Multisensor Large Scale Data Management for Training Sets and Ground Truth Automatic Generation

SUMMER SCHOOL 2020

Virtual, 9 -10 September

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Vicomtech

Outline

- **Cloud-LSVA** project
  - H2020 project
  - Large scale analytics

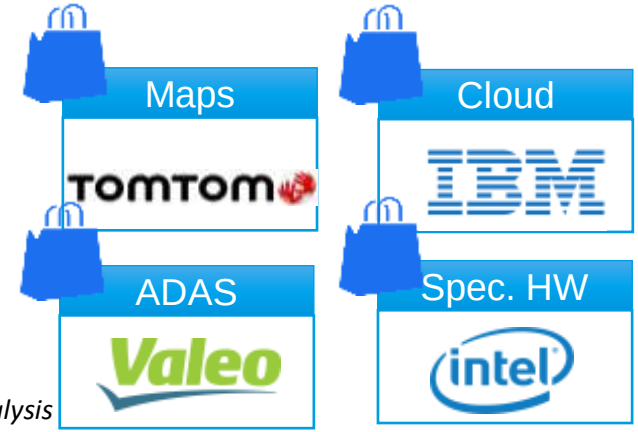
- **Annotation**
  - VCD – Video Content Description
  - Standardisation activities

Cloud-LSVA project

Cloud-LSVA - *Cloud Large Scale Video Analysis*
Co-ordinator: Vicomtech
Duration: 36M - 1.1.2016 – 31.12.2018

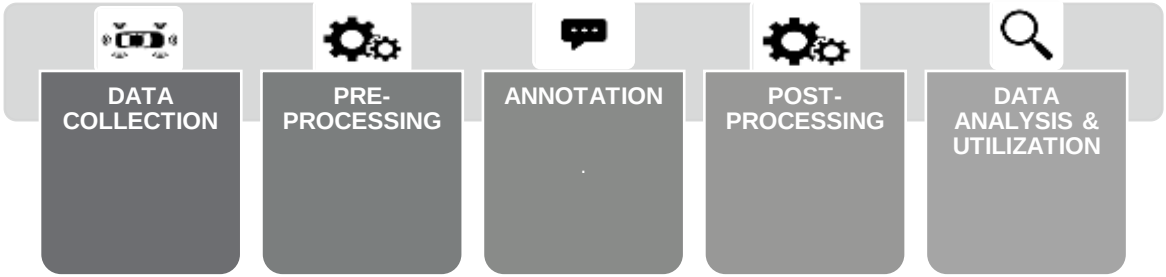
Research and Innovation Action
H2020-ICT16-Big Data Research
Outcome A – **Big Data technologies**

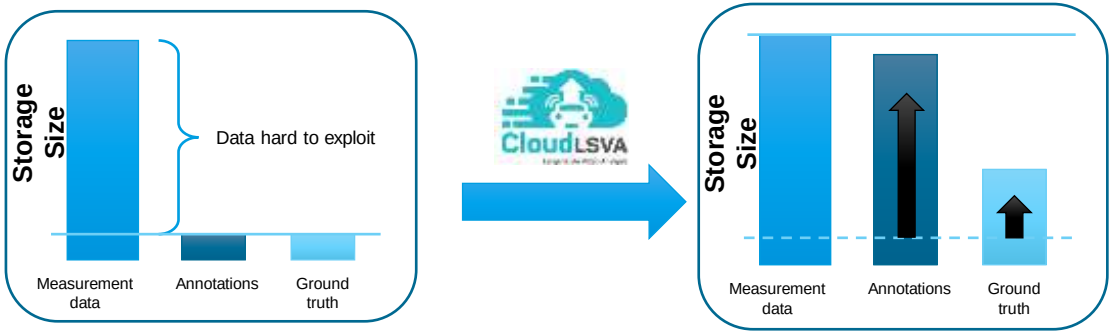
Web Page: **http://cloud-lsva.eu/**

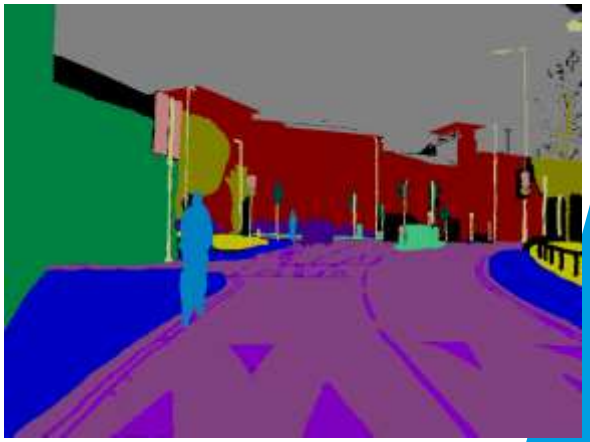


Cloud-LSVA project

- Annotation for ground truth generation

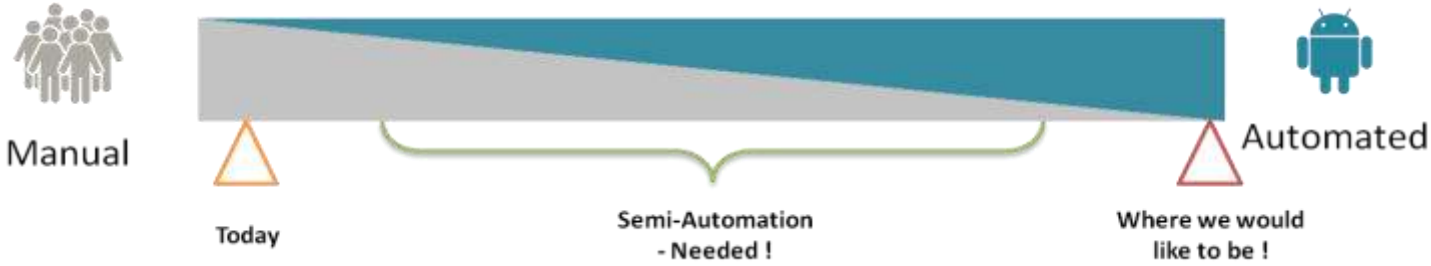


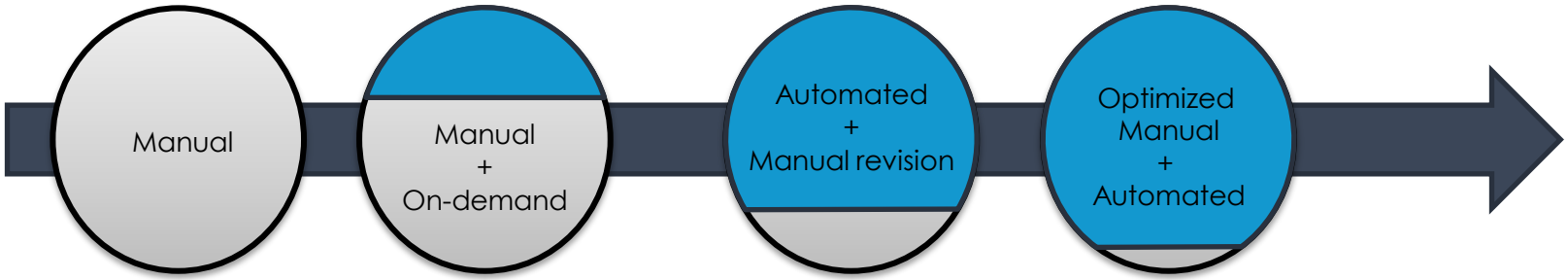




Cloud-LSVA project

- Data labeling automation process





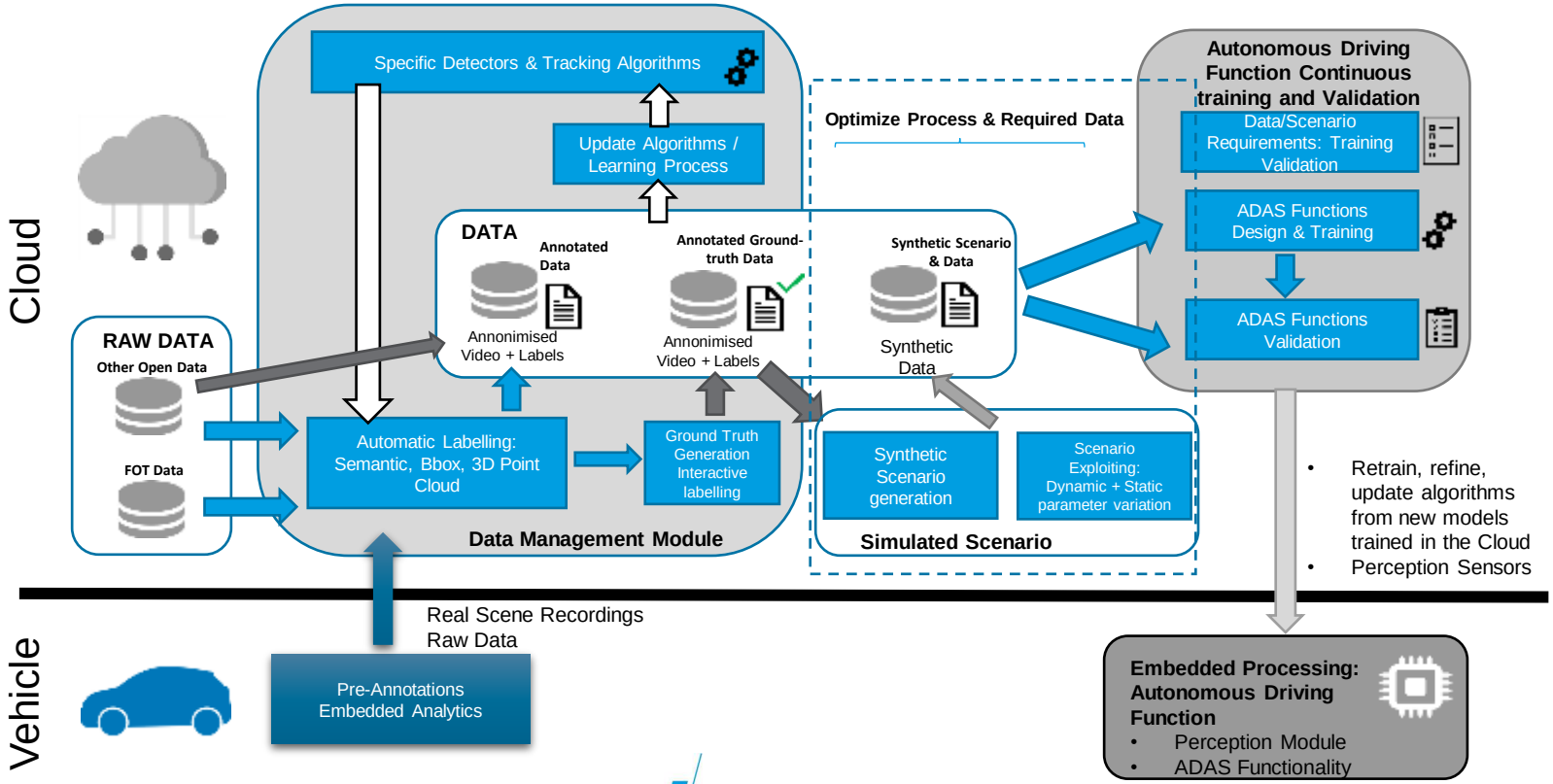
-**Fully manual**
-Annotate each frame
-Low speed

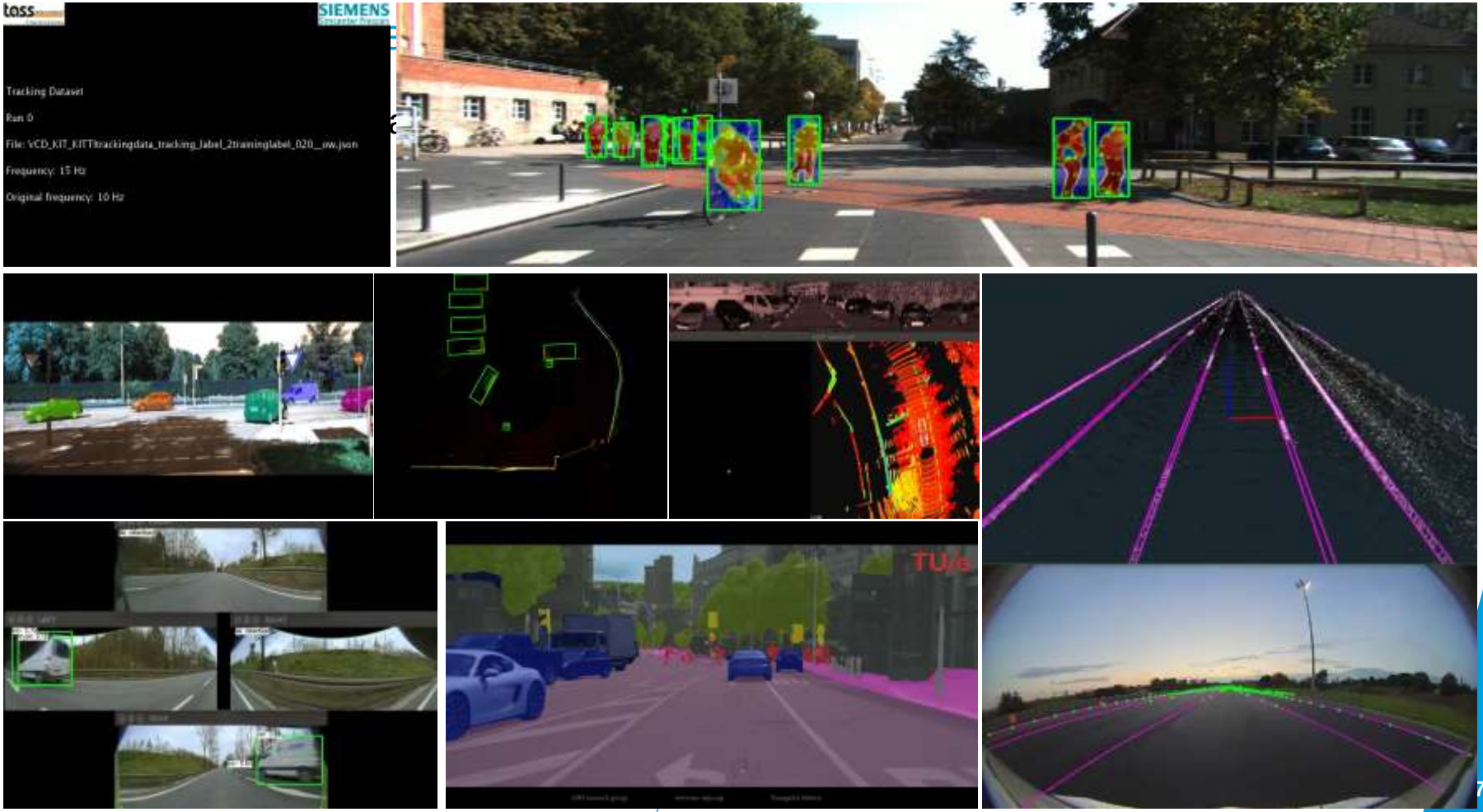
-Manual GUI
-**On-demand** analytics
-Medium speed

-Automation first
-Manual GUI to **validate**
-High speed

-**Learn** best combination of manual and automated process
-Very high speed

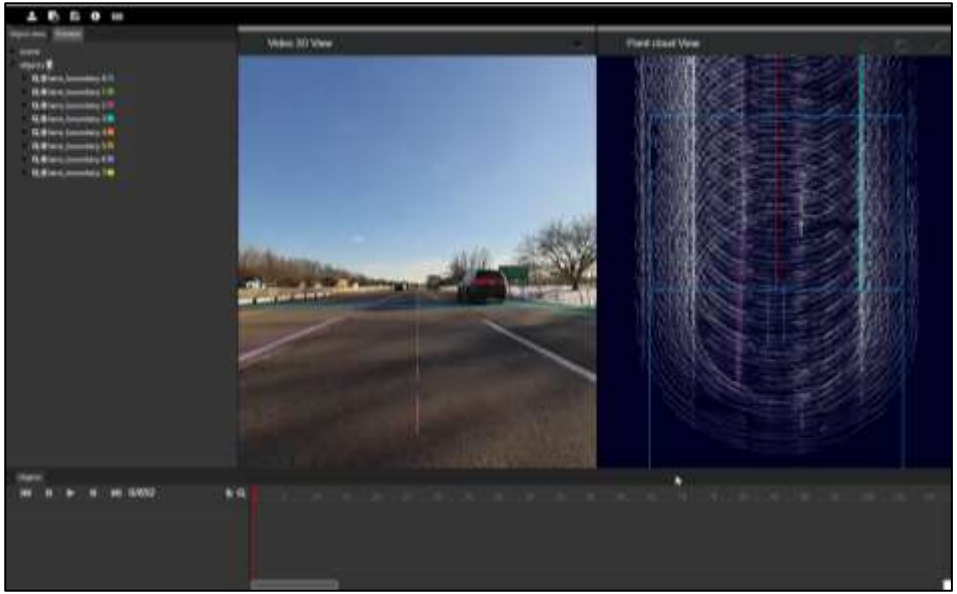
Cloud-LSVA project

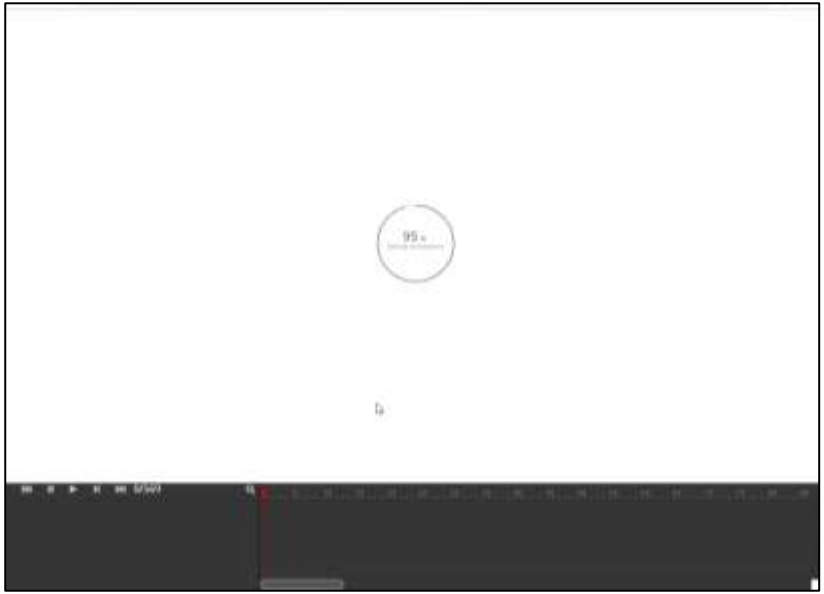



SIEMENS
Tracking Dataset
Run 0
File: vCD_KIT_KITTItrackingdata_tracking_label_2traininglabel_020__ow.json
Frequency: 15 Hz
Original frequency: 10 Hz
TU/e

Cloud-LSVA project

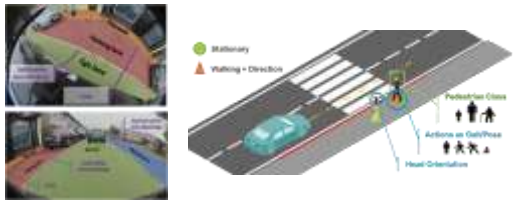
- Web UI for ground truth validation



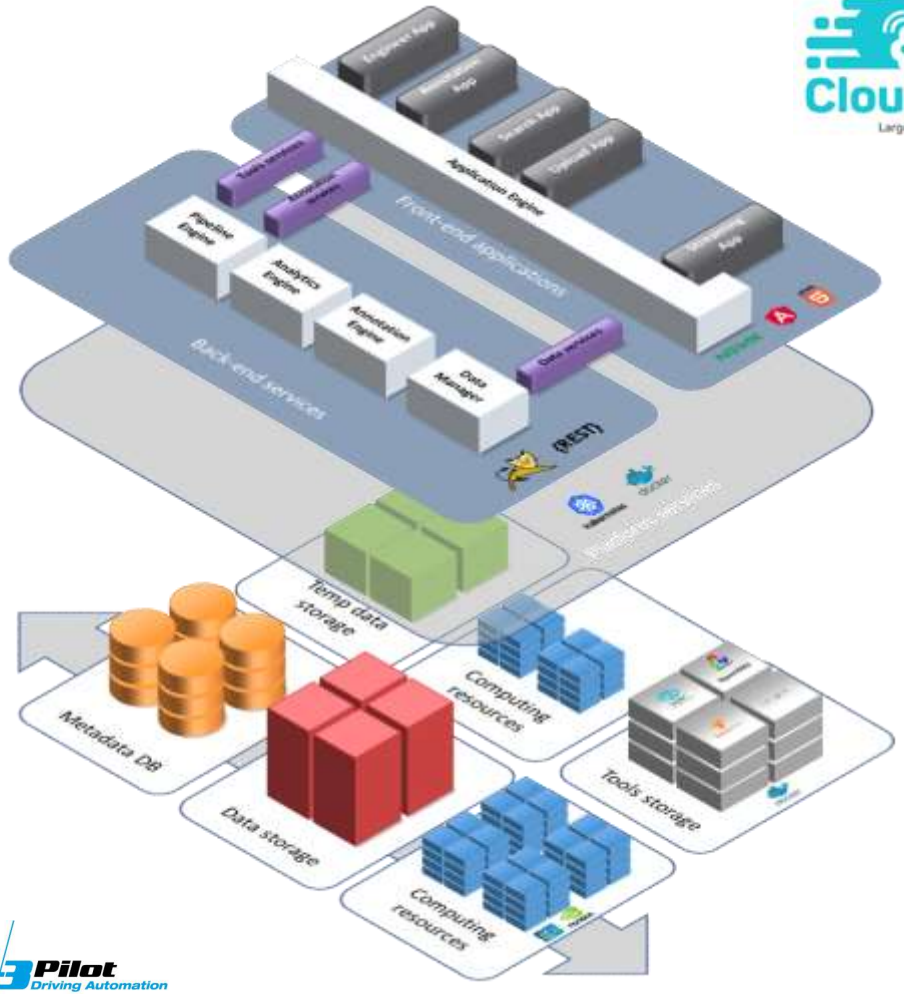


Cloud-LSVA project

- **Cloud platform for orchestration**
  - **ADAS annotation**: to create tools to enable large scale ground truth generation

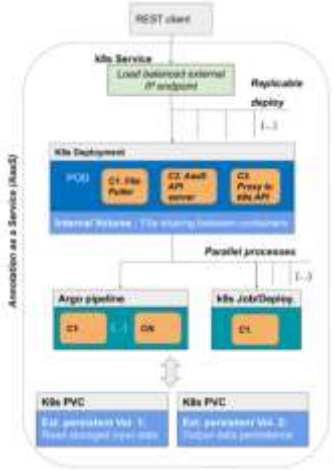


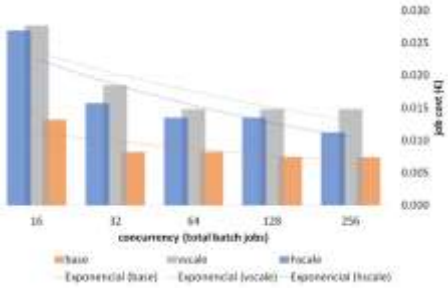
  - **Cartography update**: to develop a system to create and update HD maps from crowd sourced data



Large scale analytics

- **One-day** recording labeling exercise
  - Large-scale exercise
    - Cluster allocation, raw data pre-processing, CNN processing, cost analysis





Raw data
25 TB
8 hours video + lidar
4000 clips

Cloud cluster
32 worker nodes
x16 computing cores
x64 GB RAM
= 512 cores (2048 GB RAM)

Total: 1h 32’
Job: 0h 20’ (parallel run)
Effective time/job: 1.39 s

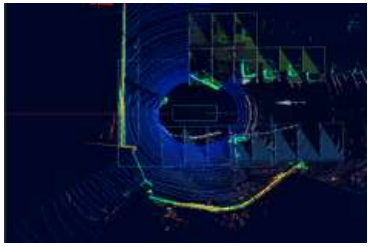
Cluster: 23.284 €/month
Cost/job: 0.012 €

Cost experiment: 48 €

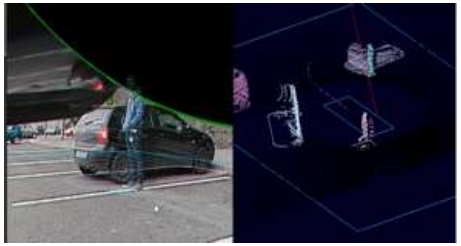
S. Sánchez-Carballido, O. Senderos, M. Nieto, and O. Otaegui, “Semi-Automatic Cloud-Native Video Annotation for Autonomous Driving,” Applied Sciences, 2020, 10, 4301, doi: 10.3390/app10124301

Annotation

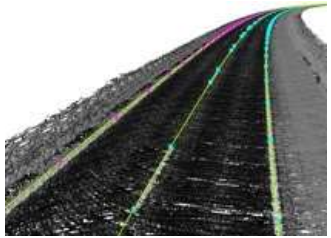
- **Metadata** which describe the content of a **scene** in an structured manner
- In many cases, **metadata needs to be attached to data series:** videos, lidar, static images, etc.
- **Annotations** need to cover:
  - Object descriptions
  - Spatio-temporal entities
  - Synchronization and timestamps
  - Sensor calibration
  - Numerical ranges
  - Actions and events
  - Time intervals
  - Relations between elements
  - Semantic concepts



3D Parking slots

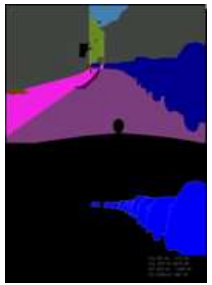


3D objects

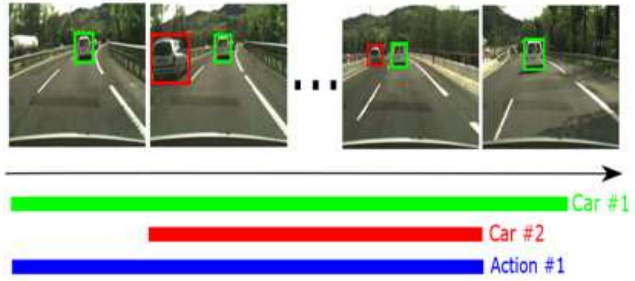


3D lane markings

2D-3D objects



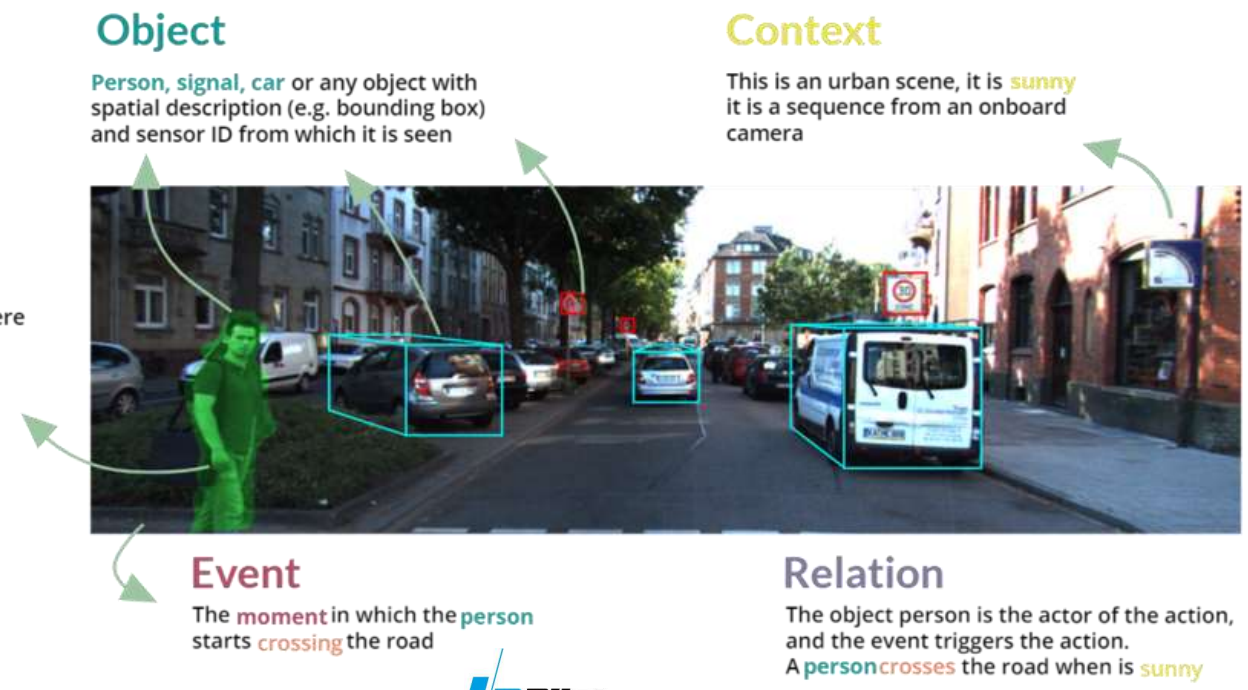
2D segmentation



Maneouvres (actions)

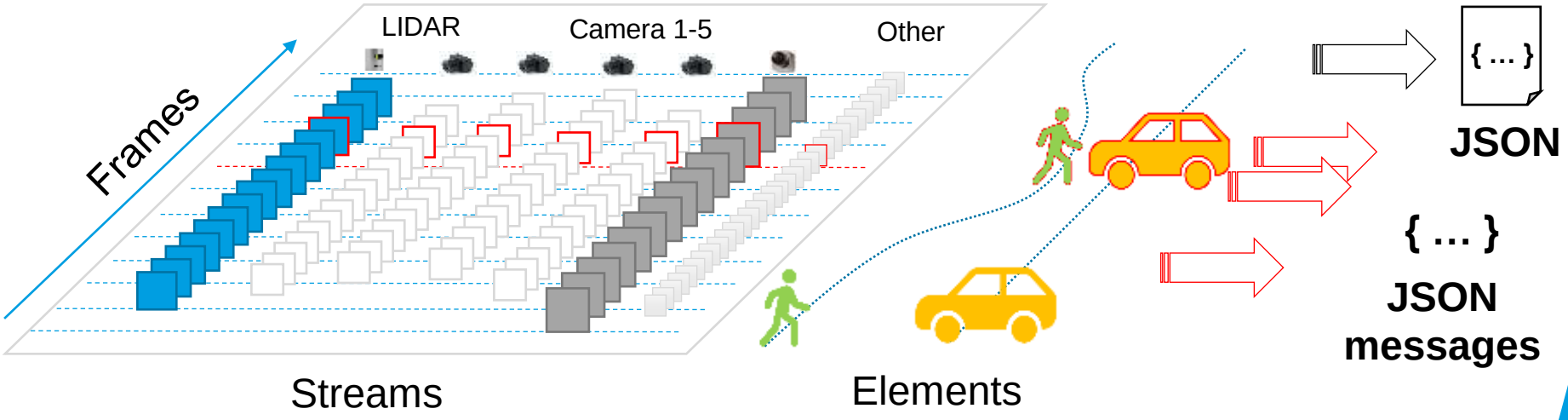
Annotation

- **Elements = {Objects, Actions, Events, Contexts, Relations}**



Annotation / Annotation format

- Elements, Frames and Streams



Annotation / Annotation format

- **VCD (Video Content Description)** syntax and tools for multi-purpose data labelling
  - JSON schema
  - Multi-sensor labels
  - Objects and Scene-level
  - Nested attributes
  - Static and dynamic information
  - Online and offline processing

- Linkage between **L3PILOT CDF** and **VCD** to extend metadata labelling capabilities for recordings

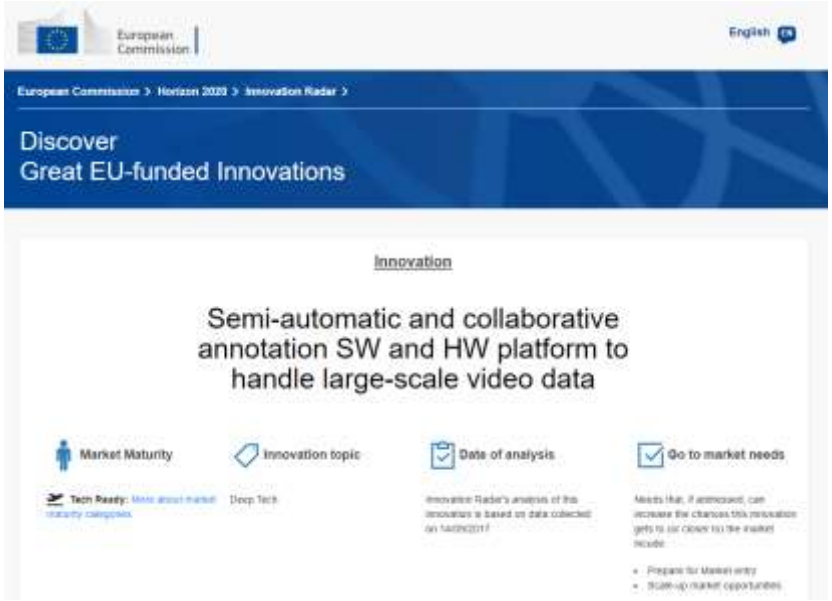
VCD

Github (open source, MIT license)
https://github.com/Vicomtech/video-content-description-VCD

Python and Typescript APIs

Annotation / Annotation format

- Horizon 2020 / Innovation radar

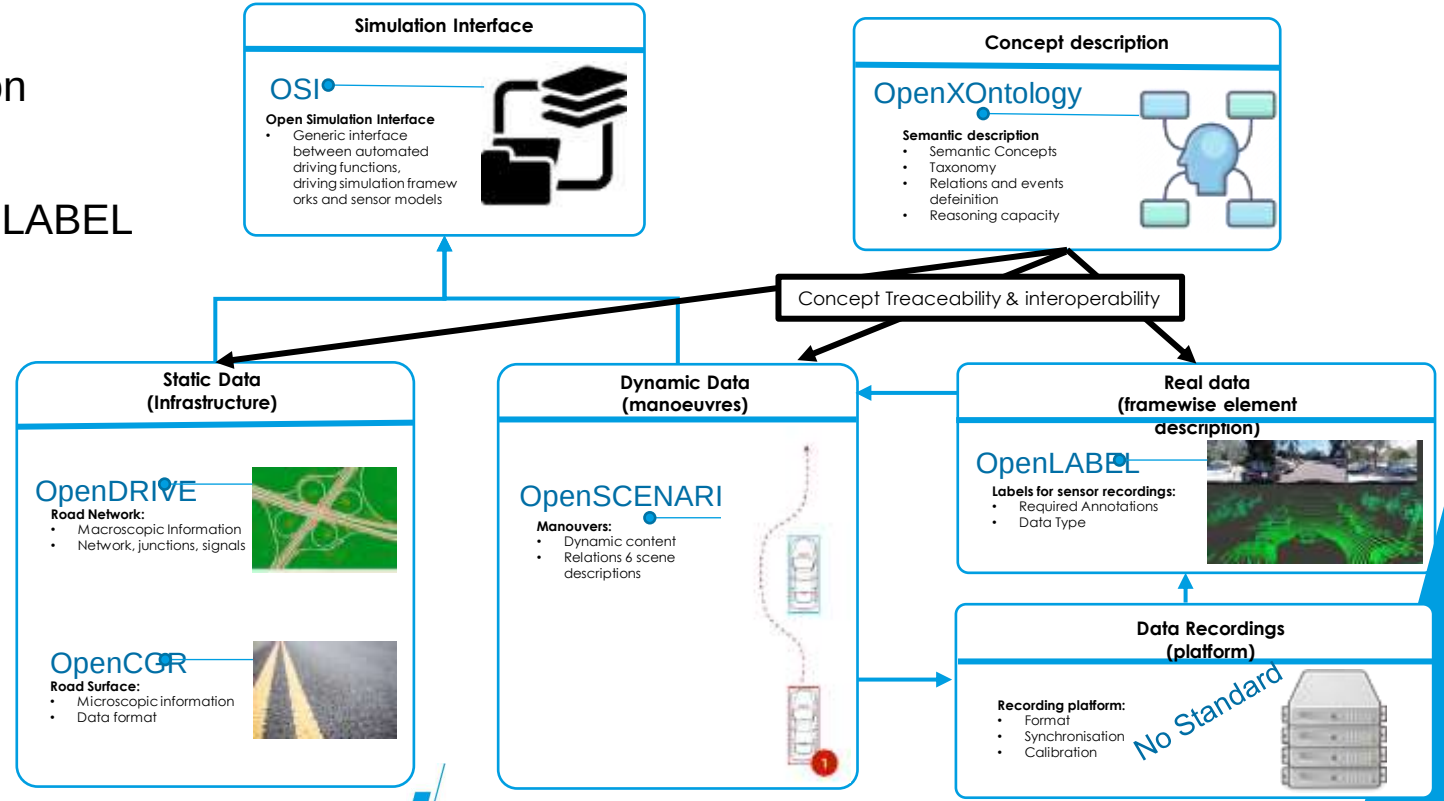


https://www.innoradar.eu/innovation/22423

https://www.innoradar.eu/innovation/22420

Annotation / Annotation format

- Standardisation
  - ASAM e.v.
  - VCD - OpenLABEL



Thank you for your kind attention.

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