



Logger systems

for autonomous drive development

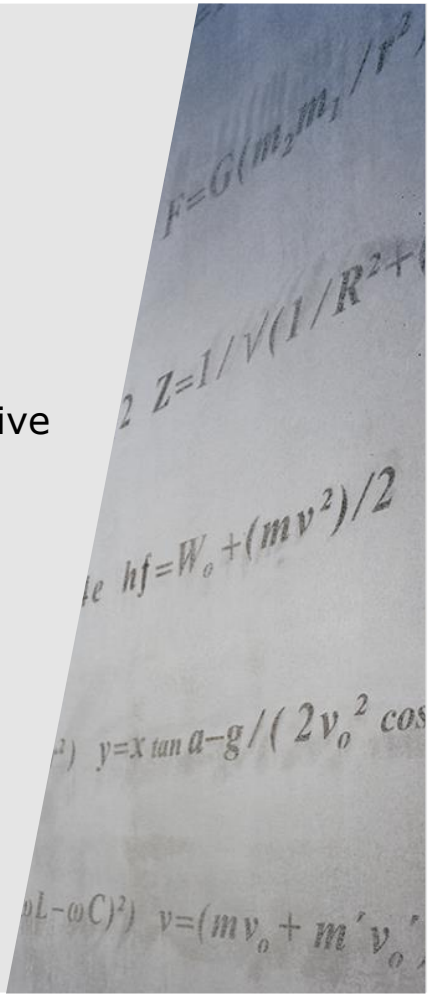
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Topics

- History of FOT projects
- Driver behaviour vs. Autonomous Drive
- Data acquisition tool chain
- Technical requirements
- Summary





History of FOT projects



Bringing intelligent vehicles to the road

EuroFOT

- FOT – Field Operation Test
- In Gothenburg, 100 cars and 50 trucks.
- Driver behaviour related to active safety measures





History of FOT projects



- ADR2 – Autoliv Data Recorder 2



- SAFER – EuroFOT logger





Field Operational Test

EuroFOT

- Type and number of vehicles: 100 cars and 30 trucks
- Duration: 18 month

DriveC2X

- Type and number of vehicles: 20 cars
- Duration: 4 month

PedFOT

- Type and number of vehicles: 12 cars
- Duration: 24 month

• ChinaFOT

- Type and number of vehicles: 8 cars
- Duration: 8 month

• Eyes on Road

- Type and number of vehicles: 10 cars
- Duration: 12 month



EUMarket



Planning



Asia Market



Test Execution



US Market



Driver behaviour vs. Autonomous Drive

FOT – driver behaviour
Driver in focus



Autonomous applications
vehicle sensors in focus

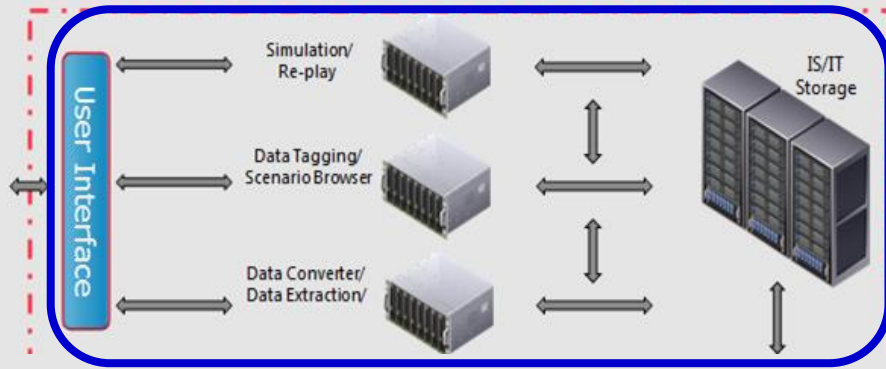




Tool chain and Data Storage



IS/IT Storage



R
A
S
I
C
B

RASIC A



Customer project specific



Bandwidth calculation

Traditional automotive FOT logger

- 4 analog B/W CCD cameras
- 1 Eyetracker
- 2 vehicle HS/MS CAN
- 1 sensor data HS CAN

~ 0.75 GB / h

100 vehicles, 1 hour/day, 1 year:

~ 25 Terabytes of data

Autonomous vehicle FOT

- 4 HD Color cameras
- 1 Eyetracker
- 2 vehicle Flexray
- 2 vehicle HS CAN
- 8 sensor data HS CAN

~ 15 GB / h

550 Terabytes of data



Bandwidth calculation

Autonomous vehicle development vehicle

Context camera and vehicle system ~ 15 GB / h

Lidar reference measurement system 15 GB / h

10 vehicles, 8 hour/day, 1 year:

- 850 TB

Uncompressed HD video 150 GB / h

2 cameras, 10 vehicles, 8 hour/day, 1 year:

- 8,6 Peta Byte



Technical requirements

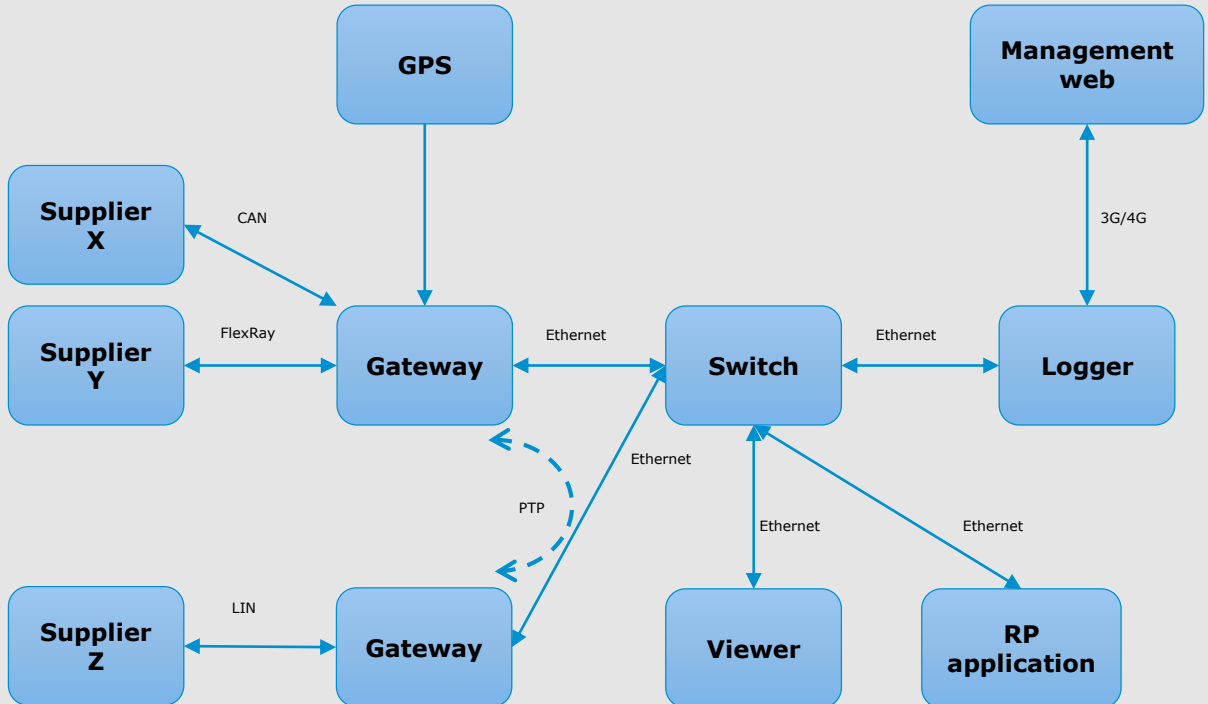
Timestamp synchronization

- Increased requirement on time accuracy on measurements
 - From 100 ms accuracy down to 1-10 ms
- GPS as input for absolute time
- PTP for synchronization between devices on vehicle
- PTP, Precise Time Protocol (IEEE 802.1AS & IEEE 1588)
- Based on Ethernet standards
- Timestamping of measurements close to source
- Transportation of data on high-speed bus interface



Technical requirements

Ethernet based logger concept





ÅF cooperation map

International

Shanghai



Coventry



Sao Paulo



National

Gothenburg



Södertälje



Linköping /Vårgårda



Research



logger

ref-system

Viewer

Tools



Thank you!