

# AUTOWARE - QUICK START



# 1. AUTOWARE

## Autoware & ROS

Autoware is an open source software based on ROS. It is developed by Nagoya University and is intended for autonomous driving research and development. It is open sourced on GitHub.

Application



Middleware

ROS ☐

Host OS

Linux, ☐ ESOL ☐ MCOS... ☐

CPU ☐

GPU ☐

Camera ☐

GNSS ☐

LIDAR ☐

## bag file (rosbag)

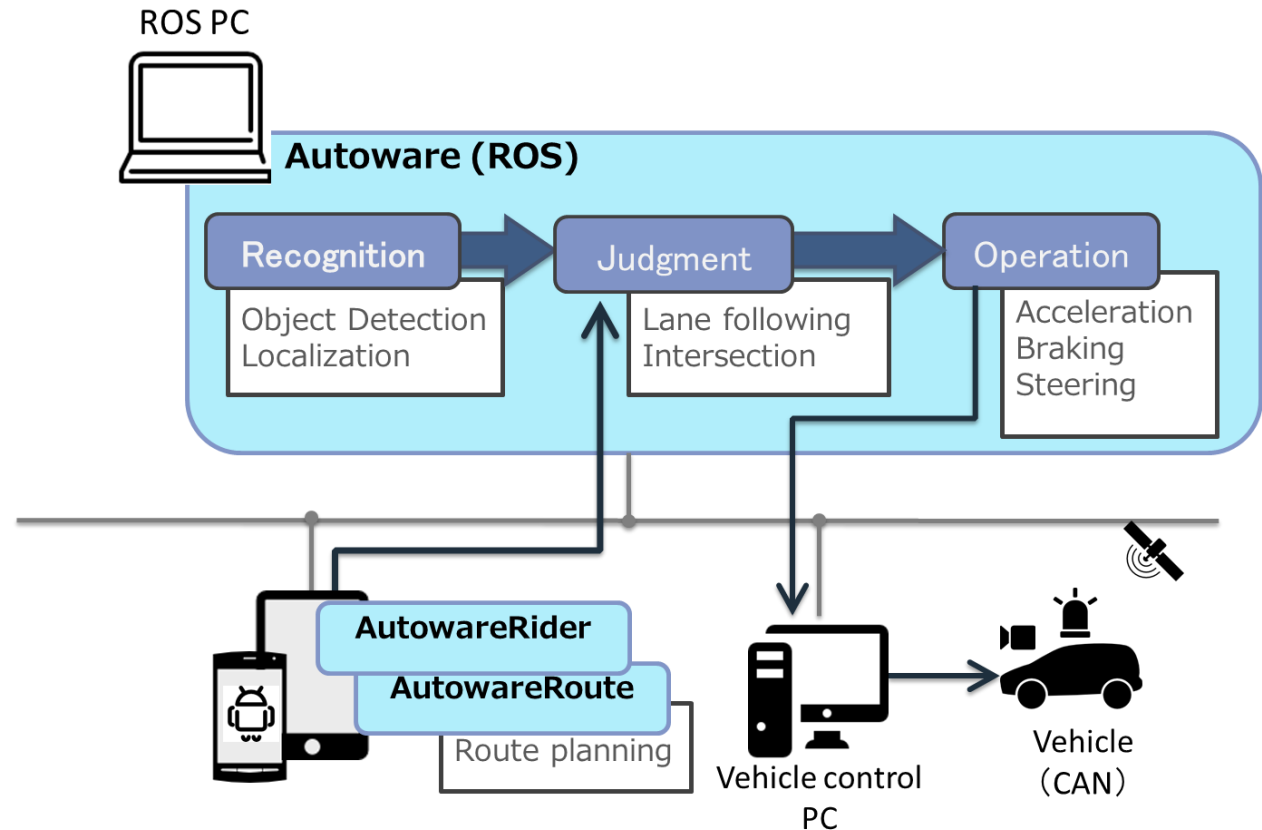
In ROS, all the messages of topics are logged and time-stamped to a .bag file called "rosbag". This can be used for replay of the messages with RViz (3D visualization tool for ROS). In robotics, it is often difficult to analyze the interactions with multiple sensors at once, and this tool enables efficient analysis and debugging of system. Also, the logged messages can be replayed repeatedly, allowing developers to debug their systems without actual sensors.

# 1. AUTOWARE

## Functions provided

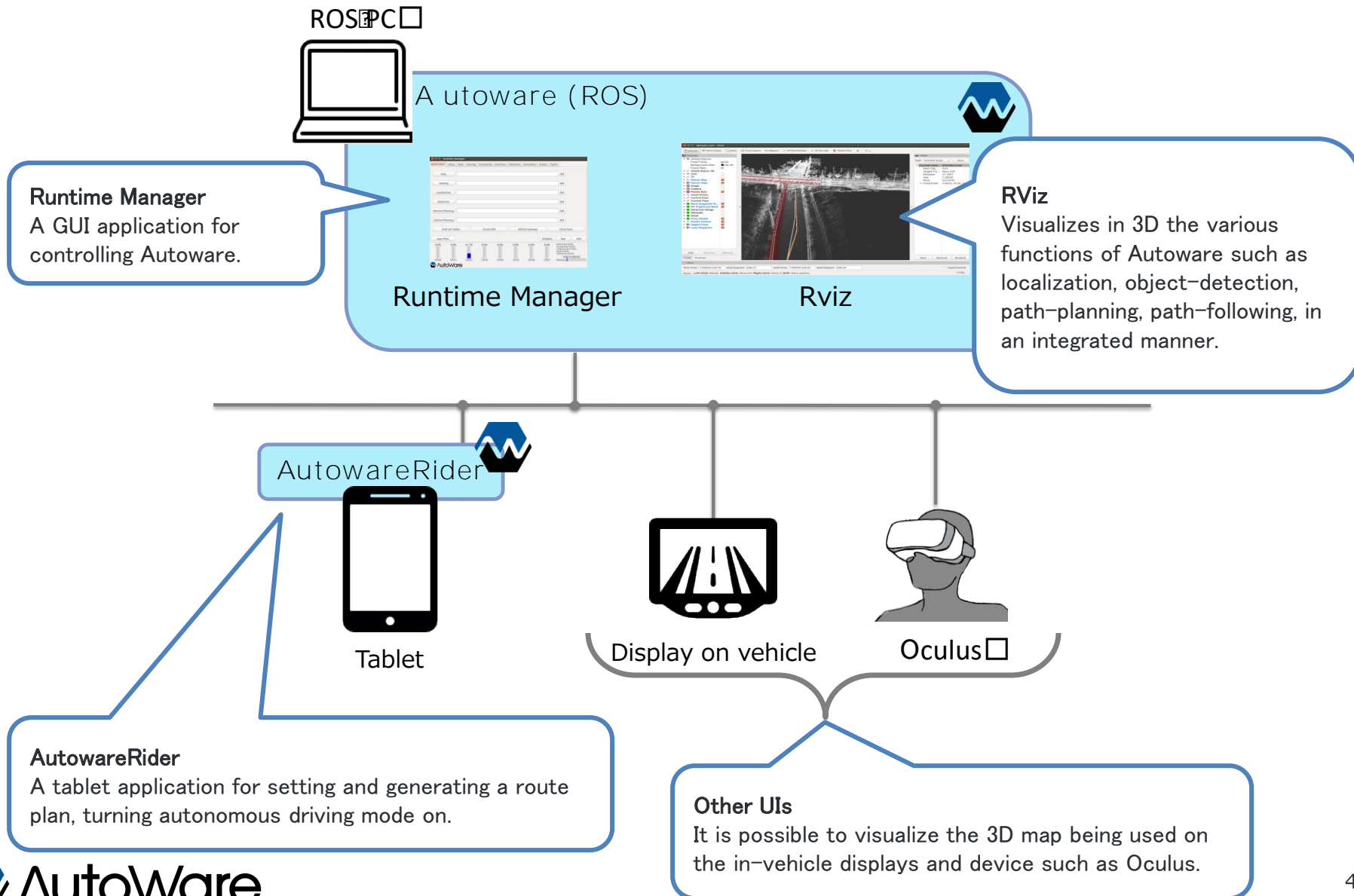
Autoware provides the following functions.

- ✓ Localization
- ✓ Object detection
- ✓ Driving control
- ✓ 3D map generation and sharing



## 2. USER INTERFACE

### Available user Interfaces



## THE OPERATIONS OF MAIN FUNCTIONALITIES OF AUTOWARE – QUICK START VERSION

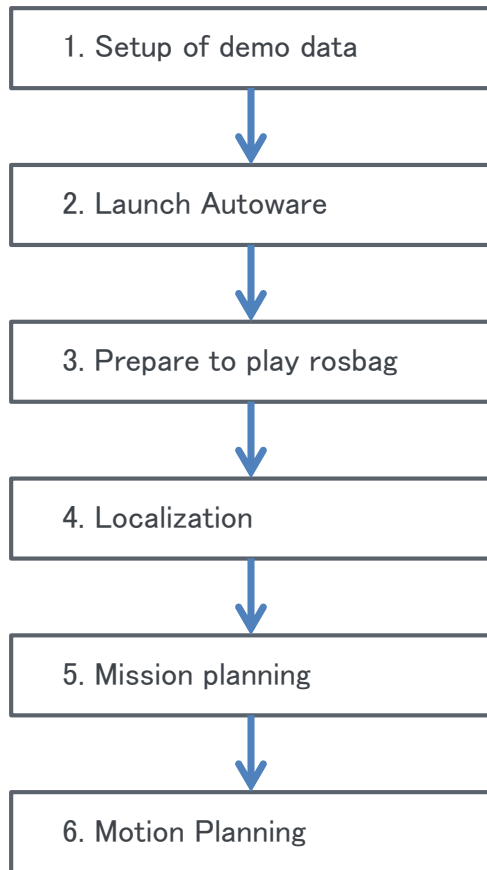
1. Setup of demo data
2. Launch Autoware
3. Prepare to play rosbag
4. Localization
5. Mission planning
6. Motion following

# THE OPERATIONS OF MAIN FUNCTIONALITIES OF AUTOWARE

## Operation steps

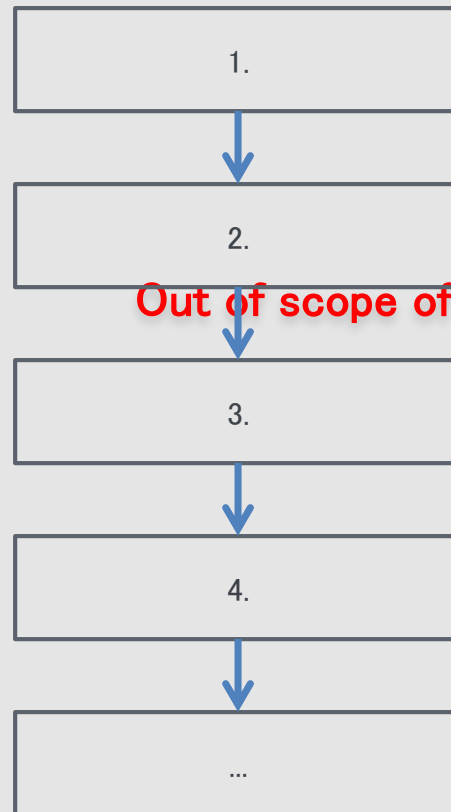
### replay of demo data

Replay the rosbag demo data downloaded from Nagoya University.



### Autoware on a real vehicle

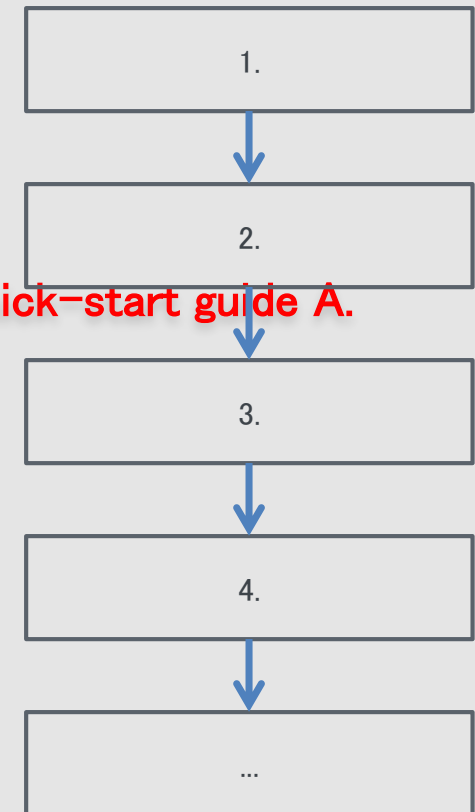
Drive a real vehicle with Autoware autonomously.



Out of scope of this Quick-start guide A.

### rosbag replay

Replay the data corrected on the procedure on left.



# 1. SETUP OF DEMO DATA

## 1.1. make a directory

Make a directory “.autoware” for demo data.

```
~$ mkdir .autoware
```

## 1.2. Downloading the demo data

Download the data from following sites and place in “~/ .autoware”

A script for generating a demo launch file:

[http://db3.ertl.jp/autoware/sample\\_data/my\\_launch.sh](http://db3.ertl.jp/autoware/sample_data/my_launch.sh)

Map/calibration/path data (Moriyama area):

[http://db3.ertl.jp/autoware/sample\\_data/sample\\_moriyama\\_data.tar.gz](http://db3.ertl.jp/autoware/sample_data/sample_moriyama_data.tar.gz)

rosvbag data:

[http://db3.ertl.jp/autoware/sample\\_data/sample\\_moriyama\\_150324.tar.gz](http://db3.ertl.jp/autoware/sample_data/sample_moriyama_150324.tar.gz)

*Note that this ROSBAG data do not contain the video data. Therefore the object detection is not supported.*

If [.autoware] directory is not shown, set your file browser to display hidden files.

# 1. SETUP OF DEMO DATA

## 1.3. Unpacking demo data

Unpack the demo data as follows.

```
~$ cd .autoware  
~/.autoware$ tar xzf sample_moriyama_data.tar.gz  
~/.autoware$ tar xzf sample_moriyama_150324.tar.gz
```

## 1.4. Run my\_launch.sh

Run the following script to generate launch files.

```
~/.autoware$ sh my_launch.sh
```

The following set of launch files should have been generated.

my_launch/	
my_map.launch	# Load PointClouds and vector maps
my_sensing.launch	# Load device drivers
my_localization.launch	# Localozation
my_detection.launch	# Object detection
my_mission_planning.launch	# Path planning
my_motion_planning.launch	# Path following



## 2. LAUNCH AUTOWARE

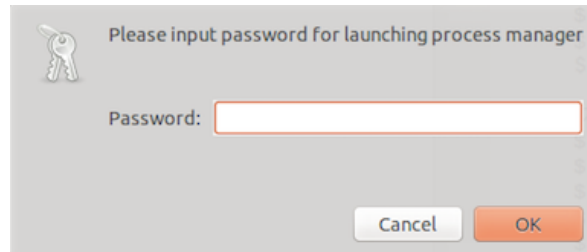
### 2.1. Launch Runtime Manager

1. Double clicking “Autoware/ros/run” or “./ run” on a ROS PC will launch the Runtime Manager.
2. Two separate terminals will appear once the run is executed. One is [roscore], and the other is [runtime\_manager].

### 2.2. Entering the supervisor credential

Autoware requires the supervisor password to execute its functions.

1. A password dialogue will be displayed upon launching the Runtime Manager. Enter the supervisor password.



2. Runtime Manager window will open.

## 3. PREPARE TO PLAY ROSBAG

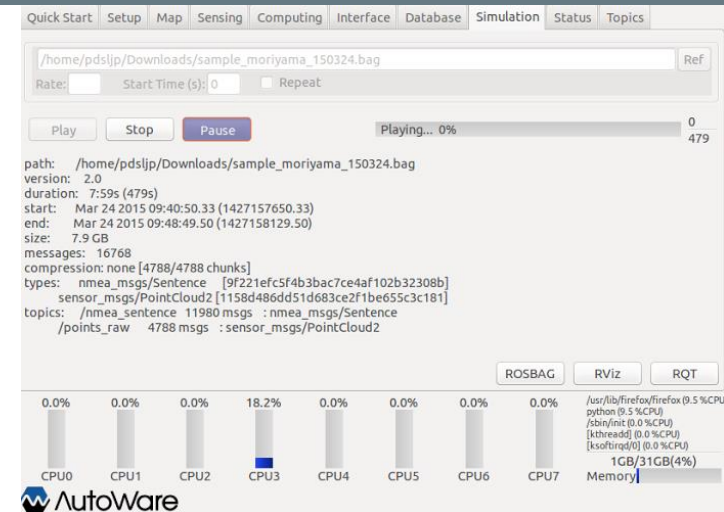
### 3.1 Play rosbag for a few seconds and pause

Autoware requires the rosbag to be played for a few seconds to connect.

1. In [Simulation] tab, specify following .bag file and press [Play] button.

“~/.autoware/sample\_moriyama\_150324.bag”

2. Press [Pause] button.



### 3.2 Launching and setting up RViz

Autoware provides set-up files for RViz.

1. Pressing [RViz] button to launch RViz.  
(The same button is available in all tabs of Runtime Manager and any can be used)
2. Select [File]-[Open Config] in RViz
3. Upon [Choose a file to open] dialogue, select the following file, then press [Open].

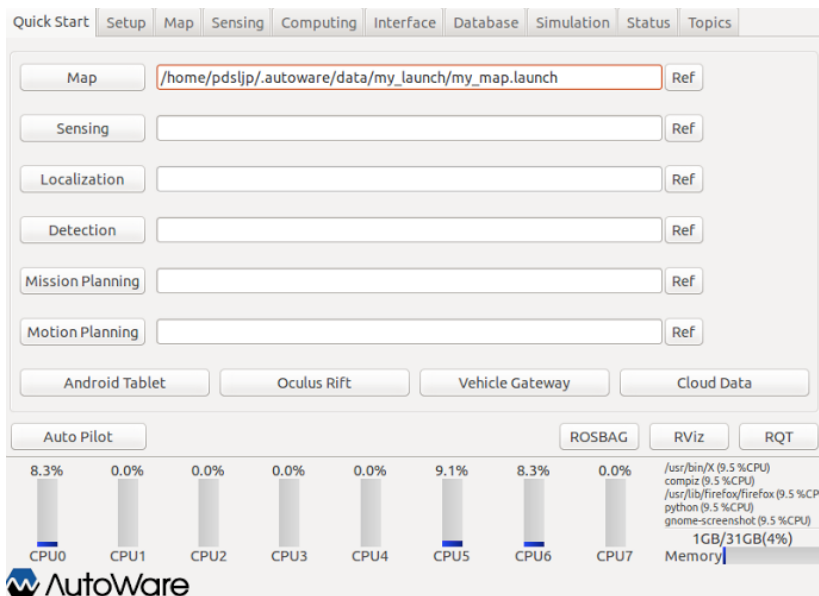
“~/Autoware/ros/src/.config/rviz/default.rviz”

# 3. PREPARE TO PLAY ROSBAG

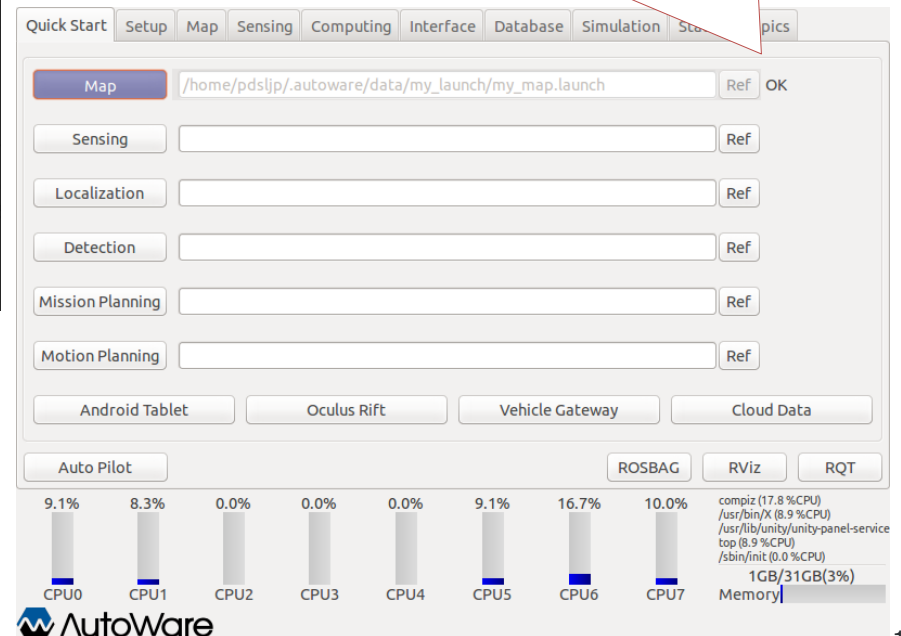
## 3.3 Loading PointCloud and Vector maps

In [Quick Start] tab, specify the “**my\_map.launch**” generated in [1. Setup of demo data](#) in the text field next to [Map] button and press the [Map] button.

“~/ .autoware/data/my\_launch/my\_map.launch”



Proceed to next step after this “OK” is displayed.



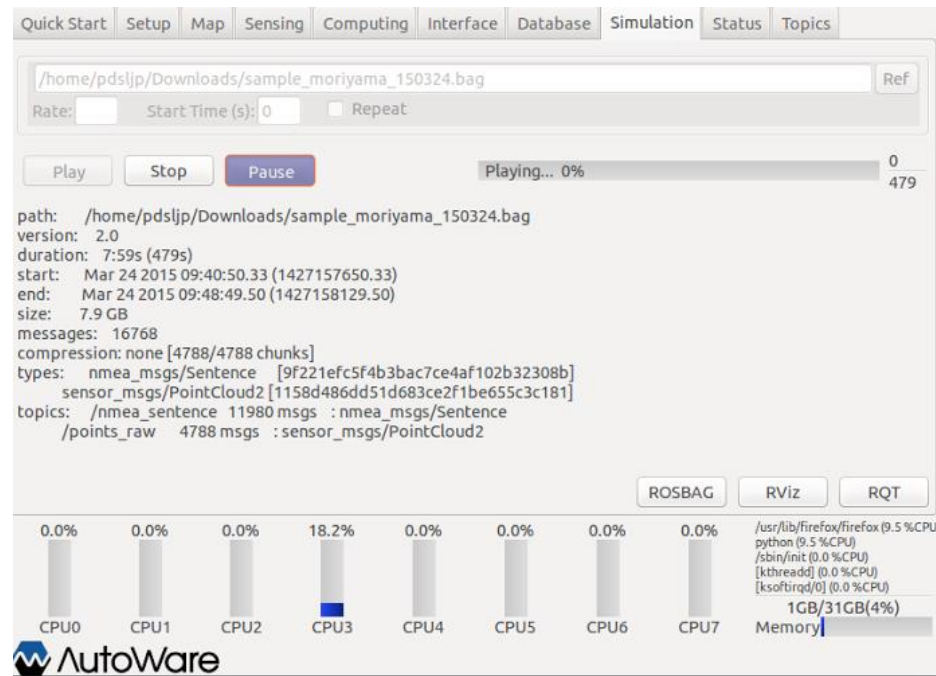
## 4. LOCALIZATION

### 4.1 Start Localization

1. In [QuickStart] tab, specify following .launch file in the text field next to [Localization] button, then press the [Localization] button

“~/.autoware/my\_launch/my\_localization.launch”

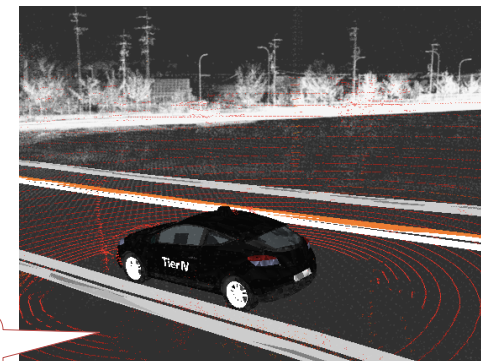
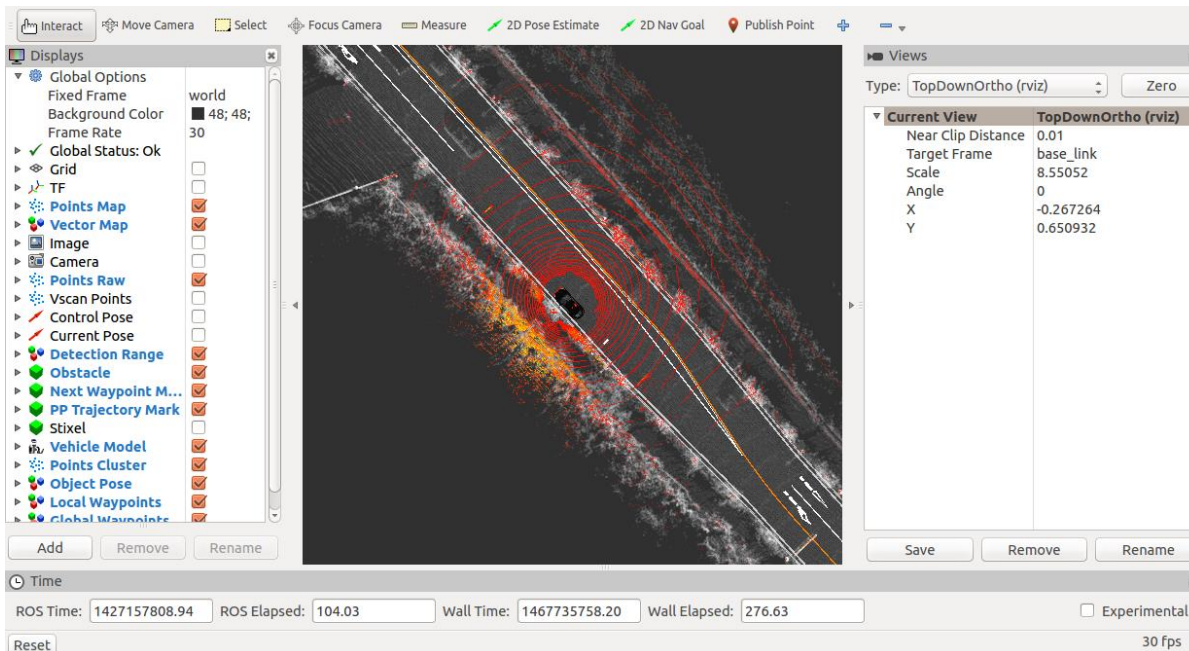
2. In [Simulation] tab, press [Pause] button to release it to restart ROSBAG replay.



# 4. LOCALIZATION

## 4.2 Display in RViz

1. In [Global Options]-[Fixed Frame] in the [Display] window, specify “world”. This will overlay the display of Velodyne data and 3D map data.
1. In [Current View]-[Target Frame] the [View] window, specify “base\_link” and set [Type] to “TopDownOrtho” then press [Zero] button. (This will initiate the tracking the car position)
1. When the progress bar in the [Simulation] tab reaches 23% (110/479 sec), the display should stabilize.



In [Current View], setting “TopDownOrtho(rviz)” to “ThirdPersonFollower(rviz)” change the display to this.

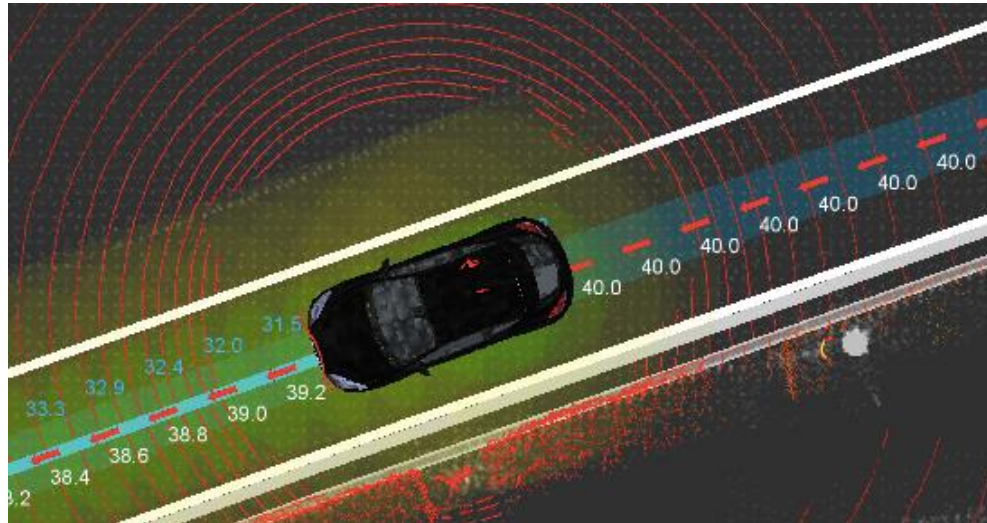
## 5. MISSION PLANNING

## 5.1 Start Mission Planning

1. In [QuickStart] tab, specify the following .launch file in the text field next to [Mission Planning] button and press the [Mission Planning] button.

```
"~/autoware/my_launch/my_mission_planning.launch"
```

2. Soon after the turning the first corner (progress bar 38%, at around 182/479 sec), the path and the speed will be displayed as shown below.





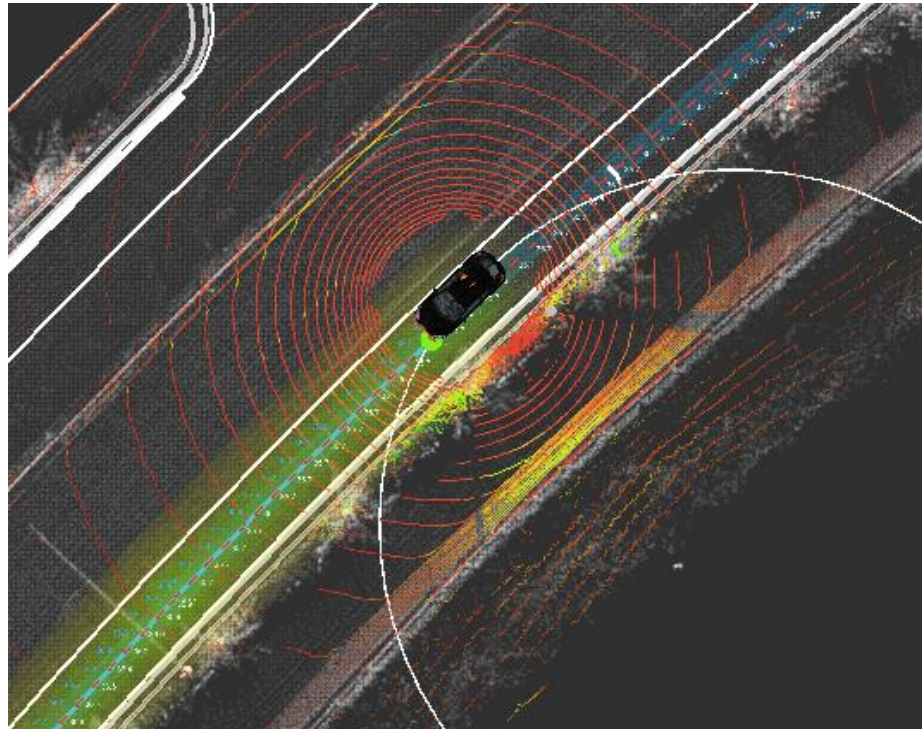
# 6. MOTION PLANNING

## 6.1 Start Motion Planning

1. In [QuickStart] tab, specify the following .launch file in the text field next to [Motion Planning] button and press the [Motion Planning] button.

`"~/autoware/my_launch/my_motion_planning.launch"`

2. Once the car reaches the path set in the path planning, it will display the small green ball and the radial circles calculated as pure pursuit.





**Intelligent Vehicle**

[www.tier4.jp](http://www.tier4.jp)