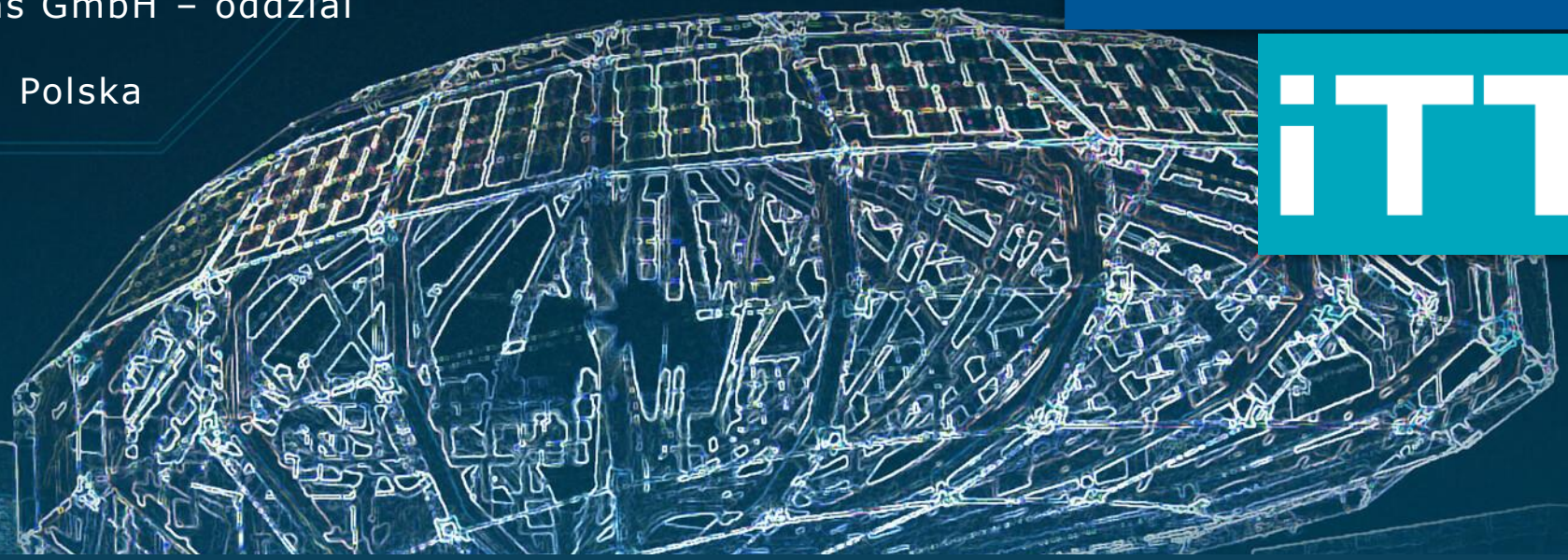
AVL Software and Functions GmbH – oddzial
w Polsce
ITTI Sp. z o.o. - Polska



IDE for CAN Networks in Space Applications – IDE4CAN

CANinSpace Workshop 2019, 11-14 June, Gothenburg, SWEDEN

Sławomir Stankiewicz, AVL S&F - Poland
Piotr Tyczka, ITTI - Poland

Agenda

- Companies presentation
- Information on IDE4CAN project
- Overview of existing CAN diagnostic tools
- Highlight of CAN Bus imperfections
- IDE4CAN – main objectives & added value
- Application presentation
- Conclusions & outlook

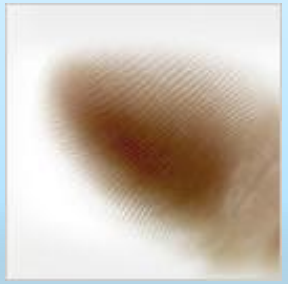
AVL company

- AVL achieves unique results with regards to the development and improvement of all types of powertrains as well as in the field of measurement and test technology.
- AVL – over 70 years' experience

Values and Philosophy

Pioneering Spirit

Customer Orientation



Problem-Solving Capability

Responsibility

Independence

ITTI company

- **SME** established in 1996, Poznań, Poland
- Main activities:
  - developement of **customised software solutions and innovative applications**
  - **applied R&D** activities in the area of ICT, Security and Space
- **ca. 70 persons** with professional certificates (e.g. PRINCE2, MSP, ITIL)
- Our customers:
  - EC, ESA, ENISA
  - Medical sector, Public administration, Manufacturing companies
- Awards:
  - **"Cristal Brussels Prize"** 2006, 2010, 2013, and 2018 for the most active and successful Polish SME participating EC Framework Programmes
  - For the **high performance in R&D projects for EDA**

IDE4CAN – ESA Contract No. 4000124053/18/NL/CBi/fg

- Started: September 2018
- Planned end: March 2020
- Reference: AO8433/ESA2016-AVL
- Polish Industry Incentive Scheme (PLIIS) funds participation
- Project TRL from 2 to 5 (up to 6)
- Authors of the project:

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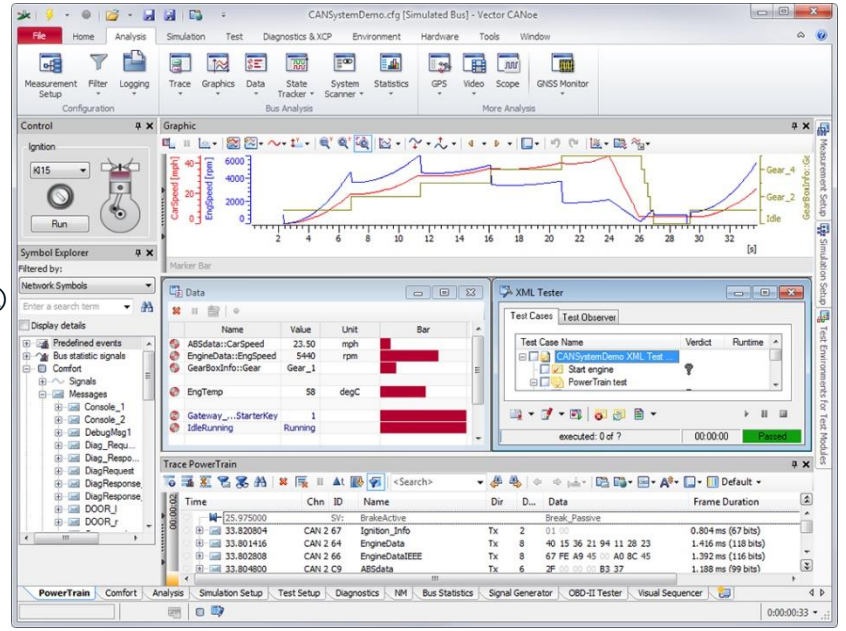
Existing CAN diagnostic tools

- CANoe/CANalyzer® - state-of-the-art CAN tool developed by Vector®
  - ❖ professional, widely used tool for CAN networking analysis
  - ❖ CAPL script language offers unlimited ways to customize
  - ❖ *.dbc file became an standard of file format for delivering basic CAN message structure of the node
  - ❖ Logging and reproduction of data flow enables real-life cases analysis
  - ❖ GUI application editor

- PCAN-Explorer – easy to use, universal - by PEAK-SYSTEM®
  - ❖ Customizable CAN dedicated tool for reasonable price
  - ❖ Logging and reproduction of data flow enables simplified analysis
  - ❖ Easy GUI application editor

- LabView® - multidisciplinary programmable measurement environment - by NI®
  - ❖ Achieving CAN functionality is the most complex process
  - ❖ Multi-node CAN communication synchronization is not optimized feature, as real time analysis



Src.: https://www.vector.com

None is dedicated to optimize CAN communication

IDE4CAN – goals and added value

Goals:

- Project idea is a response to call for CAN networks optimizing tool
- High utilization of the bus was the goal eg. on-board of satellites
- Optimization technique must not demand any changes in electric network structure and must be within CAN2.0 A/B set of rules

CAN BUS as a medium

- Developed in 80’ by BOSCH® to be used in vehicles

- Dedicated to carry low and medium data payload

- Basic data exchange and synchronization can be done with minimum occupancy of SW level – HW layer takes care for data correctness

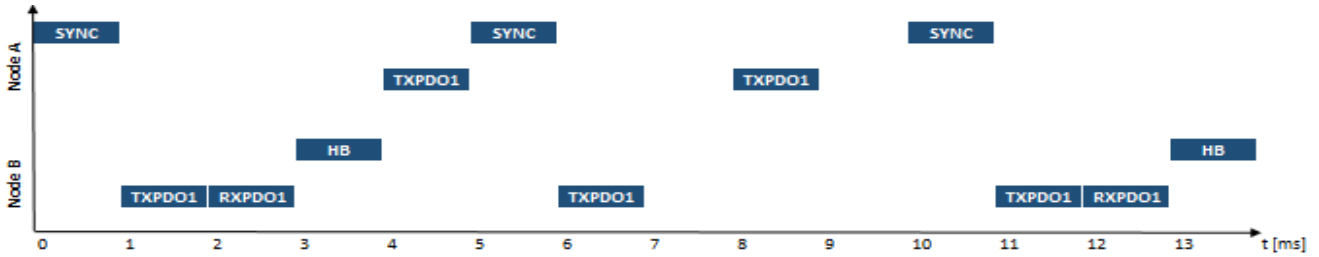
- Inbuilt Arbitration mechanism prevents data corruption
…but also makes frame deploy time tentative

For correct control process operation a distributed system requires **repetetive and time-deterministic** exchange of data between the nodes

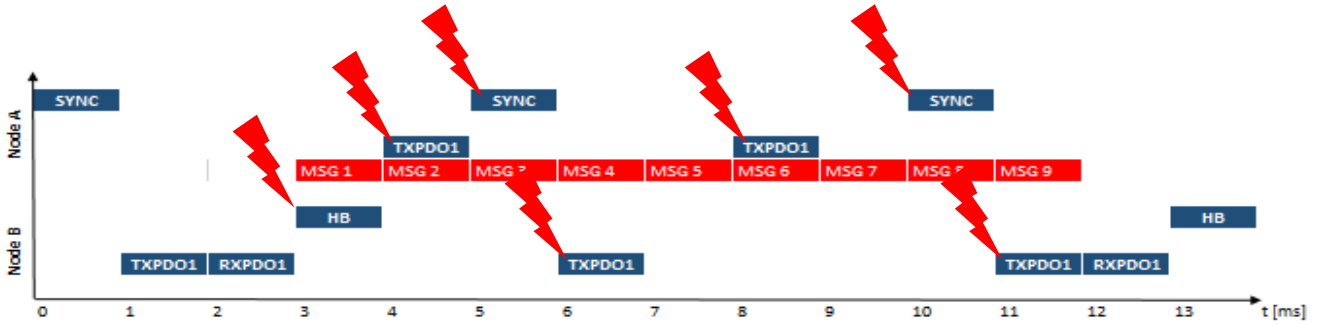
Key objective of CAN optimization

To increase CAN BUS payload:

- Send more frames!

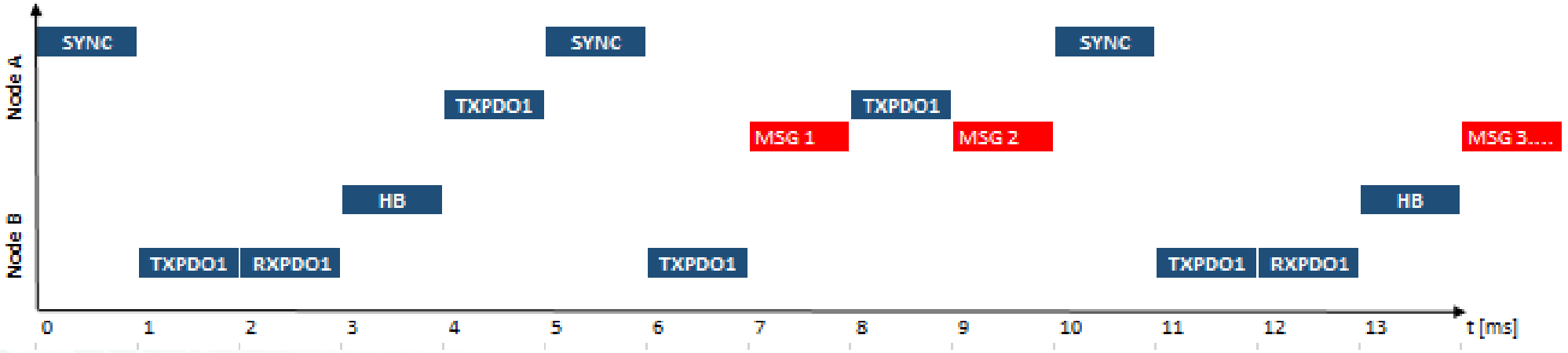


- Reduce probability of arbitration mechanism activation -> to save time



Solution

- Do the planning of frame deploy time in every node in the system



IDE4CAN computes optimized schedule and generates outputs

Outputs can be used then as input data for CAN drivers in the nodes

Idea of Containers

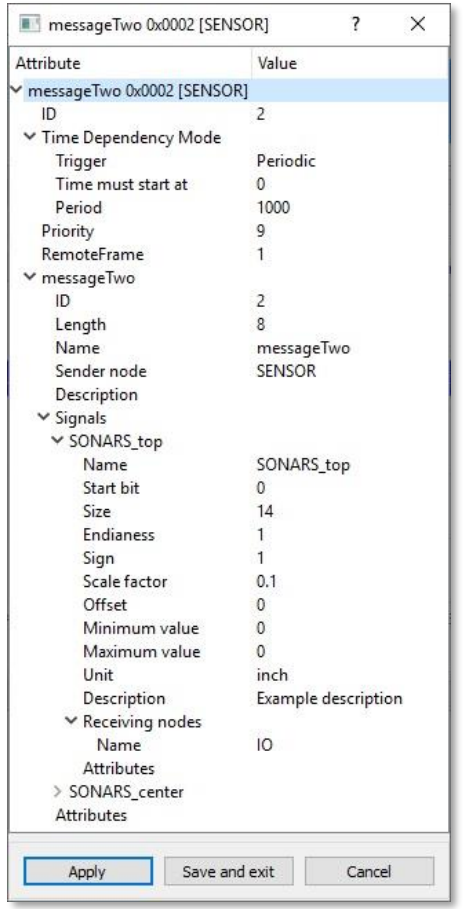
Additional metadata not available in *.dbc.

To be able to include all parameters IDE4CAN need for scheduling, data structure named CONTAINER had to be developed

Each CAN frame in system has its own container

CONTAINER carry:

- unique ID
- planned deploy time of the frame
- priority over the other frames
- information about the structure of the network
- dependency of other frames (triggers)



Idea of Triggers

Thanks to triggers, frames in the system can be tied together with time dependency.

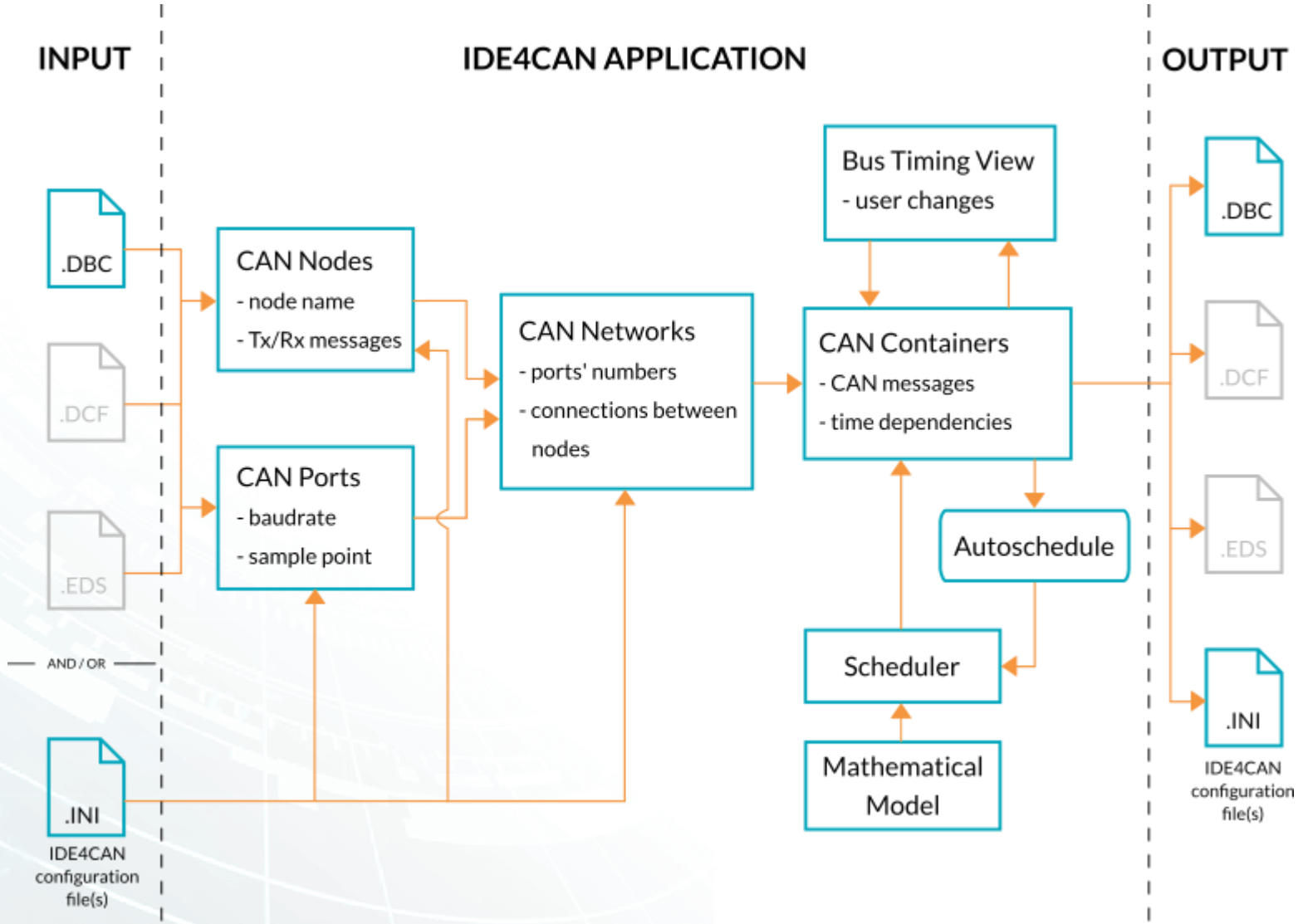
Triggers act similar like in the GanttPlan eg.:

- Starts After Frame (unique ID),
- Starts Before Frame (unique ID),
- Starts At Time 0010[us] +/-tolerance[us],
- Not Later than 0023[us] +/-tolerance[us],

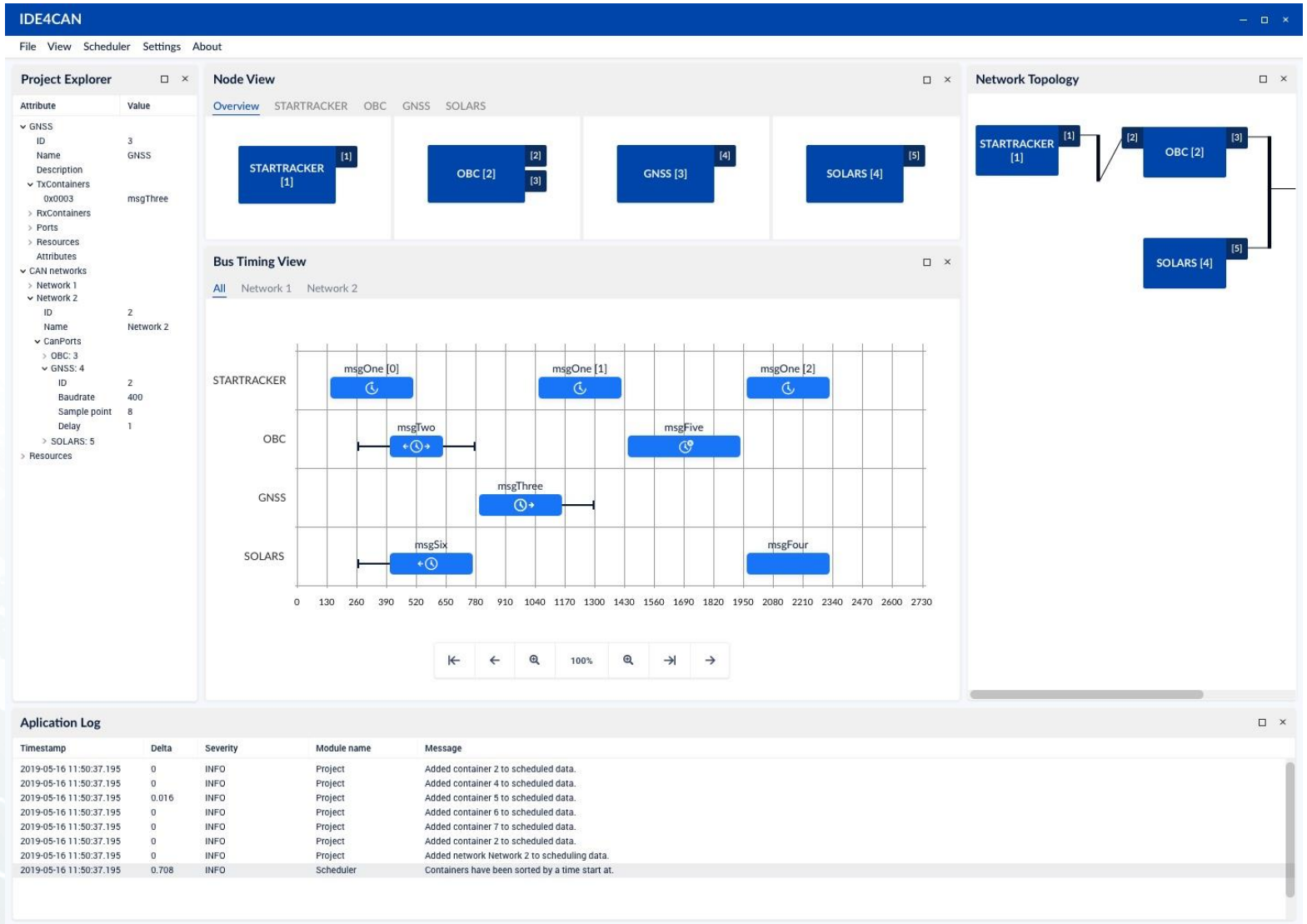
etc.

…now: the IDE4CAN application

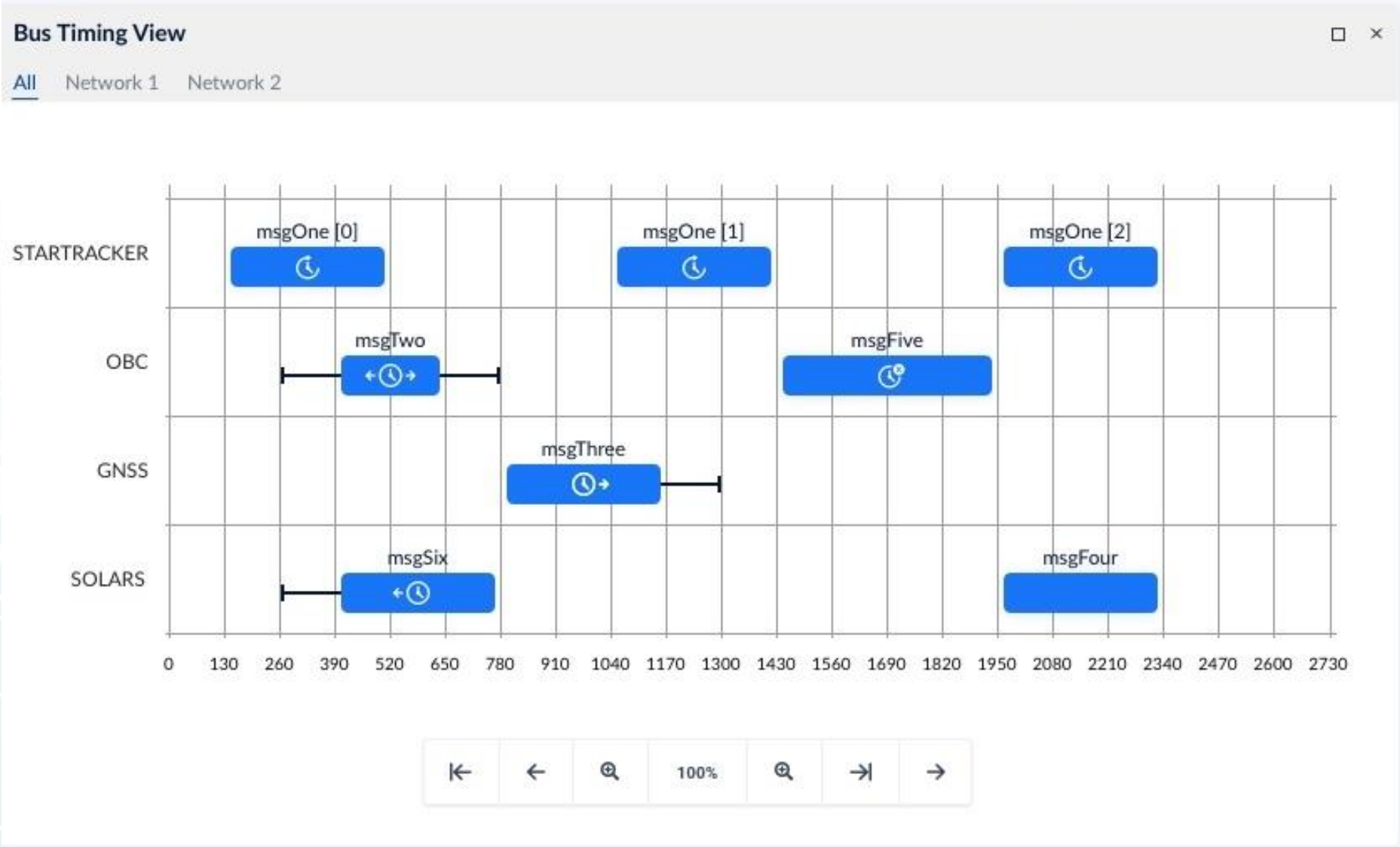
IDE4CAN: Architecture and data flow



IDE4CAN: Main window of application



IDE4CAN: Containers and Triggers

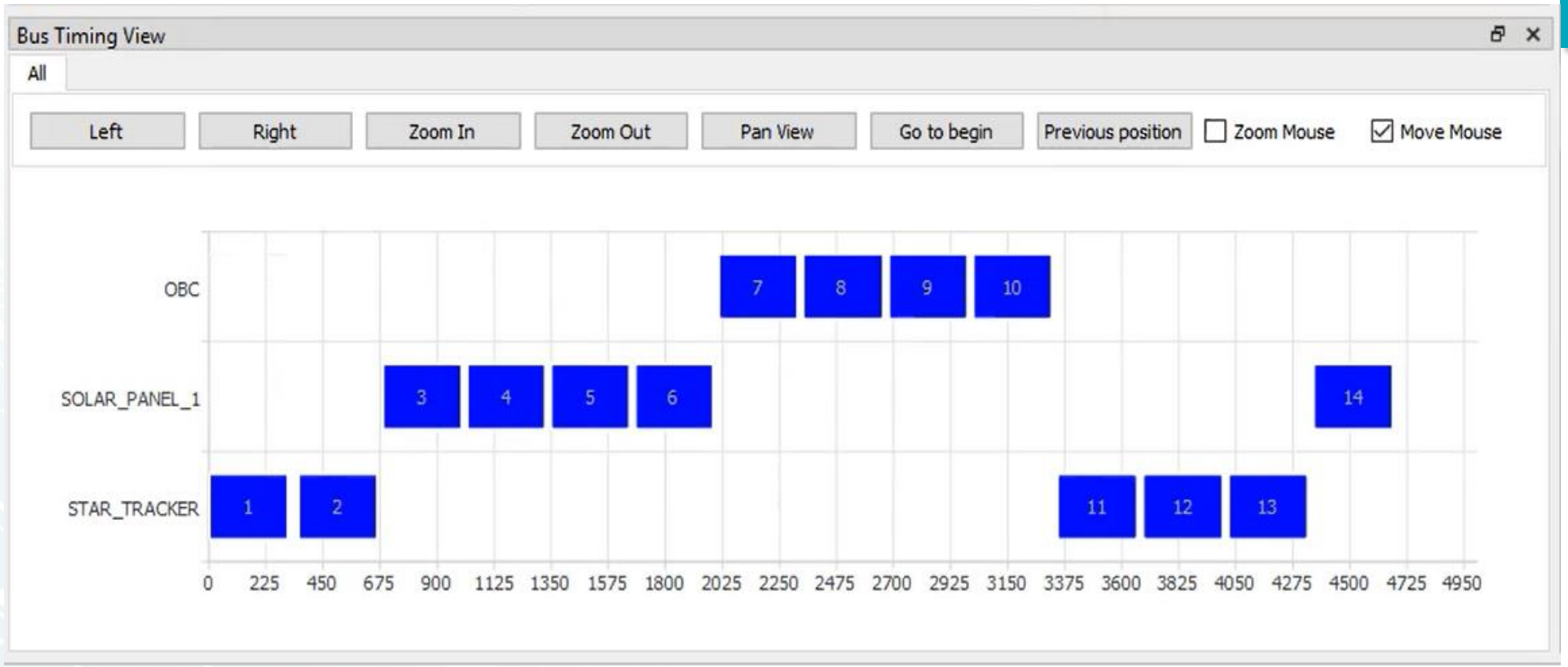


IDE4CAN: Representation of conflicts

IDE4CAN: Demonstration film

Short film demonstarting IDE4CAN application

IDE4CAN: Outcome → Optimized schedule



Conclusion and outlook

IDE4CAN:

- is a design, not diagnostic, environment!
- does not try to replace any of the existing CAN tools! Integration in future is an option!
- is a kind of CAN frame planner which goal is to eliminate arbitration mechanism
- to demonstrate full potential of the service it would need to collaborate with CAN drivers in the nodes (not in the scope of the project)
- it can support network recovery actions after data avalanche

Thank you!

AVL

iTTi

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