Future IT-architecture on-board vehicles

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The situation

- IT-systems on-board vehicles perform essential functions for Ruter
  - Fare Collection
  - Passenger Information
  - Automatic Passenger Counting (APC)
  - Automatic Signal Prioritisation (ASP)
- The systems are designed and developed «years ago» and does not meet current expectations in regards to modularity, interoperability and way of communicating with other systems

The situation

- There are additional systems on-board that perform important functions for the operators e.g Fleet Management (FMS)
- Certain functions are needed for both system categories
  - Information display for the driver
  - Geo-positioning system
  - Communications solution

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In summary

IT-systems on-board vehicles are «individual» systems (silos)

The installations are **complex**, **static** and **expensive** (both in regards to installation and operation)

The responsibility for the systems are spilt between the operator and Ruter

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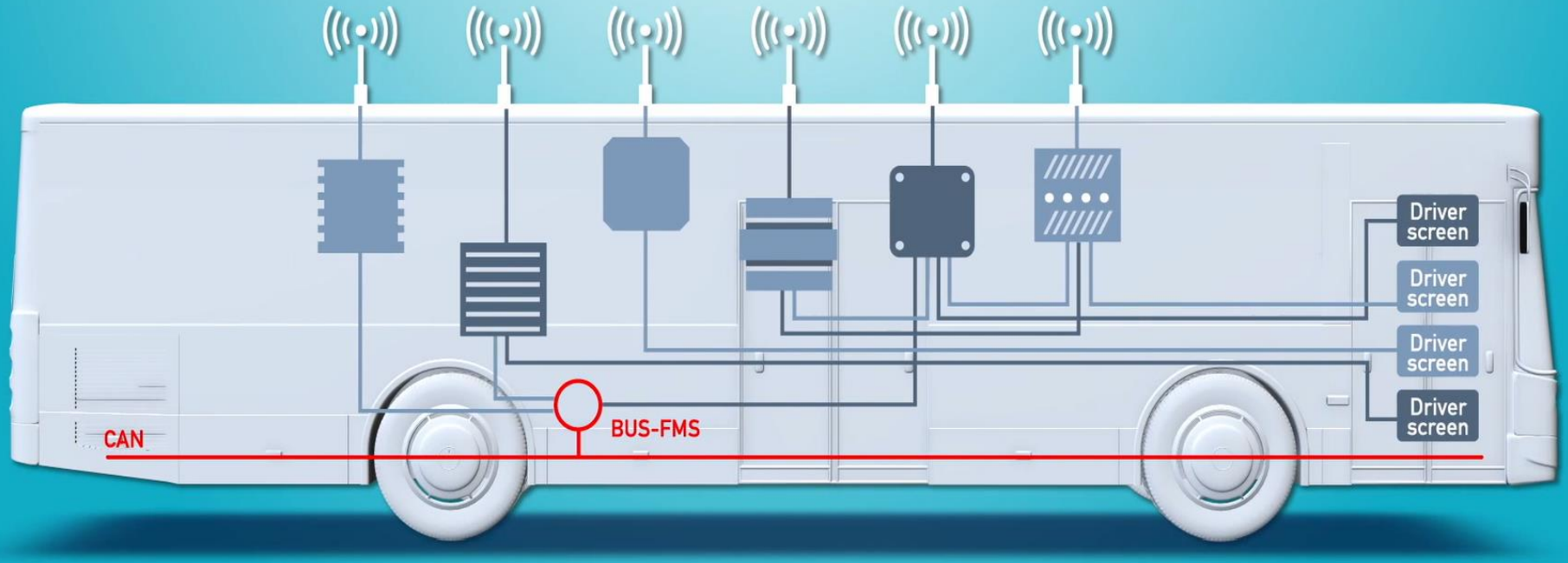
today


Driver screen
Driver screen
Driver screen
Driver screen
CAN
BUS-FMS

Future solution

- Use standards (where relevant)
- Ruter is an active contributor and participate nationally
  - SNK175
    - CEN/TC 278
    - ISO/TC 204
  - SVV
    - Håndbok xxx
- ..and internationally
  - ITxPT
    - Executive Board
    - Various WGs

1 Formal standardization bodies
- 1.1 World standardization bodies
  - 1.1.1 ISO TC204 WG8 (WORLD)
  - 1.1.2 IEC TC9 WG43 and WG46 (WORLD)
- 1.2 Europe standardization bodies
  - 1.2.1 CEN TC278 WG3 : ITS / Public Road Transport (EUROPE)
    - 1.2.1.1 WG3-SG1 : On Board Data Bus Transmission (EN13149)
    - 1.2.1.2 WG3-SG4 : Reference Data Model (TRANSMODEL)
    - 1.2.1.3 WG3-SG7 : Standard Interface for Real-Time Information (SIRI)
    - 1.2.1.4 WG3-SG9 : Network and Timetable Exchange (NeTEx)
  - 1.2.2 CENELEC TC9X WG15 (EUROPE)
- 1.3 National standardization bodies

2 National bodies working on core specifications
- 2.1 VDV - Association of German Transport Companies (GERMANY)
- 2.2 RTIG (UNITED KINGDOM)

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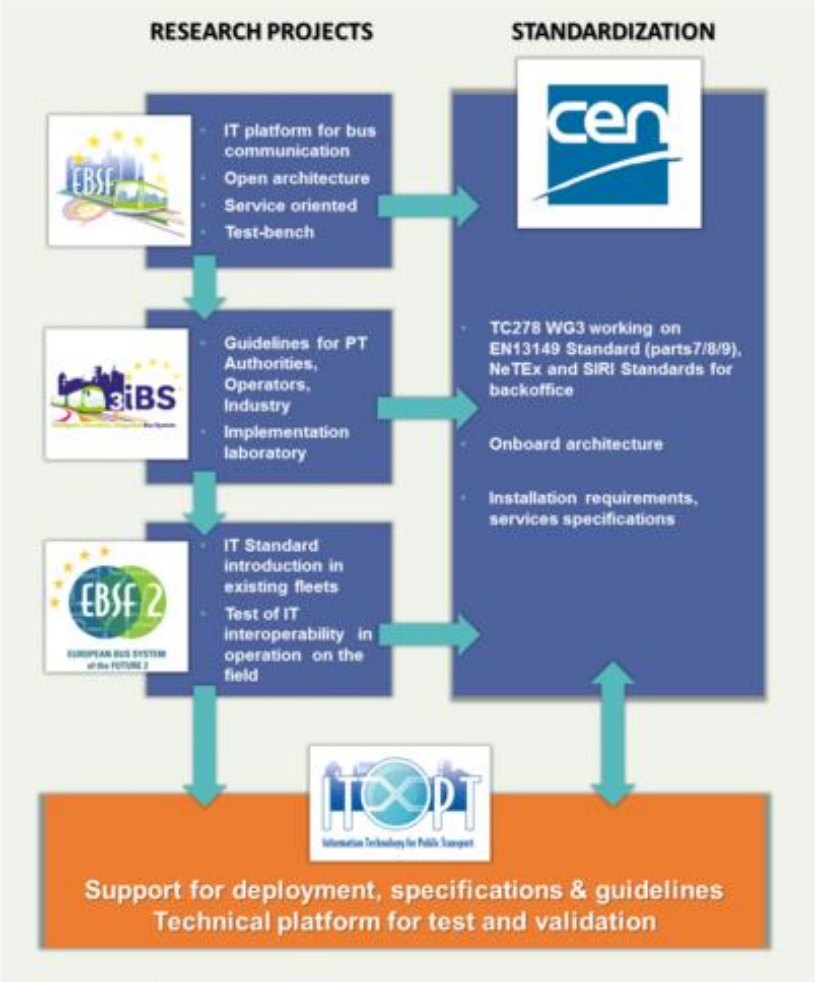

Information Technology for Public Transport

www.itxpt.org

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Future solution

- ITxPT builds upon
  - EBSF Project (European Bus System of the Future)
  - 3iBS Project (Intelligent, Innovative, Integrated Bus System)
- The purpose of ITxPTs
  - Support the implementation of standards and to provide an arena for sharing experiences within «plug & play» IT-solutions on-board vehicles
  - Contribute in the development of EN 13149-7/8/9 through thight collaboration with CEN/CENELEC (TC 278 and relevant WGs)

- 3 Formal Standards
  - 3.1 Onboard data communication
    - 3.1.1 IP-based standards
      - 3.1.1.1 EN13149
        - 3.1.1.1.1 Part 7 : Network and System Architecture
        - 3.1.1.1.2 Part 8 : Physical Layer for IP-communication
        - 3.1.1.1.3 Part 9 : Services Specifications
    - 3.1.2 CAN-based standards
      - 3.1.2.1 ISO11898
        - 3.1.2.1.1 SAEJ1939 : high-speed CAN
        - 3.1.2.1.2 Bus-FMS group
  - 3.2 Back Office data communication
    - 3.2.1 SIRI - Service Interface for Real-time Information relating to public transport operations - CEN/TS 15531
    - 3.2.2 NeTEx - Network and Timetable Exchange - CEN/TS 16614
    - 3.2.3 TRANSMODEL
- 4 National Core Specifications
  - 4.1 VDV 301 : IBIS-IP
    - 4.1.1 Part 1 : System Architecture
    - 4.1.2 Part 2 : Interface Specification
  - 4.2 RTIG T030 : Digital Air Interface Protocol

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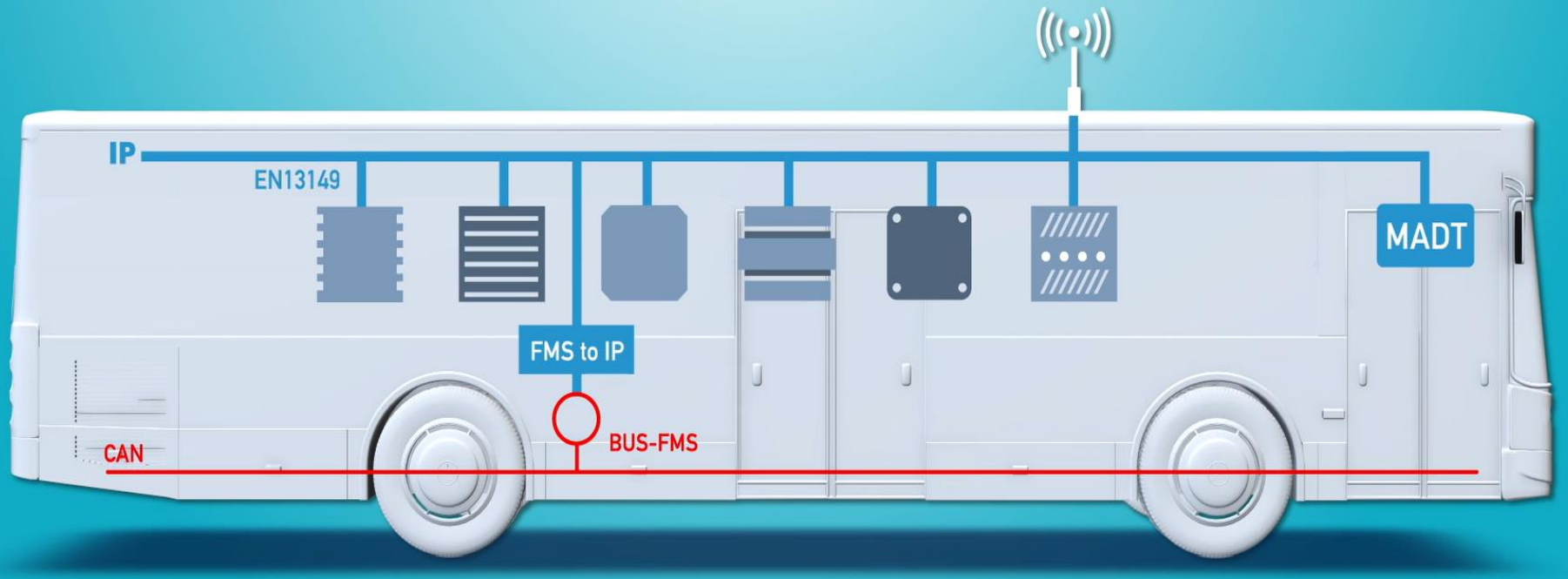
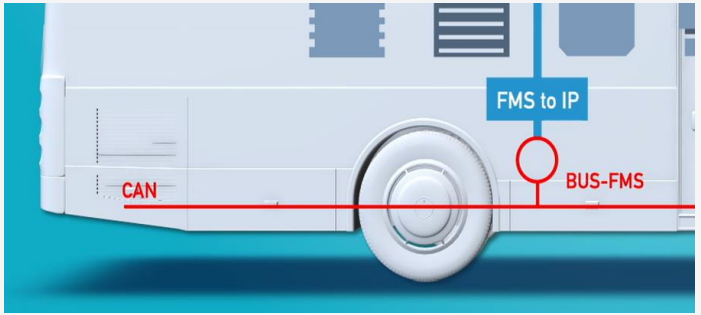
future



Future solution



- Vehicle-specific networks are not IP-based
  - CAN = Controller Area Network (bus)
  - TCN = Train Communications Network (tram)
- «BUS-FMS interface» and «FMStoIP gateway» will ensure that the vehicle-specific systems can connect to the new IP-network thus allowing resource-sharing

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In summary

- Ruter wish to adopt existing standards as quick as practically possible such that they will be implemented in the vehicles commencing operation towards the end of this decade
- Ruter will continue the development of its systems such that
  - IT-systems on-board will be generic, stand alone and independent of Ruters business logic – which will be implemented in the backend platform
  - Relevant information is shared with other on-board systems via the on-board IP-network
  - Communication between the vehicle and the backend platform is in real-time and «always on»

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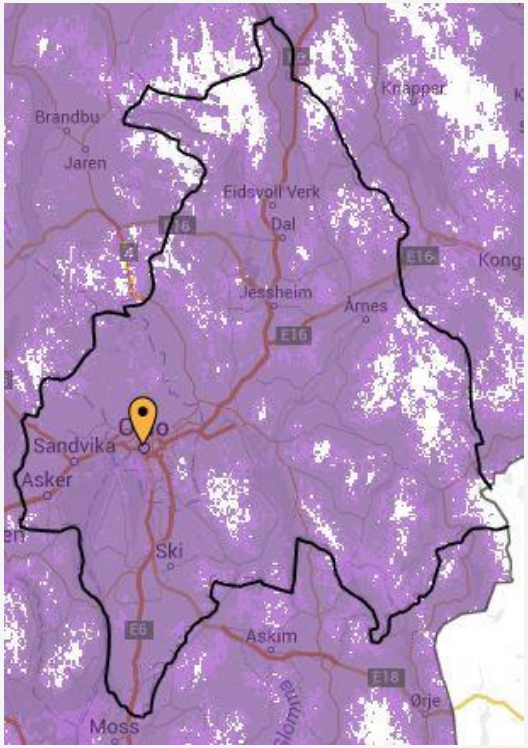
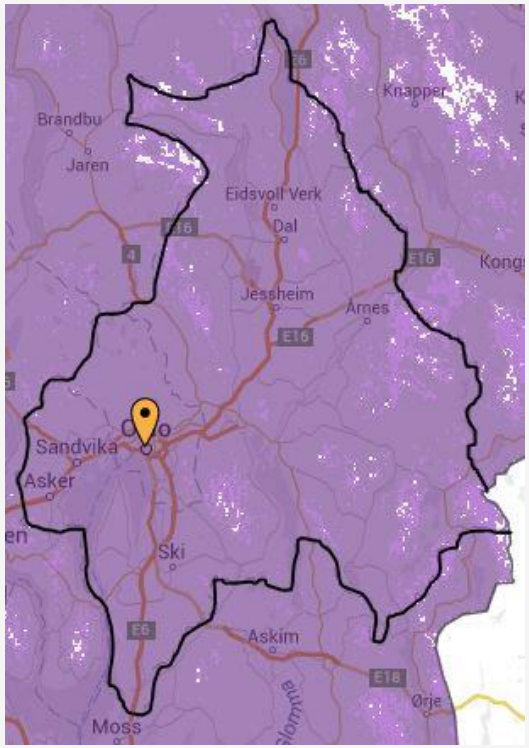
We have the mobile coverage

4G





EDGE (2G)

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Future solution

- Ruter have recently entered into parallel frame-agreements for the provision of
  - APC systems for some 400 buses to be installed during 1H 2017
  - VCG for the same buses that will connect the buses on-line to Ruters backend platform as well as providing continuous geo-location
  - Ruter have developed a new backend platform that are capable of receiving the data from these buses

Future solution

- In 2016, Ruter launched a project that evaluates alternatives for the next generation (NextGen) IT-systems
  - Fare collection
    - Fully automated (BIBO) Fare Collection System based on beacons and app’s
  - Passenger Information
    - Route information for on-board displays and announcements dynamically provided to the vehicle from the backend platform based on the actual position of the vehicle

QUESTIONS

- Ruter wish prepare new vehicles for its NextGen systems by adopting existing standards for IT-architecture on-board
- Ruter wish for the operator to take full responsibility for the vehicle – incl the on-board IT-equipment itself
  - Ruter would only specify functional requirements

- Are you able to support the new standards in time for 2019 operation ?

- Are you willing to accept full responsibility for the vehicles ?
- What are the pros & cons ?
- What would you require from Ruter ?

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Please provide your feedback by February the 24th

Ruter will then invite you to separate meetings to elaborate and discuss

Send your response to

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