long detection distance

## 2. Thermal Camera

- Detects surface temperature differences at any light condition (daytime/night vision)
- Human and animals
- Long detection distance
- Visibility weakening at snow fall and rain

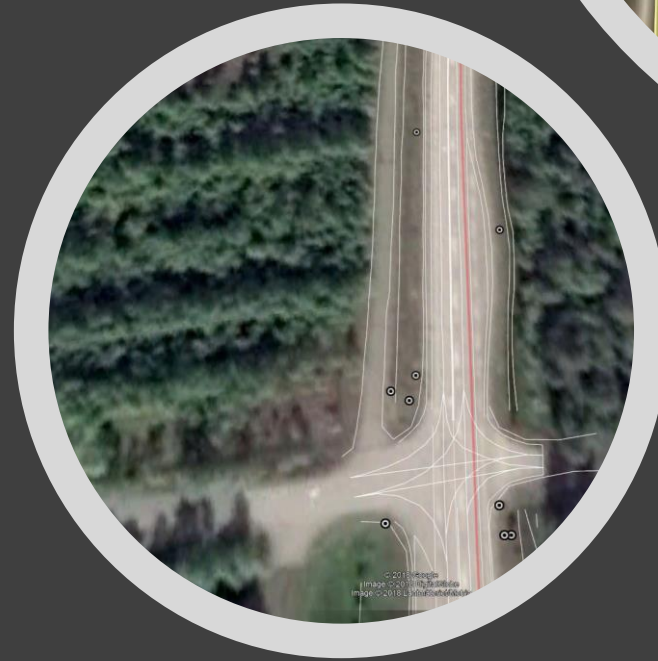
## 3. 3D-Camera

- Machine vision application
- Human, animals, objects as vehicles
- Short detection distance
- Infrared amplifier assists in the dark



# High Definition maps “HD-map”

- Road marking lines (side + center)
- Bus stops, ramps + others widening areas
- Traffic signs
- RTK positioning to within a few centimeters

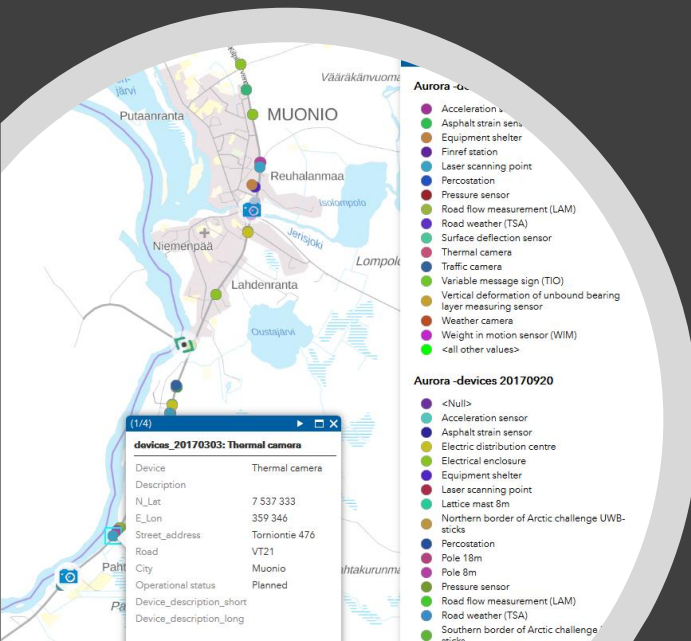
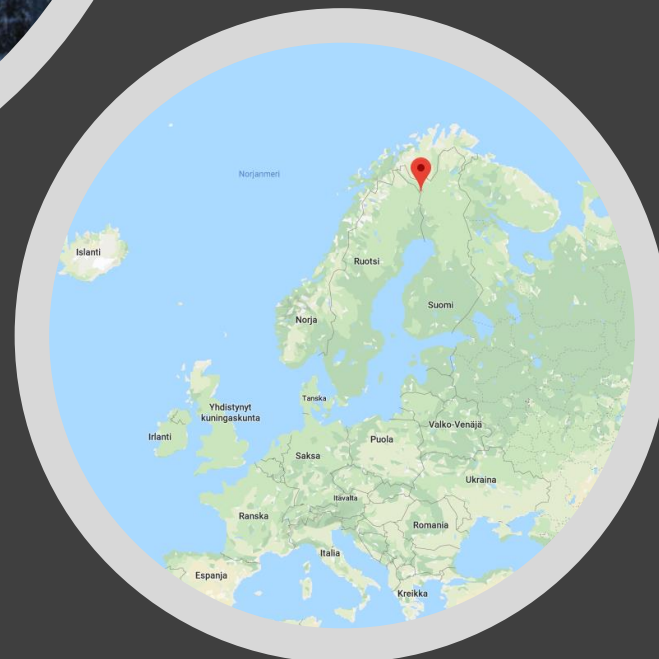






# Aurora-intelligent road

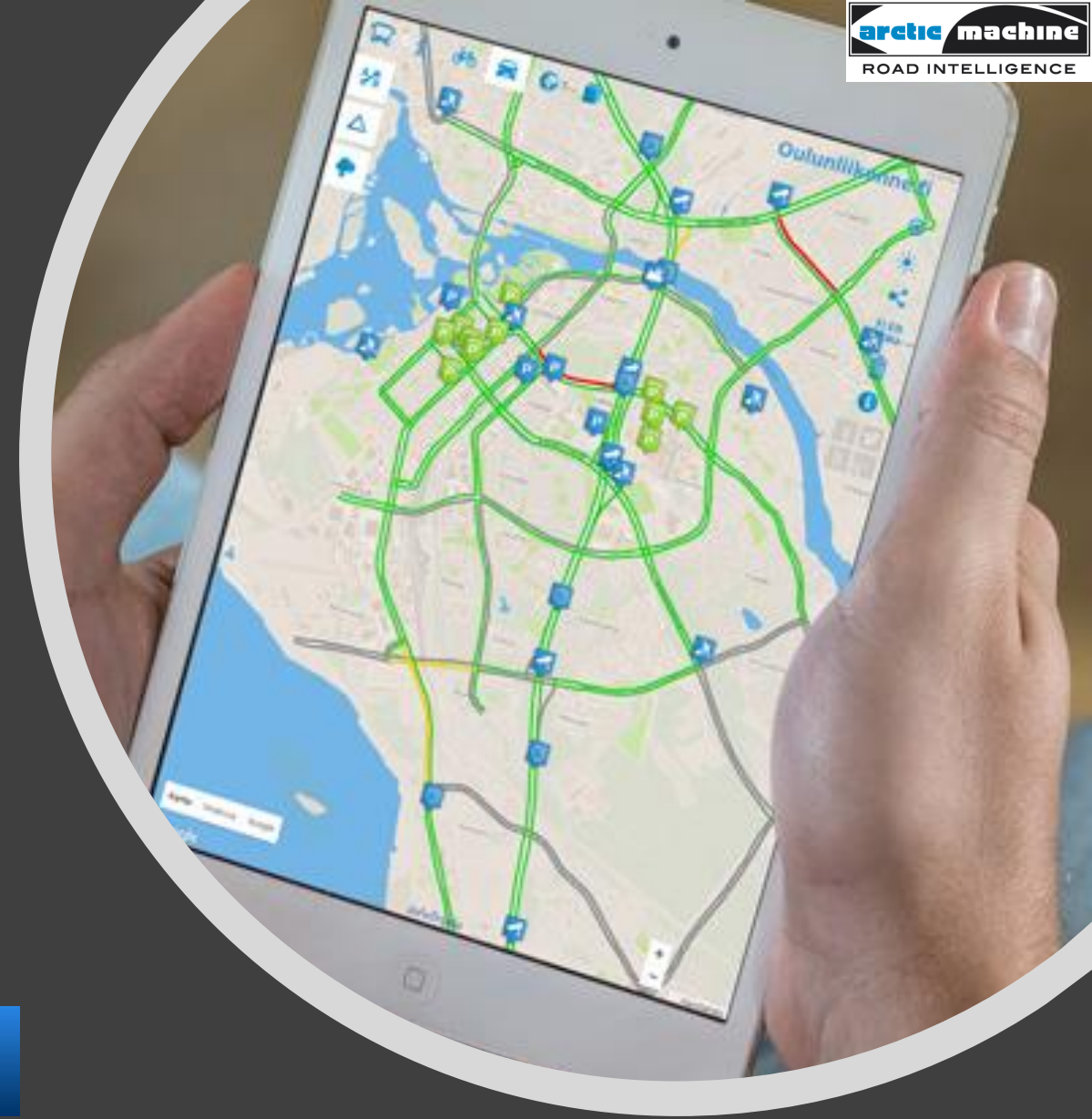
- The ten kilometer (Pahtonen - Puthaanranta) intelligent road on Muonio highway 21 offers the conditions for testing automated vehicles and related technologies in challenging road and weather conditions.
- Equipped in great numbers with various sensors
- High-speed data communications
- Arctic condition in the winter season for testing



# Road management background systems

- Real-time full picture in the cloud service
- Weather forecasts and weather information (by location)
- Advance work plan and measure information
- Mobile sensors, intelligent road data
- 2-way AM2X control system, communication between road maintenance truck and cloud service

**infoTripla**





# Summary

- Various technologies tested in many projects (land, offshore, agriculture etc.)
- Almost all manufacturers have autonomous projects on going
- Integration of technologies
- Levels of autonomy in traffic, road maintenance
- Functioning and reliable infrastructure
- Legislation? → Privacy Policy (GDPR), robot traffic regulations, morality and liability issues, etc.
- Dream or reality?

## 5 Stages of Automation

### 1 Driver Only

Vehicle handles all driving, steering, braking, etc.

### 2 Assisted Driving

Vehicle handles some functions such as emergency braking, lane-keeping, etc.

### 3 Partially Automated

Vehicle handles at least 2 functions such as cruise control and lane-centering.

### 4 Highly Automated

Vehicle handles all functions, but driver is required to be able to take control.

### 5 Fully Automated

Vehicle handles all functions automatically. No driver required.



# Thank you!

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