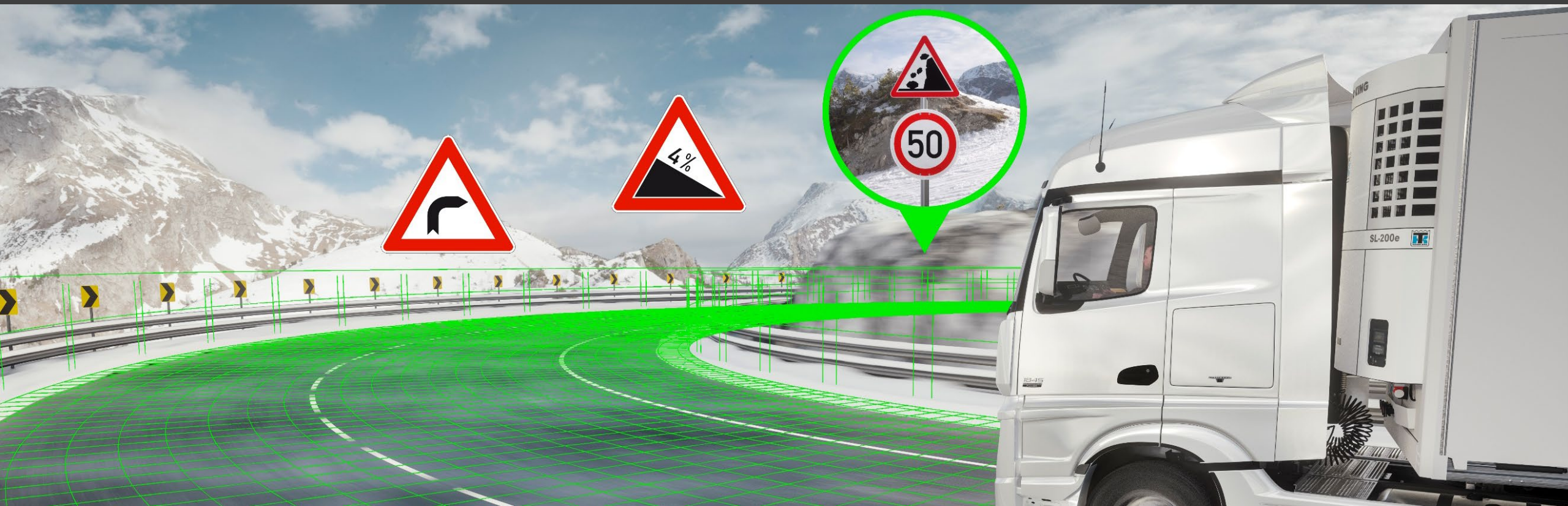
NDS + ADASIS: Bringing maps to vehicle and driving functions

Elektrobit

Roman Dolgov, Project Manager, Elektrobit
1st NDS public conference, June 13, 2019



Agenda

1. Map data:
   Enabling a safe and comfortable automated driving experience

2. Manage complexity by using the NDS standard

3. Providing map data via an electronic horizon

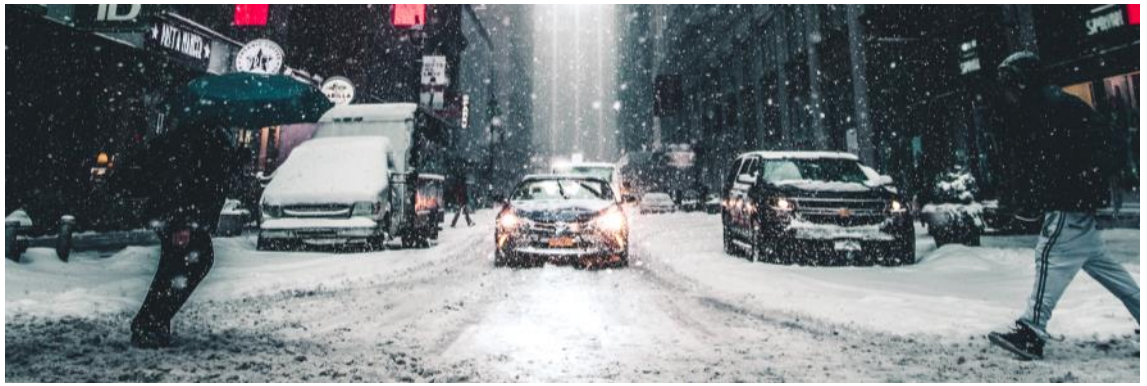
Challenges for safe and comfortable automated cars

Complexity

Unusual situations

Hazards

Difficult conditions



Applications benefitting from map data

Full automation

RoboTrucks

Mobility as a Service

Partial, conditional, and high automation

Traffic Jam Assist | Highway Pilot | Platooning | Automated Valet Parking | Urban Driving

Active driver assistance systems

Adaptive Cruise Control | Forward Collision Warning | Lane Keep Assist

Economic/ecologic assistant systems

Eco Drive Assist | Range Control Assist | Diesel Particulate Filter Control | Power Train Control

Passive driver assistant systems

Intersection Warning | Traffic Sign Assistant | Curve Speed Warning | Predictive Curve Light | Night Vision

past — today — future

Evolution of automotive map requirements

COMPLEXITY / FUNCTIONALITY

TIME

PAST

TODAY

FUTURE

NAVIGATION

Navigation Data Standard

- Standard navigation maps
- Map attributes used for drivers only
- TMC traffic data
- Annual map update
- GNSS positioning

DRIVER ASSISTANCE

- Standard navigation maps and ADAS attributes
- Reliability of few ADAS attributes as needed for ADAS functions
- Online traffic, third-party content
- More frequent map updates
- GNSS & dead reckoning positioning

AUTOMATED DRIVING

- HD maps: highly precise information about the lanes and objects ahead
- Up-to-date information about speed limits, geometry and curvature, street type (crossroad, motorway, …)
- High reliability of dedicated ADAS attributes
- Online traffic, third-party content
- On-demand daily map updates
- Lane accurate positioning/localization

The need for high-definition maps

- HD maps offer highly accurate geometry of the lanes on the road
- Additional elements like road furniture or point clouds provide reference data for localization using various sensors
- Widespread coverage already available across Europe, America, and Japan through different map suppliers
- Highly accurate dynamic data created through crowed data

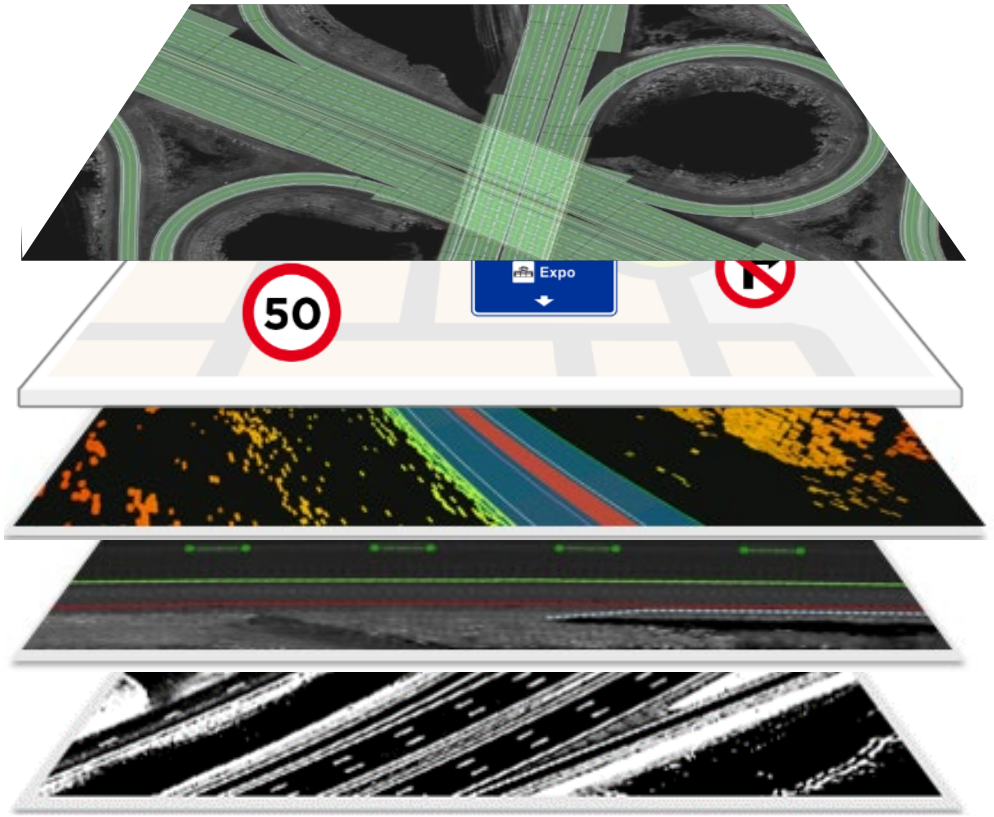
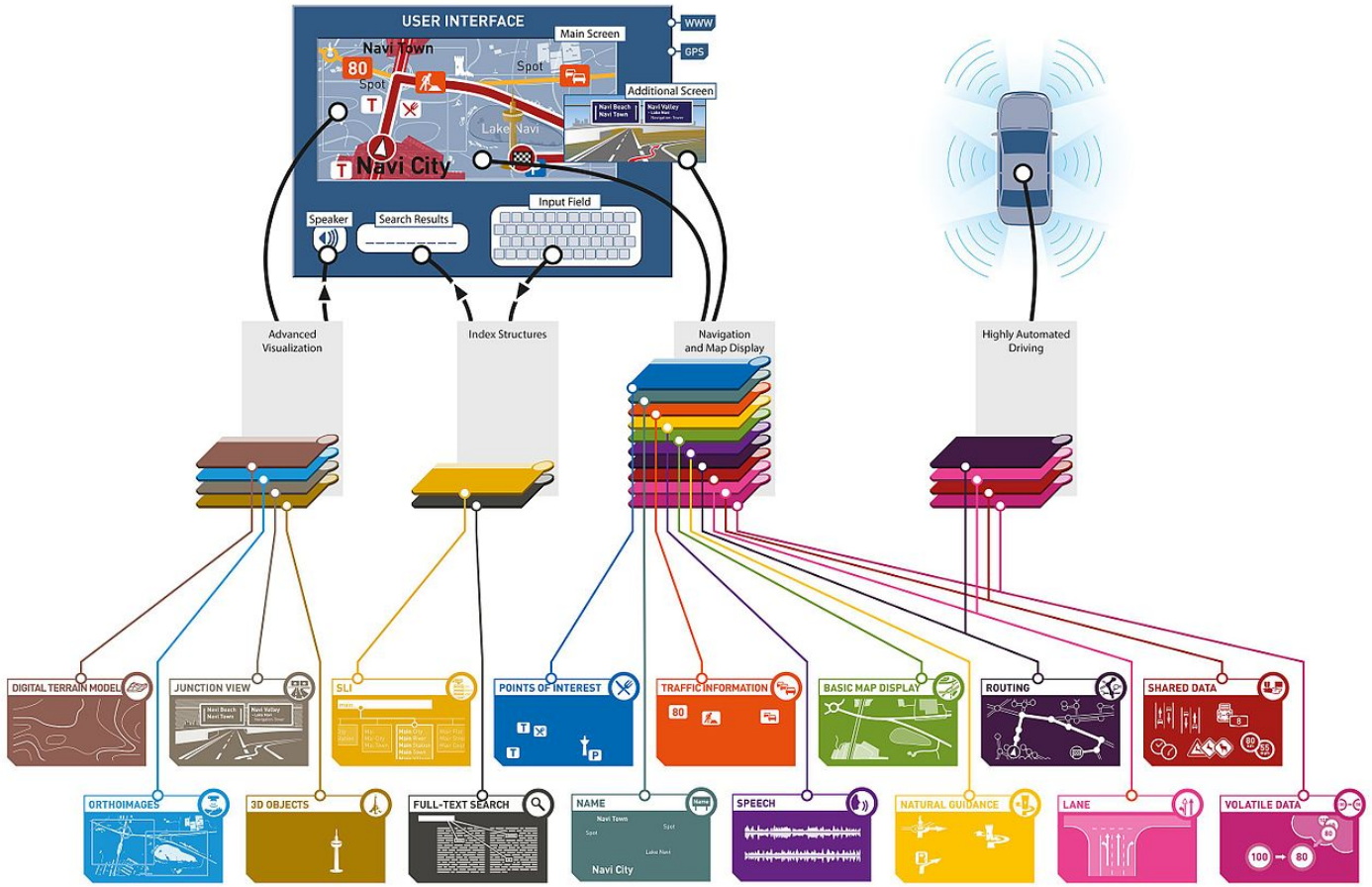


Image by TomTom

Versatile map attributes managed in one standard: NDS



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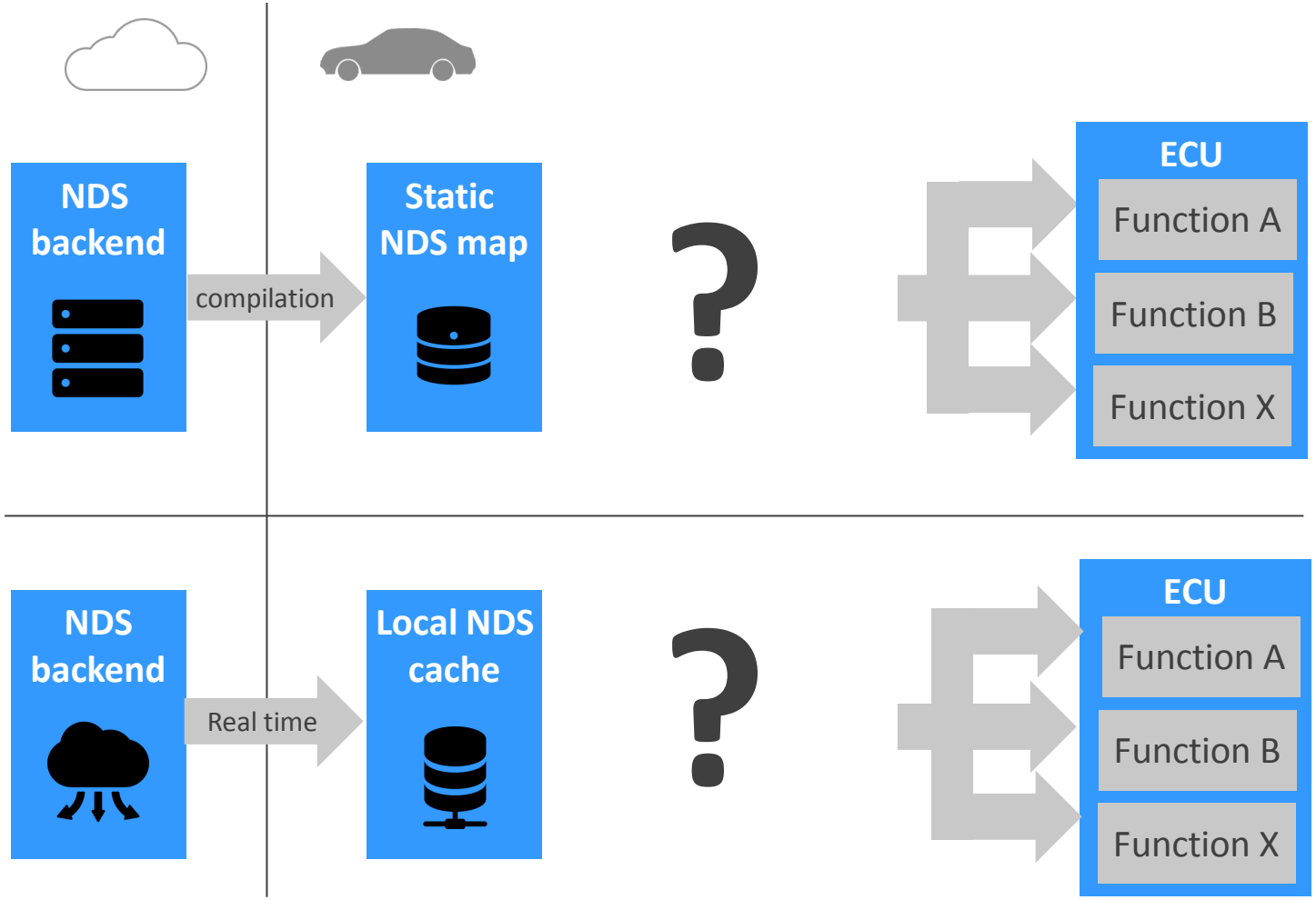
Navigation Data Standard

- Standardized map database format
- Separation of navigation software from navigation data, to enhancing flexibility
- Support of incremental updates, compactness and protection against illegal use

NDS standard and ADASIS: maps for in-vehicle applications



Standard maps for ADAS applications:
- Maps based on road geometry
- Stored locally
- No automatic map updates

HD maps for HAD applications:
- Maps based on lane geometry
- Stored in backend, cached locally
- Always up-to-date maps

Generating an electronic horizon

- An electronic horizon translates available map information into usable data for ADAS and automated driving applications
- Distributing map data to other modules (ECUs) on-board of the vehicle, complementing sensor data
- ADASIS Advanced Driver Assistant Systems Interface Specifications the established standard for map data distribution within the E/E system

Scope of the ADASIS forum

Advanced Driver Assistant Systems Interface Specifications

Advancing map-enhanced driver assistance systems

Group of global vehicle industry and suppliers

Interfaces for exchanging information between in-vehicle map database and ADAS/AD applications

Applications to access map sources, build predictive and vehicle environment data based on map/position/georeferenced data

Defacto standard used worldwide

2012: ADASIS v2 specification release, supporting e.g. Predictive Powertrain Control, relying on SD maps

2014: Start of development of ADASIS v3 with support of HD maps as enabler for automated and autonomous driving

2018: Stable ADASIS v3 specification

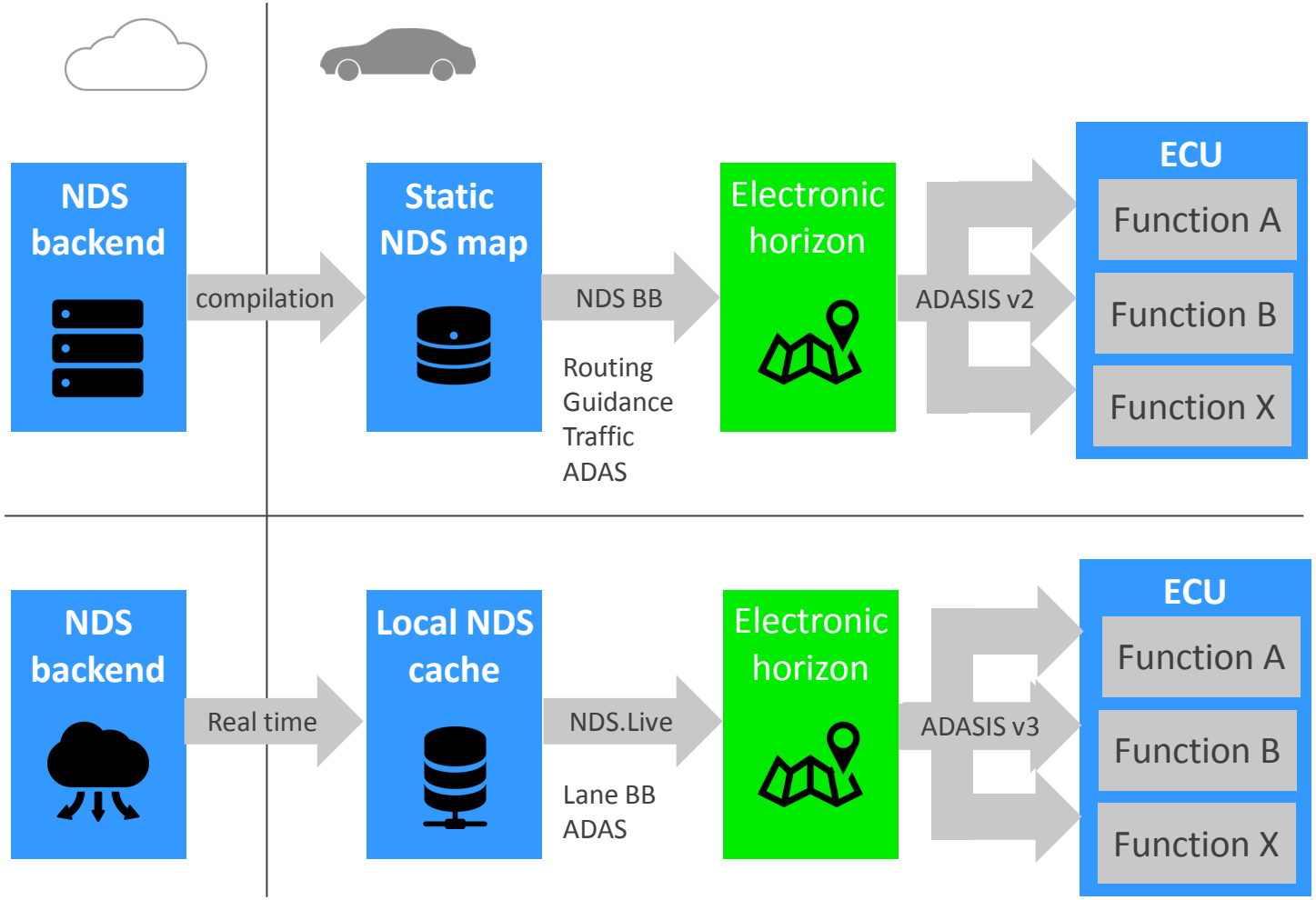
2019: EB provides first reference implementation and Eval Kit to the forum

2020: First expected SOP with ADASIS v3

Comparing ADASIS v2 and v3

	ADASIS v2	ADASIS v3
Purpose	Standard and ADAS map with road-level data for advanced driver assistance applications	High-definition map with lane-level data for automated driving
Vehicle bus	Designed for CAN bus	Broadband connection (Ethernet, TCP/IP)
Communication scheme	Broadcast communication: ▪ 1 provider, n clients	Bi-directional communication mechanisms supported: ▪ Broadcast for most probable path (MPP) ▪ Publish-subscribe (P2P) for additional attribute information ▪ Multiple sub-provider
Electronic horizon road network representation	Single tree support	Support for multiple independent trees
Most probable path (MPP) and tree length	Up to 8190m (13 bit)	Ca. up to 43.000 km (32 bit)
No. of possible profile types	31 attribute profiles	Room for up to 2^{32} bit possible profiles, 45 types currently specified
Profile attribute value range	Profile short: 10 bit Profile long: 32 bit	64 bit for all profile attributes
Attribute resolution	Meter [m]	Centimeter [cm]
Content	▪ Standard map attribute profiles on link level ▪ Traffic data	▪ Map attribute profiles on lane level ▪ Extended road lane model | detailed intersection model ▪ Road boundaries / furniture / land marks

NDS standard and ADASIS: maps for in-vehicle applications



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- Electronic horizon protocol: ADASIS v2

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Evolution of automotive map requirements

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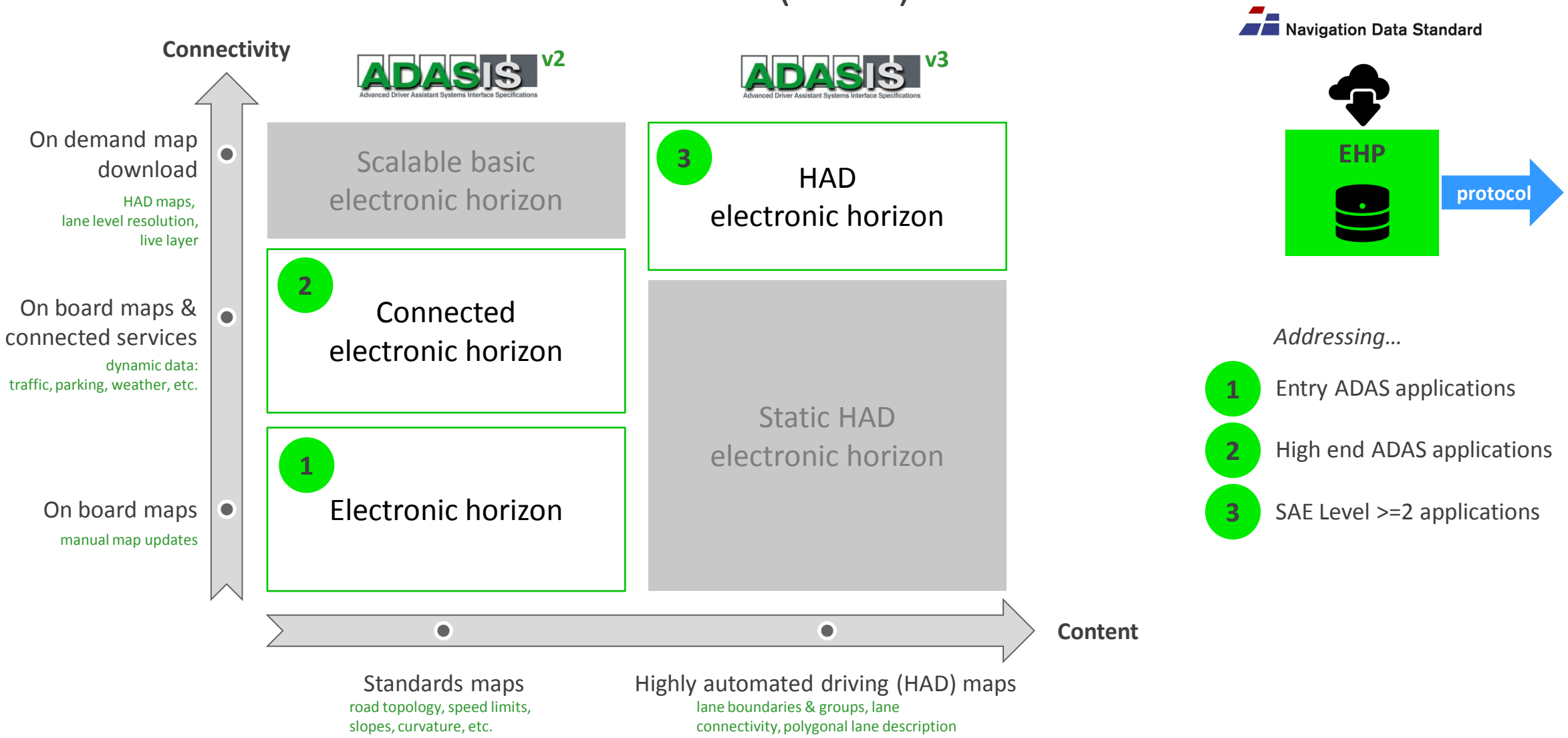
TIME

PAST TODAY FUTURE

Electronic horizon – Provider (EHP)



EB robinos Predictor Eval Kit: ADASIS v2 and ADASIS v3 Provider

Record test drives and play them back in exact timing behavior at your desk

- ✓ **Use a robust and series-ready ADASIS Provider for your R&D activities**
- ✓ **ADASIS v2: Use Q3/2018 NDS MapScape maps, EU, and NAR**
- ✓ **ADASIS v3: Use HERE or TomTom online HD maps**
- ✓ **Use GNSS receiver as positioning source**
- ✓ **Record / Replay your tracks of all test drives**
- ✓ **Configure your ADASIS v2 Provider**
  - ➢ **Configure your CAN connection and CAN layout**
  - ➢ **Configure your applied maps (EU / NAR)**
  - ➢ **Configure ADASIS protocol settings**
- ✓ **Connect easily with any mobile device (PC, tablet, mobile phone) via LAN/WiFi (WebApp) for configuring and controlling your Eval Kit**

Dont miss the demo!

Plug in power supply and start!

Give it a try!

Network:	**EBRaspi**
Password:	**elektrobit**
WebApp:	**192.168.42.1:5000**

Let‘s conclude

Versatile and high data amount is kept under control by using the NDS standard

ADASIS v3 electronic horizon is a standardized way of providing HD map data to on-board units

We see NDS and ADASIS as a perfect bundle for automated and autonomous driving functions

Navigation Data Standard

ADASIS
Advanced Driver Assistant Systems Interface Specifications

Thank you! Questions?

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