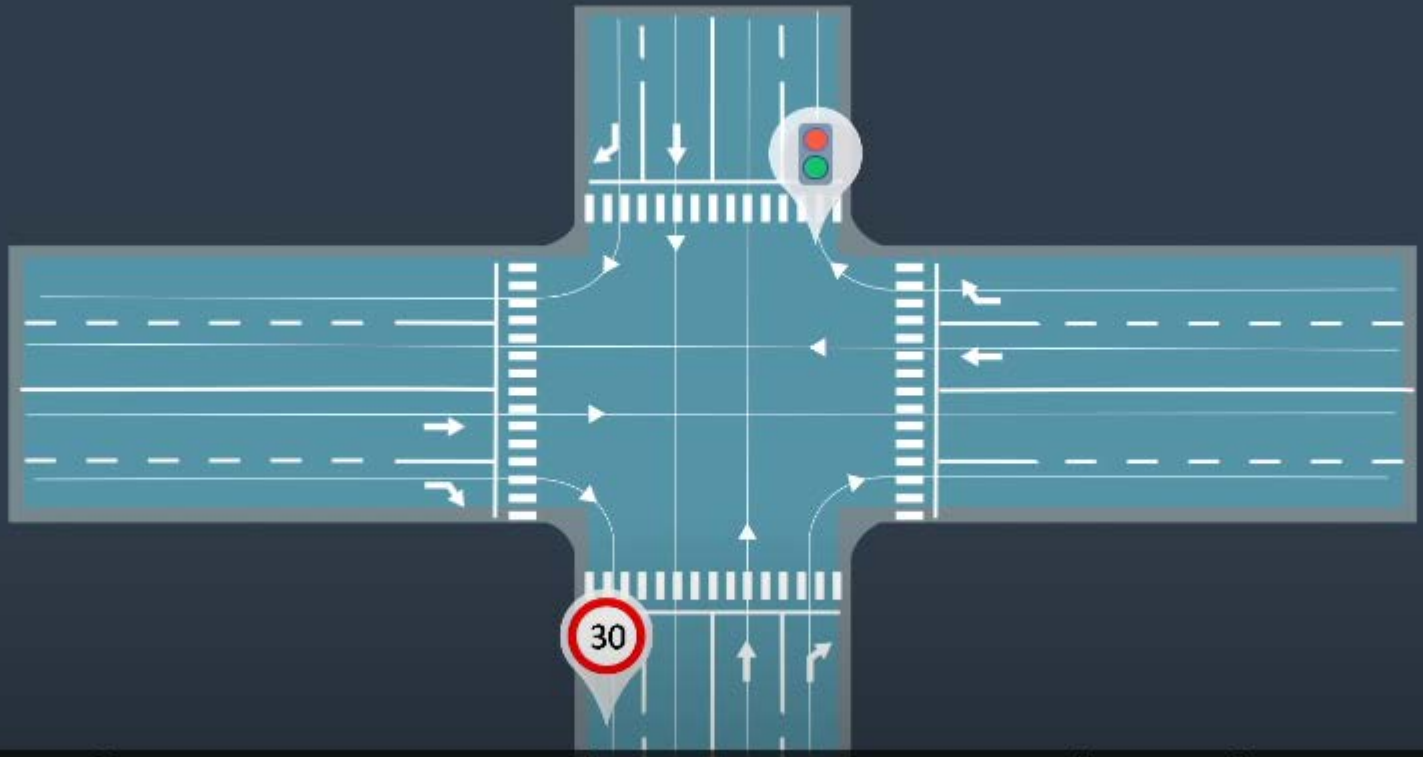
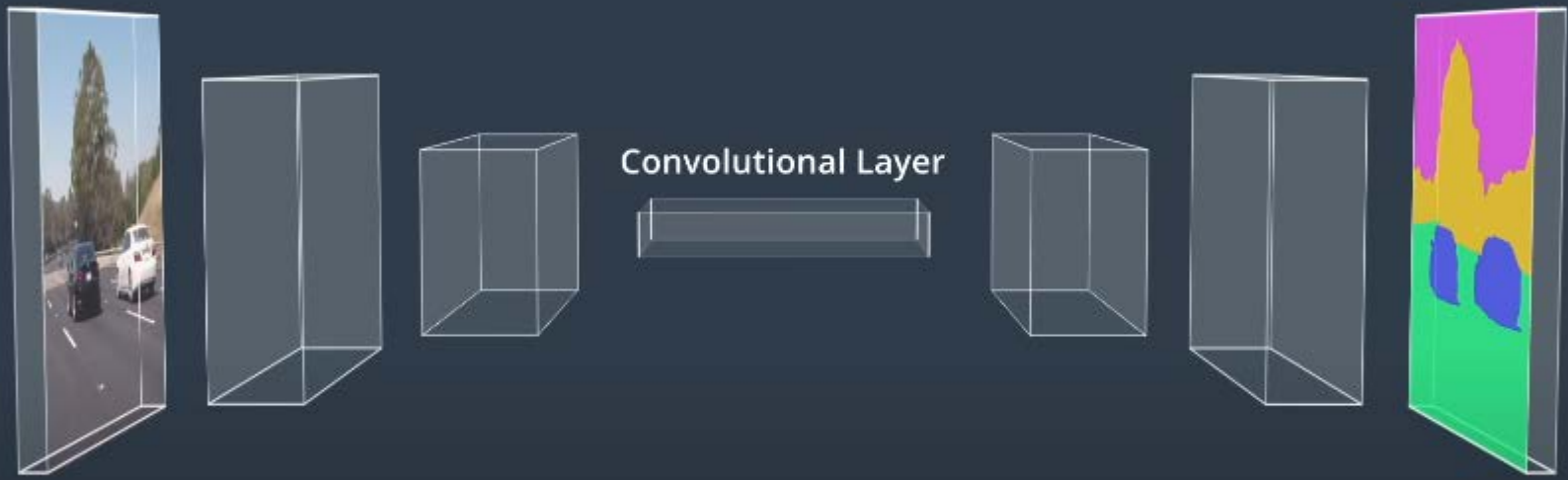


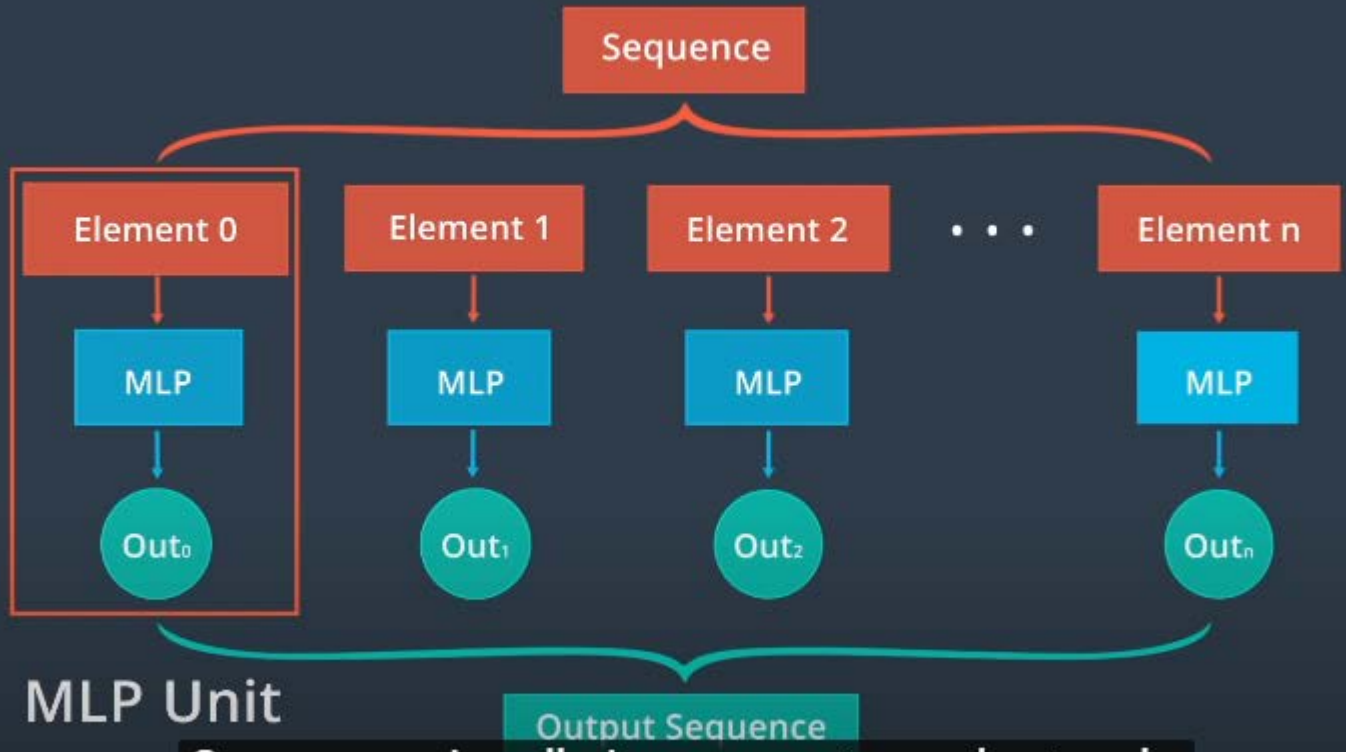
High-definition maps underpin almost every other part of the software stack,

and compares what it sees through these sensors to a high-definition map.

Fully Convolutional Network

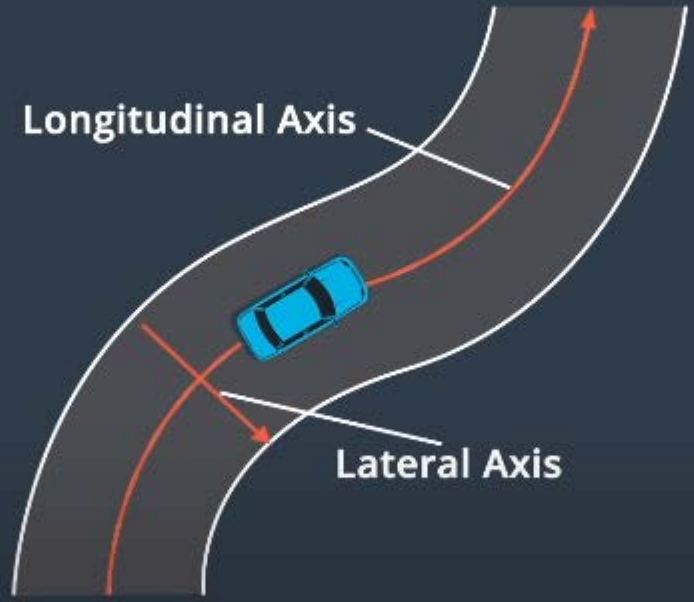


Original Size = Output Size



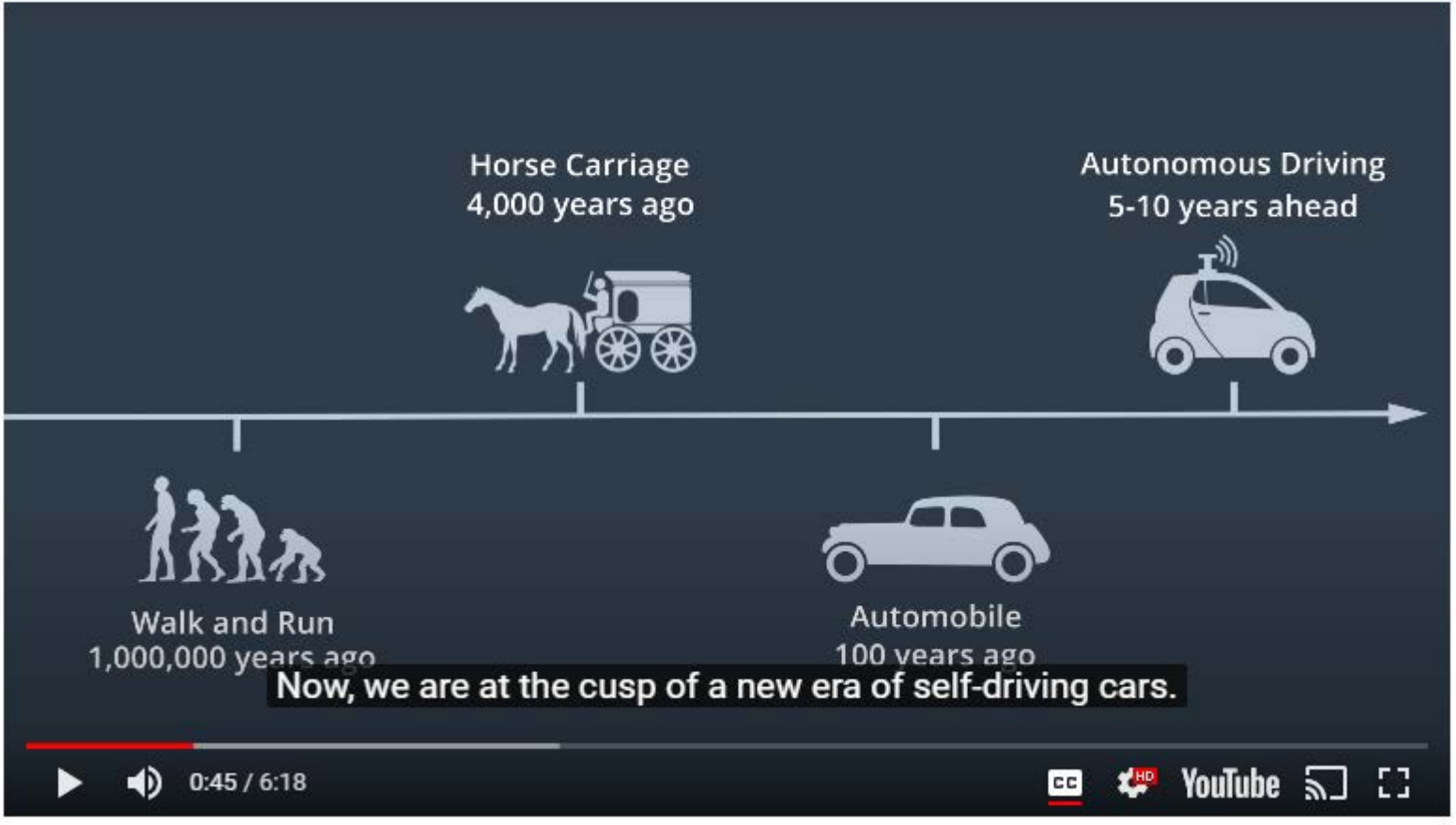
One approach, called a recurrent neural network,

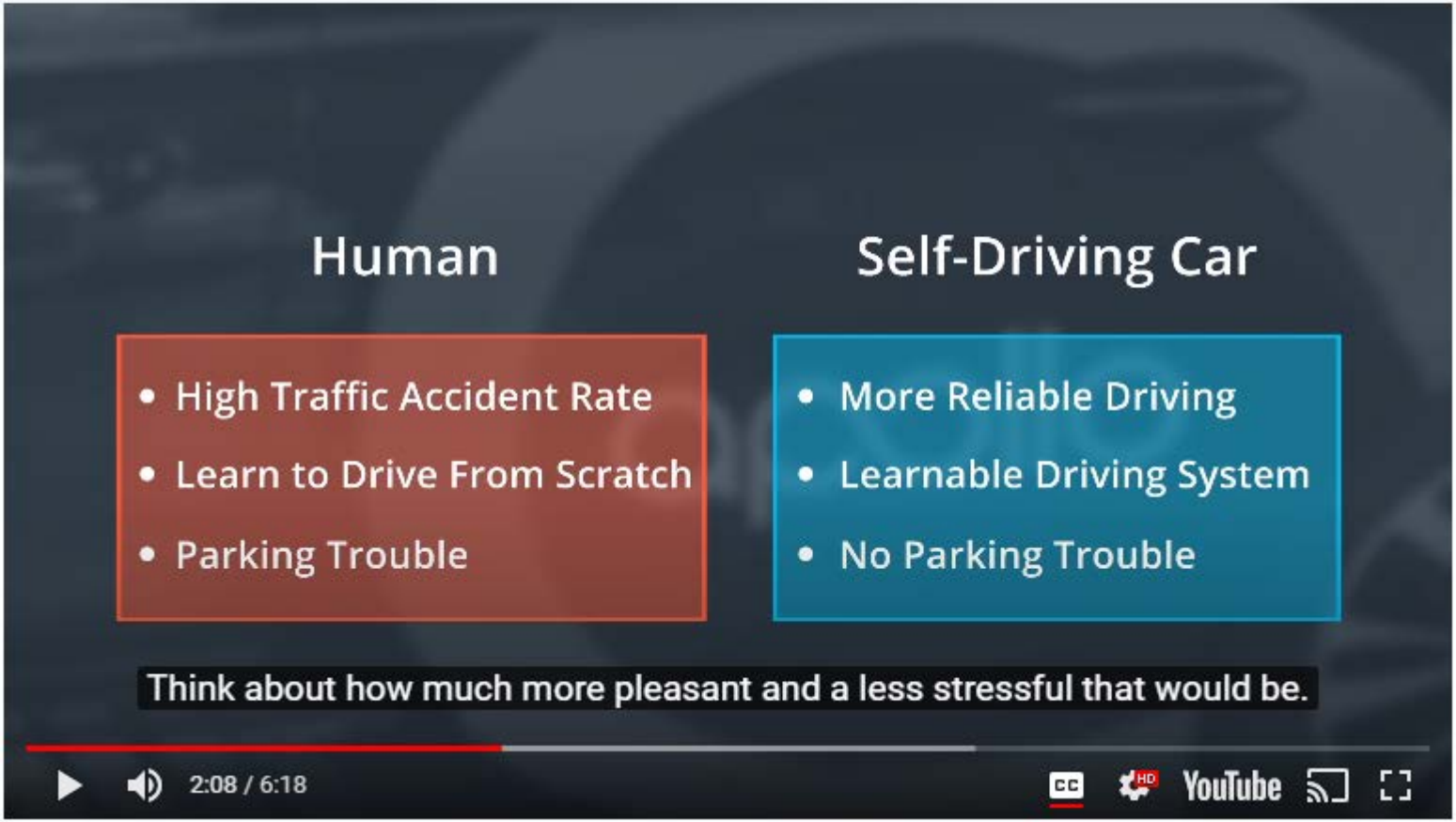
Frenet Coordinates



Time Horizon

but also increasingly powerful.

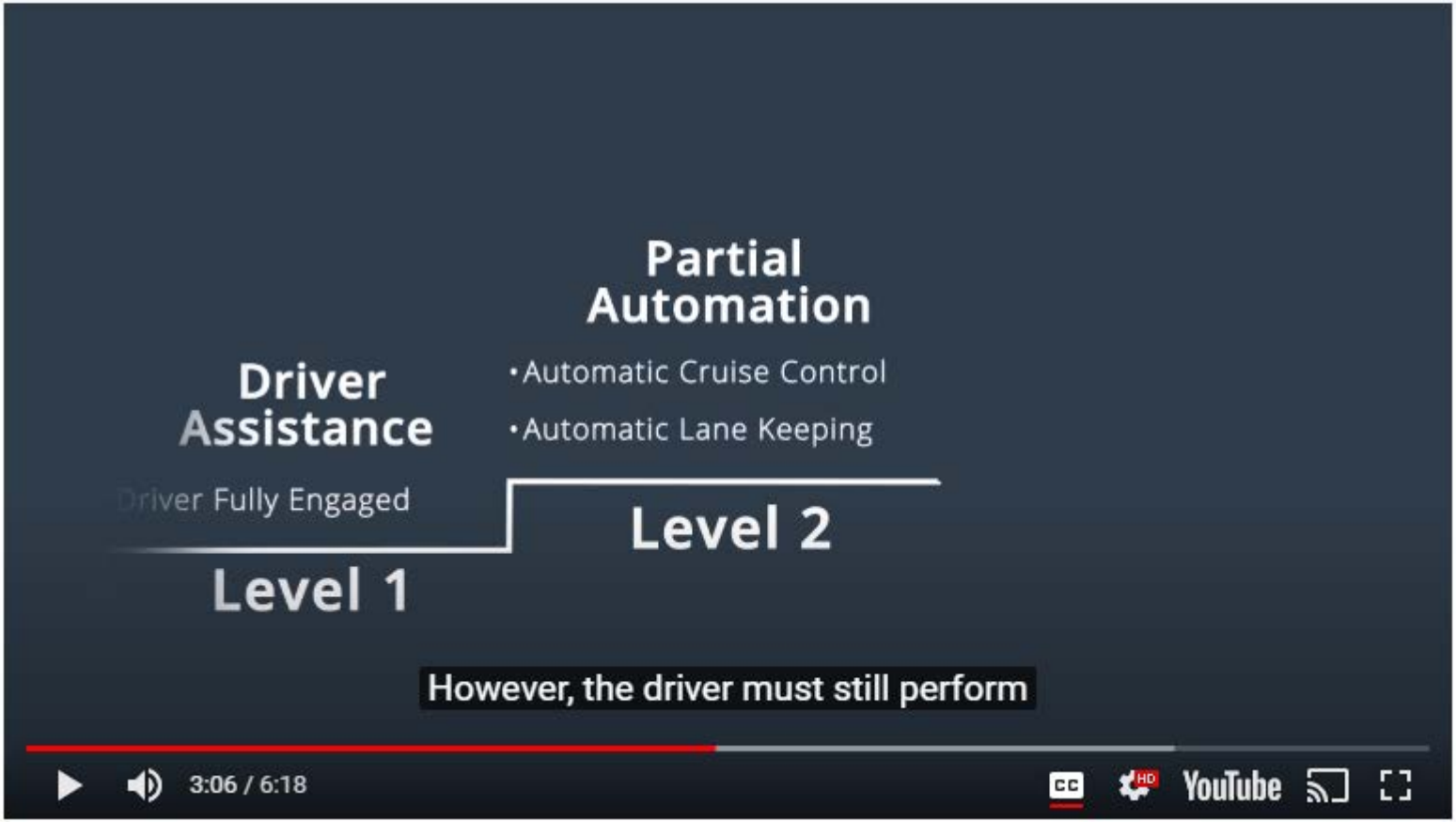

Horse Carriage
4,000 years ago
Autonomous Driving
5-10 years ahead
Walk and Run
1,000,000 years ago
Automobile
100 years ago
Now, we are at the cusp of a new era of self-driving cars.
0:45 / 6:18
YouTube


Human
Self-Driving Car
• High Traffic Accident Rate
• Learn to Drive From Scratch
• Parking Trouble
• More Reliable Driving
• Learnable Driving System
• No Parking Trouble
Think about how much more pleasant and a less stressful that would be.
2:08 / 6:18
YouTube

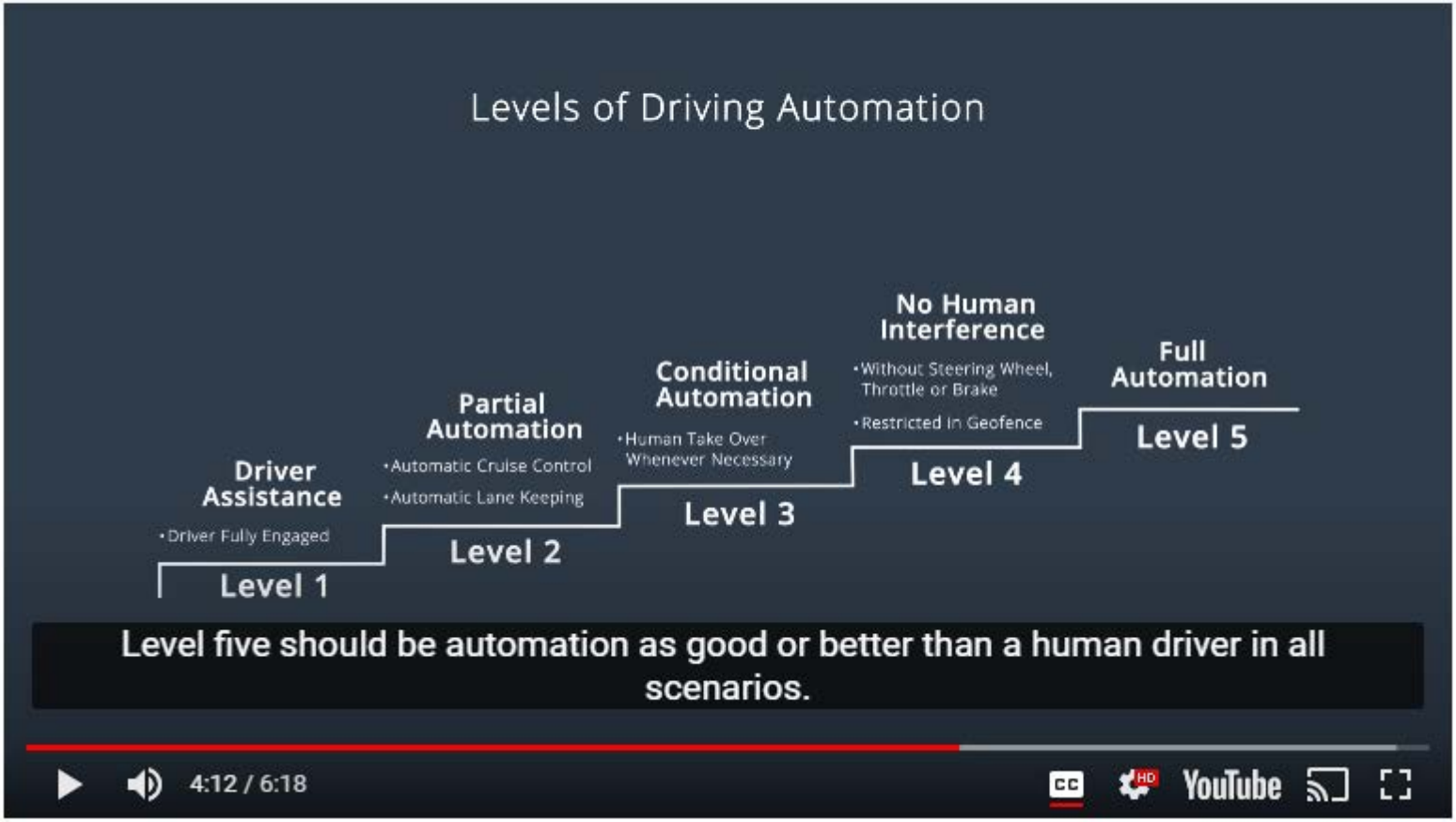

Level zero is the base level.
2:20 / 6:18
YouTube


At this level, the driver is the sole decision-maker for the system.
2:23 / 6:18
YouTube


Driver
Assistance
Level 1
At this level, the vehicle supports the driver with either steering or acceleration.
2:41 / 6:18
CC
HD
YouTube


Partial
Automation
•Automatic Cruise Control
•Automatic Lane Keeping
Driver
Assistance
Driver Fully Engaged
Level 2
Level 1
However, the driver must still perform
3:06 / 6:18
YouTube


Conditional Automation
Human Take Over Whenever Necessary
Level 3
No Human Interference
Level 4
no expectation that the human driver will ever intervene.
3:31 / 6:18
CC
HD
YouTube


Levels of Driving Automation
Driver Assistance
•Driver Fully Engaged
Level 1
Partial Automation
•Automatic Cruise Control
•Automatic Lane Keeping
Level 2
Conditional Automation
•Human Take Over Whenever Necessary
Level 3
No Human Interference
•Without Steering Wheel, Throttle or Brake
•Restricted in Geofence
Level 4
Full Automation
Level 5
Level five should be automation as good or better than a human driver in all scenarios.
4:12 / 6:18
CC
HD
YouTube

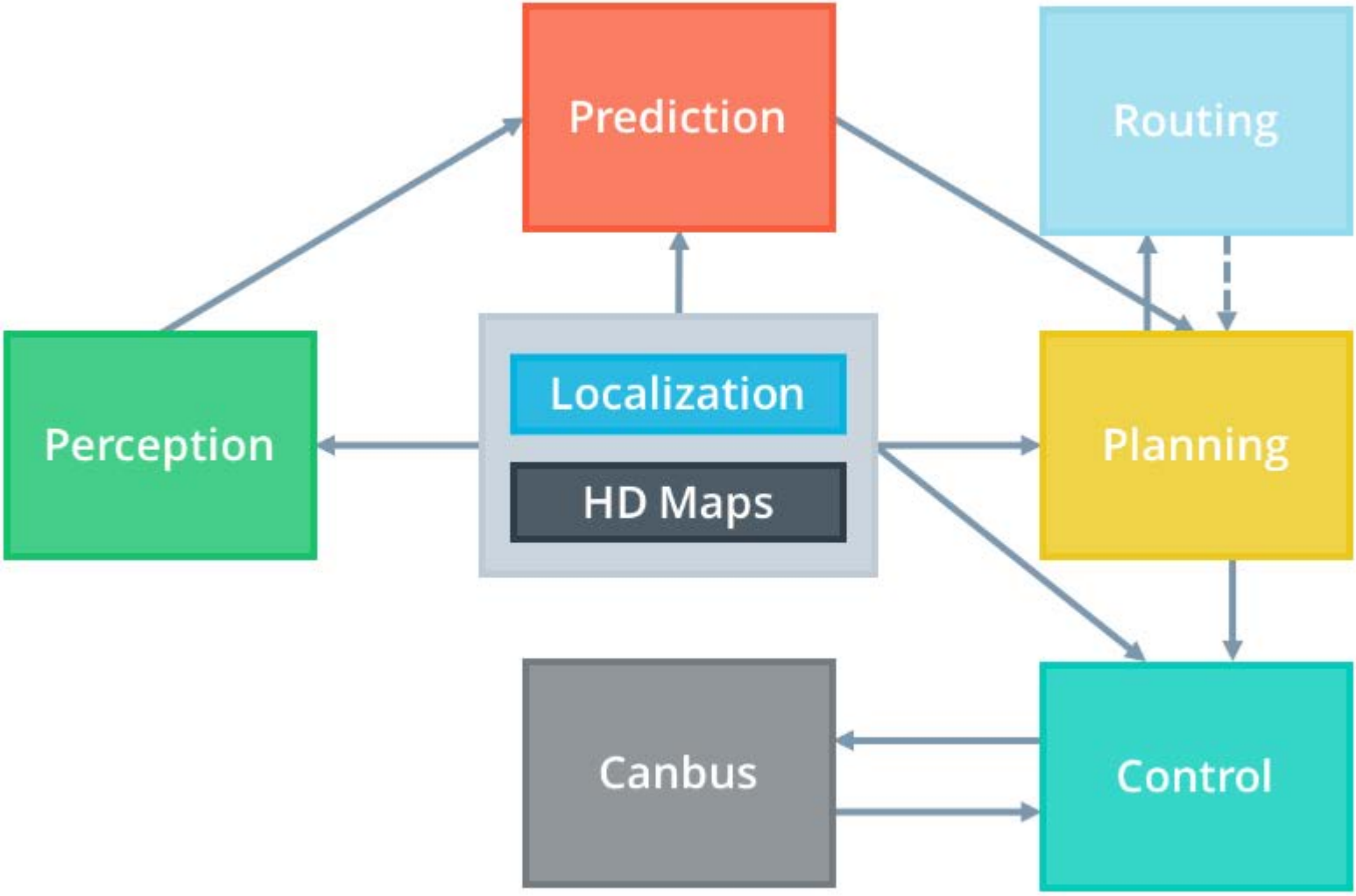
hardware systems to build complete autonomous systems.

5:43 / 6:18

How a Self-Driving Car Works

sensor fusion, localization, path planning, and control.

Apollo Structure



Apollo's system centers around HD Maps and Localization. The other components of the system revolve around Perception, Prediction, Planning and Control, as we'll see throughout this course.

L1 Apollo Team

Watch later Share

Jinghao Miao
SR. ENGINEERING MANAGER
APOLLO PLATFORM, BAIDU

David Zhou
HEAD OF PRODUCT,
APOLLO PLATFORM, BAIDU

David Silver
SELF-DRIVING CAR LEAD, UDACITY

Ning Qu
CHIEF ARCHITECT,
HEAD OF CAROS, BAIDU

Apollo is an open software platform that provides hardware specifications,

0:08 / 1:50

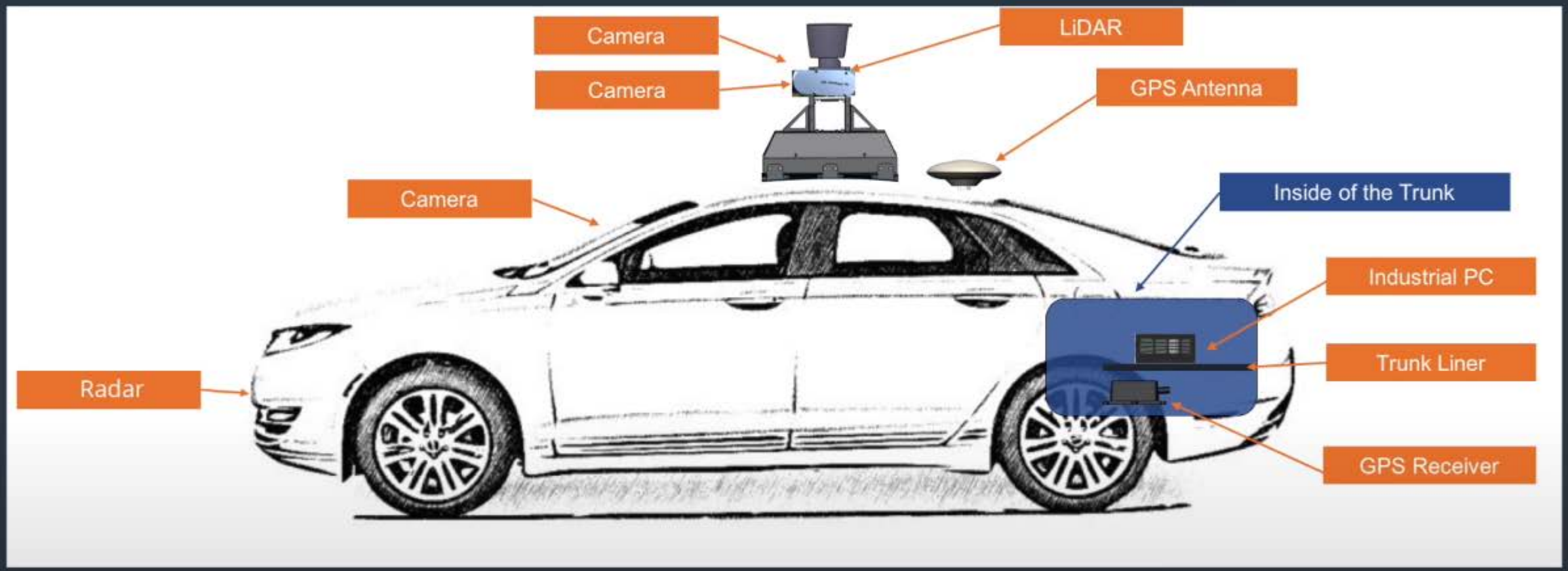
QUIZ QUESTION

Apollo platform framework consists of:

- Reference Vehicle Platform
- Reference Hardware Platform
- Open Software Platform
- Cloud Service Platform
- ALL of the above are correct

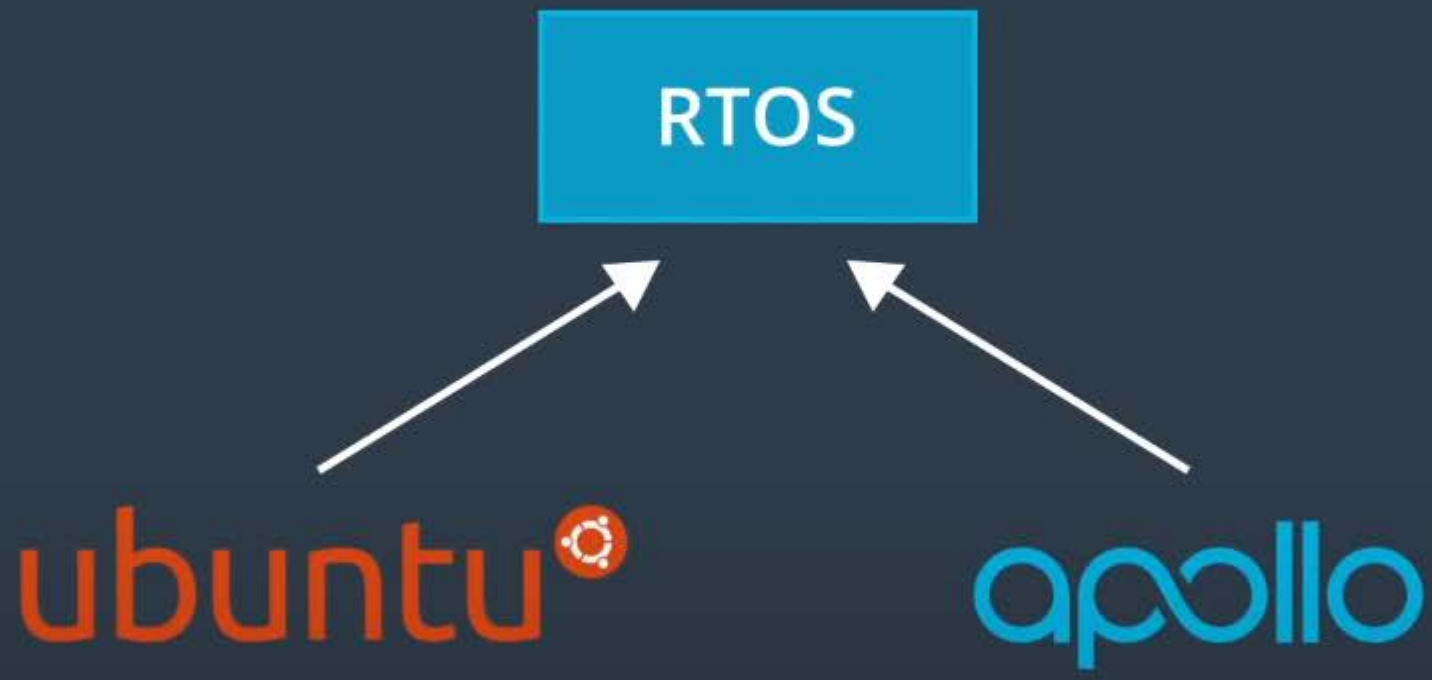

apollo
David Zhou
we start with a base vehicle that can be controlled electronically,
0:10 / 2:38
YouTube


apollo
This type of vehicle has special name, a drive-by-wire vehicle.
Full screen (f)
0:20 / 2:38
CC
HD
YouTube



radar, LiDAR, GPS-IMU and IPC could be installed on a vehicle.


apollo
real-time operating system(ROTS), Runtime Framework and a layer of application modules.
0:15 / 6:03
YouTube



Apollo RTOS is a combination of Ubuntu Linux operating system and the Apollo kernel.

ROS

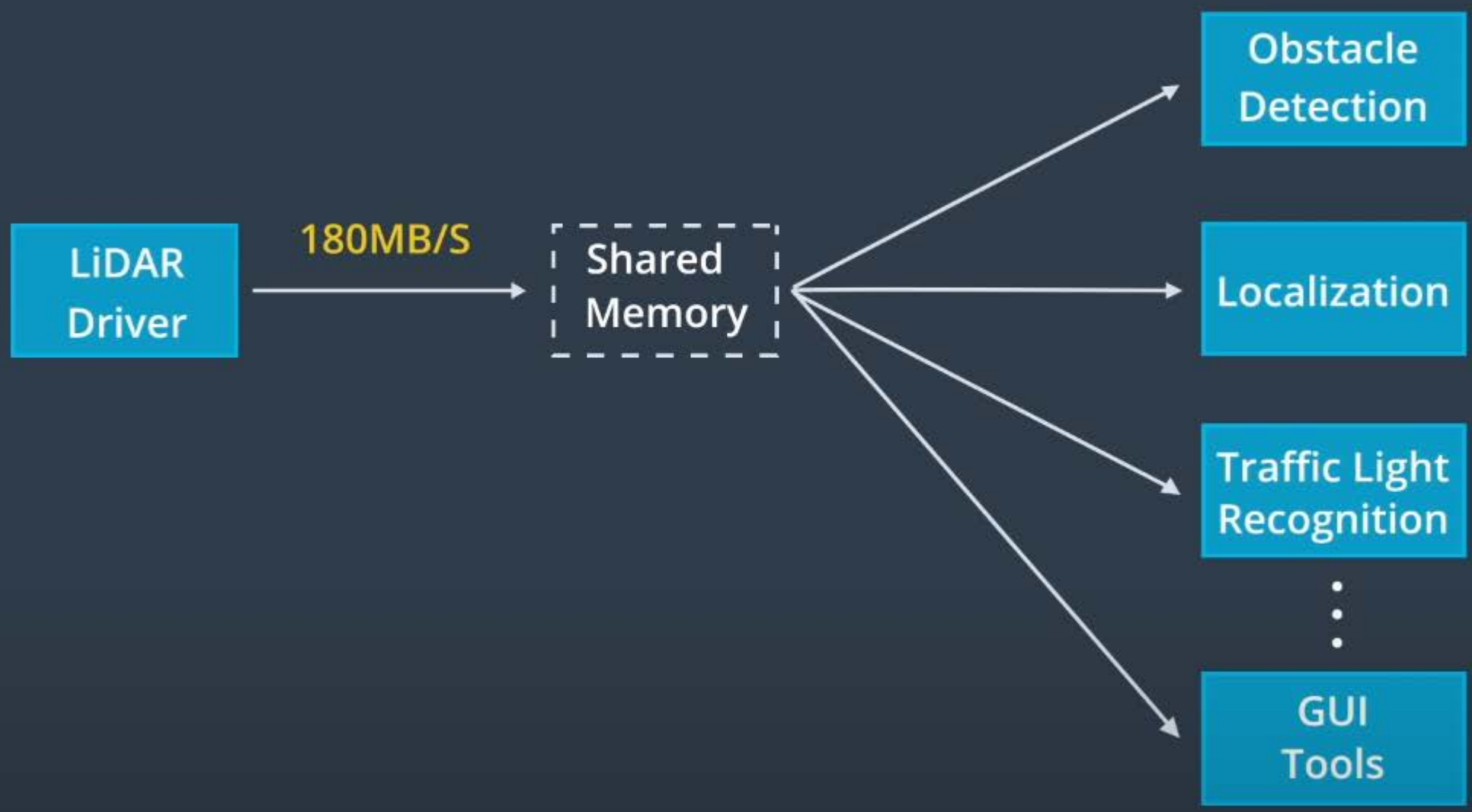
March 2, 2010

Box Turtle

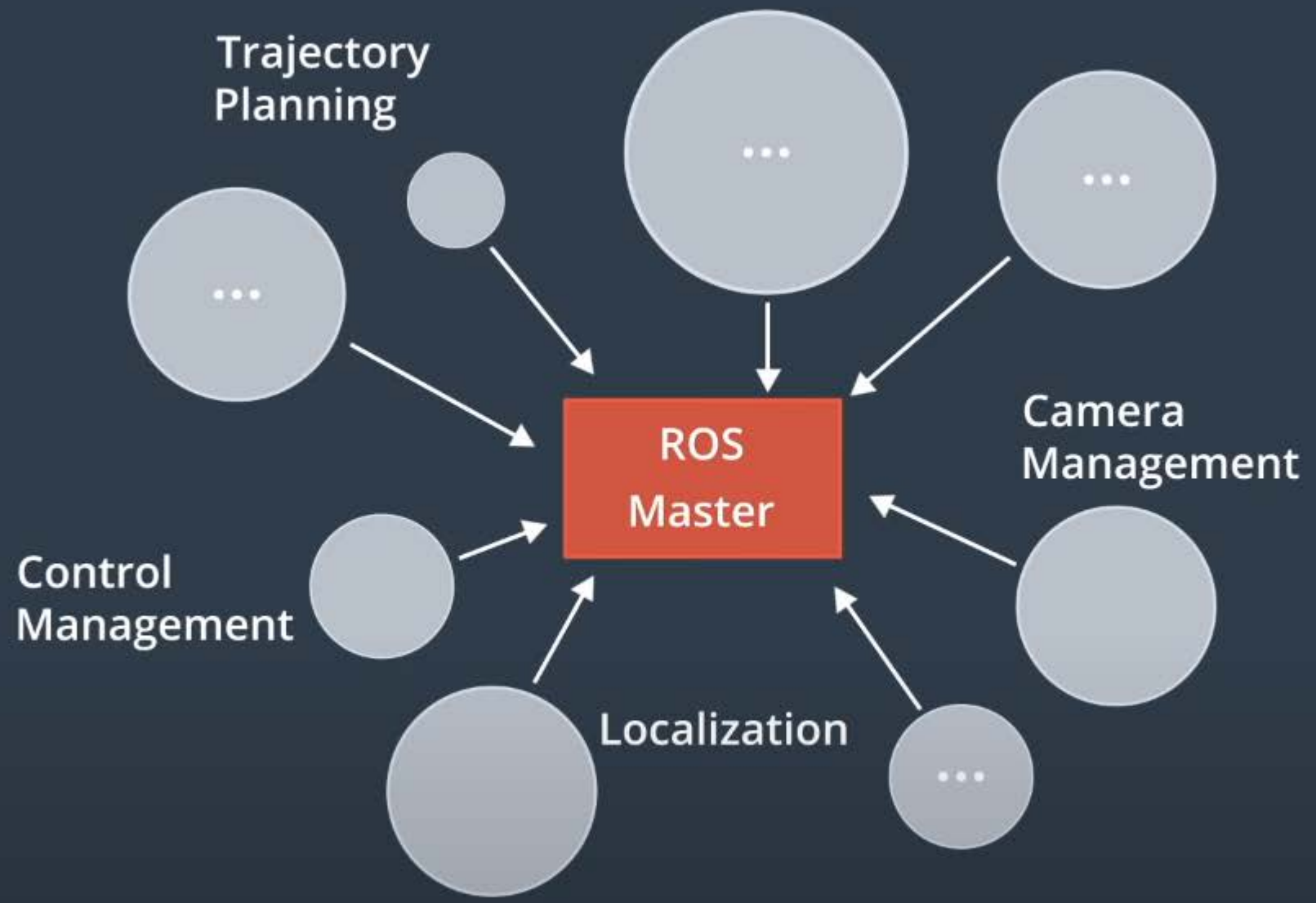
April 23, 2012

May 23, 2018

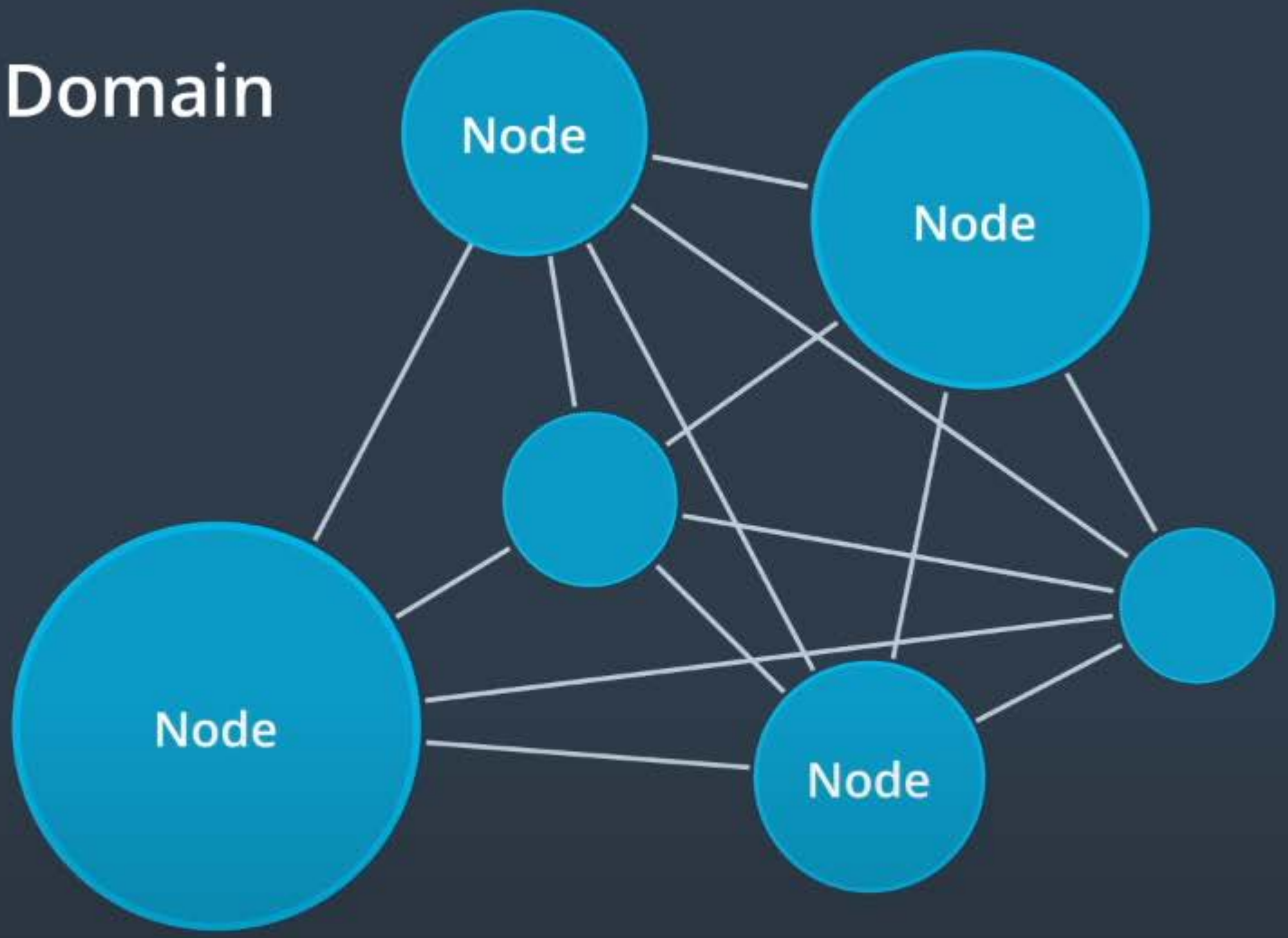
more than 3,000 basic libraries that support the rapid development of applications.



shared memory supports the “write once, read multiple” pattern.



To avoid this problem,



Through this decentralization scheme,

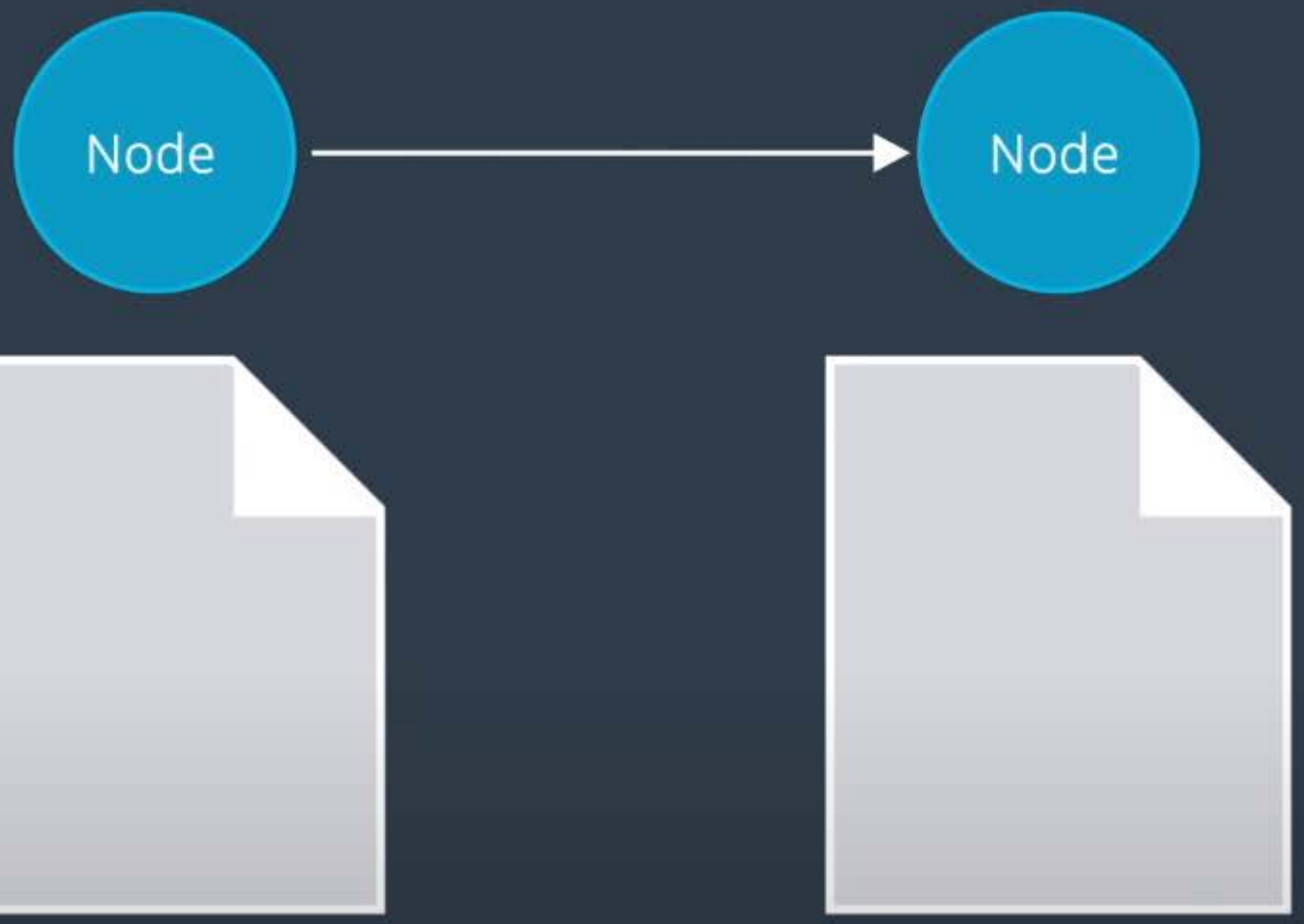
through an interface language called ROS Message.

L1 Open Software Stack

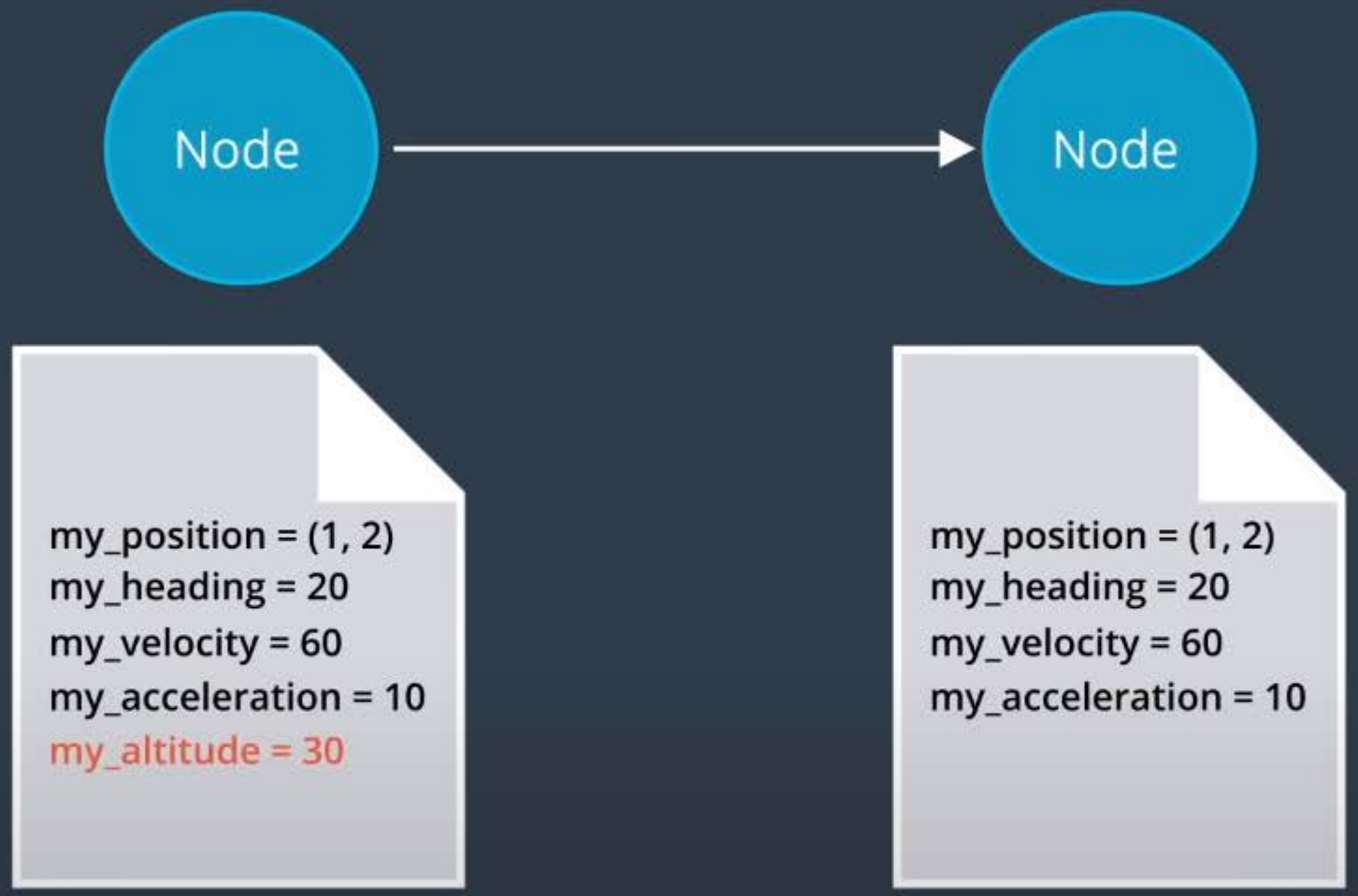
Watch later Share

called Protobuf instead of native ROS Message.

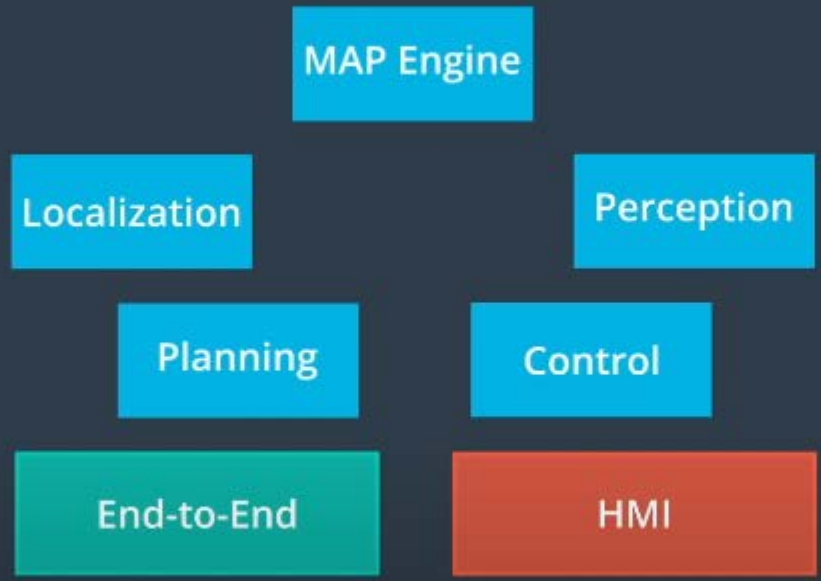
5:03 / 6:03



Protobuf is a method of serializing structured data.



You can add new fields to your message formats without breaking backwards-compatibility.



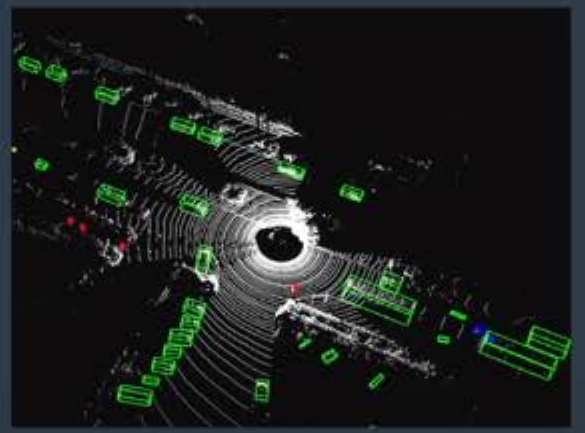
planning, control, end-to-end driving and the human-machine interface or HMI.

anywhere as long as you have an Internet connection and authorized accounts.

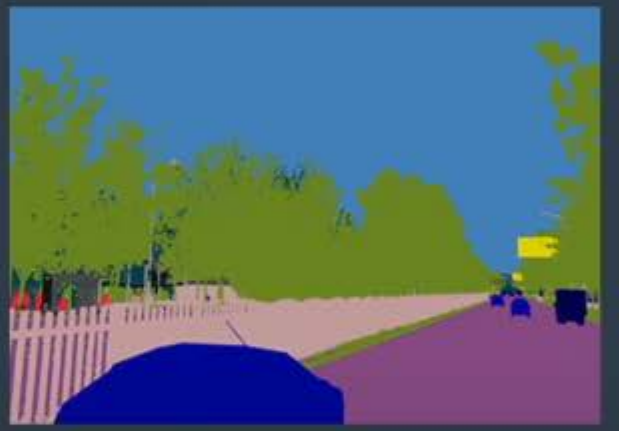

Cloud Services
• HD Map
• Simulation
• Data Platform
• Security
• OTA
• DuerOS
and intelligent voice system called DuerOS.
0:55 / 4:31
YouTube

Traffic Lights Data

Obstacles
with Bounding Boxes



Segmentation Data



and semantic segmentation data.

Apollo is an open platform whose primary purpose is to become a vibrant autonomous driving ecosystem by providing a comprehensive, safe, secure, and reliable solution that supports all major features and functions of an autonomous vehicle.

In order to safeguard the architectural integrity, system reliability, and rapid evolution of Apollo, Baidu is willing to step up and exercise its leadership in driving important decisions whenever needed while preserving active participation of the wider community.

Apollo provides high quality code and data that allows anyone to bootstrap their autonomous driving development, but only with contributions from Apollo's partners and the wider community can Apollo become increasingly more capable. The goal is to create a virtuous cycle where software and services are deployed onto the vehicle to obtain quality data, which is then used to create an even more capable autonomous system.

If you are a developer, Apollo welcomes anyone to make technical contributions. Therefore, do not hesitate to join the Apollo project. There you will see a brand new world. You will be one of them who can change the autopilot technology history.

Click the link of Apollo repo to learn more if you're interested.