

# High Definition Road Maps

Course 4, Module 2, Lesson 4



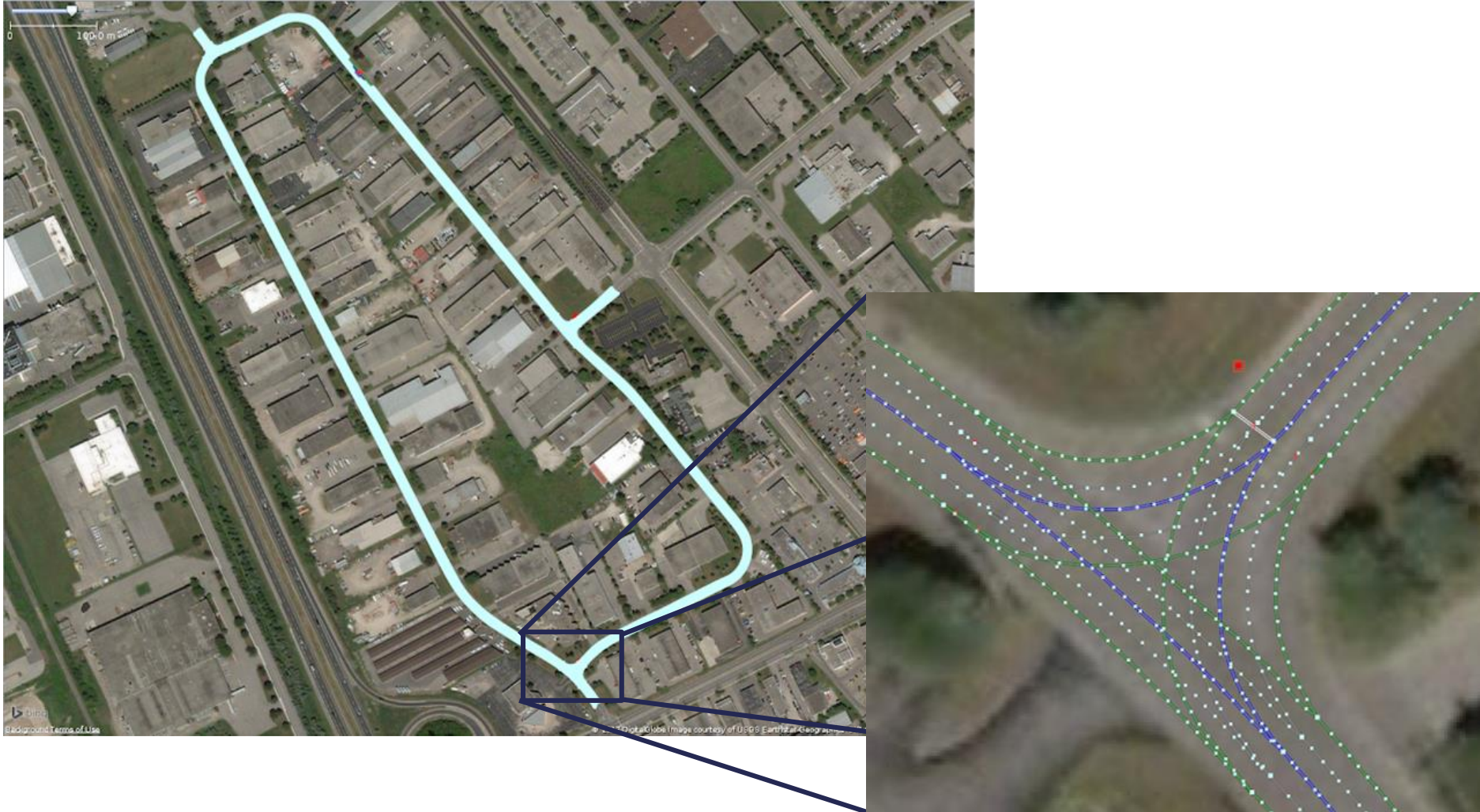
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# Learning Objectives

- Defining lanelet map
- Defining the elements that make up a lanelet map
  - Lanelet element
  - Intersection element
  - Operations that can be done on lanelets
- Creation of lanelet maps
- Connectivity between lanelets

# High Detailed Road Map

*locations (all lanes down to cm accuracy)  
road signs & signals*



## Lanelets: Efficient Map Representation for Autonomous Driving

# Lanelet Map

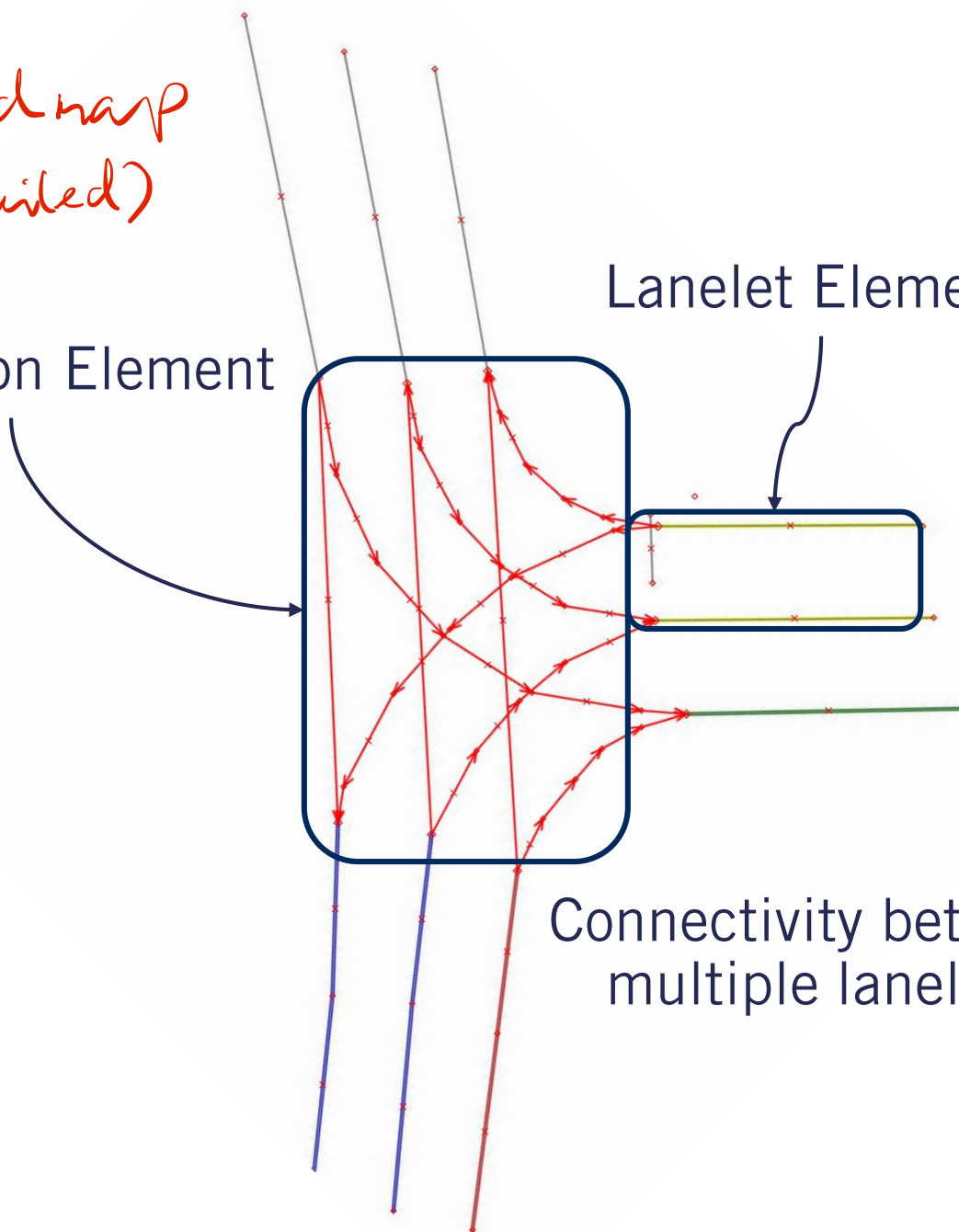
*an HD road map  
(high detailed)*



Intersection Element

Lanelet Element

Connectivity between  
multiple lanelets

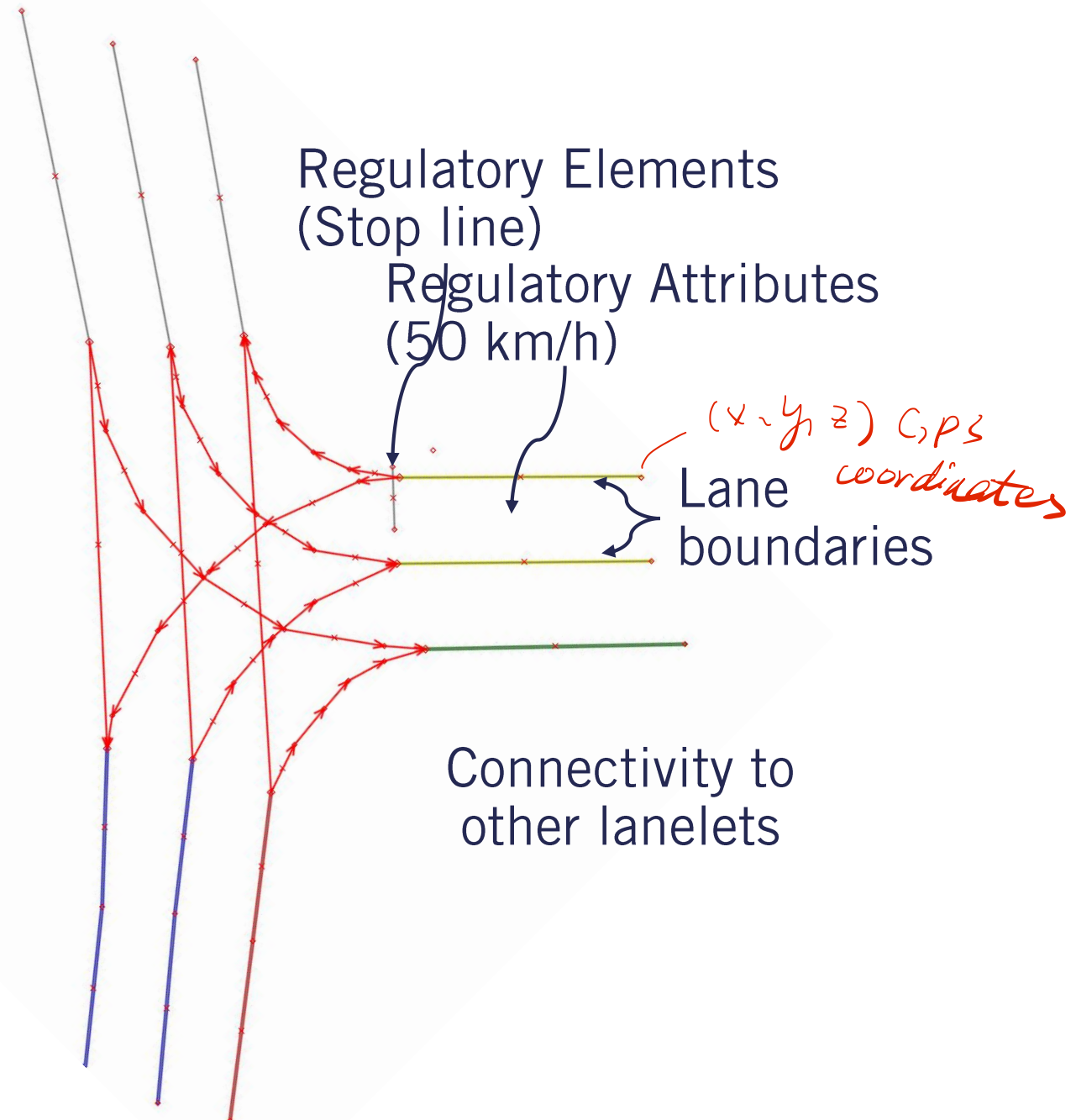




# Lanelet Element

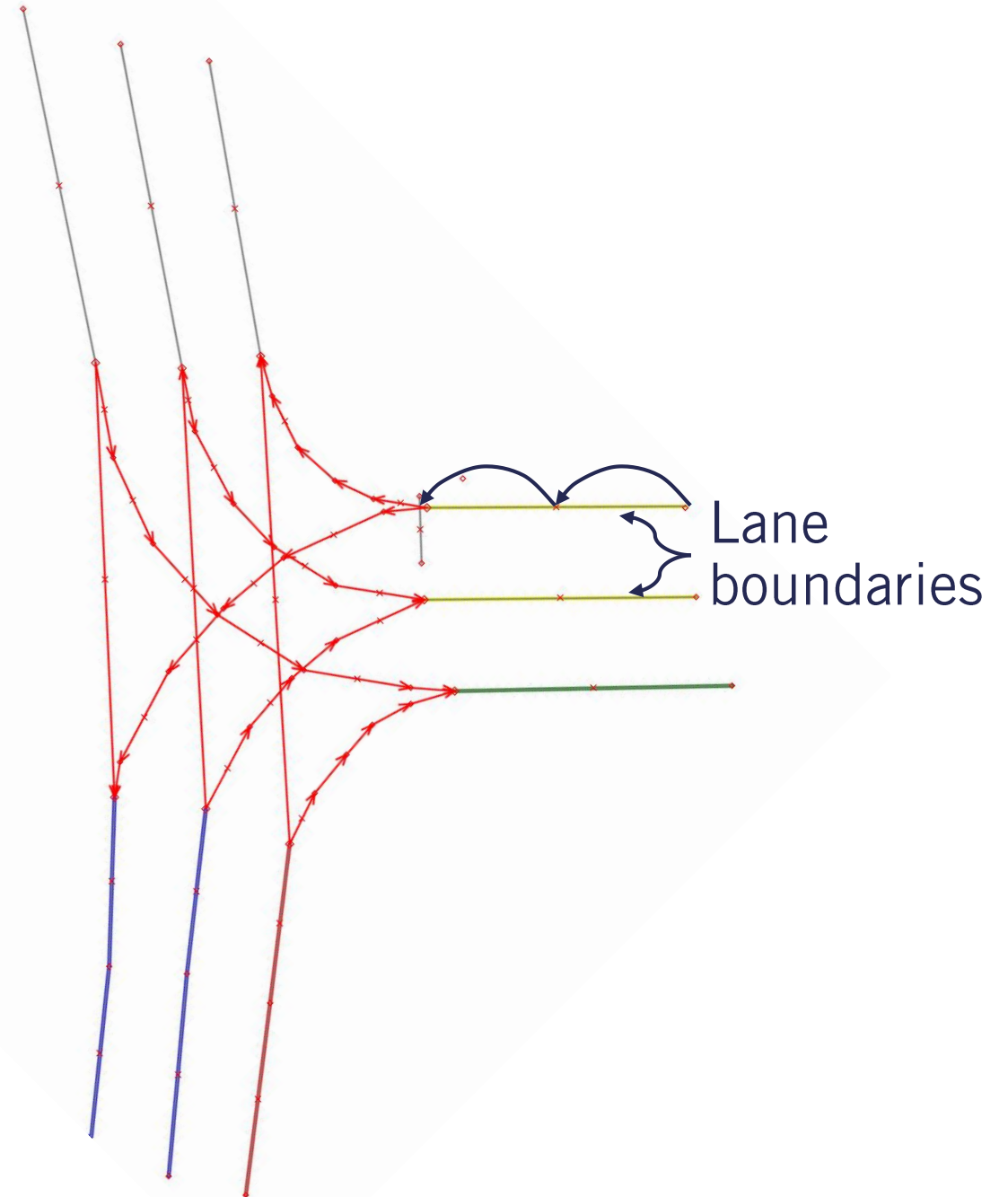
- Defines the following:
  - Left and Right Boundaries
  - Regulation (*represented as lines*)
    - Elements
    - Attributes (*ex. speed limit*)
  - Connectivity to other lanelets
- A new lanelet is created when a new regulatory element is encountered or ends

*Can be a few meters or hundreds of meters (highway)*



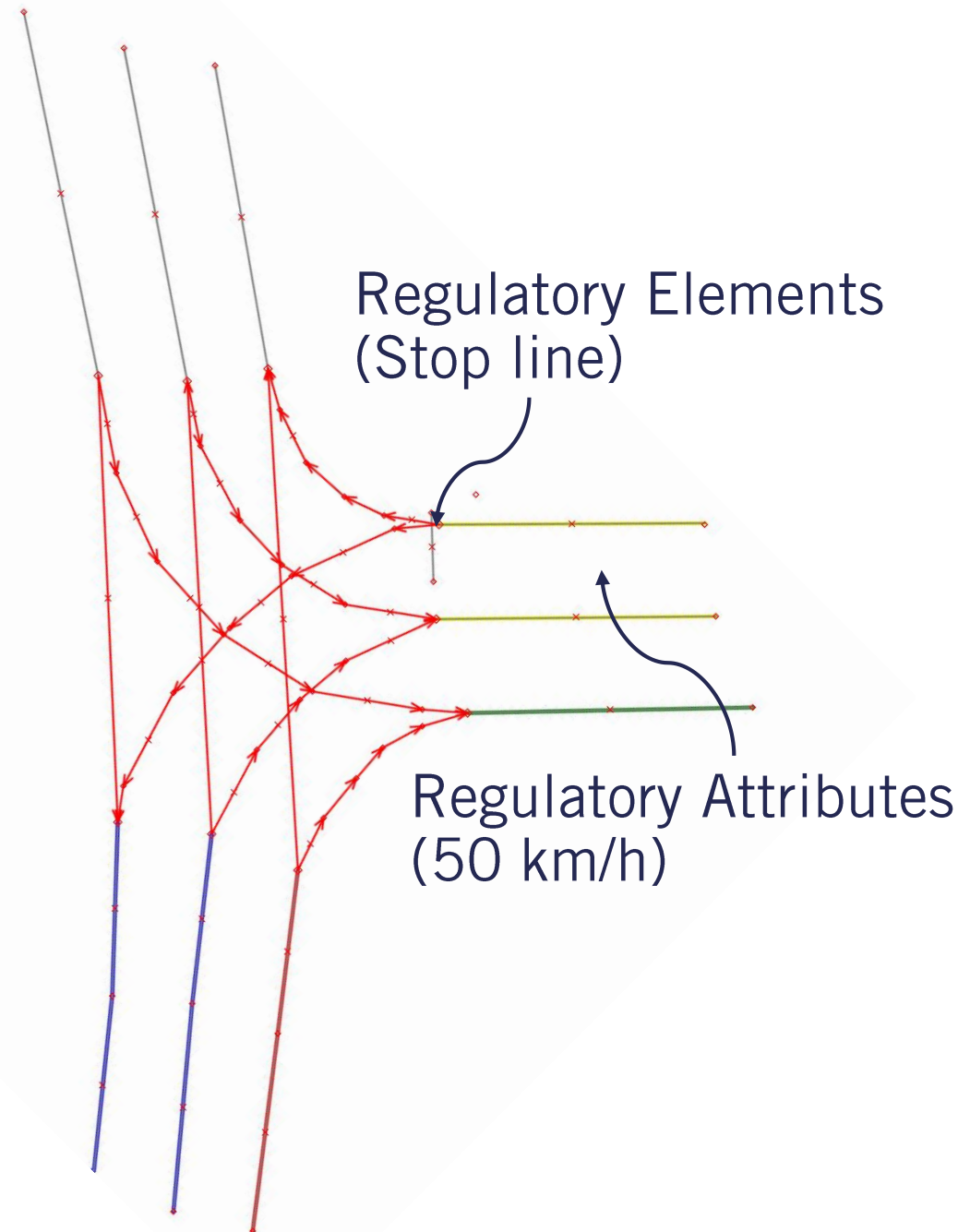
# Lanelet Boundaries

- Defines the edges of a driving lane
- A list of pointers points creating a polygonal line
  - X, Y, and Z coordinates
- Different operation can be performed on boundaries:
  - Heading
  - Curvature
  - Center line

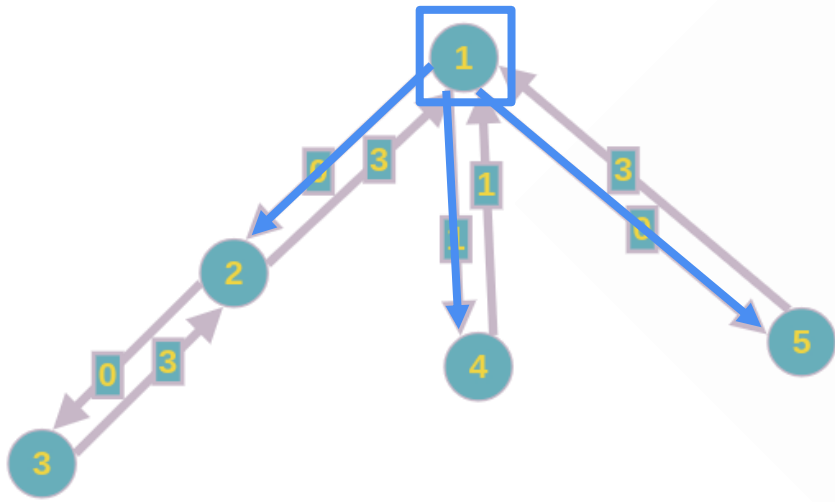


# Lanelet Regulations

- Elements - a list of points creating a line identifying stop location
  - Stop line
  - Traffic lights line
  - Pedestrian crossings
- Attributes - a set of regulation attributes assigned to a lanelet
  - Speed limit
  - Crossing another lanelet



# Lanelet Connectivity



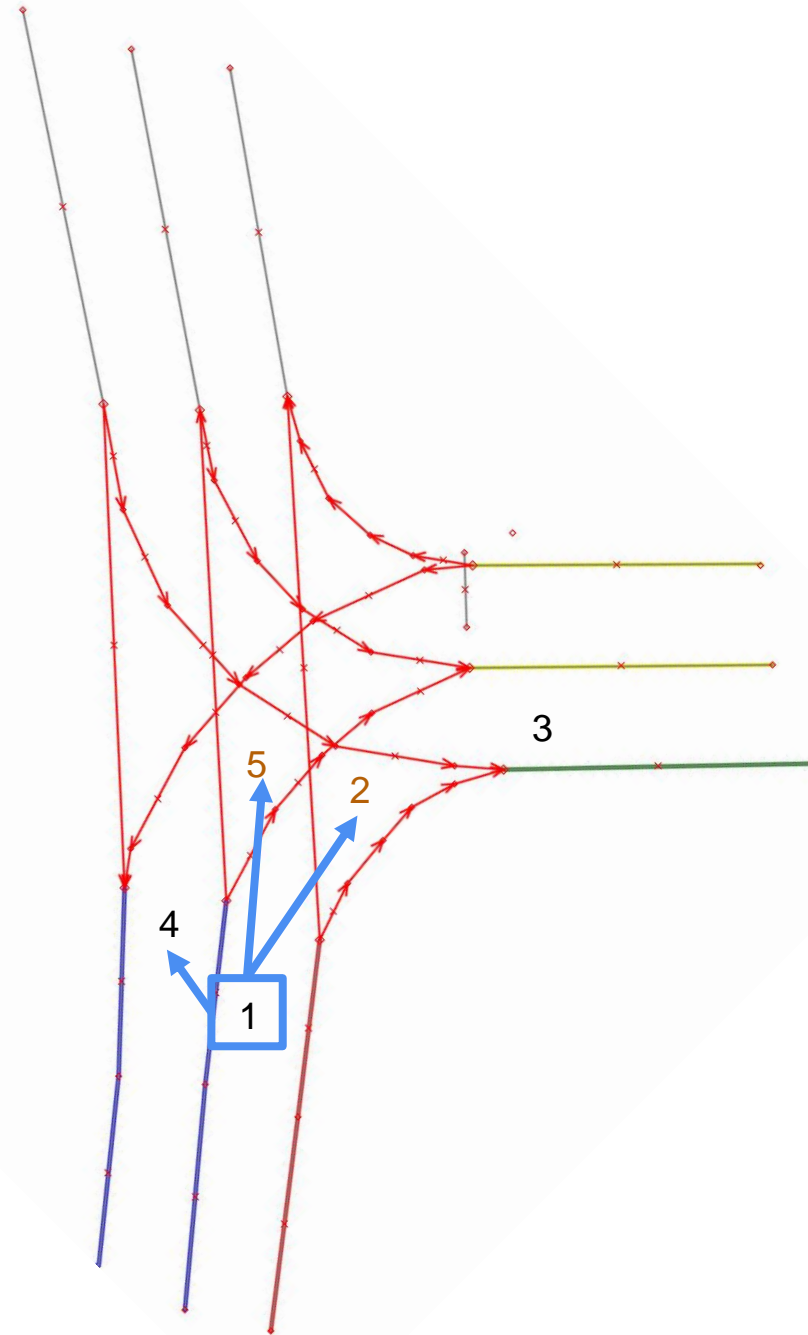
Edges:

0 = next

1 = left

2 = right

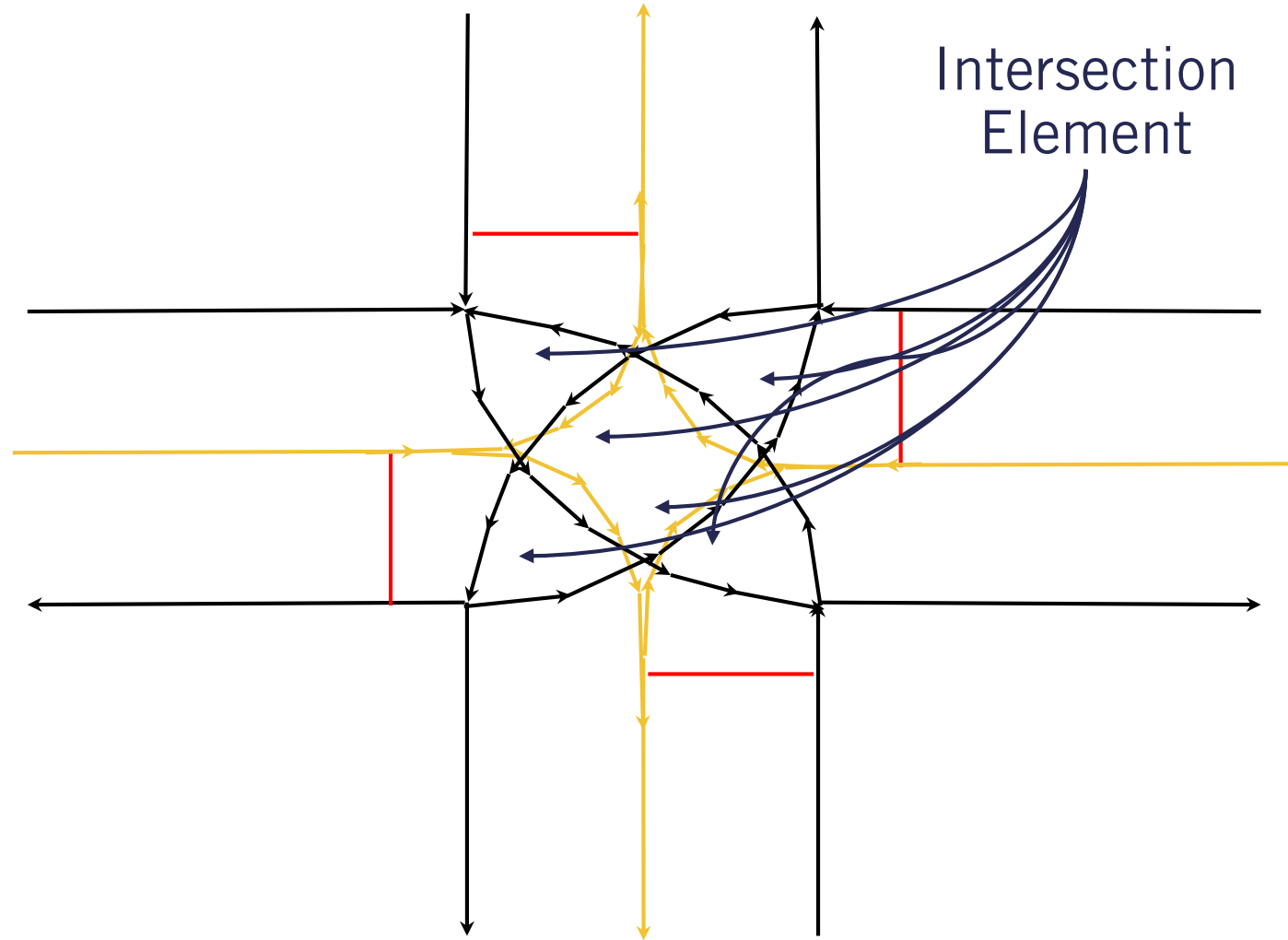
3 = previous





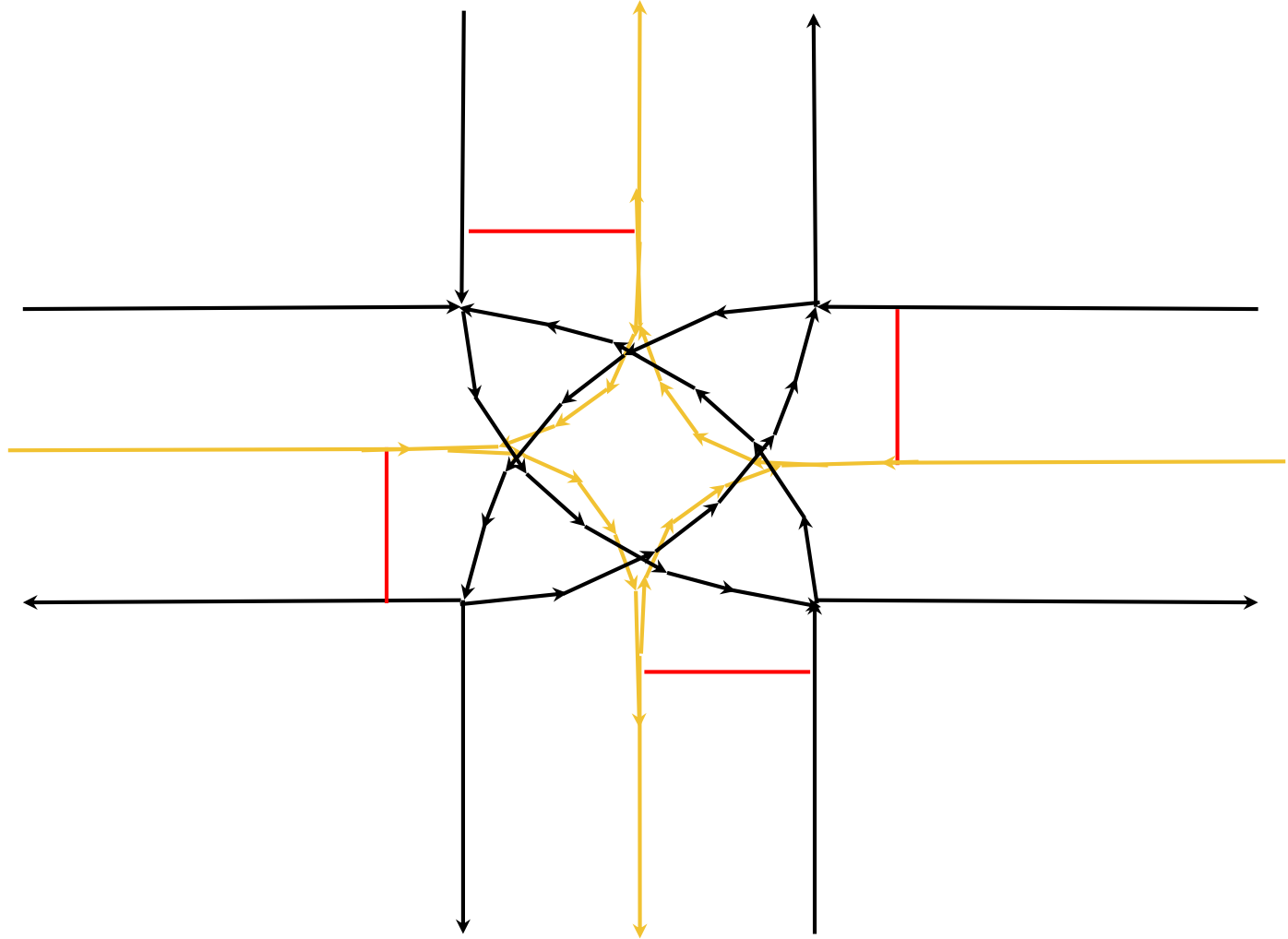
# Intersections

- Intersection Element - pointer to all lanelets which are part of an intersection
- Helps with behaviour assignments



# Operations Done On Lanelets

- Path planning through complex road networks
- Localize Dynamic Objects
- Interactions with other Dynamic Objects



# Creations Of Lanelets

- 3 methods to create the lanelet map

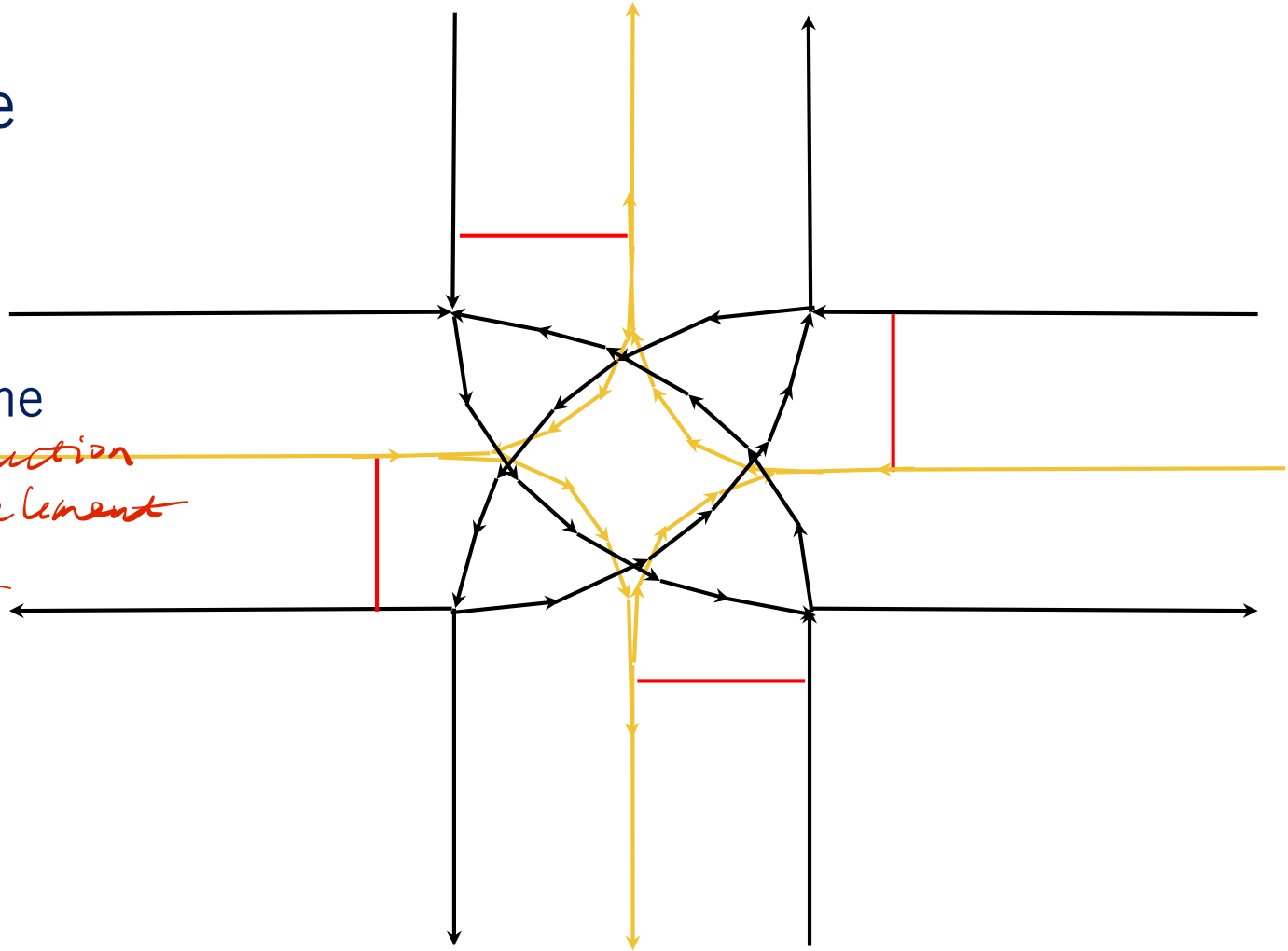
- Offline creation
- Online creation
- Offline creation with online updating

*a new construction  
regulatory element*

*computationally expensive*

- motion planning task
- perception task

*rarely used*



# Summary

- Defining lanelet map
- Defining the elements that make up a lanelet map
  - Lanelet element
  - Intersection element
  - Operations that can be done on lanelets
- Creation of lanelet maps
- Connectivity between lanelets
  
- Next: Mission Planning

# Additional slides



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# Lanelet In Code

