RAIL SYSTEMS ENGINEERING

OPENTRACK

nextRail19

OpenTrack with API as Digital Twin in Industrial Product Development

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Agenda

- Introduction
  - OpenTrack and us
- Objective of our project
  - To test our on-board unit
- Problems
- Solution: OpenTrack with API as Digital Twin
- Future development

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Our companies

Rail Systems Engineering Sdn Bhd:

- Based and registered in Kuala Lumpur, Malaysia
- Founded in 2008
- Timetable, Simulations and Operations Consulting
- OpenTrack's representative for East Asia

Rail Systems Engineering AG:

- Based and registered in Wallisellen, Switzerland
- Founded in 2017
- ETCS, ATP and ATO

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About us

Philipp Goetz

- Founder and MD of "Rail Systems Engineering Sdn Bhd"
- Dipl. Eng. ETH Zurich
  Master of Science in Electrical Engineering
- 26 years in Railway business
- Swiss, living in Malaysia for 19 years

DeeKeat ONG

- Railway Operation Simulation
- Dipl. Ing. ENSAM Lille
  Master of Engineering in Mechanical Engineering
- Malaysian

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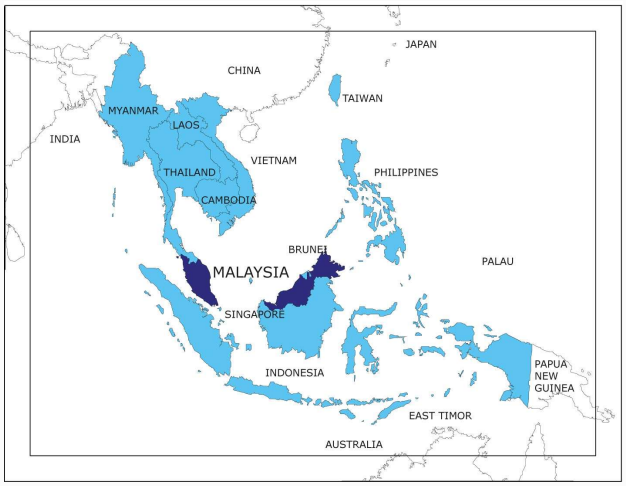
Our World with OpenTrack

- Malaysia
- Thailand
- ASEAN
- Taiwan
- South Korea



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Objective of our project

- To develop an ATO computer and run it with a real train
  - E.g. controls the train's operation from starting until the next stop

ATO On-board Unit

Train Control

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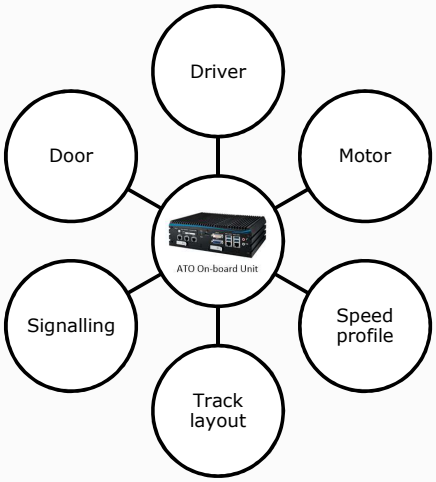
Interface of on-board unit (OBU) with the environment



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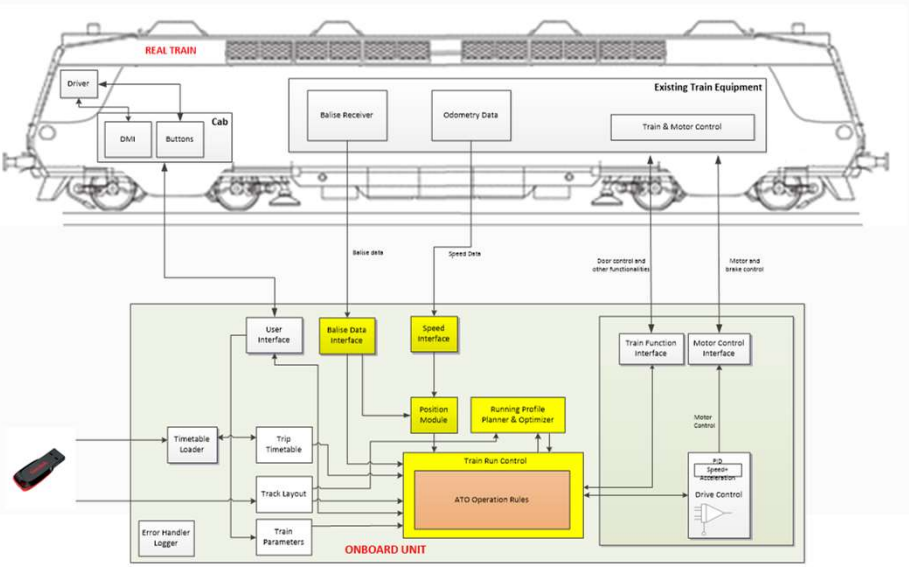
Real train's interaction with ATO-OBU



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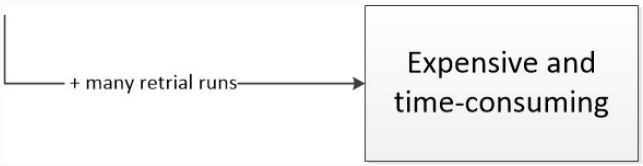
Problems

To test the OBU, we need

- A driver
- A trainset (ready for testing)
- A timeslot
- Complete test team



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Solution: Create a Digital Twin to run with OT API

- Testing in the real world
  - Real train
  - Real track
  - Real driver
- Testing with a Digital Twin
  - OpenTrack is our reality
    - Itinerary
    - Track layout
    - Signalling
    - Rolling stock
  - The ATO On-board unit will not know the difference of real and Digital Twin world

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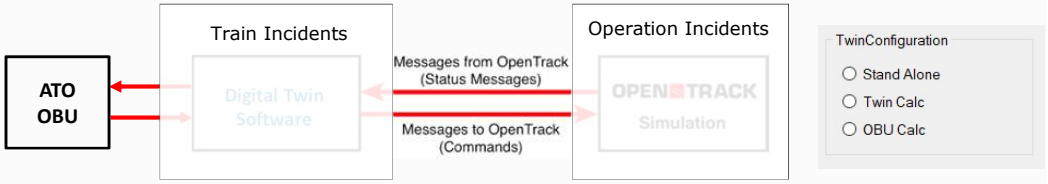
Our Solution using OpenTrack API:

- OpenTrack API principle

- Our application



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Our Test System's Setup

Digital Twin's Software

- Our Software (.Net)
- Data Interfaces

Digital Twin's Hardware

- **Test PC**
  with OT and our own Digital Twin Software
- **Mini Cab (optional)**
  - with Buttons and indication as in a cab
- **ATO-OBU**
  - real hardware to be installed in the train

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Mini Cab

- Cab Train Driver Interface used for Digital Twin
- Buttons and indications as in the Cab
- Controlled with Arduino
- USB plug to Digital Twin PC

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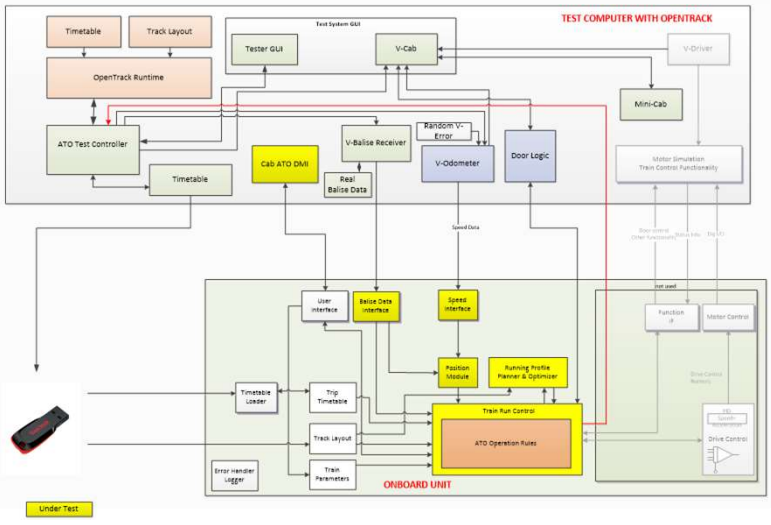
Digital Twin interaction with ATO-OBU



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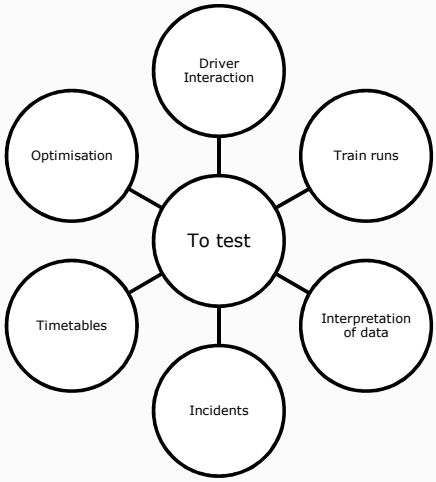
Things that we test



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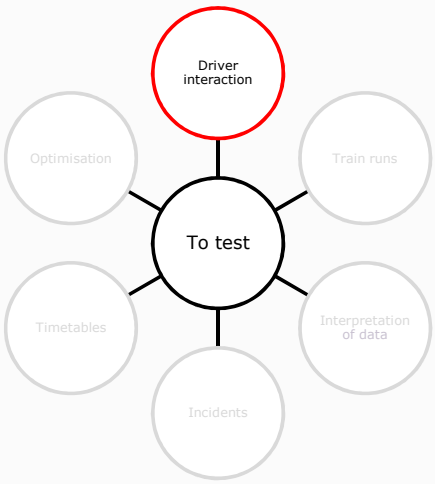
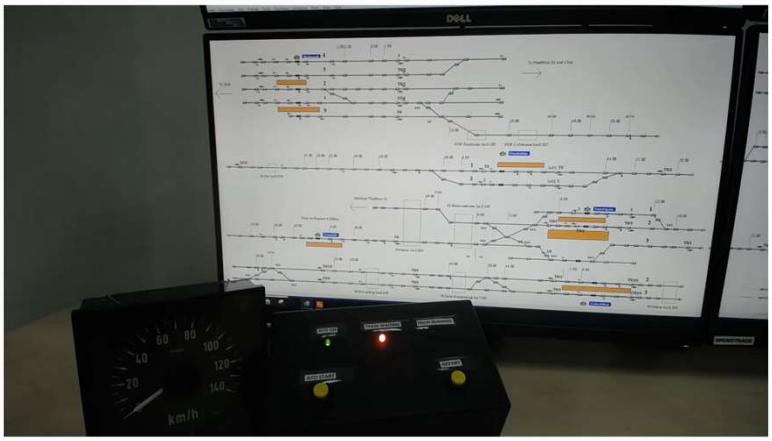
Things that we test





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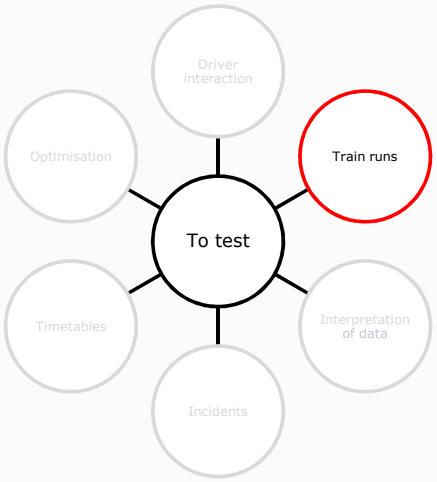
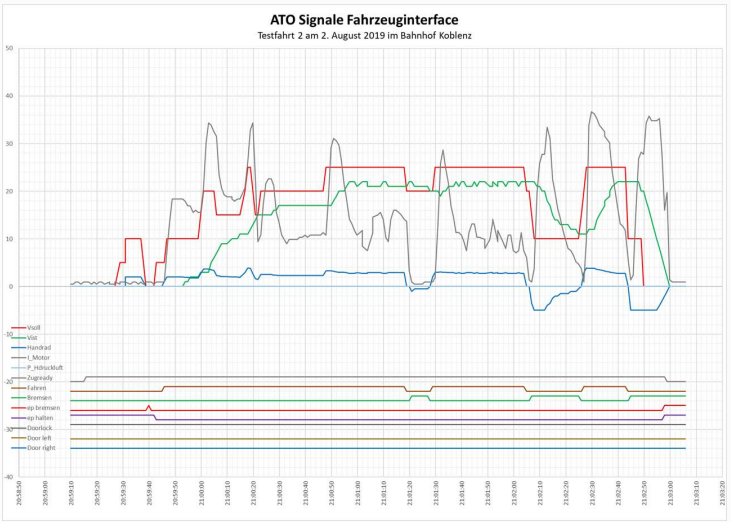
Things that we test





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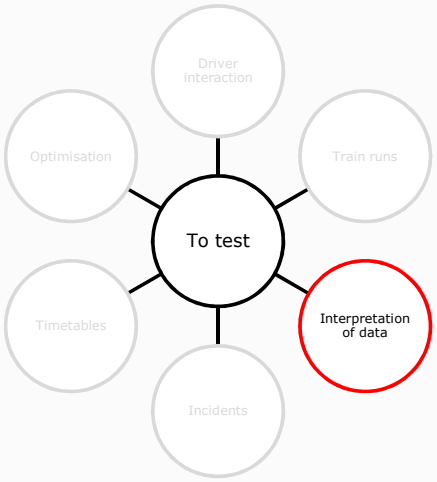
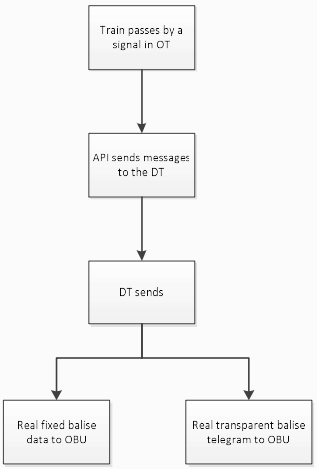
Things that we test





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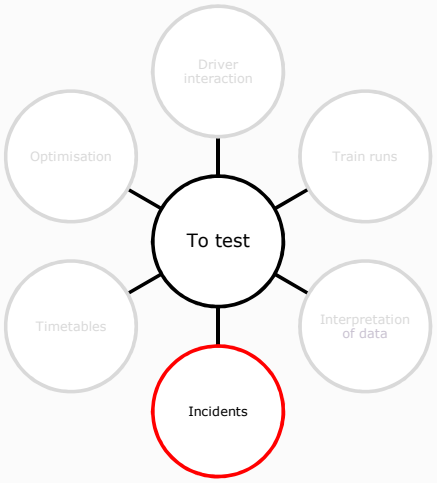
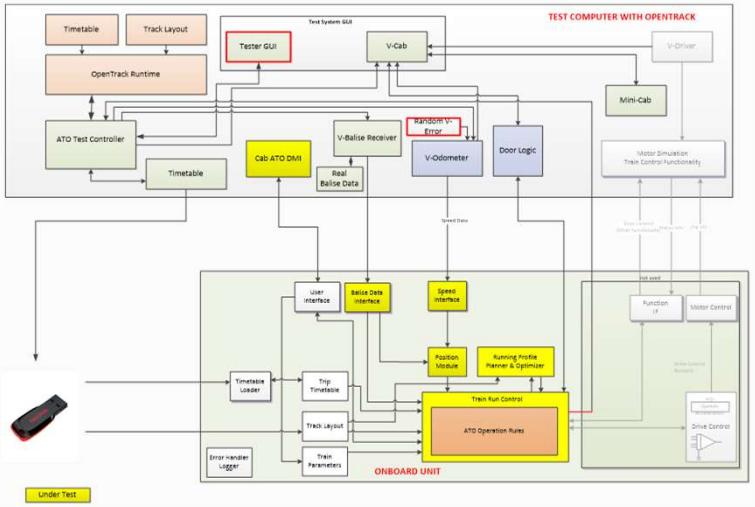
Things that we test





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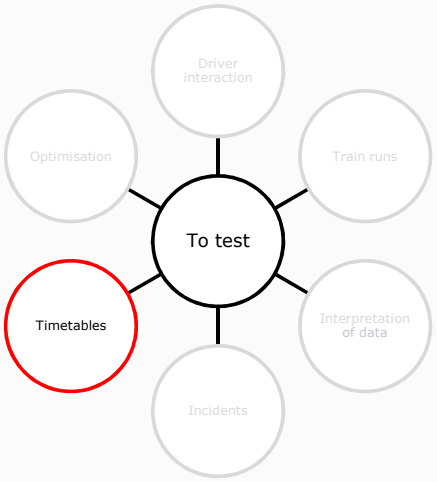
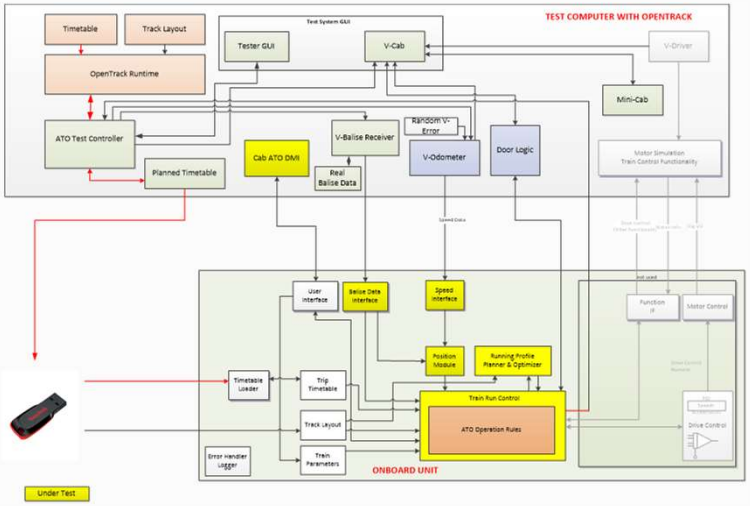
Things that we test





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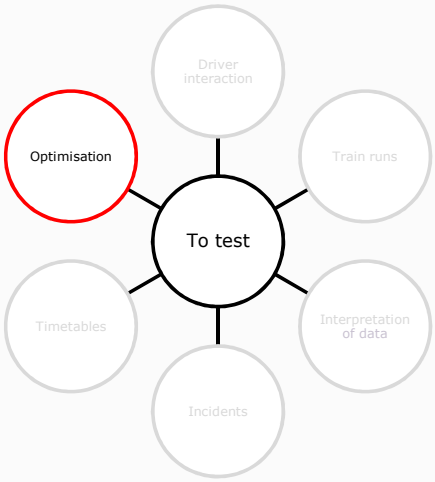
Things that we test



OT API can run an optimised speed profile

- With coasting
- To catch up delays (higher acceleration/ target speed)

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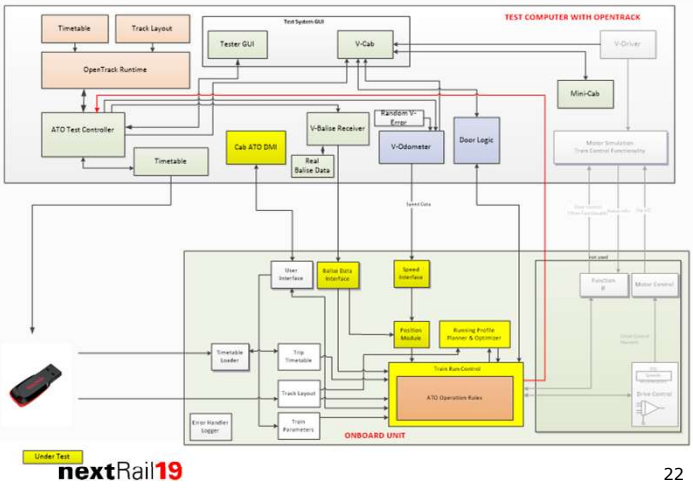
Shortcuts taken in our solution

- The motor control is not considered
  - Motor control is verified separately



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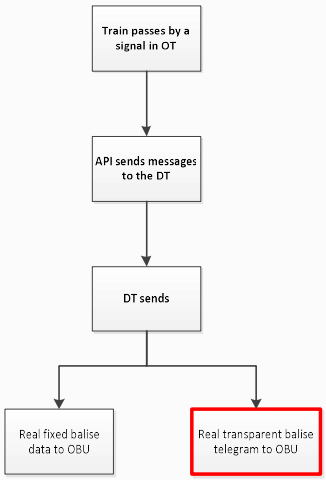
Constant Improvement in OpenTrack API

- New functions for our DT
  - Balise telegram
    - showing signal aspect message of both main/distant signal in API
  - Train control
    - specifying maximum acceleration



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Summary

- Our Task:
  - To develop and test a product used to control a train
- Our product:
  - An industrial computer (ATO-OBU) with interfaces with our own software
- Testing
  - Too complex

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Conclusion

- OpenTrack with API gives us all the control and info we need:
  - Simulation of running time (OT)
  - Real-time location and movement specific data (OT+API)
  - Control train run from "outside" (OT+API)

- OpenTrack with API is the perfect tool to build a Digital Twin