Optimising Multimodal Transport: Modelling Shared Spaces with Agents with Diverse and Conflicting Goals

TRANSW2023 Presentation

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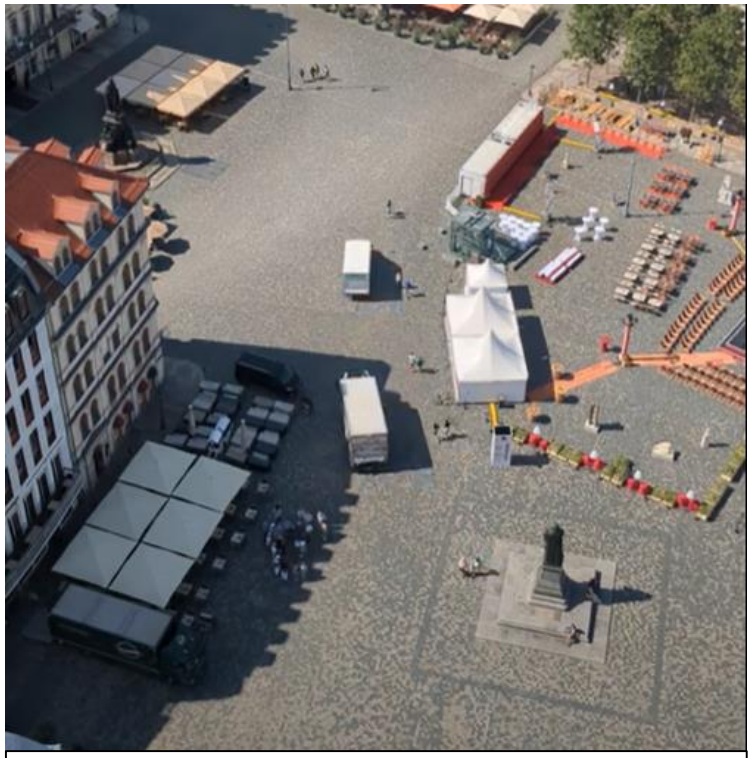
Supported by

Background

- Shared space designs:
  - Are increasingly popular;
  - Assign equal priority;
  - Minimise separation and distractions;
  - Include place-defining aspects, *e.g.* furniture, art, nature.
- Quantitative studies have shown:
  - Efficiency (high flow of pedestrians and vehicles);
  - Safety; and
  - Comfort.
- Significant Challenges:
  - Some road users require priority and benefit from separation, *e.g.* vulnerable road users;
  - Shared space design and evaluation needs guidelines, standards and tools.



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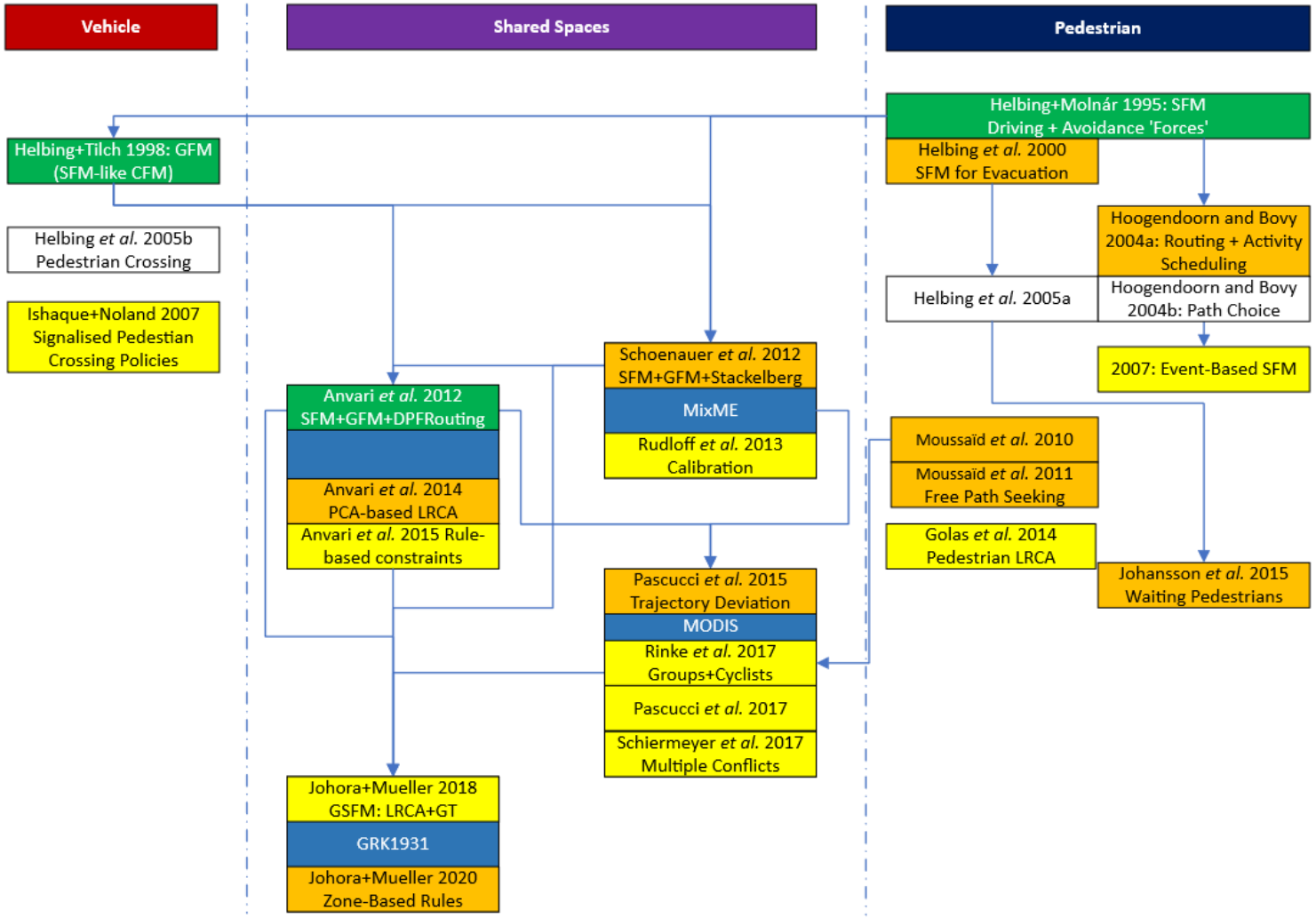
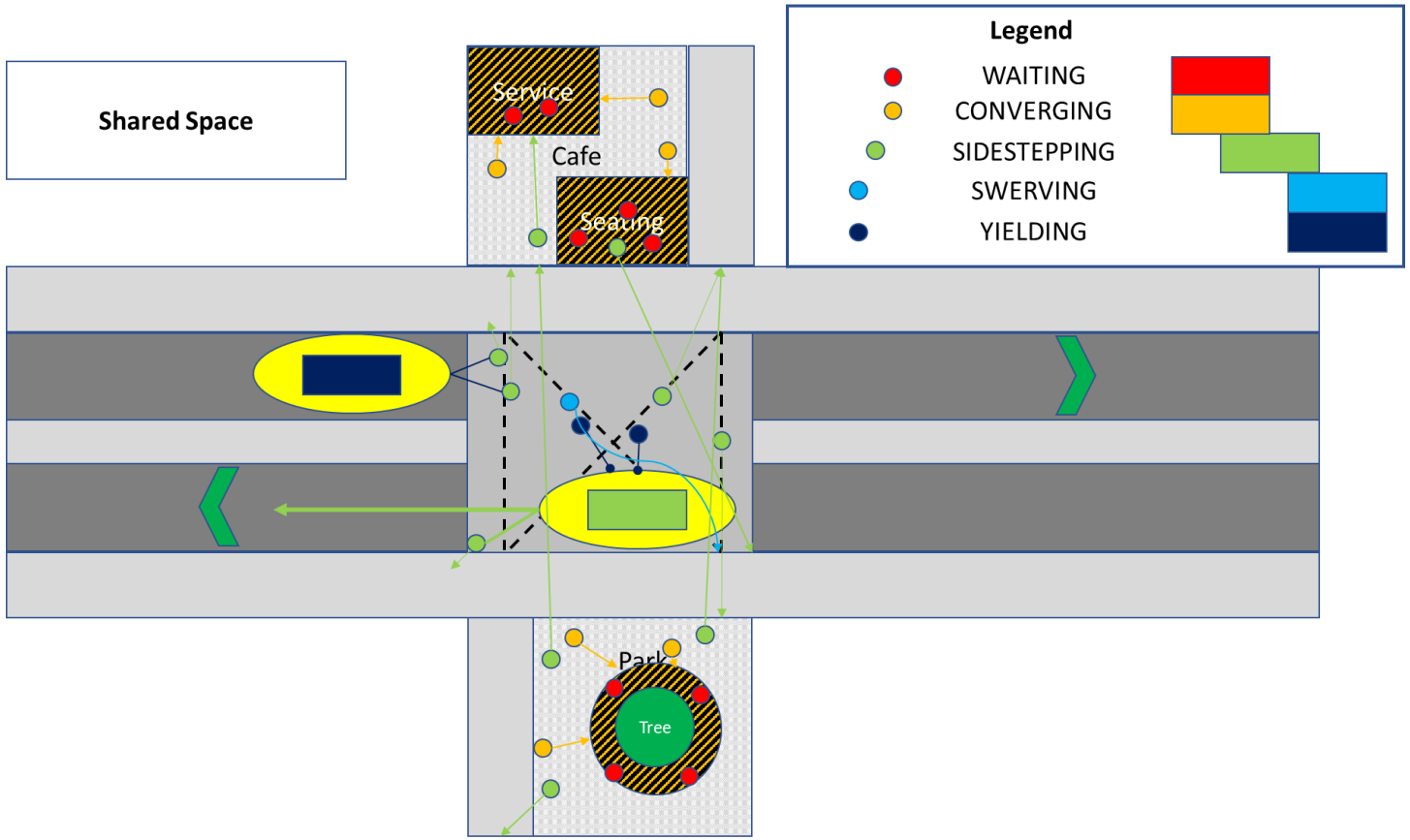
Literature Review



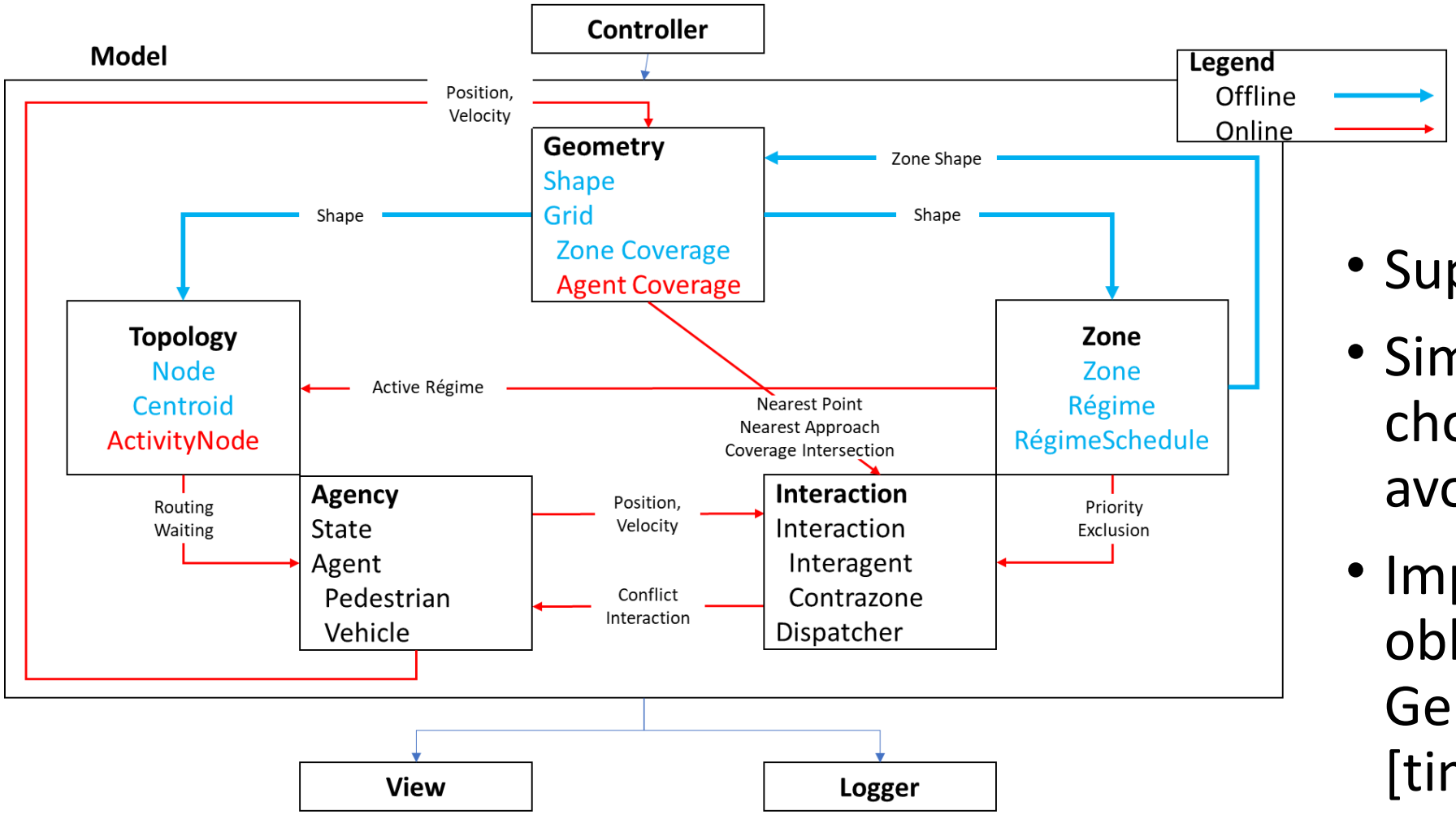
- Shared space models combine:
  - Pedestrian Models
  - Vehicle Models
  - Intermodal Conflicts
- Our ATRF2023 paper will provide more details.

Problem (Shared Space Use Case)



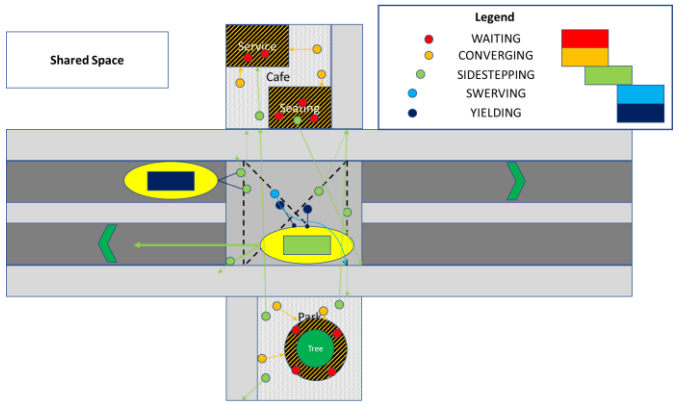
- The café and the park are activity nodes.
- Each agent is colour-coded with its current action-state:
  - agents converge to and wait at activity nodes.
- Equalised priority:
  - cars may *yield* to pedestrians or vice versa;
  - only pedestrians *swerve*.

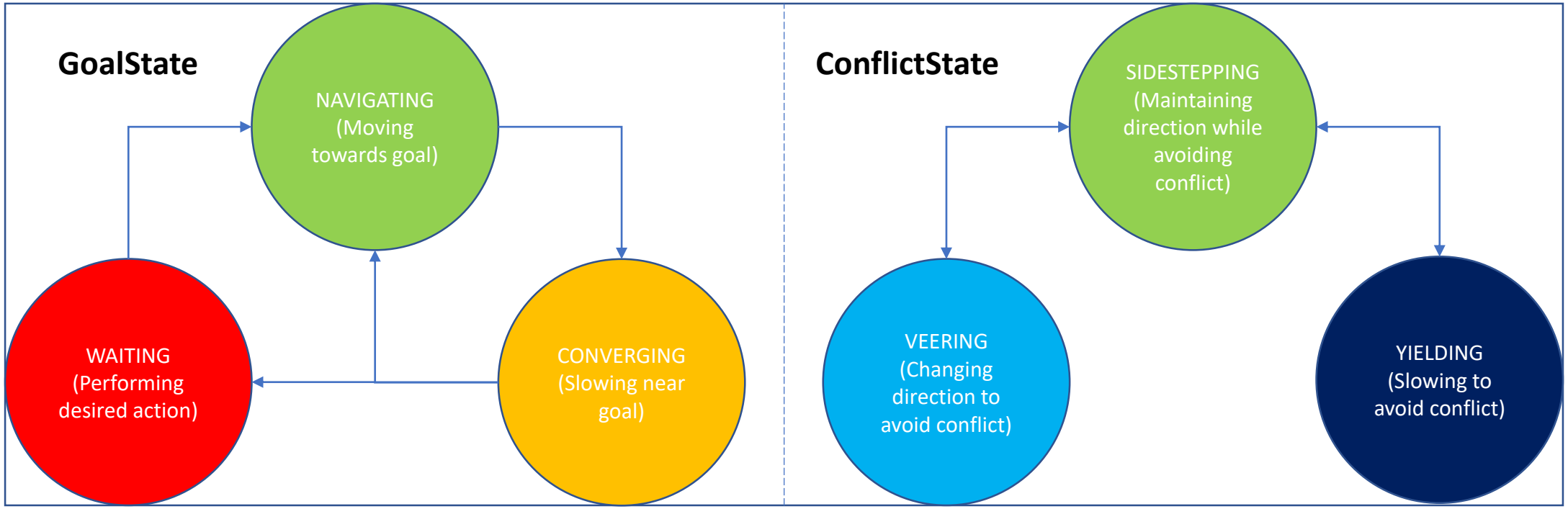
Solution: Software Model Structure



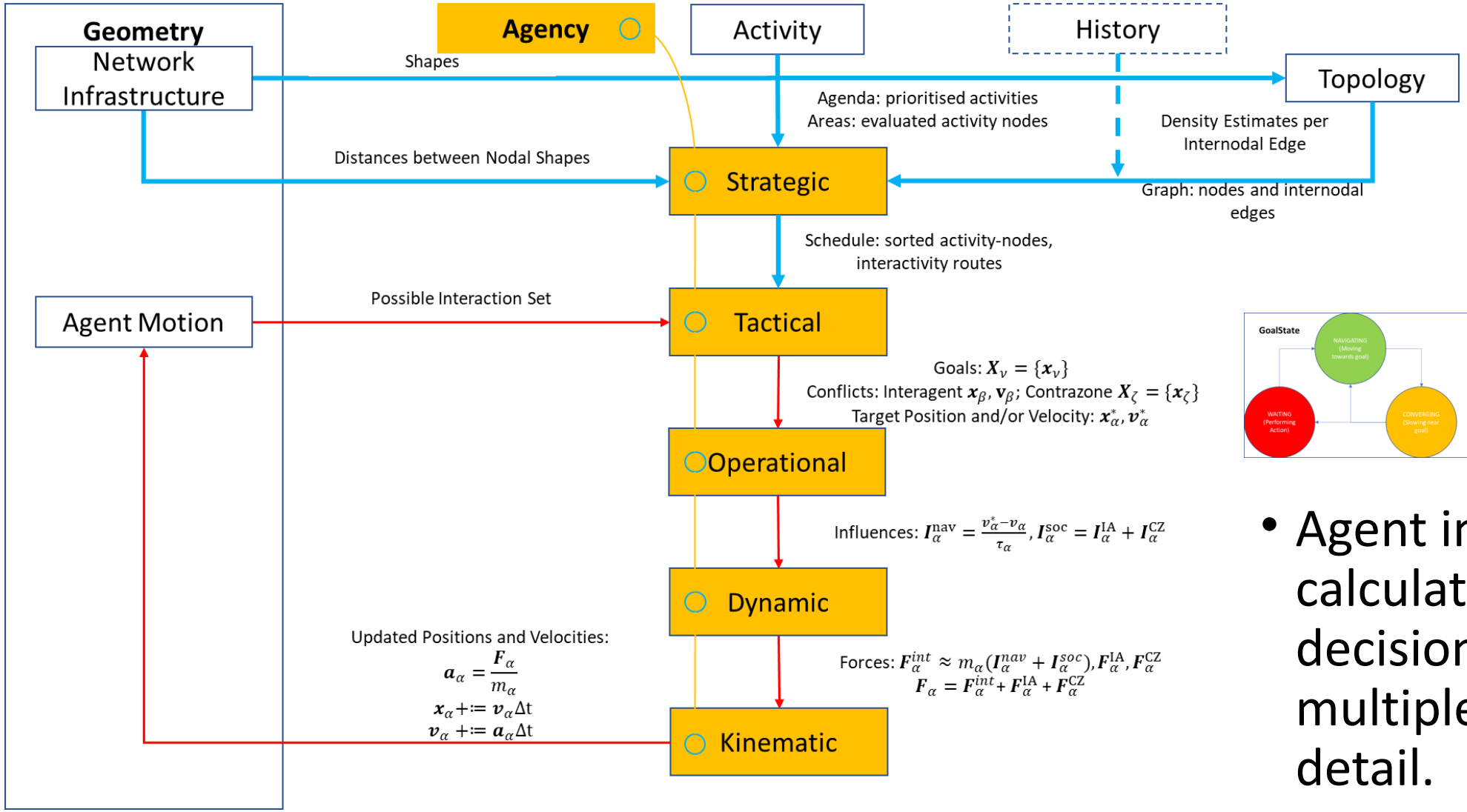
- Support activity areas.
- Simple criteria to choose conflict avoidance strategy.
- Improve support for oblique approach. Generate trajectories [time-]efficiently.

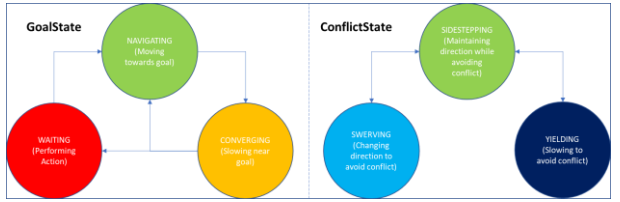
Agent State: Goals and Conflicts





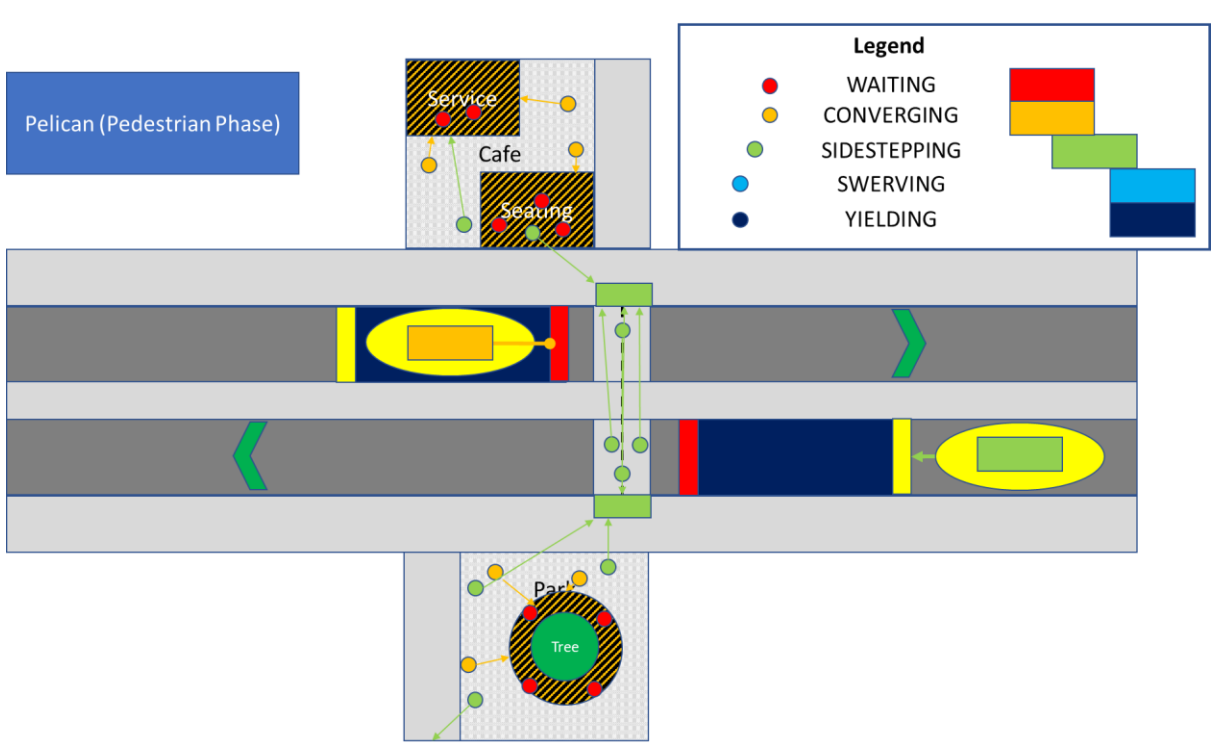
Agent interaction

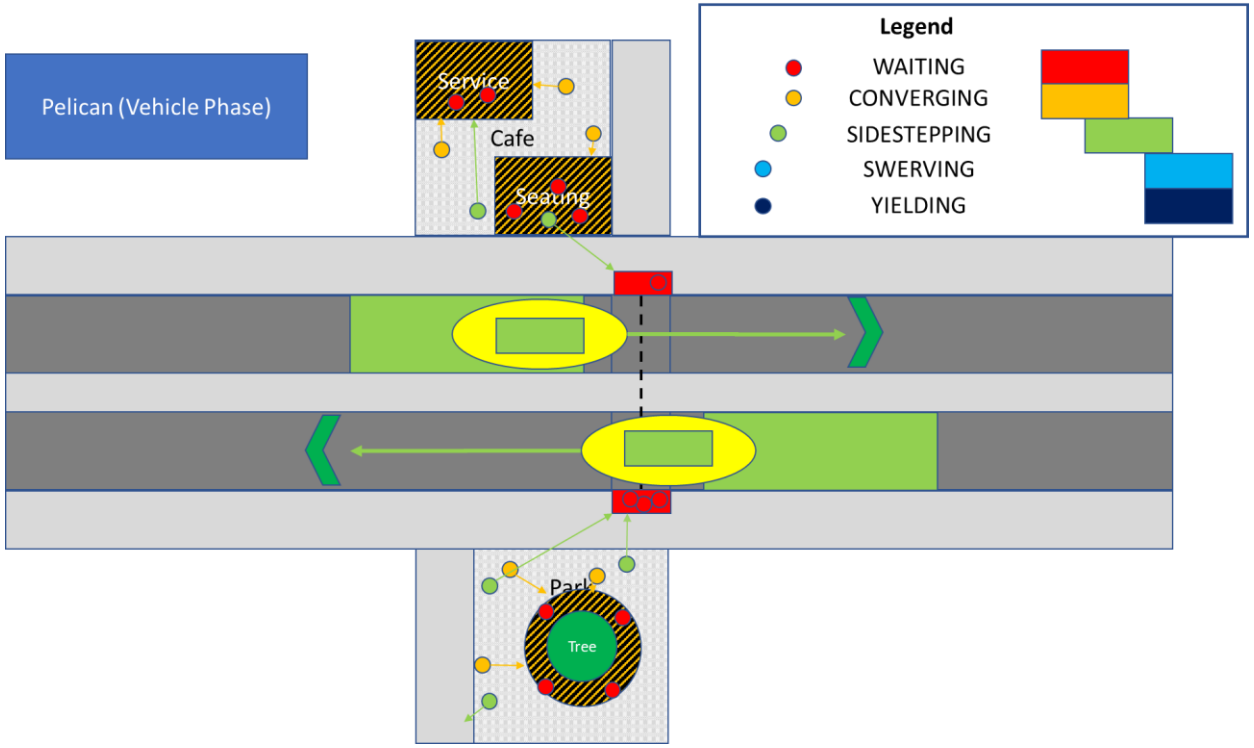




- Agent interaction calculation and decision relies upon multiple levels of detail.

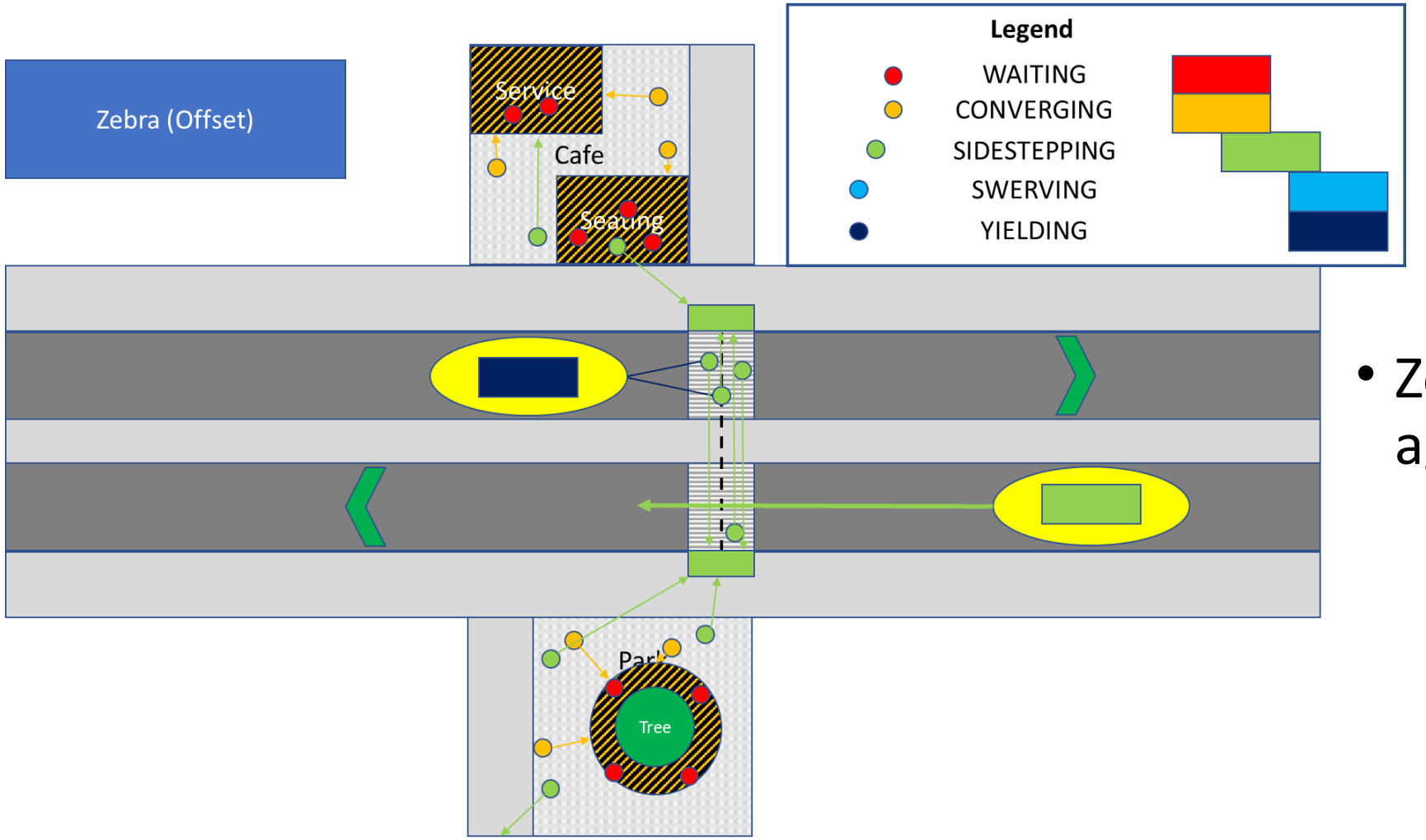
Alternative Use Case (Pelican Crossing)





- Zones have been given states
  - Comparability between shared spaces and non-shared solutions.
  - Consistency during evaluation process.

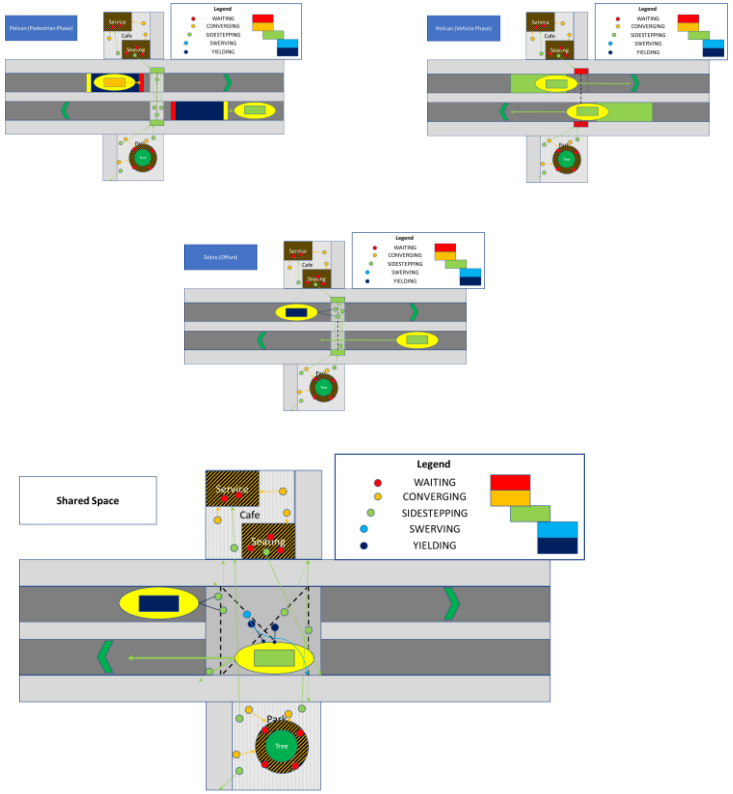
Alternative Use Case (Zebra Crossing)



- Zones can prioritise agents, e.g.:
  - Pedestrian priority.

Demos for Relevant Use-Cases

- For comparison of shared space designs with non-shared space designs, I've extended the model to support them.
- Pelican crossing:
  - https://youtu.be/sukl21KdDUQ
- Zebra crossing:
  - https://youtu.be/QMceCIdQDB8
- Shared space:
  - https://youtu.be/AakNbjOWQe8
- Activity space:
  - https://youtu.be/6CHIav3esYE



Contribution and Impact

- Contribution:
  - Support for more complex realistic human behaviour, such as humans juggling goals they want/need to achieve and conflicts they must avoid:
    - Support activity areas with *activity nodes*;
    - Simplify criteria to choose conflict avoidance strategy with *agent states*;
    - Improve support for obliquely converging agents.
- Impact
  - Creation of better tools to support design and implementation of shared spaces and other multimodal infrastructure.

Questions?

Appendices