Environment Representation

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Environmental Map Types

- Localization of vehicle in the environment.
  - Localization point cloud or feature map.

Lidar point + camera image features + GPS/IMU/odometry → estimate precise location of the vehicle at all times

- Collision avoidance with static objects.
  - Occupancy grid map.

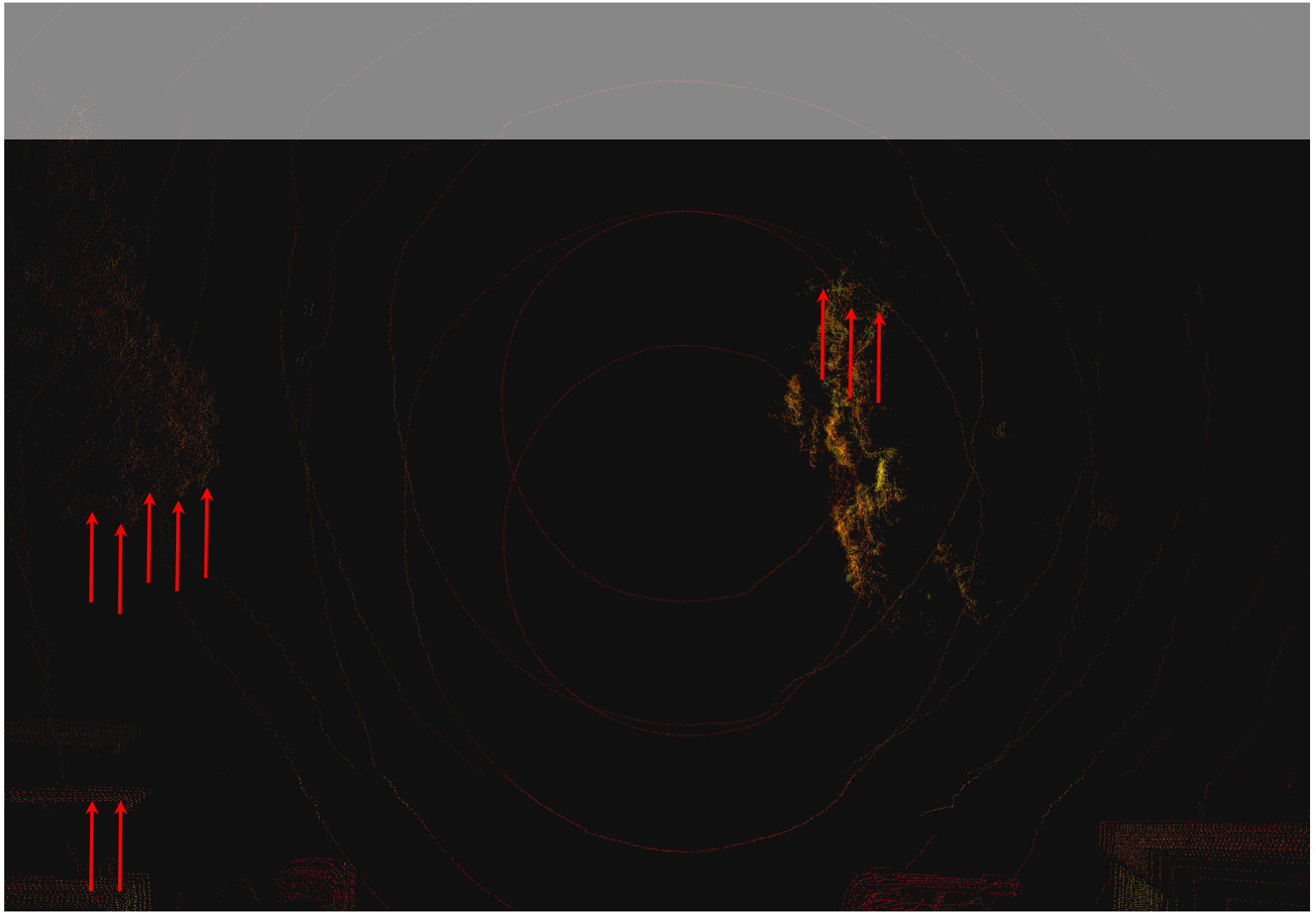
LiDAR points → is used to plan safe collision-free path

- Path planning.
  - Detailed road map.

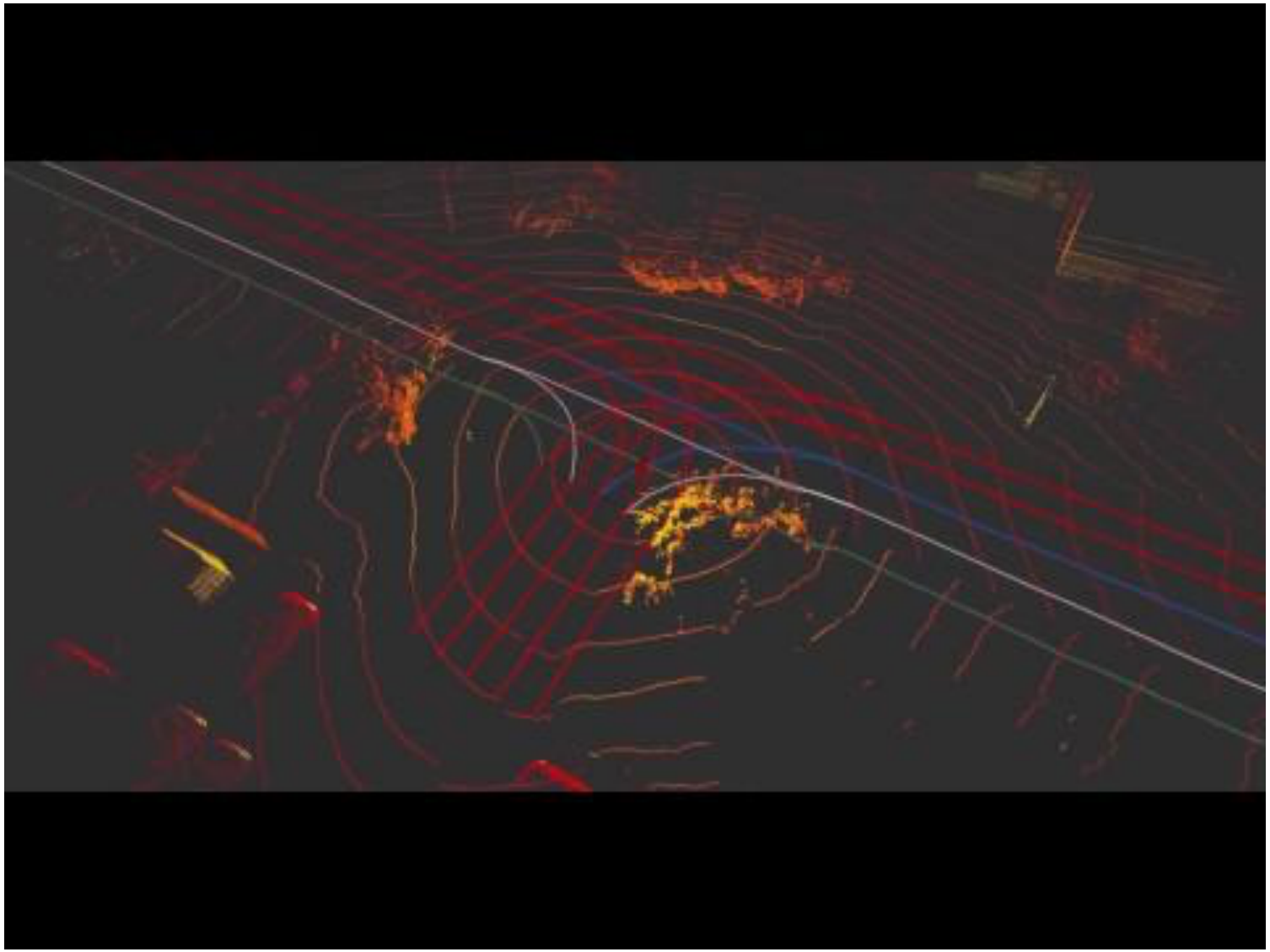
is used to plan a path

Point cloud or Feature Map (Localization Map)

- Collects continuous sets if LIDAR
- The difference between LIDAR maps is used to calculate the movement of the autonomous vehicle



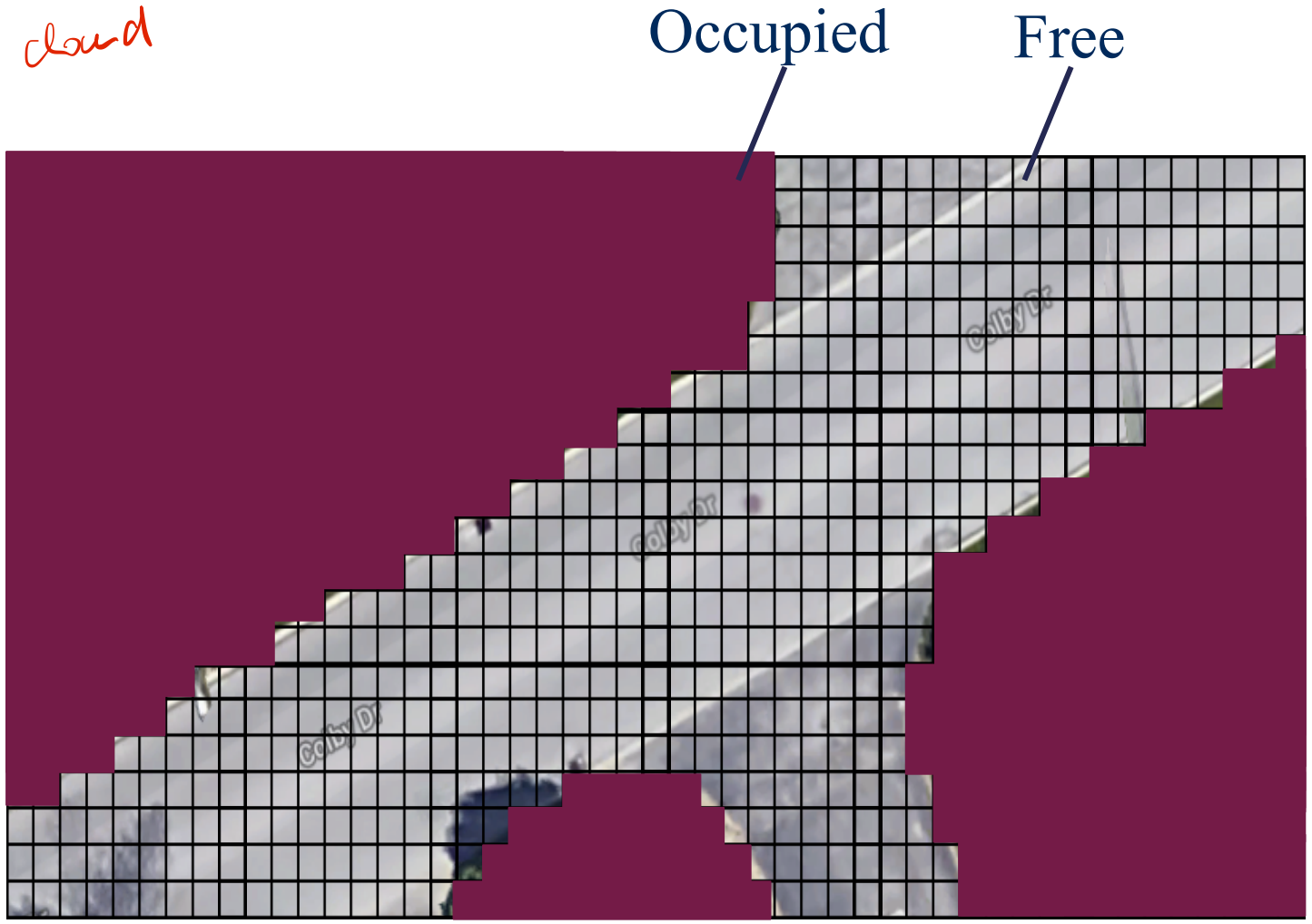
Point cloud or Feature Map (Localization Map)



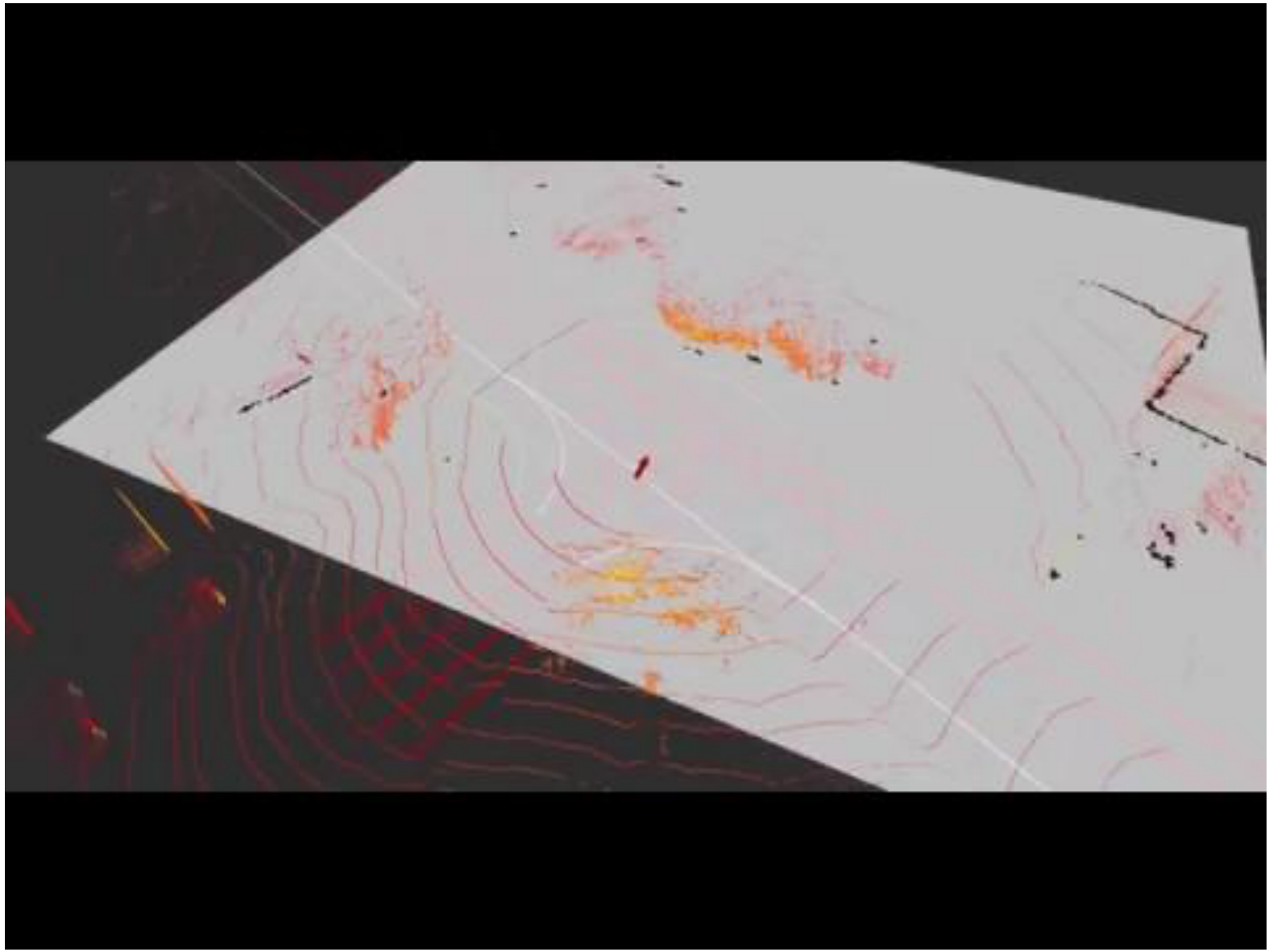
Occupancy Grid

using lidar point cloud

- Discretized fine grain grid map
  - Can be 2D or 3D
- Occupancy by a static object
  - Trees and buildings
- Curbs and other non drivable surfaces
  - Dynamic objects are removed



Occupancy Grid Map



Detailed Roadmap

3 method of creation:
fully online; fully offline;
created offline & updated online
(rarely used)

- 3 Me
  - F
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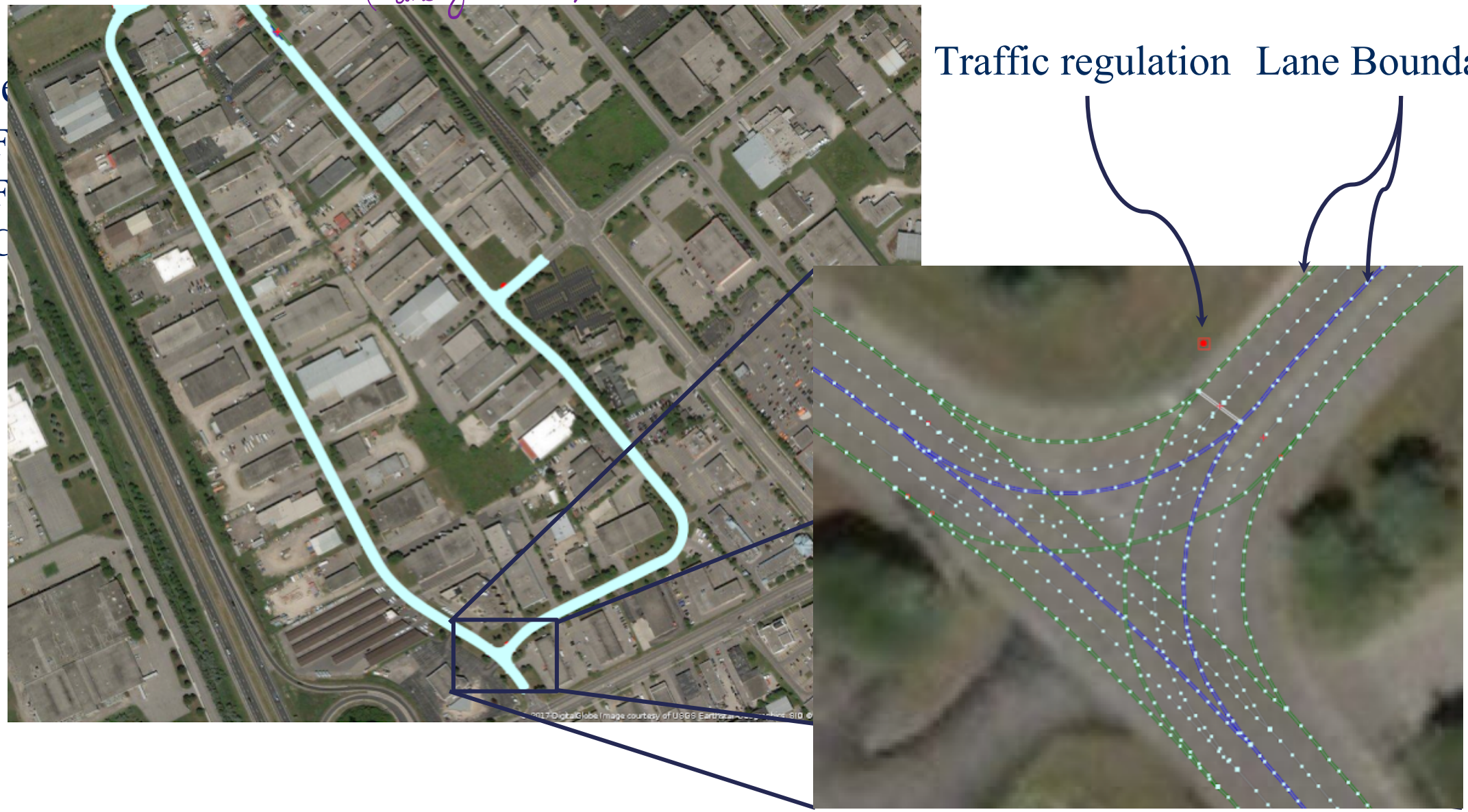
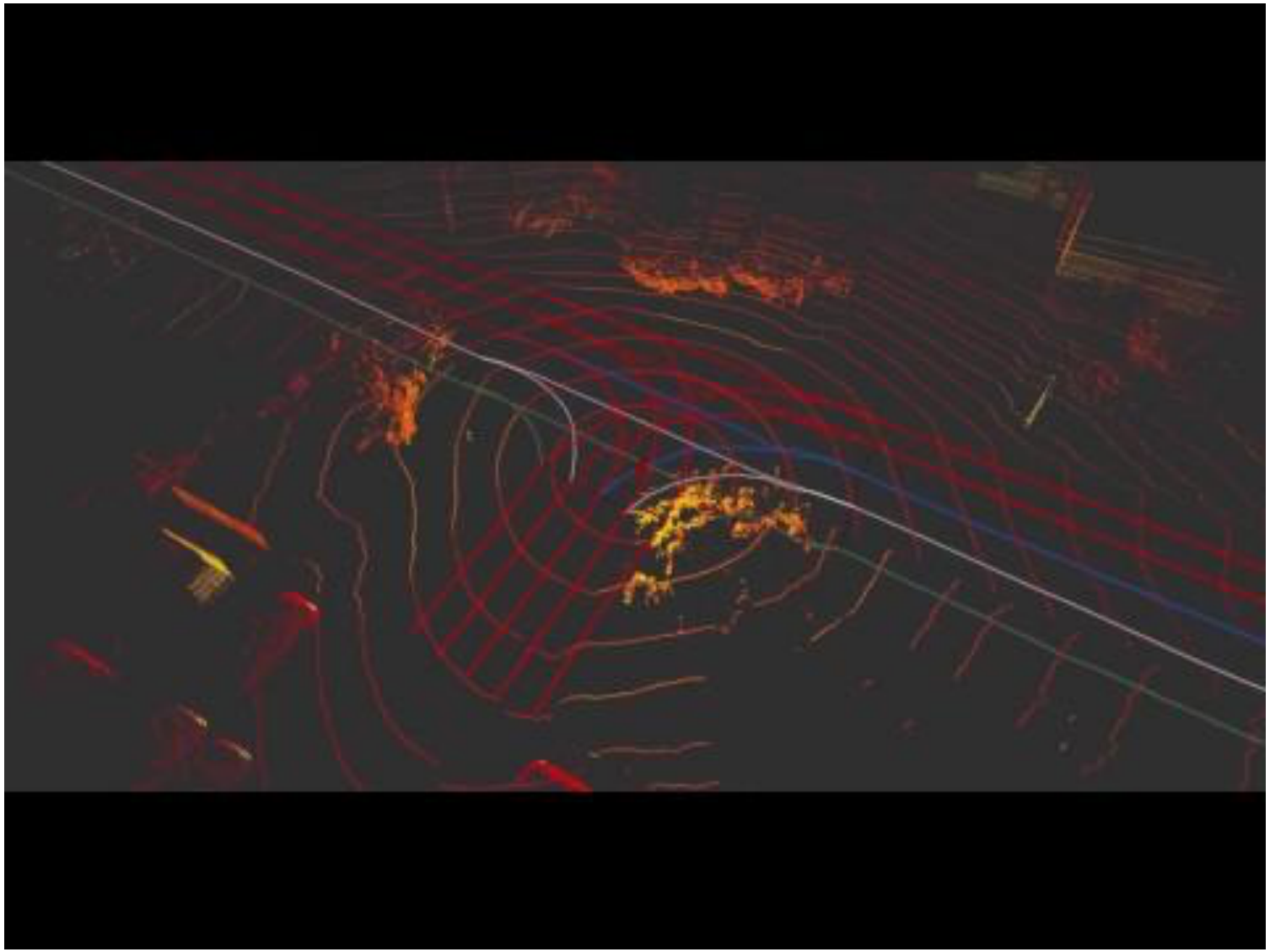
  - C



Detailed Roadmap



Summary

- Environmental maps used by self driving cars
- Localization point cloud or feature map
- Occupancy grid map
- Detailed roadmap

Module Summary

- Understand various sensor and computing hardware used for autonomous driving
  - The relative strengths and weaknesses
- Understand the design of hardware sensor configurations for autonomous driving
- Describe the basic architecture of a typical self-driving software system
  - Understand the standard decomposition for each software module
- Define the different types of maps used in autonomous driving

- **Next Module**: Vehicle modeling