infraspatialOT: spatial relationships in road infrastructure

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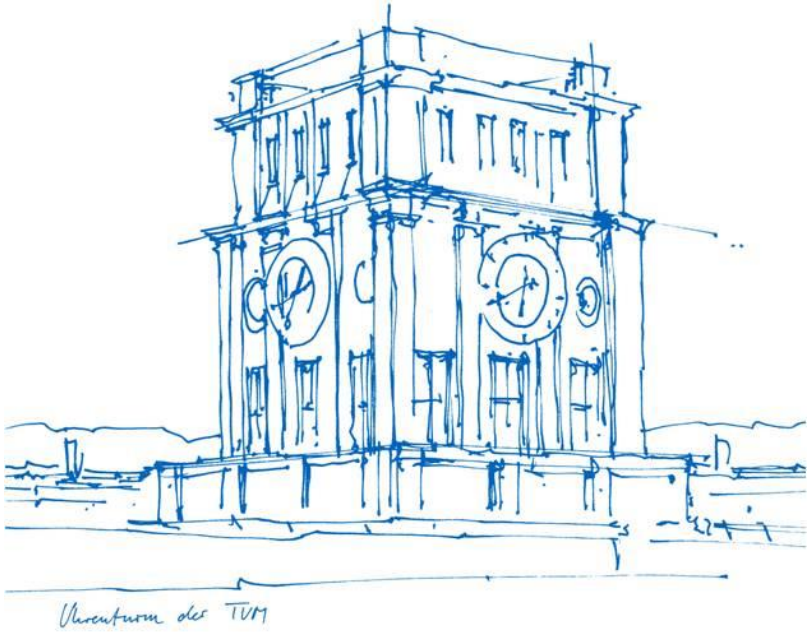


Motivation

Digital twin as a tool for supporting the maintenance and repair by providing a comprehensive, reliable information base for **decision support**

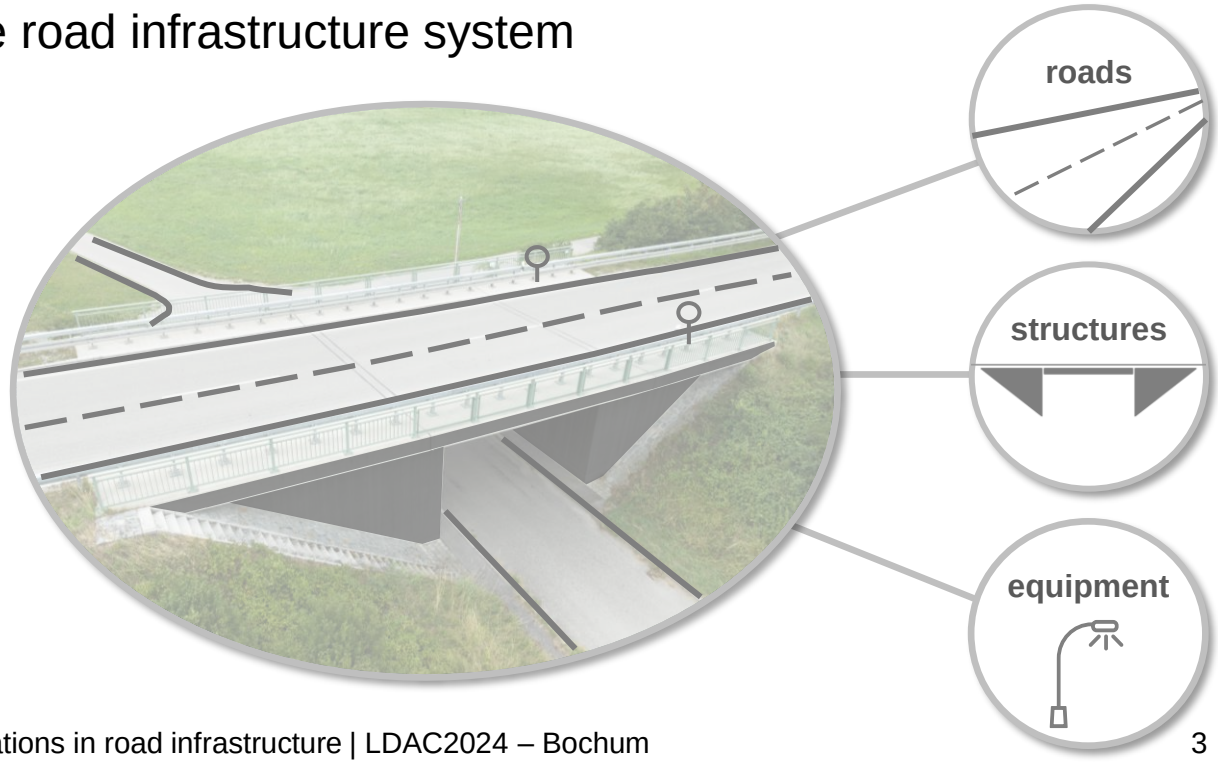
Key requirements

for a digital twin of an entire road infrastructure system

Road infrastructure consisting

of **various interacting**

subsystems

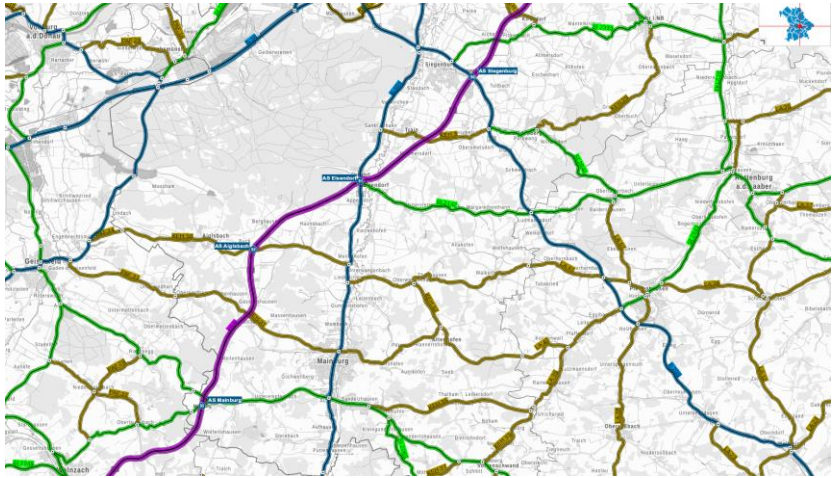


Key requirements

for a digital twin of an entire road infrastructure system

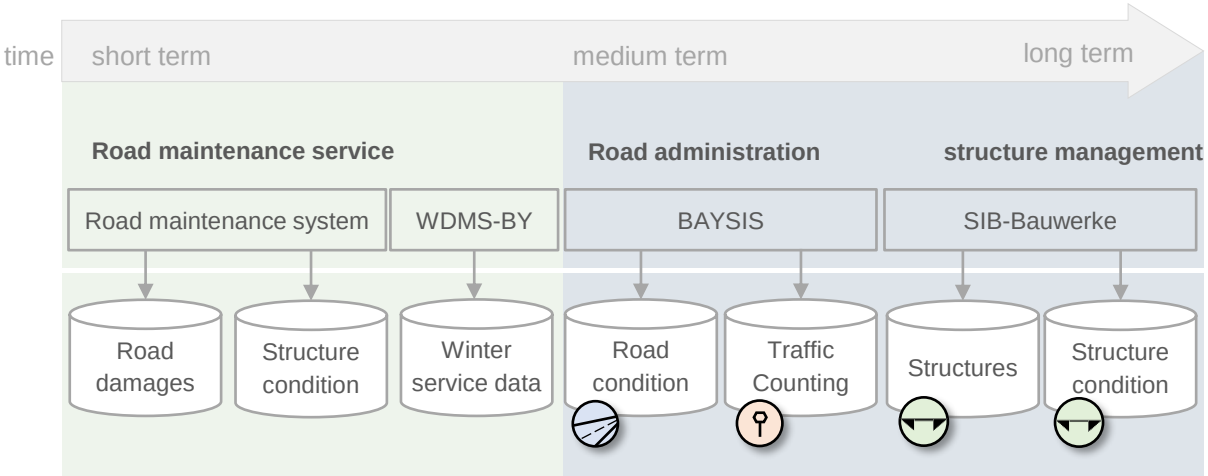
Scalability:

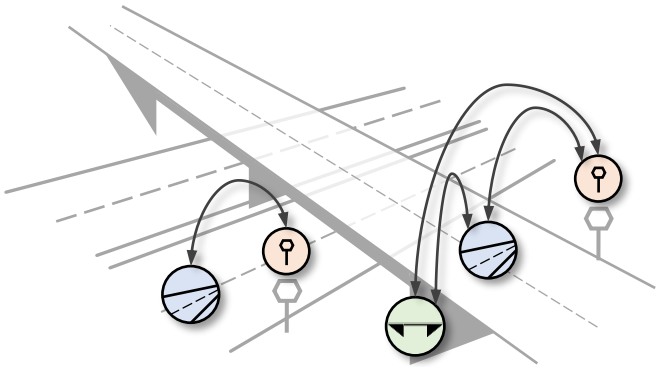
- in Bavaria: >27 800 structures and > 40 000 km of roads
- **Automated evaluation of relationships** between different subsystems



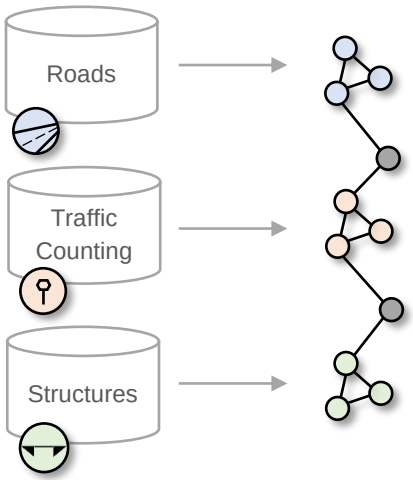
Example use case

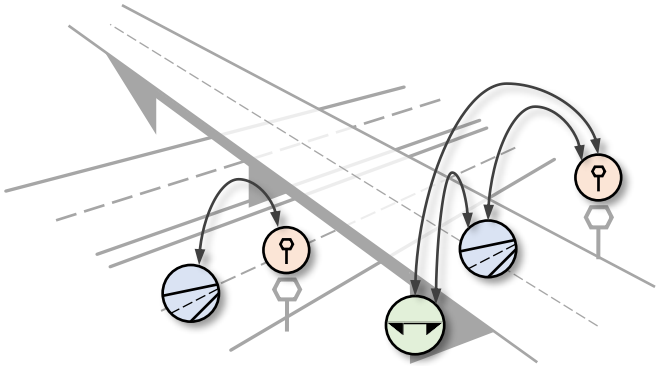
Systems currently in use





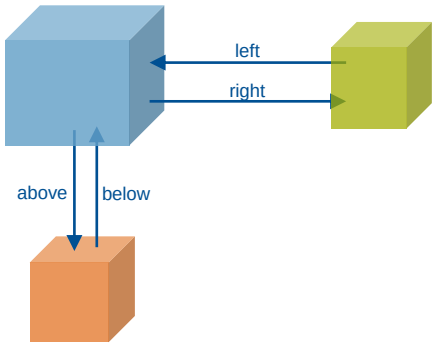
Using graph-based representations of the legacy data

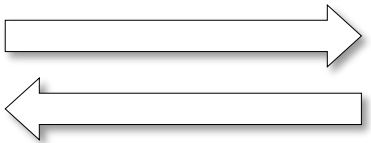




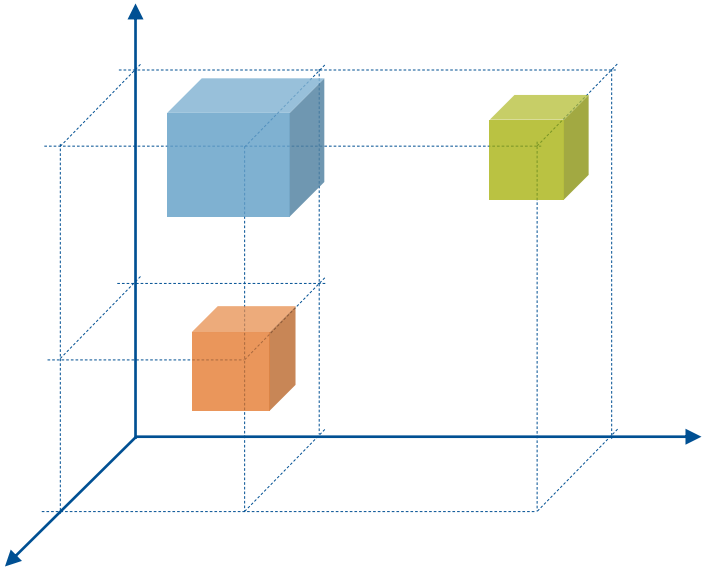
Possible location schemes

Qualitative relation to an object





Quantitative relation to a reference system:



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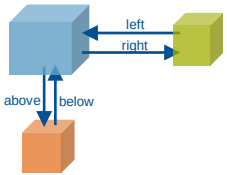

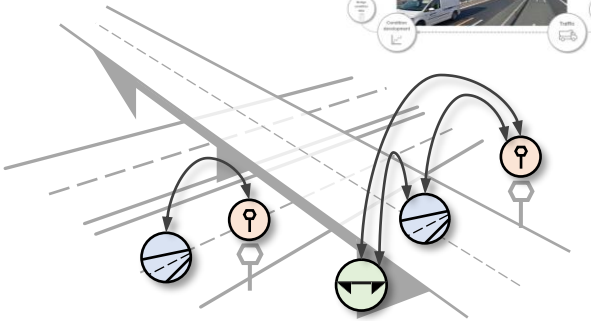

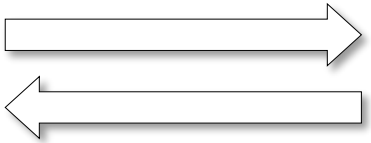

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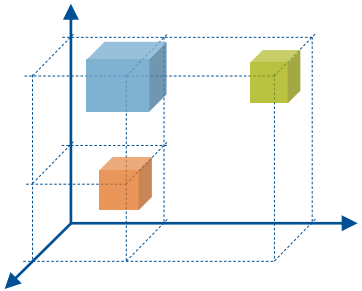

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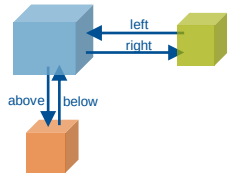
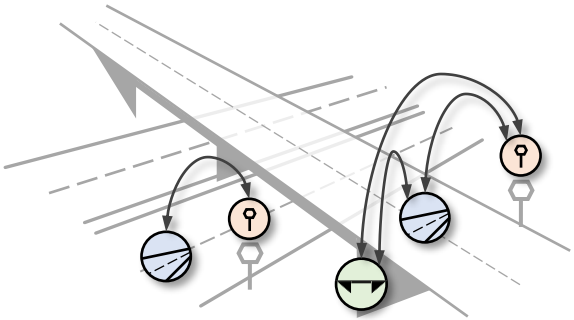
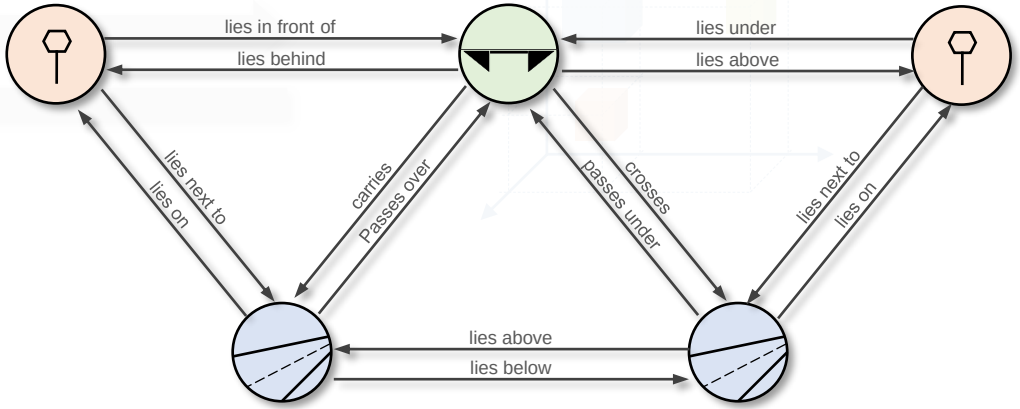




Quantitative in relation to a reference system:



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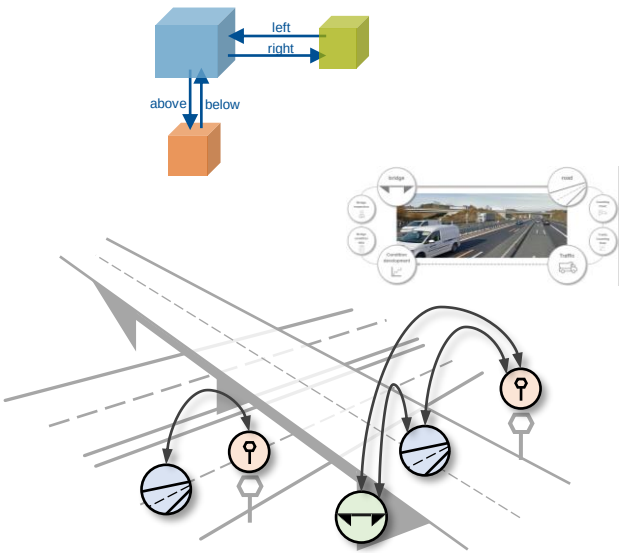

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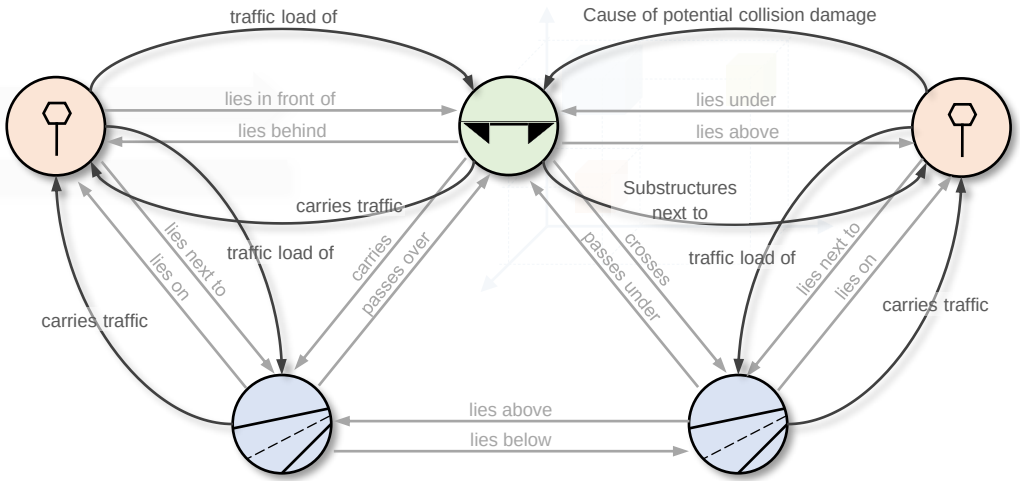

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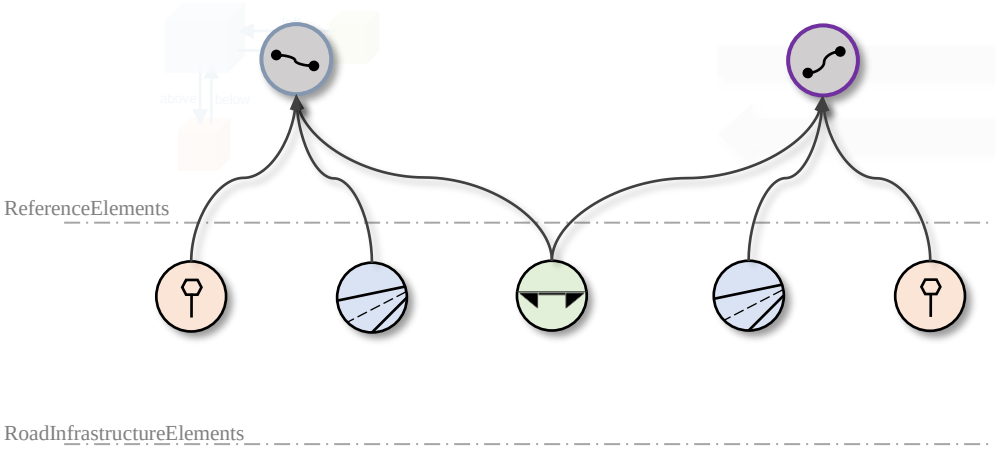

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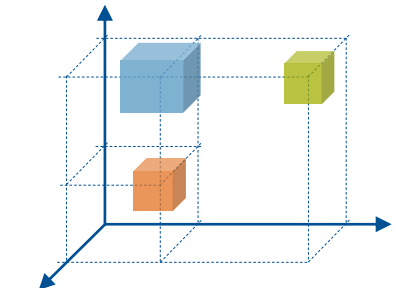
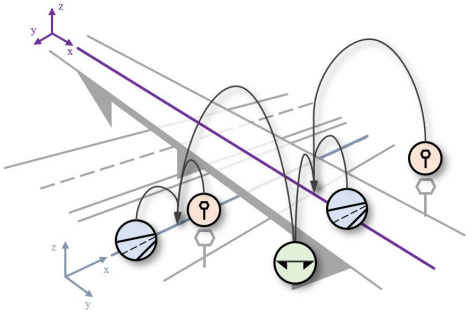
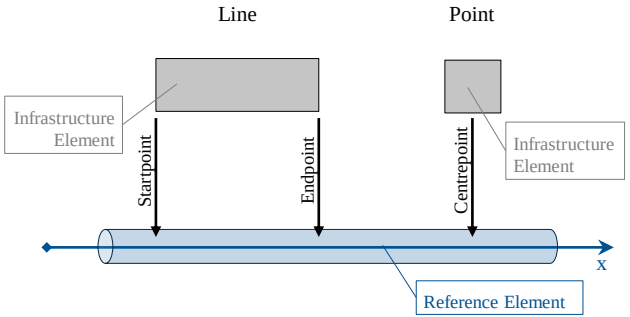
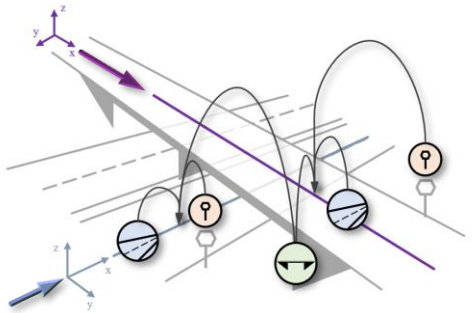




Development of an ontology

Localisation in longitudinal direction:





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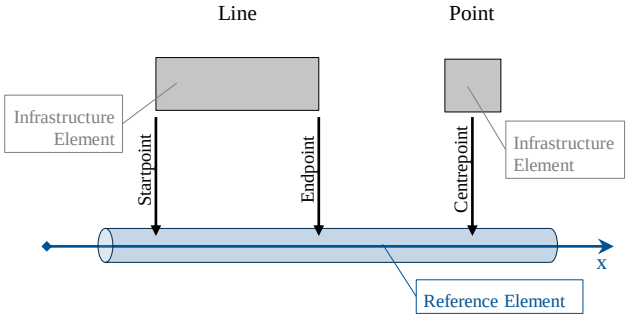
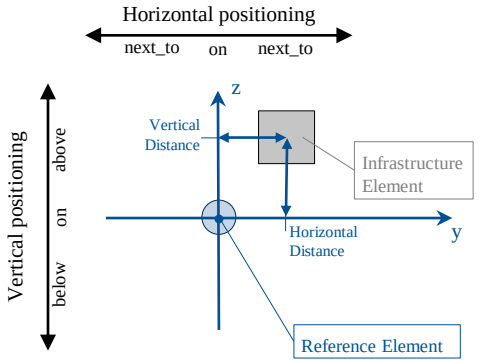
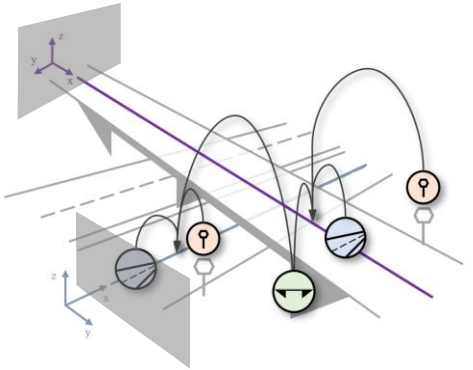


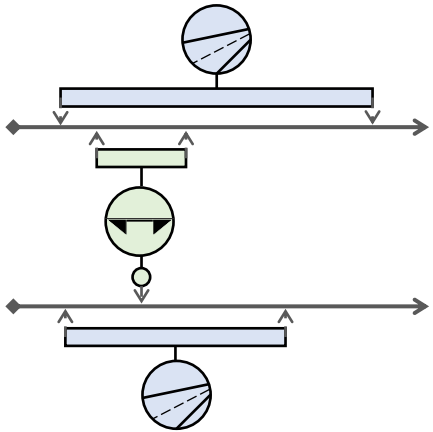
Positioning in transverse direction:





Derivation of spatial relationships between road infrastructure elements

Localisation in longitudinal direction



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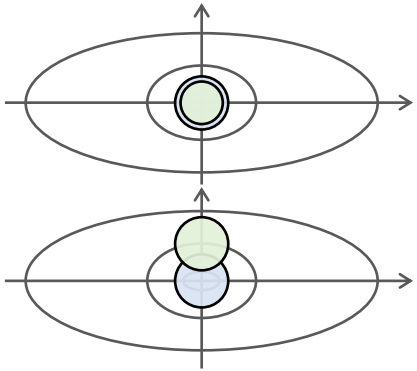
Positioning in transverse direction



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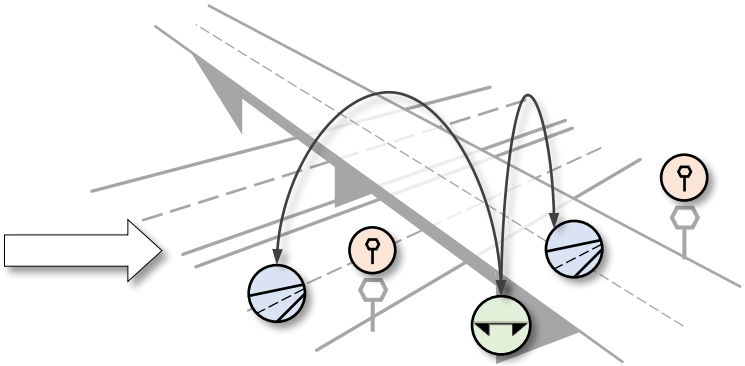
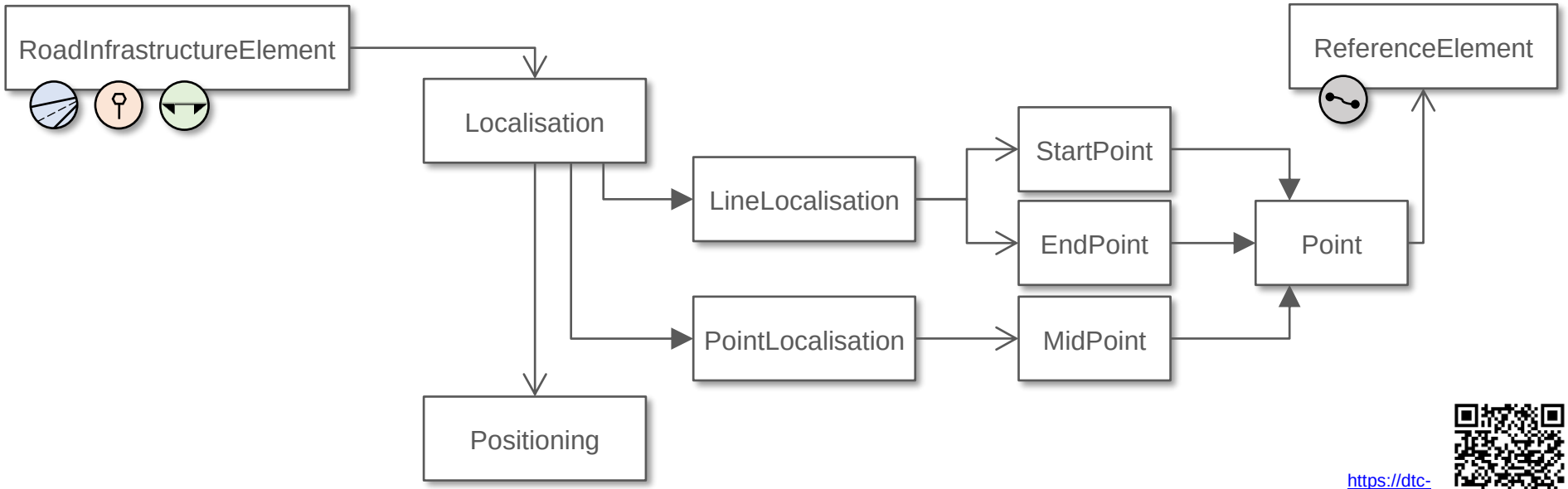


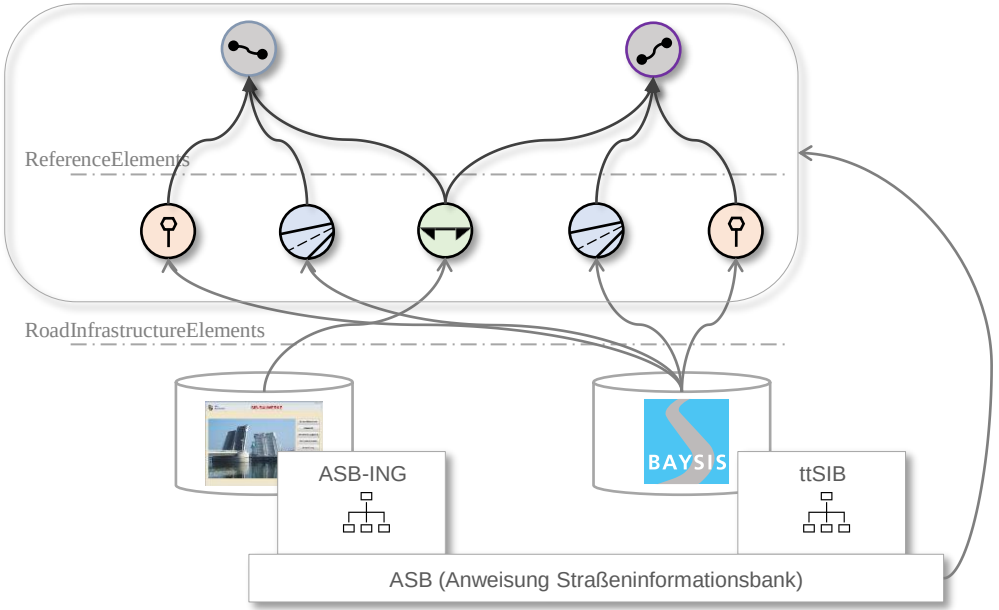
Formalization as ontology



https://dtc-ontology.cms.ed.tum.de/infraspatialot/index.html

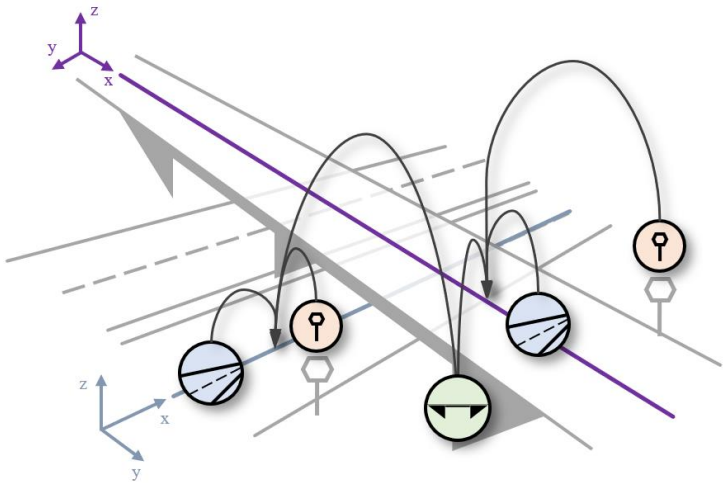
Case study: Infrastructure data from Bavaria (Germany)

- Resulting from ASB (Standard for all German infrastructure data), all infrastructure data contain a **reference to a defined network**
- Implementation of network reference varies between the different data structures used
- Two considered systems:
  - SIB-Bauwerke for structure management
  - BAYSIS for road management



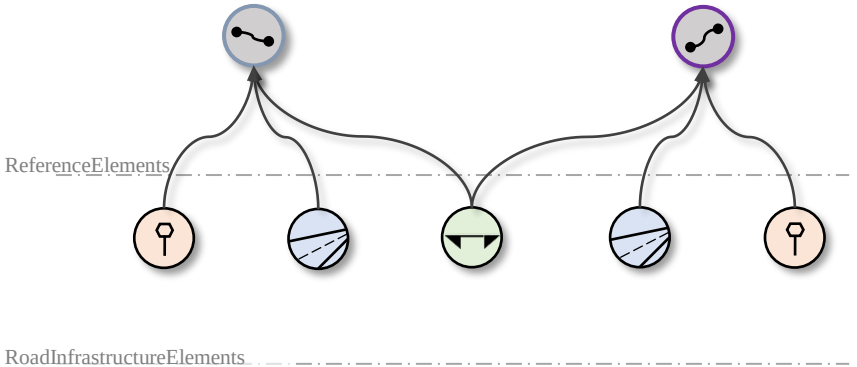
Conclusion

- description of spatial relationships between road infrastructure elements
- using a reference system consisting of linear reference elements
- Enabling derivation of use case-specific relations between infrastructure elements



Limitations and future work

- Consistency between legacy data and graph-based representation
- Derivation of relationships between road infrastructure elements and reference elements
  - from geometry information
  - from further data structures of other legacy data sets
- Extension of the approach to higher levels of detail



Acknowledgement

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Bayerisches Staatsministerium für
Wohnen, Bau und Verkehr