MUNICH
Connext® 2018

April 24-25

Soji Jose Iyamvelil and Heiko Ruth

System Engineer and Head of Systems
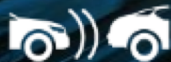
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...As your partner for development and validation of future mobility applications

We provide you with effective solutions and innovative products - from system design, software development and data engineering to final validation

In the fields of

ADAS   AD   E-Mobility   Connectivity   HMI   Measurement Technology

Our locations

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Eschborn
Sales & Development Center

Aurangabad (India)
Joint Venture EC.MOBILITY

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Sales & Development Center

Ingolstadt
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Lindau
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Böblingen
Calwer Straße 27
D-71034 Böblingen

Krefeld
Gimesgath 5
D-47803 Krefeld

Eschborn
Niederurseler Allee 8–10
D-65760 Eschborn

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Kemptener Straße 99
D-88131 Lindau/Bodensee

Ingolstadt
Hans-Denck-Straße 17
D-85051 Ingolstadt

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Lyonel-Feininger-Straße 28
D-80807 München

Koblenz
Friedrich-Mohr-Straße 14
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Aurangabad
EC MOBILITY PVT LTD
MIDC, Chikalthana,
IND-Aurangabad – 431003

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ADAS & AD Development & Validation Loop

Integrated Data Solutions

System Engineering
Requirements Engineering
Simulations
Benchmarks

Software & Algo Development
Embedded Software
Intelligent Algorithms

Integrated Measurement Systems Design
Software
Hardware

Integrated Reference Systems Design
360° referencing
Driver Monitoring

Vehicle Prototyping
Test Vehicle concept Design
Vehicle Instrumentation

Data Collection
Fleet Management
Test Drives

Data Annotation
Annotation tool
Scalable workforce

System Validation
Development & Validation Framework
System Test Services
Data Analysis

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- CMORE Automotive

- **PODBOX – Multi diagnostic device for automotive application**

- Motivation

- CMORE Diagnostic Service

- RTI Connext DDS Solution

- System Architecture

- CAN-DDS Gateway Diagnostic System

- Demonstration

- Future Work

PODBOX
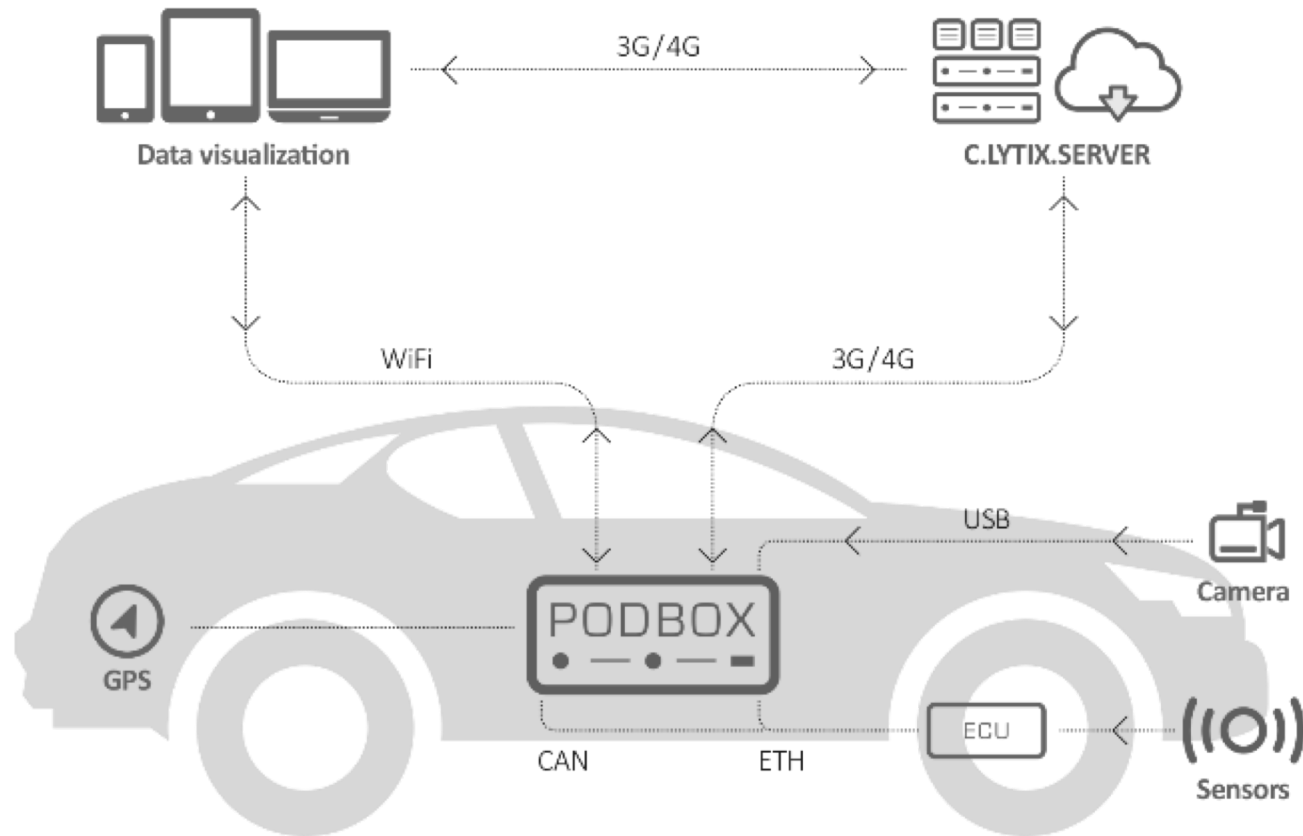Multi diagnostic device for automated driving and ADAS

Standard Functions

- PB Log - Logging of bus/sensor data

- PB Tagging Tool – Real time tagging

- PB Smart Measurement – Visualization of Sensor Data

- PB In-Vehicle Diagnostic

- PB In-Vehicle Test

- PB In-Vehicle Report

Vehicle, Cloud, User

Connection from anywhere in the world to your Prototype

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Standard Functions
PB Measurement

- Live measurement and visualization of in-vehicle data
- Graphical data visualization
  - Table View
  - Oscilloscope View
  - Bird Eye View
- GPS Trace
- CAN Trace
- Customizable UI

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Motivation
Autonomous driving

Autonomous Driving

Several diferent QoS at the same time

ADAS

QoS: Sensor – hard real time criteria

Connectivity

QoS: Security

HMI

QoS: soft real time criteria

Electro Mobility

QoS: Robustness

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Motivation
## Autonomous driving

- Challenge:

    - New Autonomous Driving Standards

    - System, Software and Data Integration

    - Diagnostic information from ECUs for validation

    - Distributed/Centralized diagnostic network and service

- Solution:

    - QoS based diagnostic service with multi diagnostic devices for autonomous driving

RTI DDS + CMORE PODBOX

RTI Connext DDS Solution

- RTI Connext DDS:

  - Network middleware for real-time application
  - Simpilfy application development, deployment and maintenance
  - Provide fast, predictable time-critical data distribution

- Components:

  - DDS Types, Topics, Keys, Instances and Samples
  - Publisher/DataWriter
  - Subscriber/DataReader
  - DDS Domain and DomainParticipants

RTI Connext DDS Solution
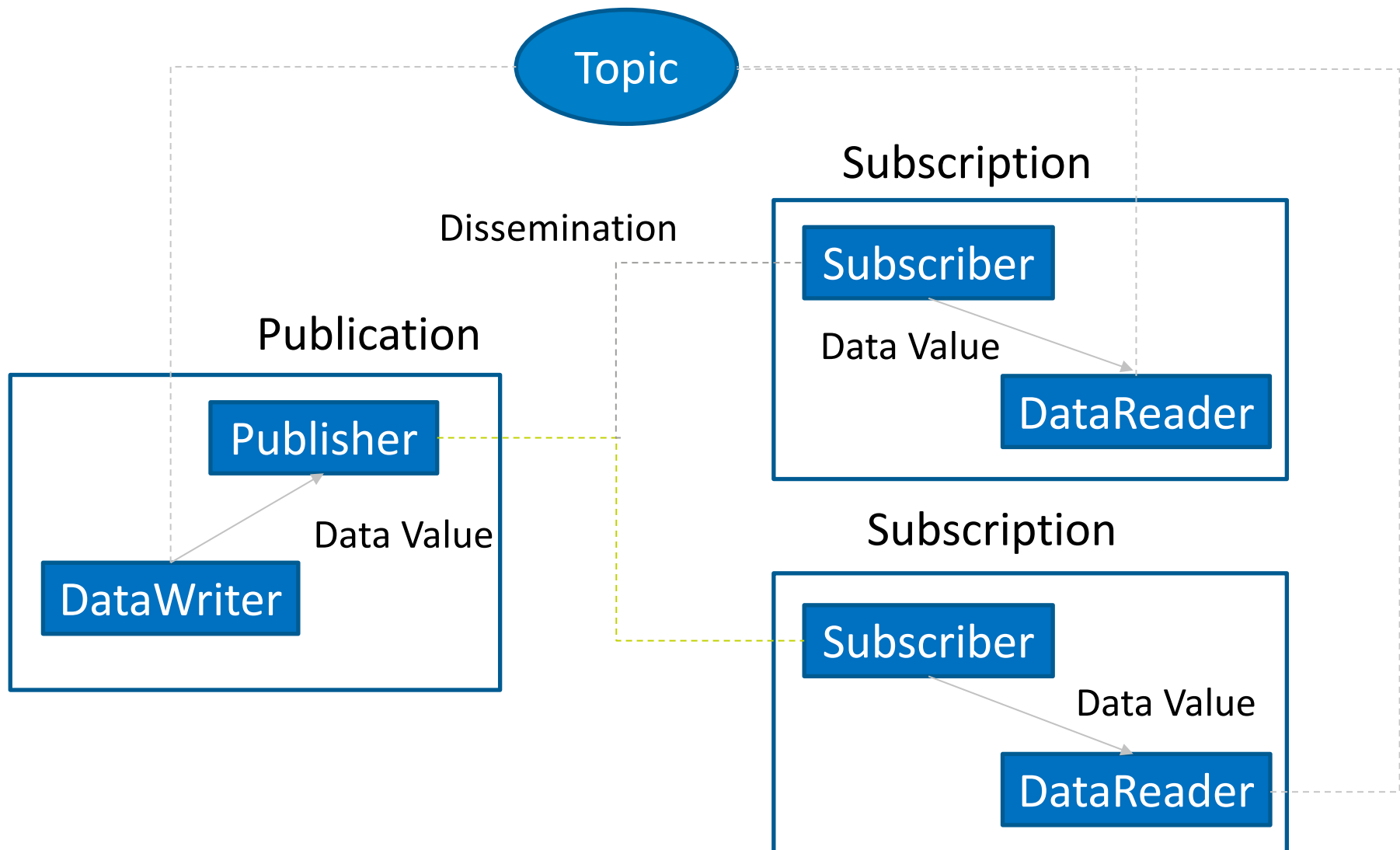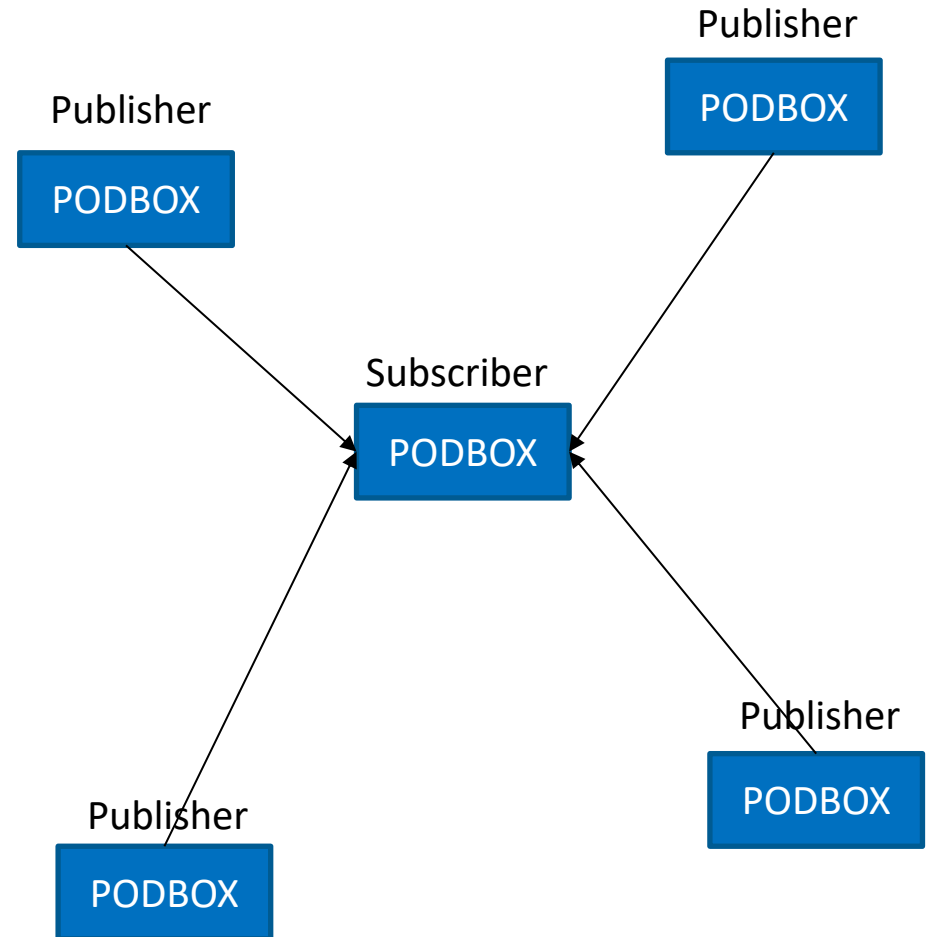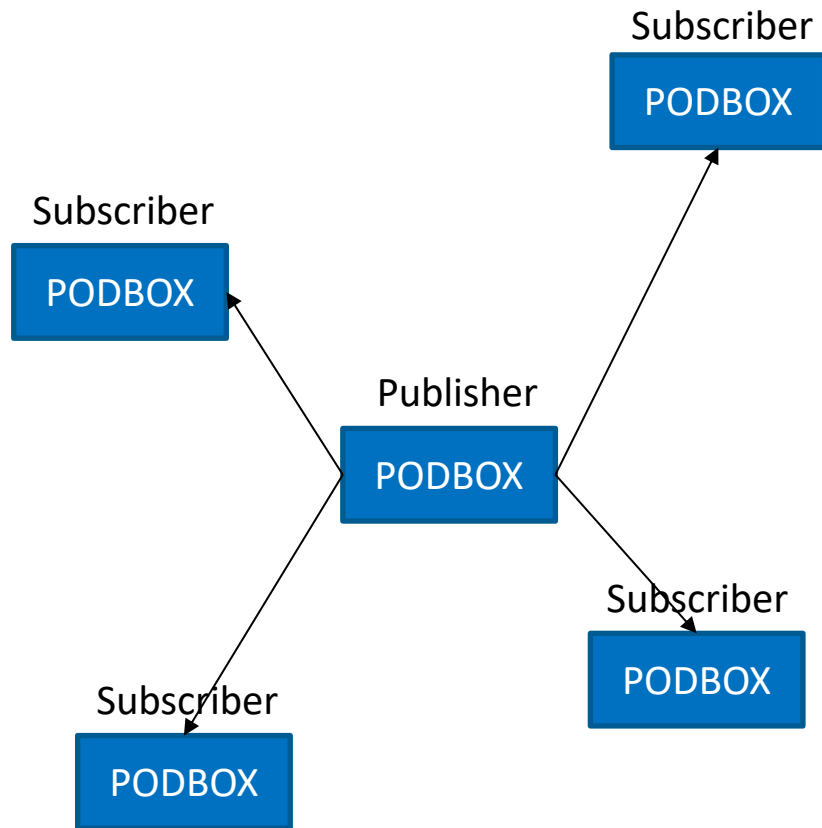
RTI Connext DDS Solution

- Features:

    - Data-centric publish-subscribe communication

    - User-defined data type

    - Reliable Messaging

    - Mutiple Communication Network

    - Symmetric architecture

    - Multiple-language support

    - Multiple-platform support

    - Compliance with Standards

    - QoS

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- RTI Connext DDS Solution

- **System Architecture**

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- Future Work

System Architecture
Centralized Strategy

Subscriber
PODBOX

Subscriber
PODBOX

Publisher
PODBOX

Subscriber
PODBOX

Subscriber
PODBOX

Publisher
PODBOX

Publisher
PODBOX

Subscriber
PODBOX

Publisher
PODBOX

Publisher
PODBOX

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System Architecture
Distributed Strategy

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- System Architecture

- **CAN-DDS Gateway Diagnostic System**
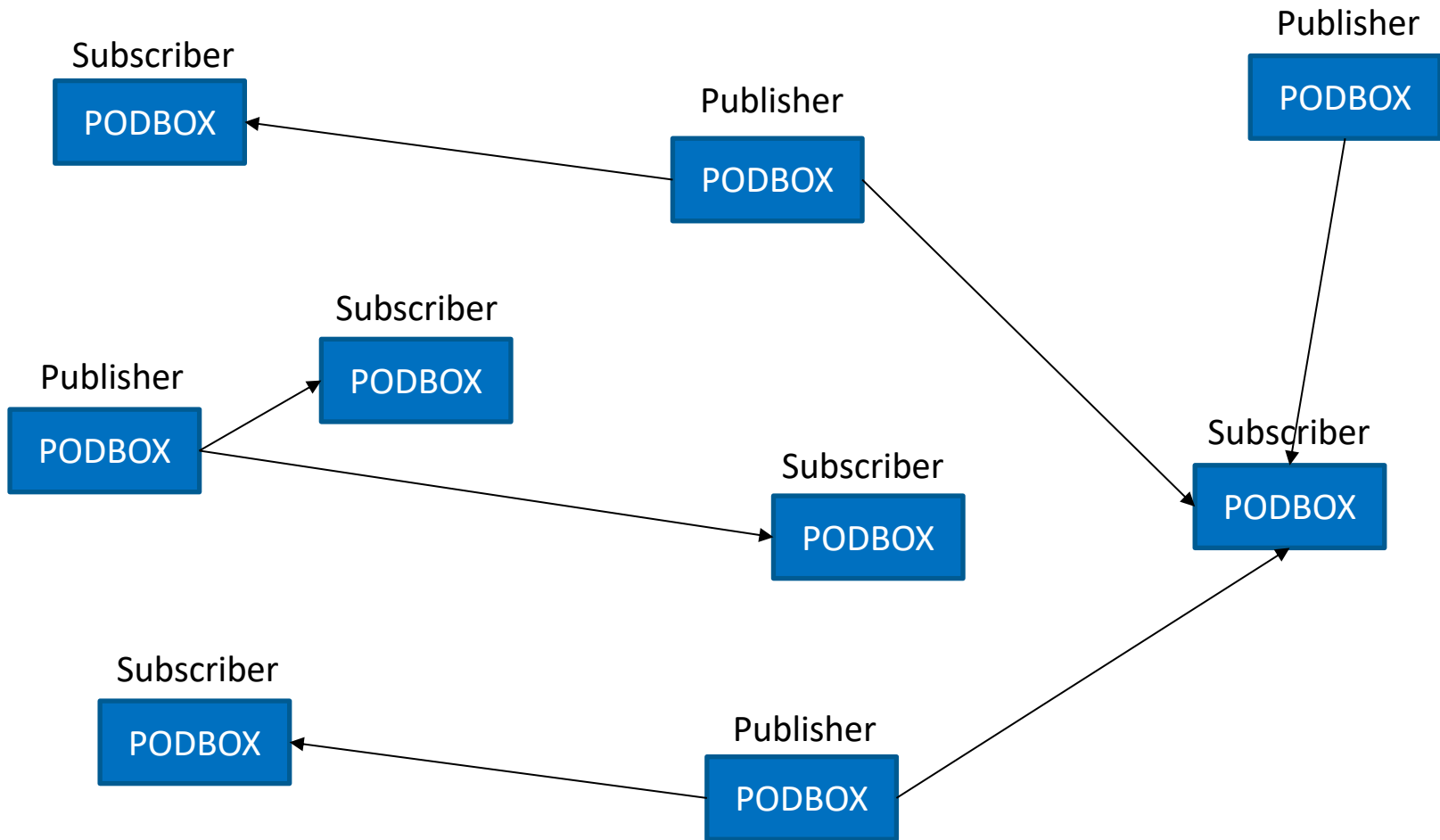
- Demonstration

- Future Work

CAN-DDS Gateway

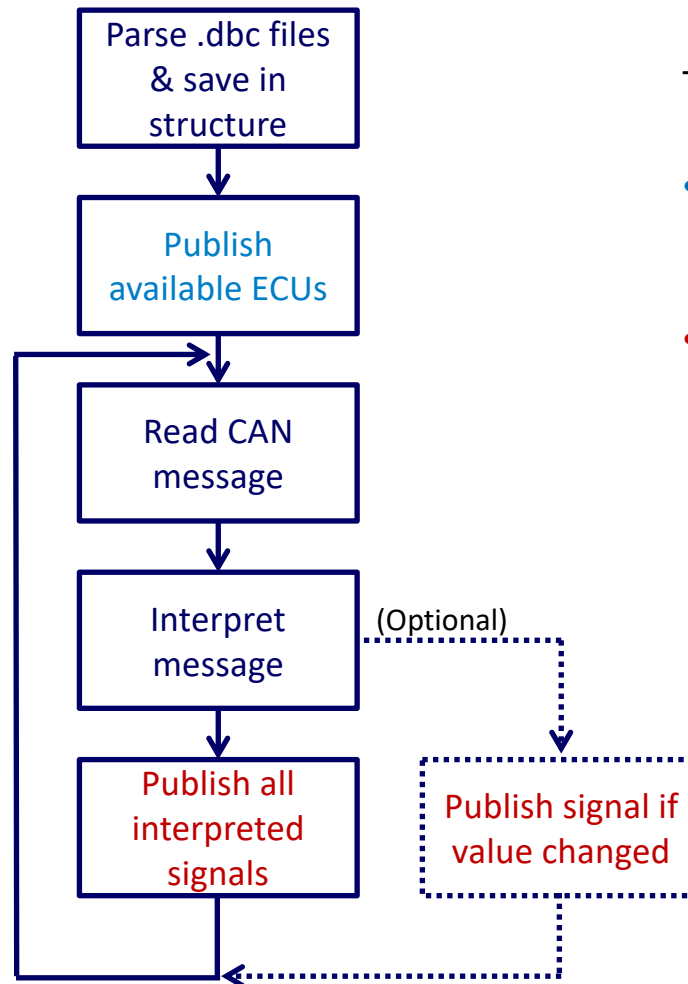## Components

- Objective:

  - Create a demo of a CAN-DDS Gateway based Diagnose System by using the PODBOX.

  - Use the ECU's CAN database as input file.

- PODBOX's tasks:

  - Read the CAN message from the ECU.

  - Parse the CAN database file to interpret the message.

  - Publish the message to the ethernet network.

  - Read the message from the eth network and display it.

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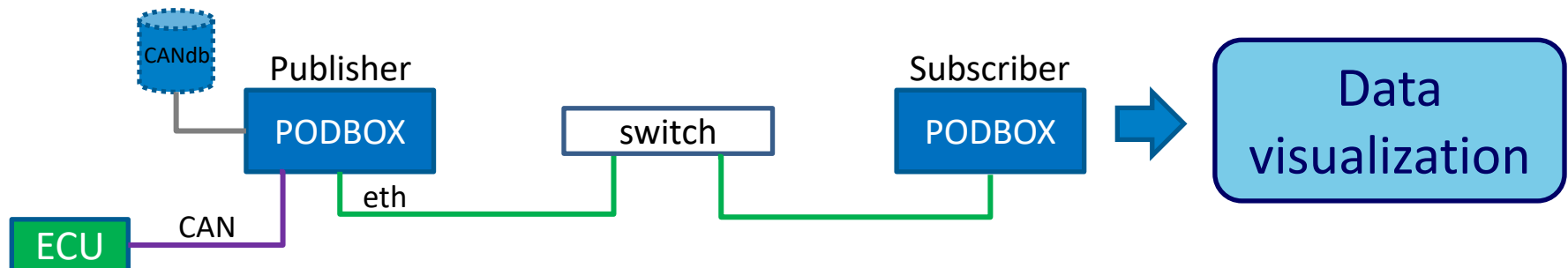
CAN-DDS Gateway
Components

- *Publisher:* reads CAN data, interprets it and sends real value

```
┌─────────────────────┐
│   Parse .dbc files   │
│     & save in        │
│     structure        │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│      Publish         │
│   available ECUs     │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│     Read CAN         │
│     message          │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐      (Optional)
│     Interpret        │ ┄┄┄┄┄┄┄┄┄┄┐
│     message          │           ┆
└─────────────────────┘           ▼
           │              ┌──────────────────┐
           ▼              │  Publish signal if│
┌─────────────────────┐   │   value changed  │
│   Publish all        │   └──────────────────┘
│   interpreted        │
│   signals            │
└─────────────────────┘
```

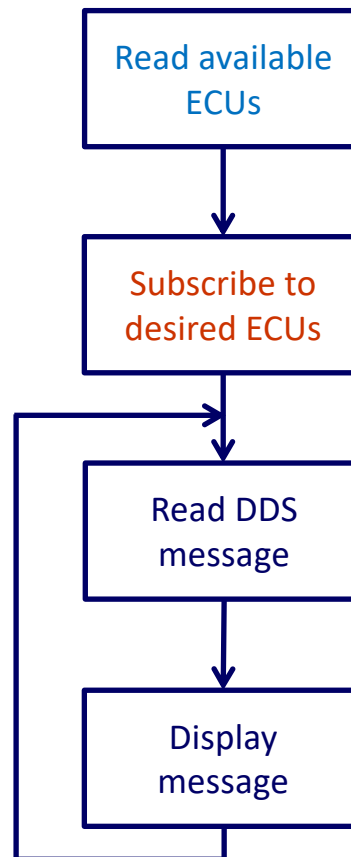Topics:

- ECUS_TOPIC: to get the name of the available ECUs in the Gateway

- CAN_GATEWAY_TOPIC: to publish the interpreted CAN signals

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CAN-DDS Gateway
Components

- *Subscriber:* subscribes to the ECUs and reads DDS data and displays it

```
┌─────────────────┐
│  Read available │
│       ECUs      │
└─────────────────┘
          │
          ▼
┌─────────────────┐
│  Subscribe to   │
│  desired ECUs   │
└─────────────────┘
          │
          ▼
┌─────────────────┐
│   Read DDS      │
│   message       │
└─────────────────┘
          │
          ▼
┌─────────────────┐
│    Display      │
│    message      │
└─────────────────┘
```

Legend:

- ECUS_TOPIC

- CAN_GATEWAY_TOPIC

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Live Demo

CMORE at a Glance & Future outlook

- *CMORE provide DDS implementation for Embedded systems*
  - *Focus on safety critical applications (automated driving)*
  - *Focus on data collection from several sensors (Radar, LIDAR, Camera…)*
  - *Robotics and Automation use cases*
  - *Software implementation for complex emebdded systems*
  - *Validation of sensor systems*

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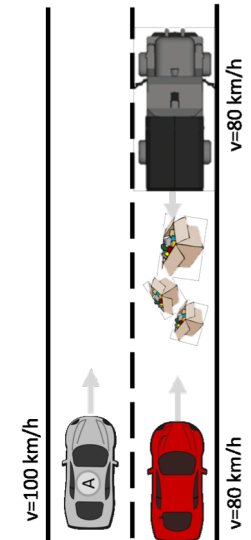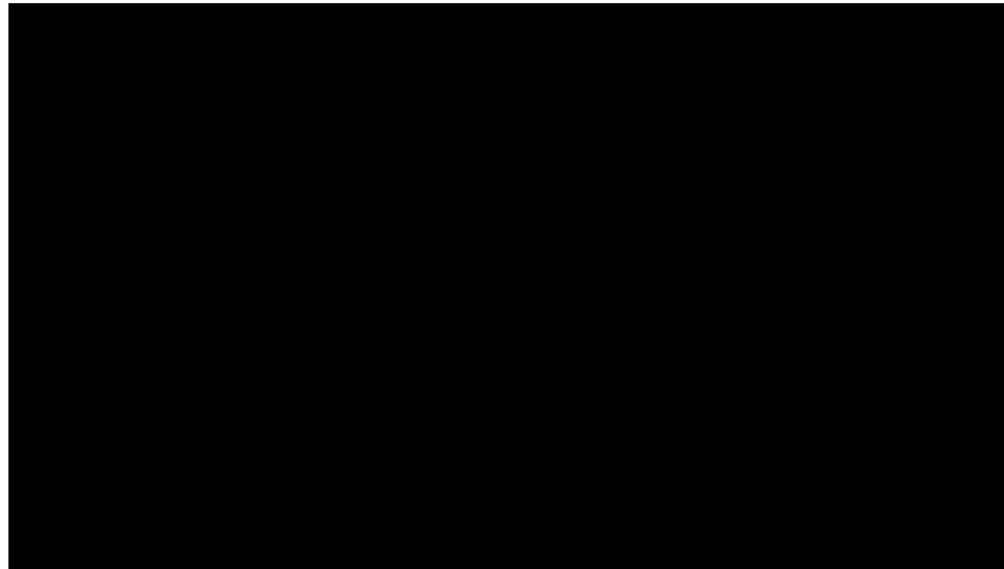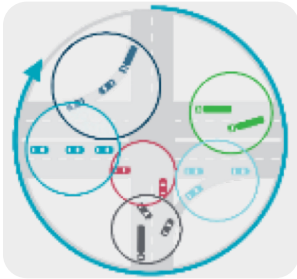
Contact us!

Headquarters Lindau
Kemptener Straße 99
D-88131 Lindau/Bodensee
T. +49 (0) 83 82 / 3 04 93-0

Office Böblingen
Calwer Straße 27
D-71034 Böblingen
T. +49 (0) 70 31 / 3 04 87-50

Office Rhein-Main
Niederurseler Allee 8 – 10
D-65760 Eschborn
T. +49 (0) 61 96 / 2 04 82 40

Office Koblenz
Friedrich-Mohr-Straße 14
D-56070 Koblenz
T. +49 (0) 8382/ 3 04 93-0

Office Ingolstadt
Hans-Denck-Str. 17
D-85051 Ingolstadt
T. +49 (0) 83 82 / 3 04 93-0

Office Munich
Lyonel-Feininger-Straße 28
D-80807 Munich
T. +49 (0) 83 82 / 3 04 93-0

Office Krefeld
Girmesgath 5
D-47803 Krefeld
T. +49 (0) 83 82 / 3 04 93-0

info@cmore-automotive.com
www.cmore-automotive.com

Your contact person
Heiko Ruth
Mobile: (+49) 151 5486 5732

heiko.ruth@cmore-automotive.com

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