

15th International Conference Geoinformation and Cartography

Vodnjan, 27 September 2019

# Mapping the New Generation of Maps – High Definition Maps



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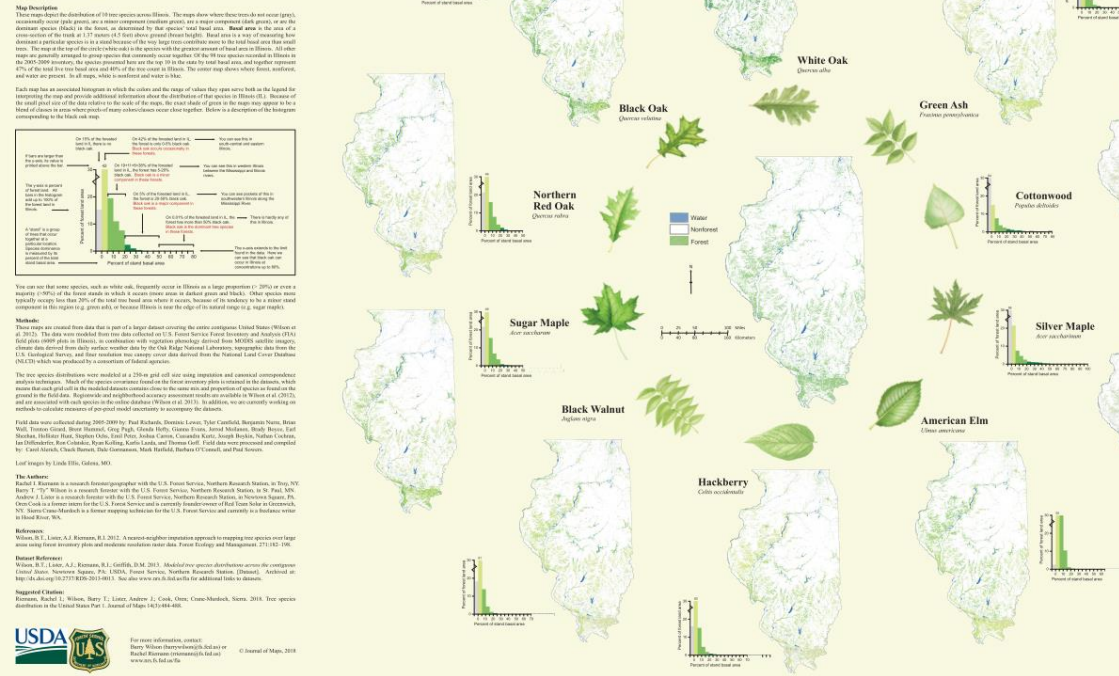
- Cartography = Map making
- Traditionally always done by cartographers (paper and pen / GIS software)
- Standard maps → purpose, audience, layout, visual hierarchy, color, scale, projection, context, visual variables, labels



source: US Census Bureau

# Modeled distributions of 10 tree species in Illinois

Rachel Riemann, Barry T. Wilson, Andrew J. Lister, Oren Cook, and Sierra Crane-Murdock



source: Riemann et al. (2018)

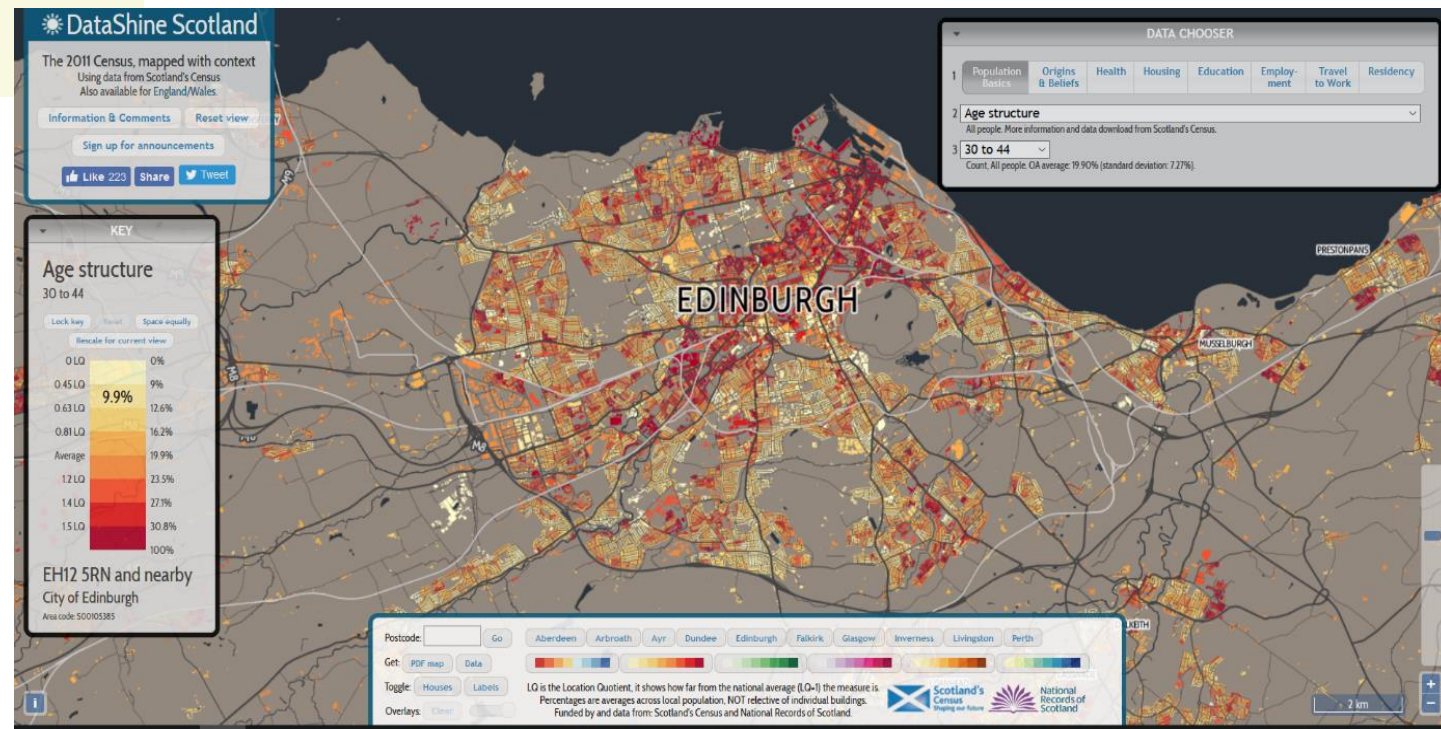
- Contain all / most map elements
- User-centered → visualization and design is very important
- Used to: answer a question, make a decision, see data in context, tell a story, inspire

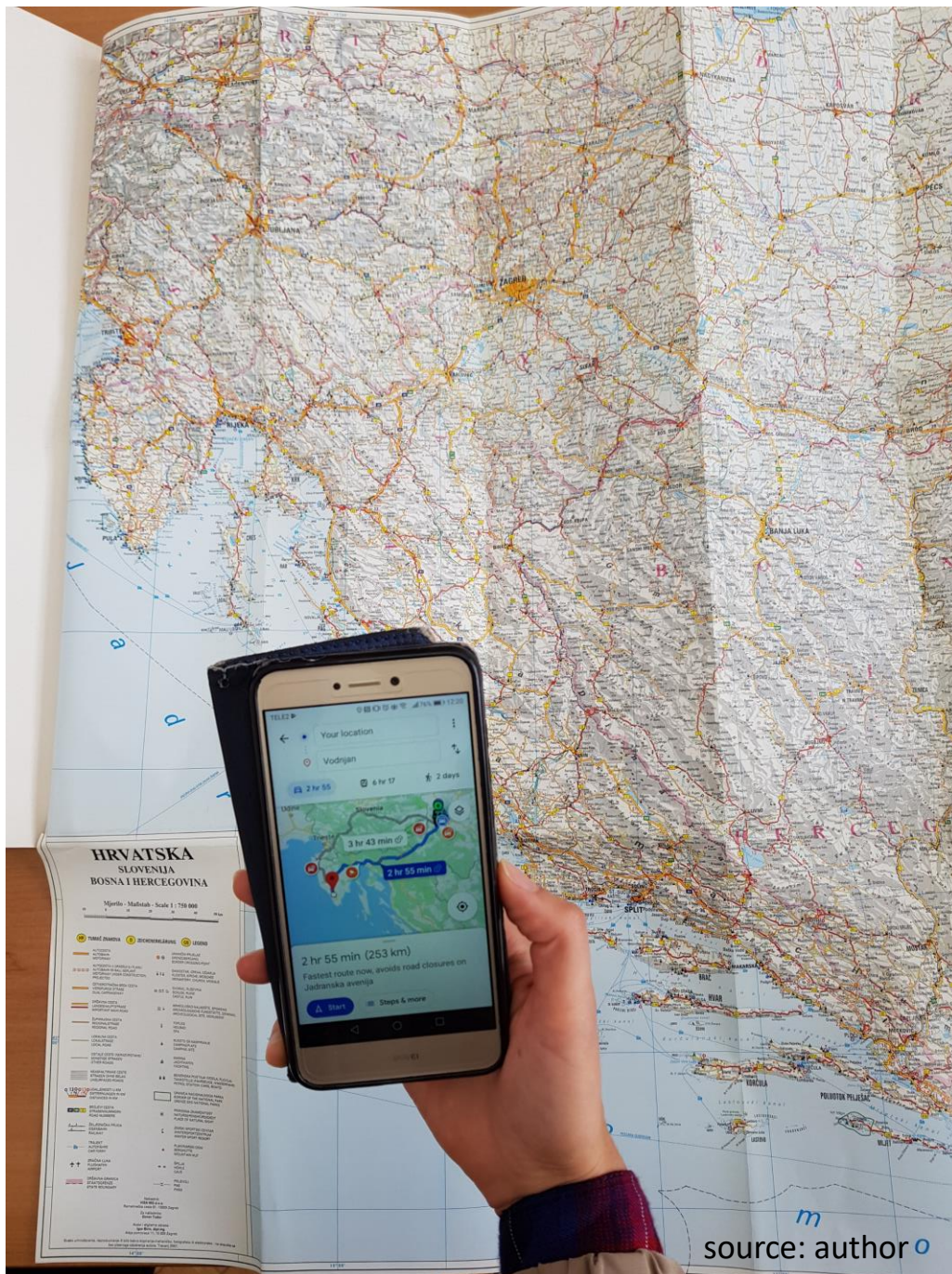
← paper / manual map

digital / web map



source: DataShine Scotland





- Focused on goal-directed route planning and the execution of movement
- Usability is key – consumed by humans
- Standard definition map – accurate but not precise, updatable but not up-to-date

- autonomous cars require the surrounding environment information
- the **High definition (HD) map** is a detailed representation of the physical environment features
- 3 challenges / characteristics of map making for autonomous vehicles:
  1. precision (cm level) = HD
  2. fresh (up-to-date) – once/week
  3. work seamlessly w. autonomous driving system



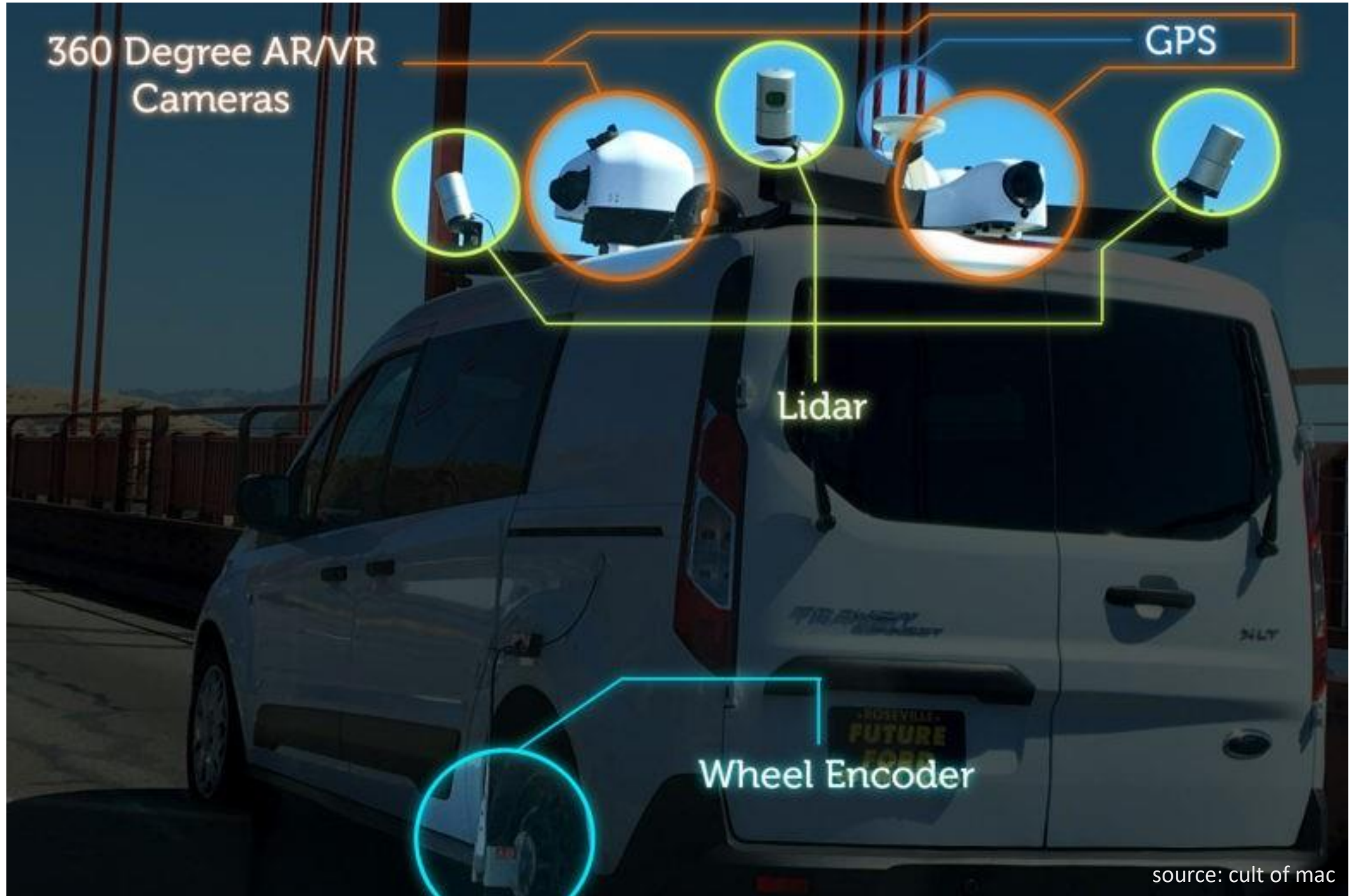
Lidar

360 Degree AR/VR  
Cameras

GPS

Lidar

Wheel Encoder









source: Waymo



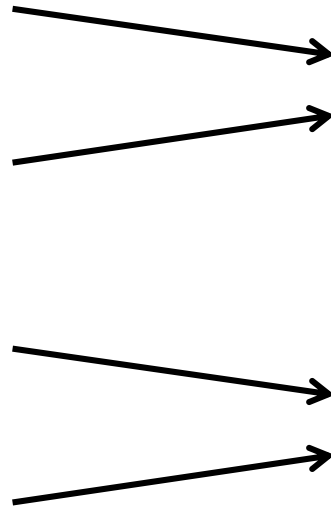
source: Mapillary

### 3. seamless work w. autonomous system →



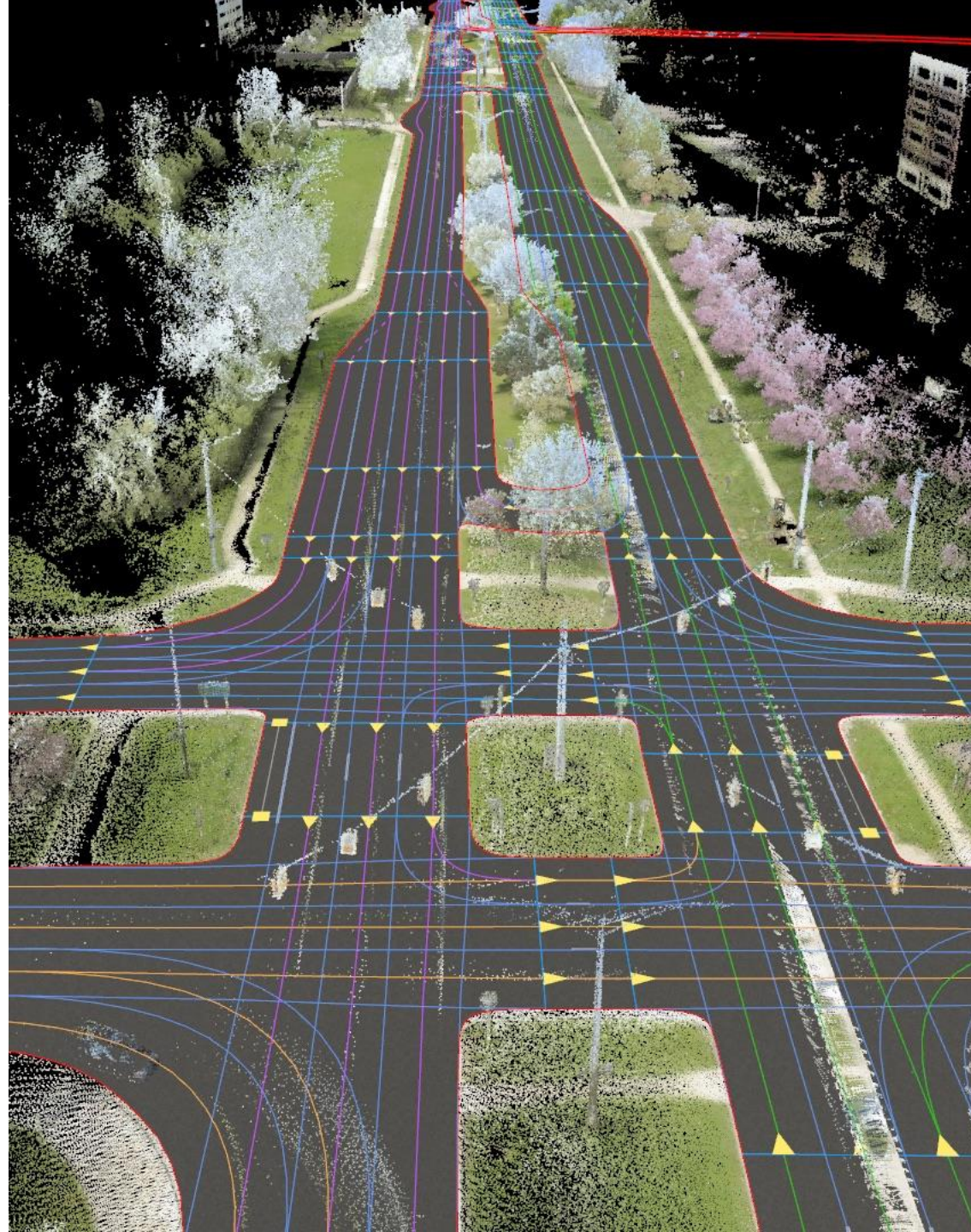
# Layers of HD maps

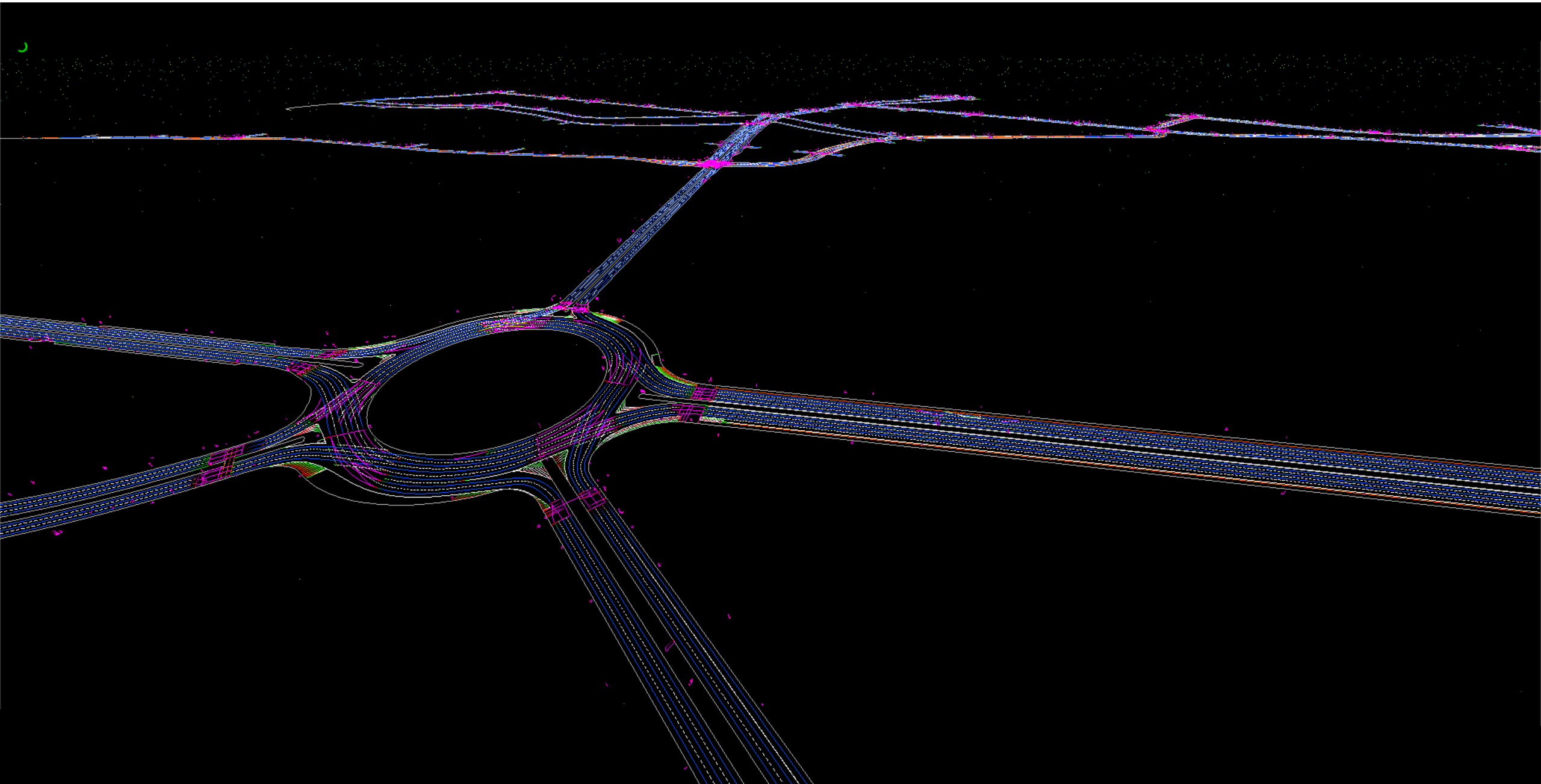
- 2D orthographic map
- DEM
- Lane / Road model
- Stationary map



foundation layer  
(geometric map layer)

semantic layer





# HD mapping process

## Data collection

- LiDAR point clouds
- Camera imagery
- GPS + IMU

## HD map generation

- Sensor fusion & pose estimation
- Data fusion & data processing
- Object location detection
- Semantics extraction

## Quality control & validation

## Update & maintenance

# Conclusions (challenges, concerns)

- high costs of creation & huge amount of data
- lack of standards → there's no Google Maps / SDI for self-driving cars

- legal

- information failure

*Developers, Developers, Developers...  
The Key Ingredient for an Autonomous  
Revolution*

- rapidly growing market
- HD map is the "key part of the autonomous driving puzzle"
- cartographers need developing skills if they want to be part of the HD mapping process



Thank you!

Questions?

PS: Don't throw away the paper maps just yet.