

Integration of Autoware.AI into a research vehicle

Install Autoware.AI

Vehicle hardware components

Required software components from Autoware

Mapping of road network



Capabilities

- Wide selection of algorithms (planning, perception)
https://gitlab.com/autowarefoundation/autoware.ai/core_perception
https://gitlab.com/autowarefoundation/autoware.ai/core_planning
- Simulator integrations
<https://gitlab.com/autowarefoundation/autoware.ai/simulation>
- Large community, widely used

End-of-Life 2022

- That Autoware.AI be scheduled to go into maintenance mode (no new features added, only patch releases containing only bug fixes) at the end of 2020.
- That Autoware.AI receive only minor updates (1.15, 1.16, etc.) between now and the end of 2020.
- That Autoware.AI be scheduled for end-of-life (no new releases at all, no MRs accepted) at the end of 2022.

<https://discourse.ros.org/t/technical-steering-committee-tsc-meeting-17-2020-04-15-minutes/13749>



- **Recommended System Specifications for complete stack**

- Number of CPU cores: 8, Nvidia GPU
 - RAM size: 32GB, Storage size: 64GB+

Depends extremely which components are used from the stack. Runs also in a virtual machine.

- **Source Build**

- **Docker (recommended)**

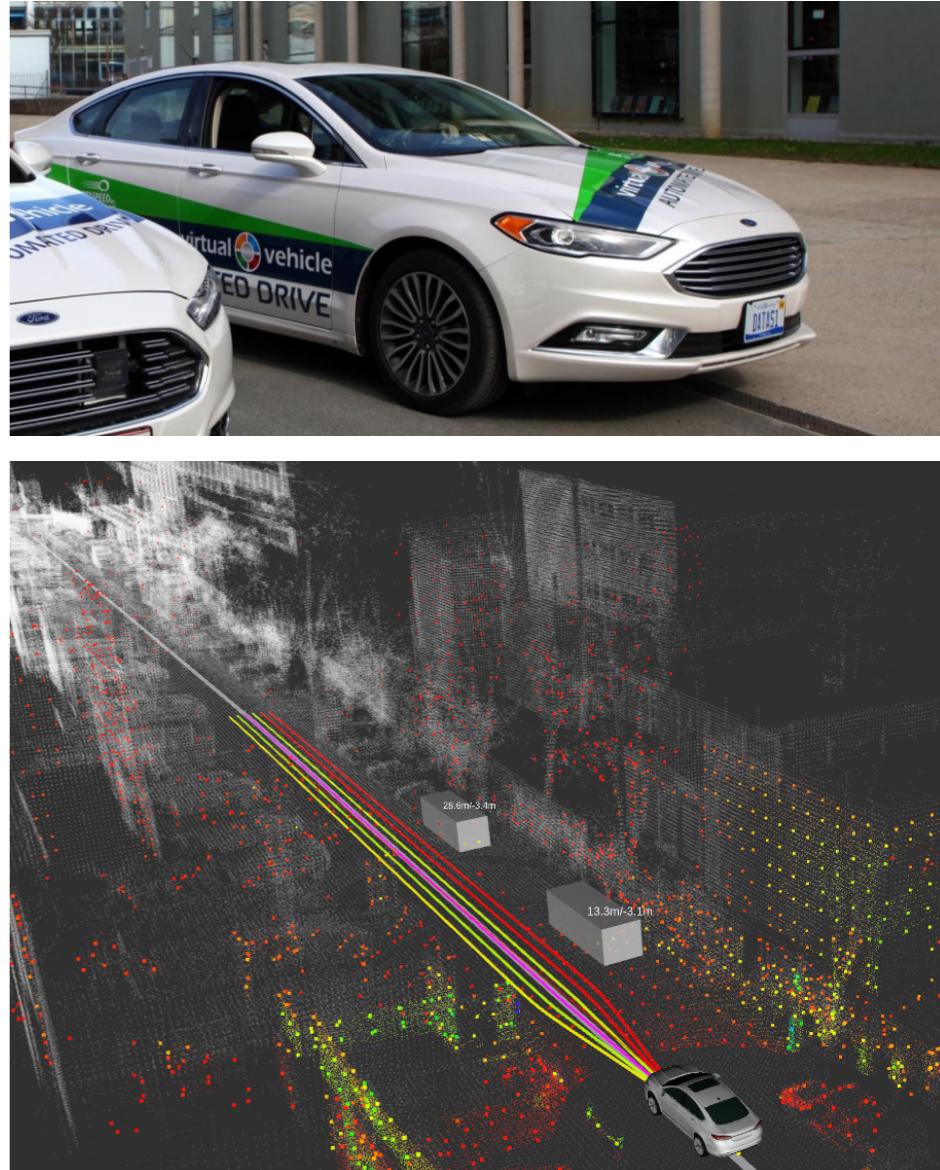
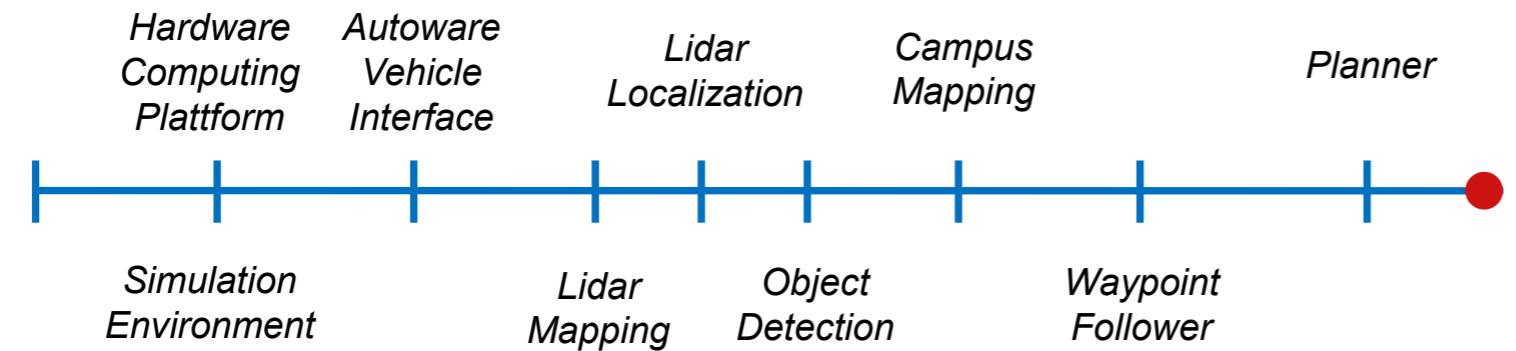
<https://gitlab.com/autowarefoundation/autoware.ai/autoware>



Driving on campus from A to B

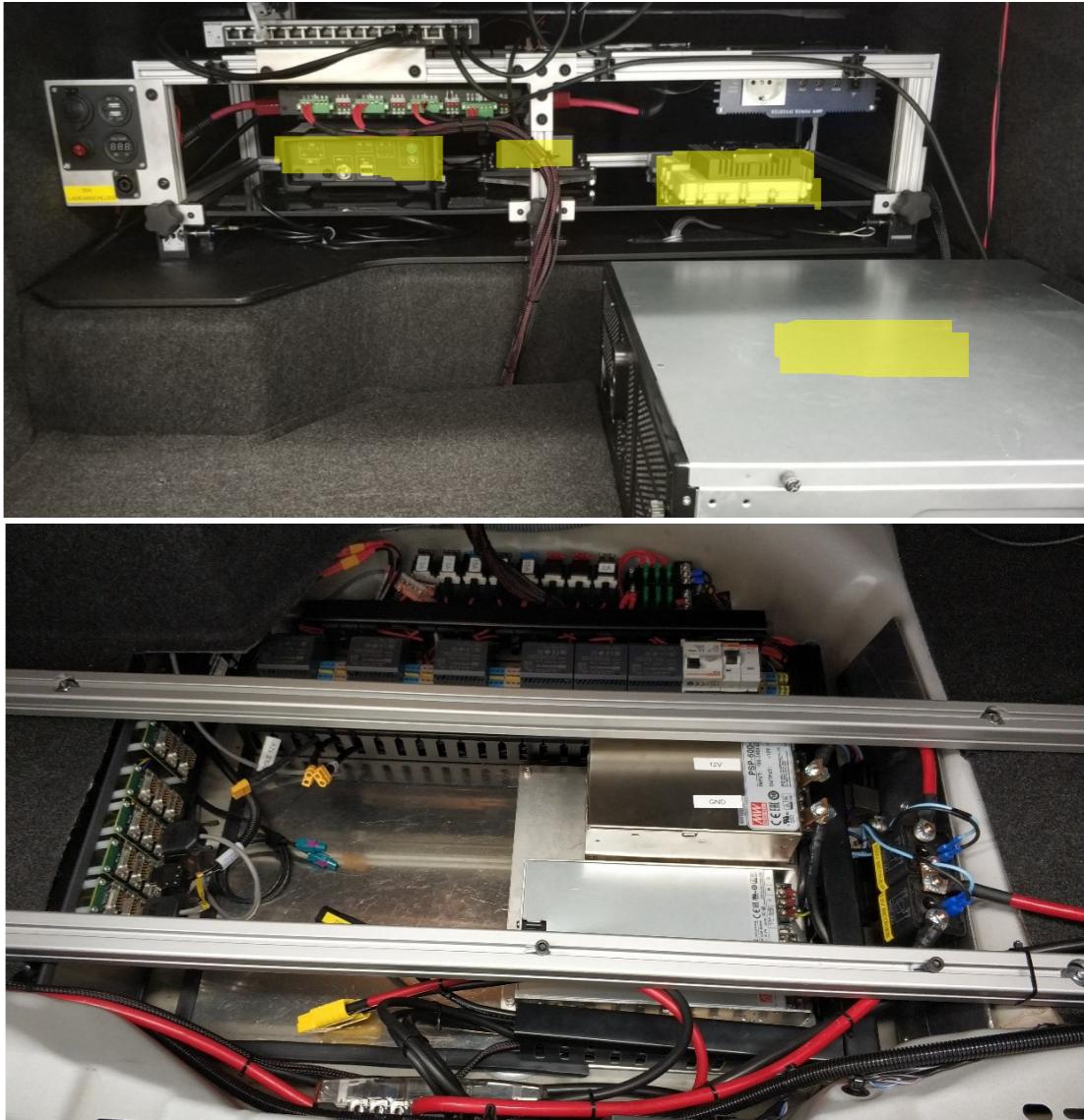
Evaluation of the functionality / performance of Autoware

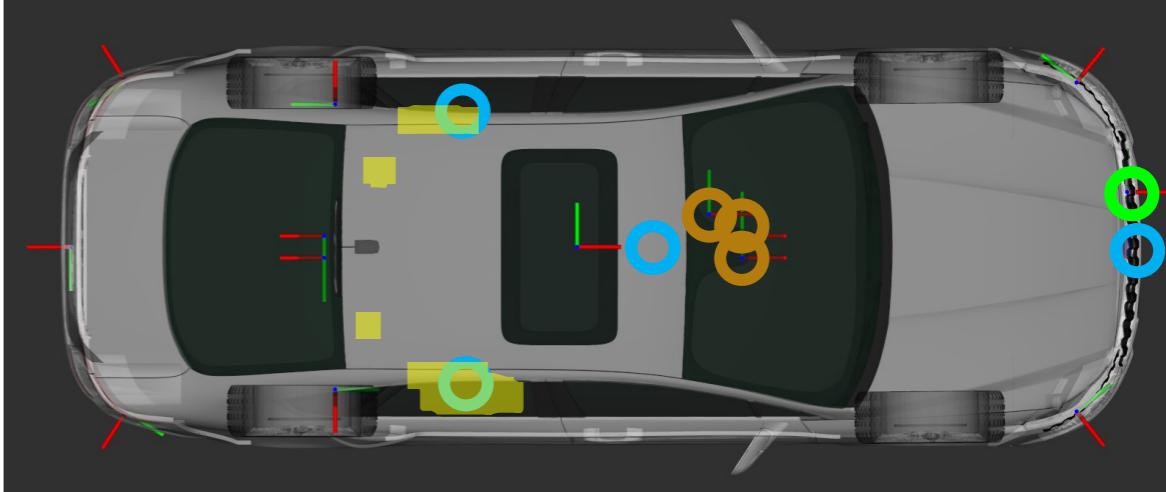
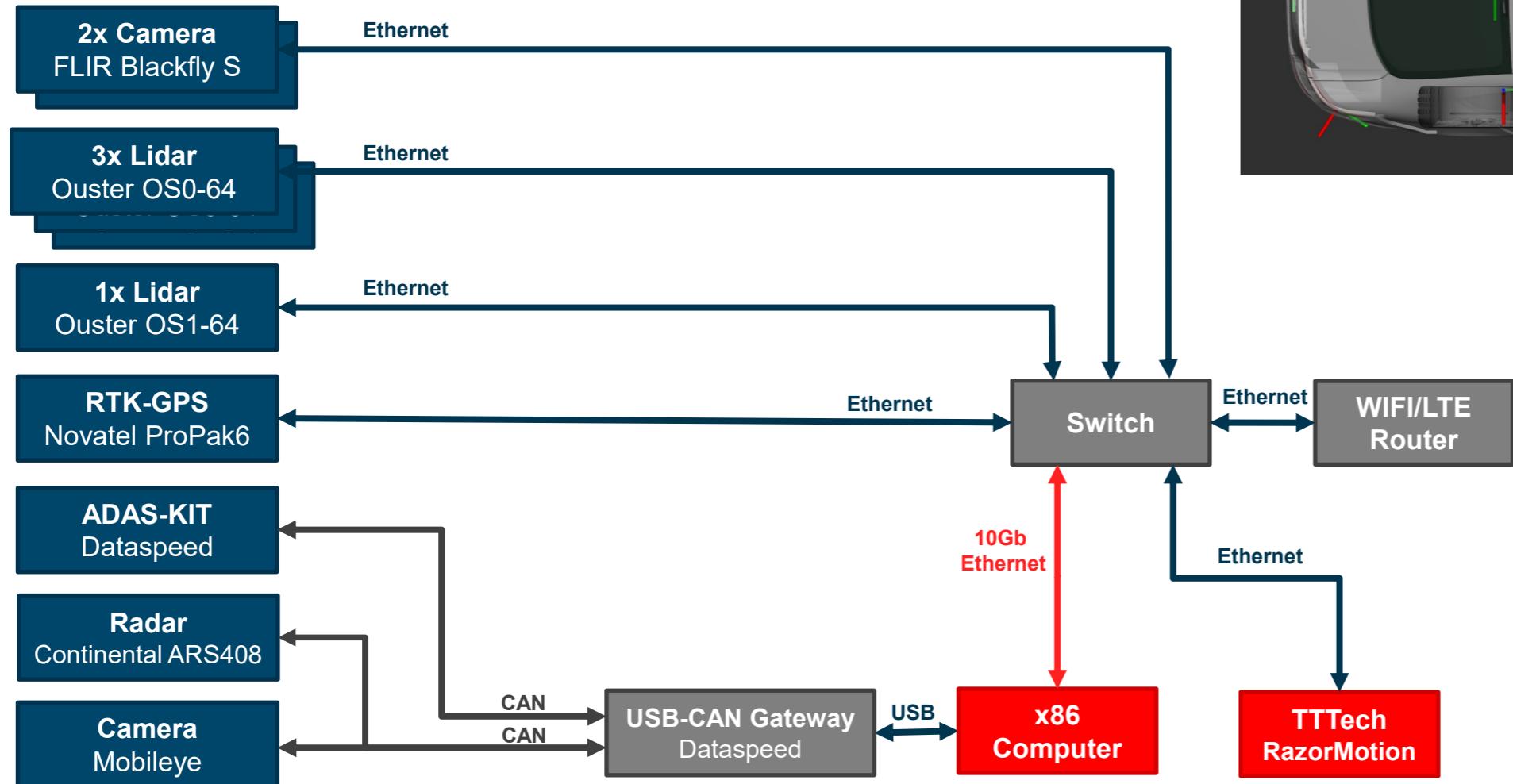
- Localization / navigation map
- Autoware / Dataspeed Interface
- Local planner (collision avoidance)



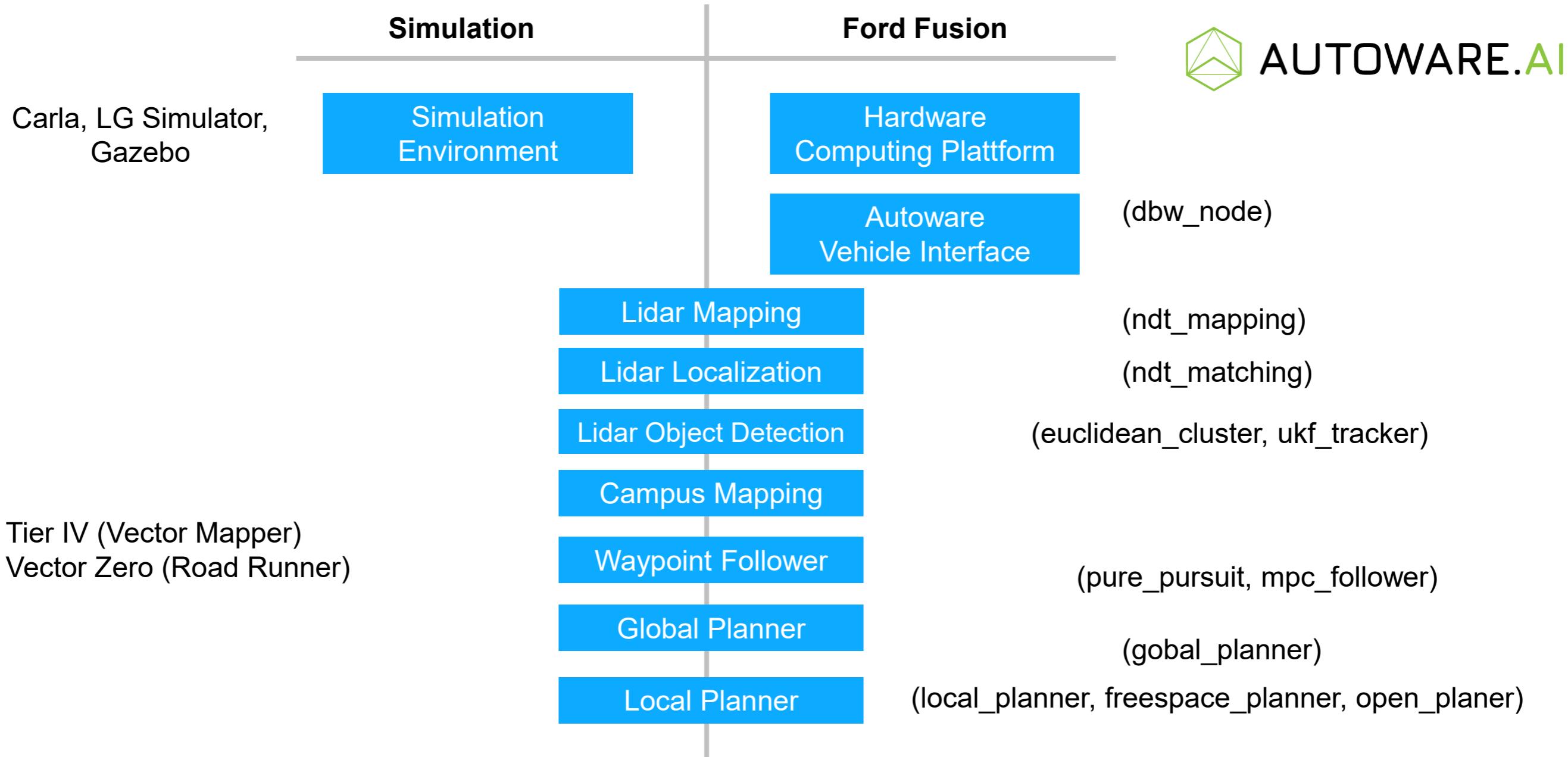
Driving on university campus

Virtual Vehicle – Automated Drive Demonstrator





- Radar
- Camera
- Lidar



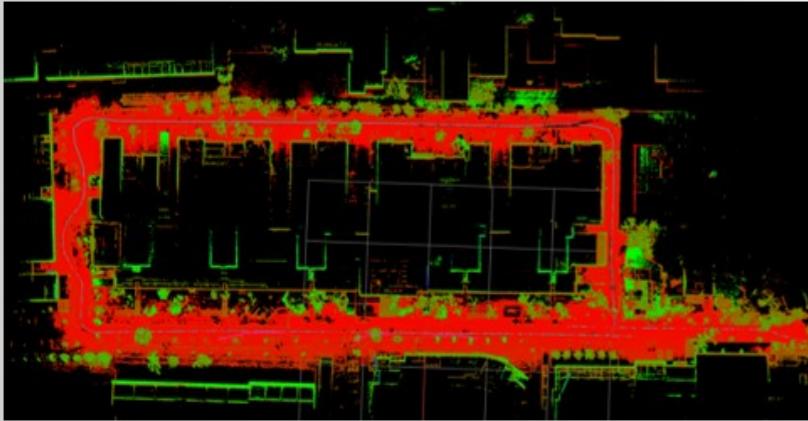
Map

Localization

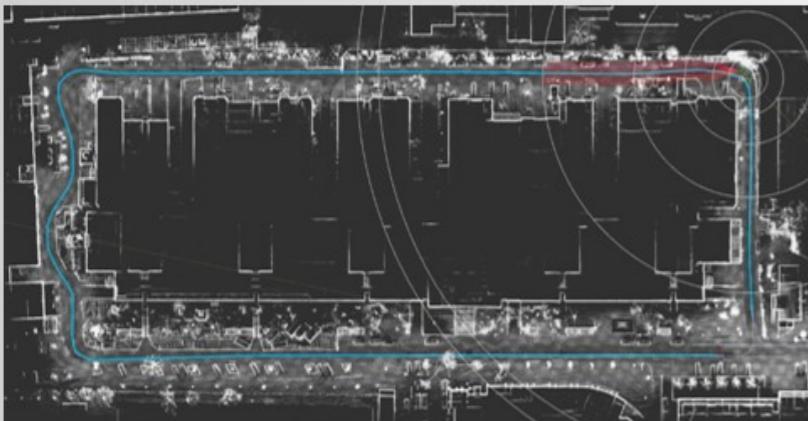
Object Detection

Path Planning

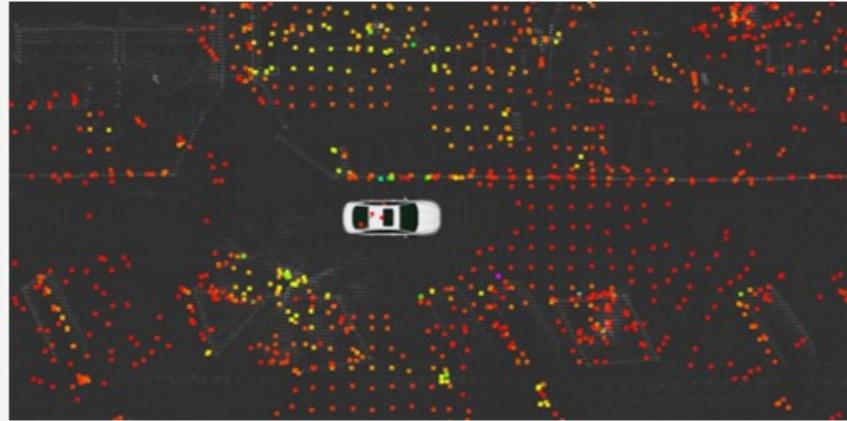
HD map



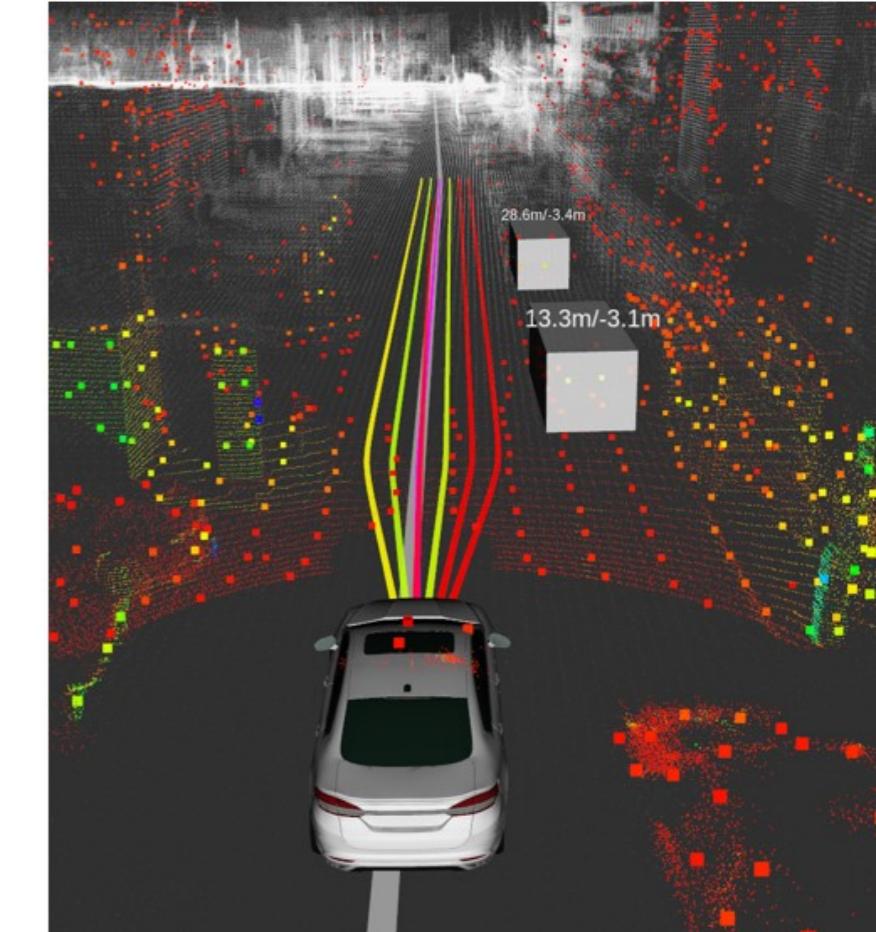
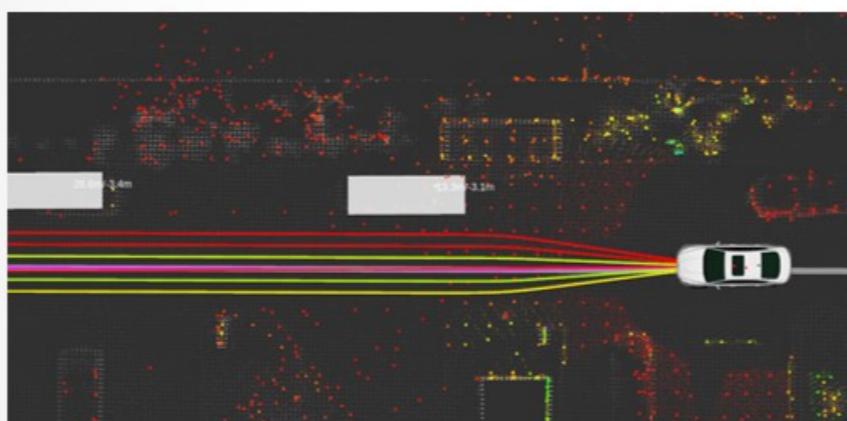
Global planning



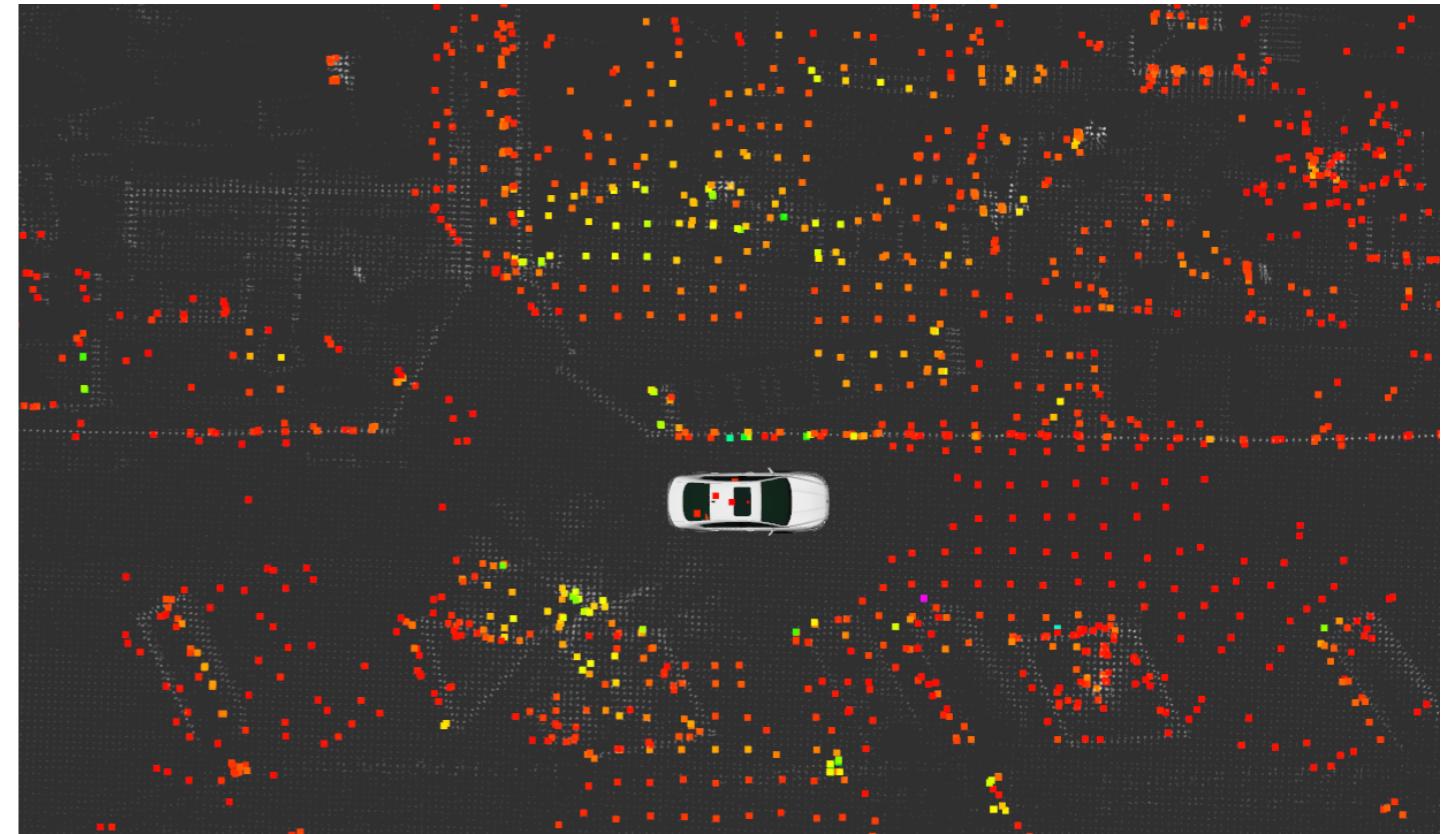
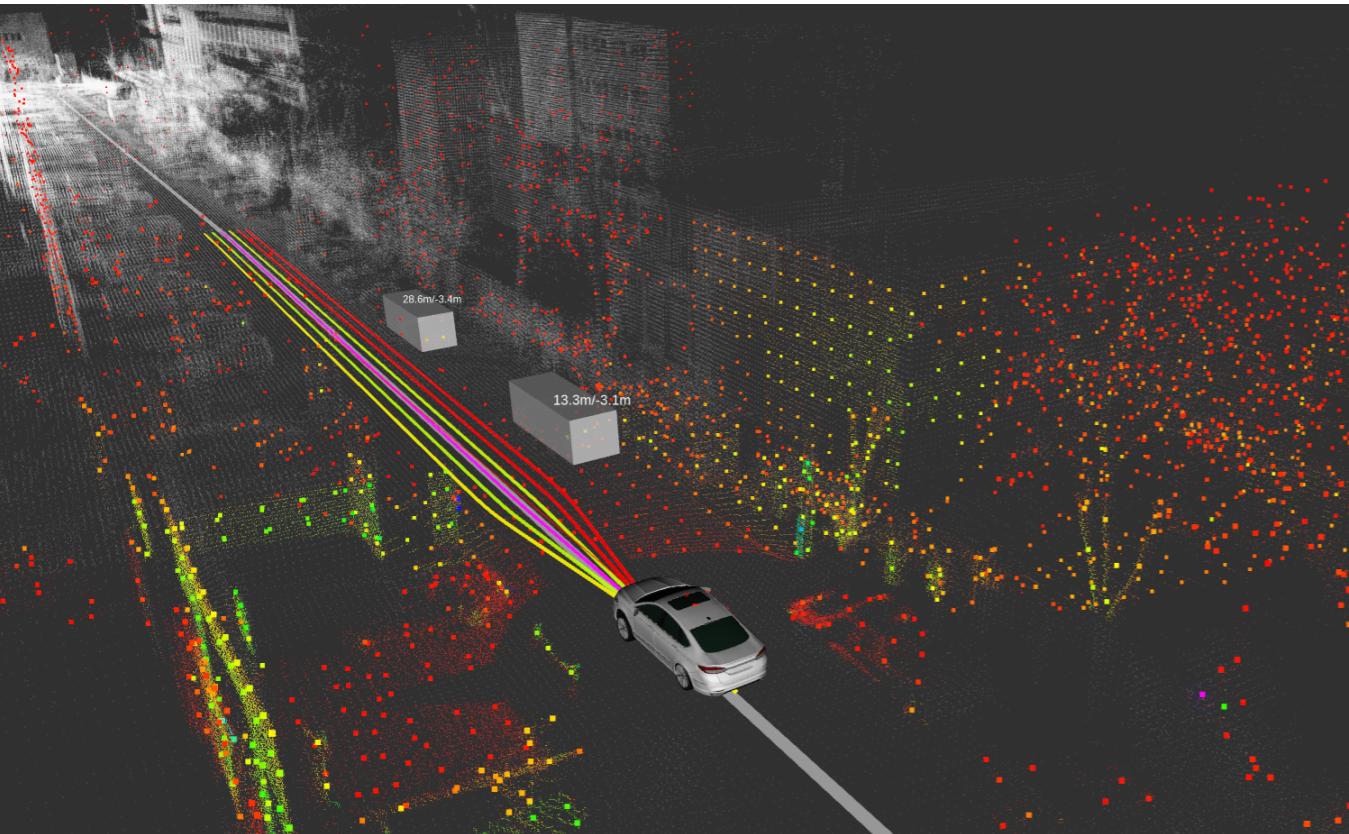
Lidar localization



Local Planning

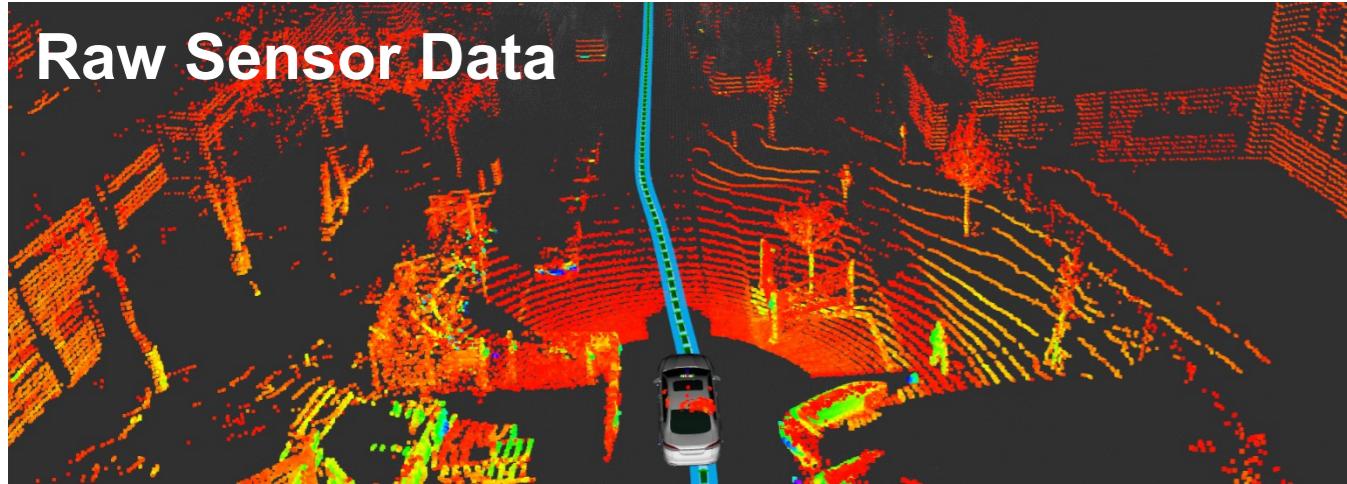


- Normal distributions transform (NDT) matching
- Lidar based / 64 Layers / 20 Hz / Voxel Grid 1m

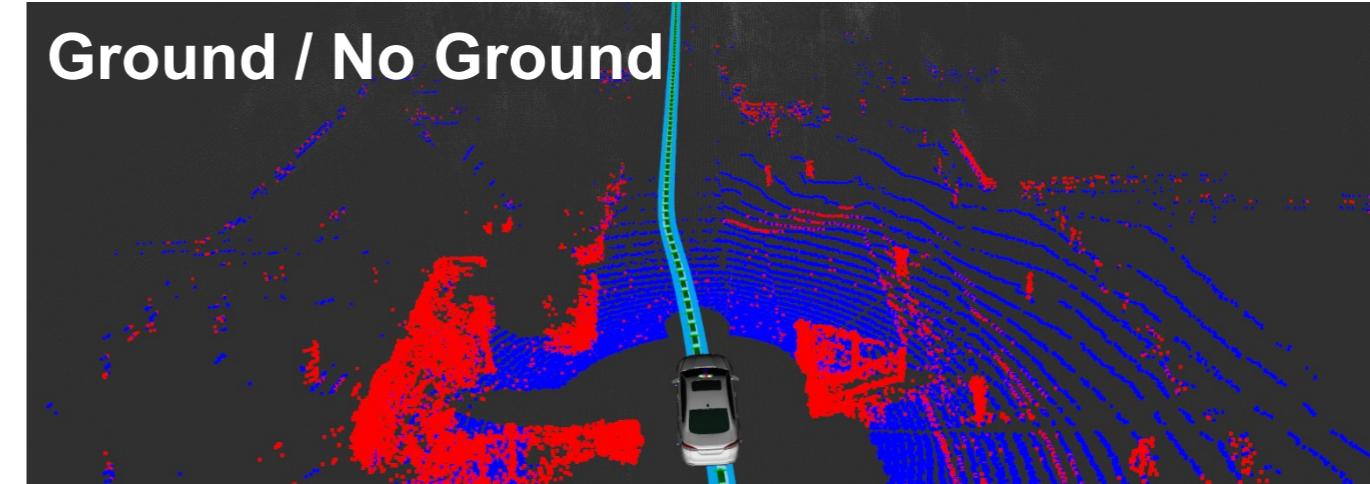


<https://gitlab.com/autowarefoundation/autoware.auto/AutowareAuto/-/tree/master/src/localization>

Raw Sensor Data



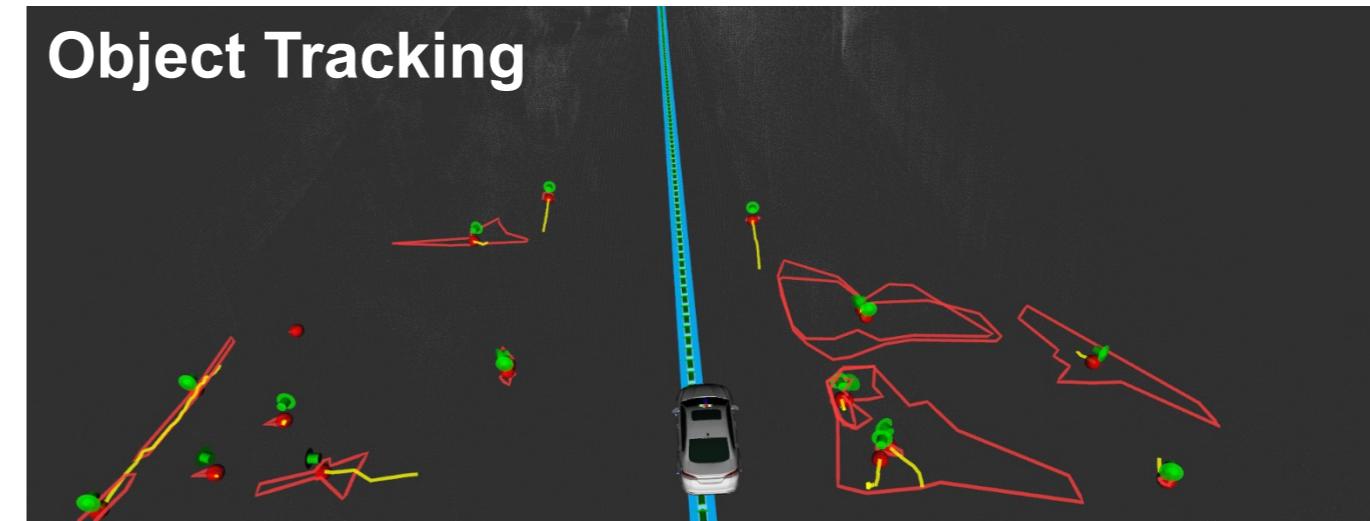
Ground / No Ground



Point Cloud Clustering



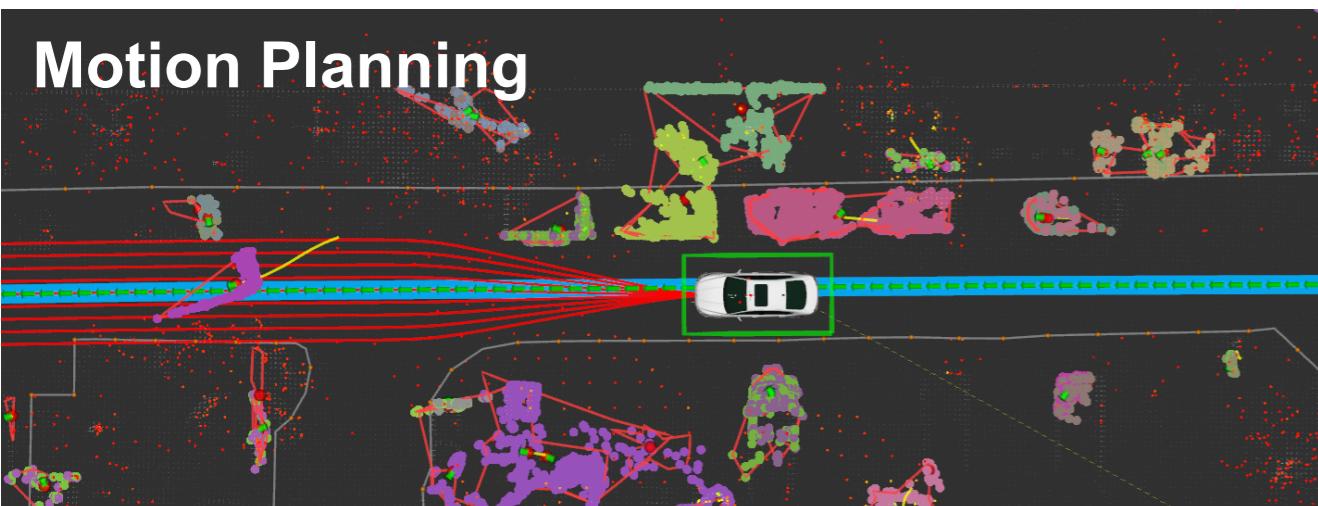
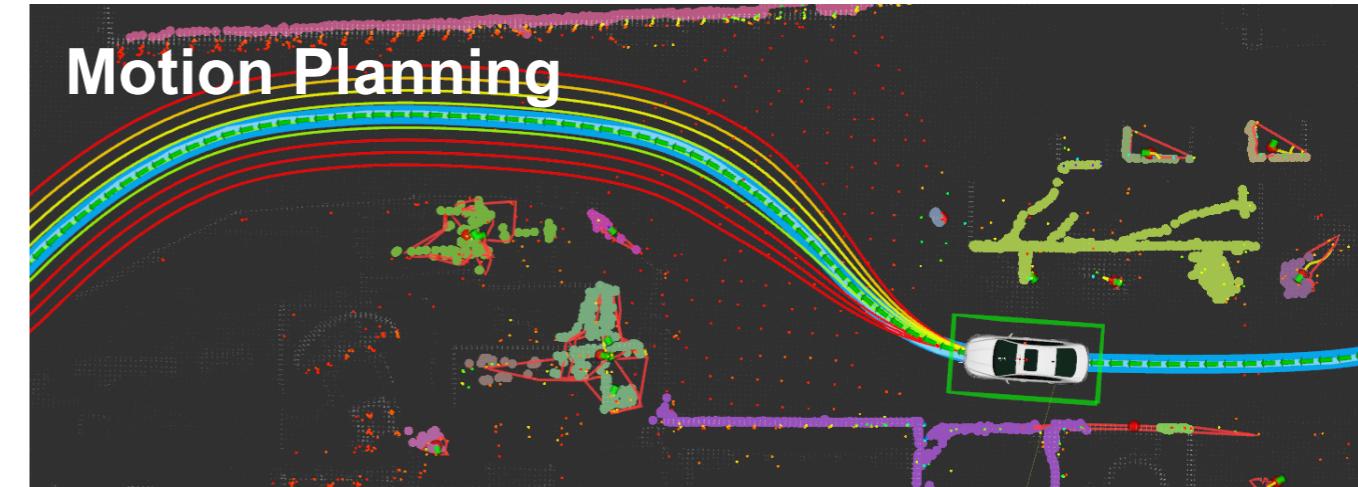
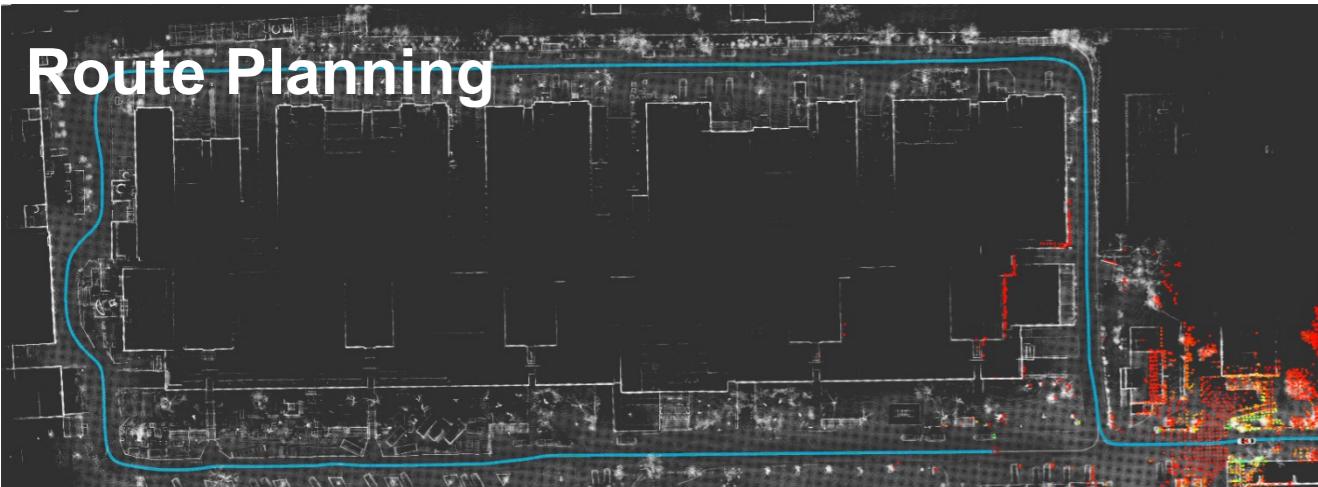
Object Tracking



<https://gitlab.com/autowarefoundation/autoware.auto/AutowareAuto/-/tree/master/src/perception>

Velodyne device driver, ground / no ground segmentation, object clustering





<https://gitlab.com/autowarefoundation/autoware.auto/AutowareAuto/-/tree/master/src/motion/planning>

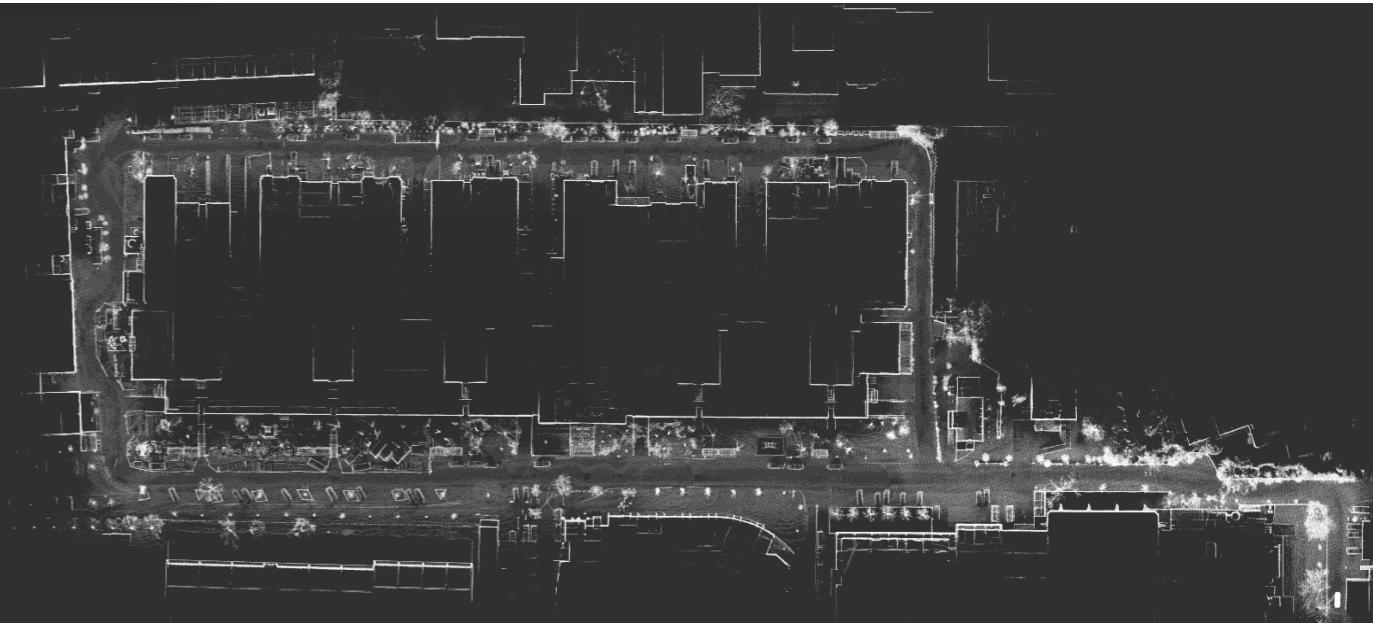
<https://gitlab.com/autowarefoundation/autoware.auto/AutowareAuto/-/tree/master/src/motion/control>

<https://gitlab.com/autowarefoundation/autoware.auto/AutowareAuto/-/tree/master/src/external>



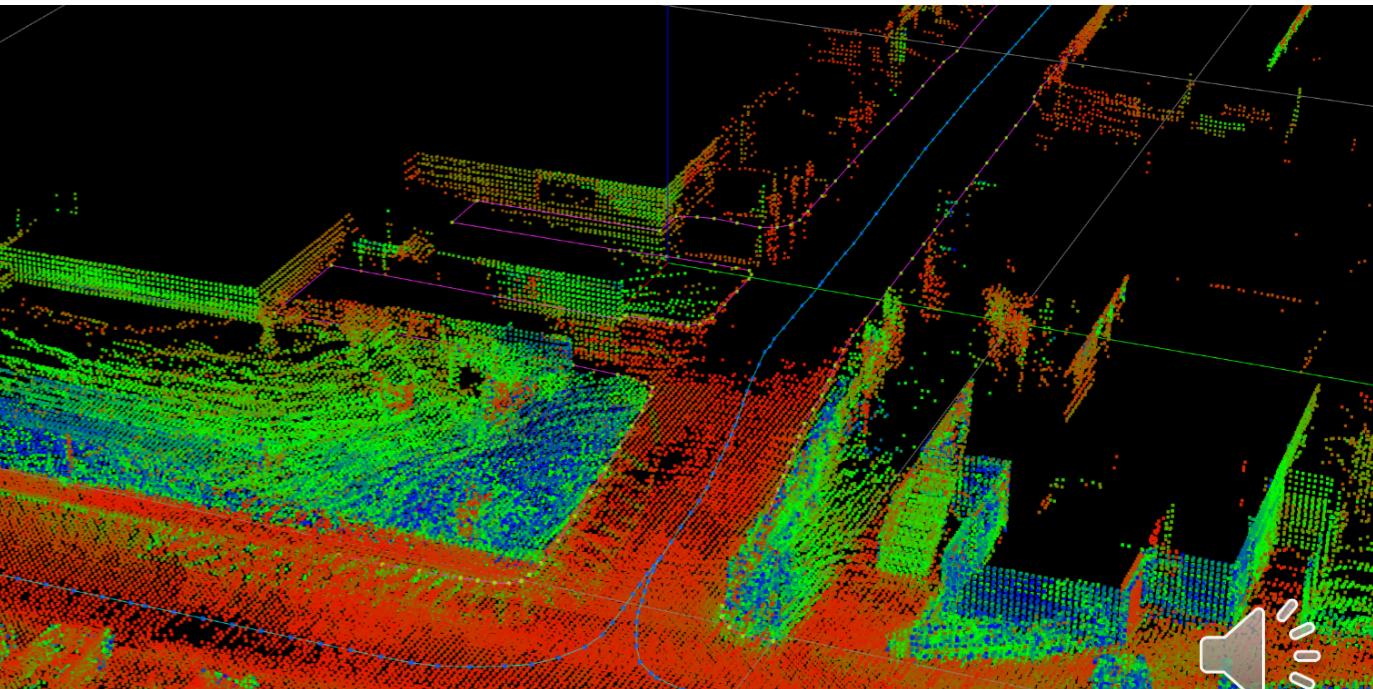
Mapping for localization (without RTK-GPS)

- Lidar with 64 layers
- NDT (normal distribution transformation)
- Output: Point cloud



HD map for path planning

- Browser based tool for mapping (Tier IV)
- Data format: Lanelet2, Vector Map
- https://tools.tier4.jp/feature/vector_map_builder/



Automated driving on campus

