Towards Scaling Agent-Based Transport Simulations via Independent Distributed Simulations

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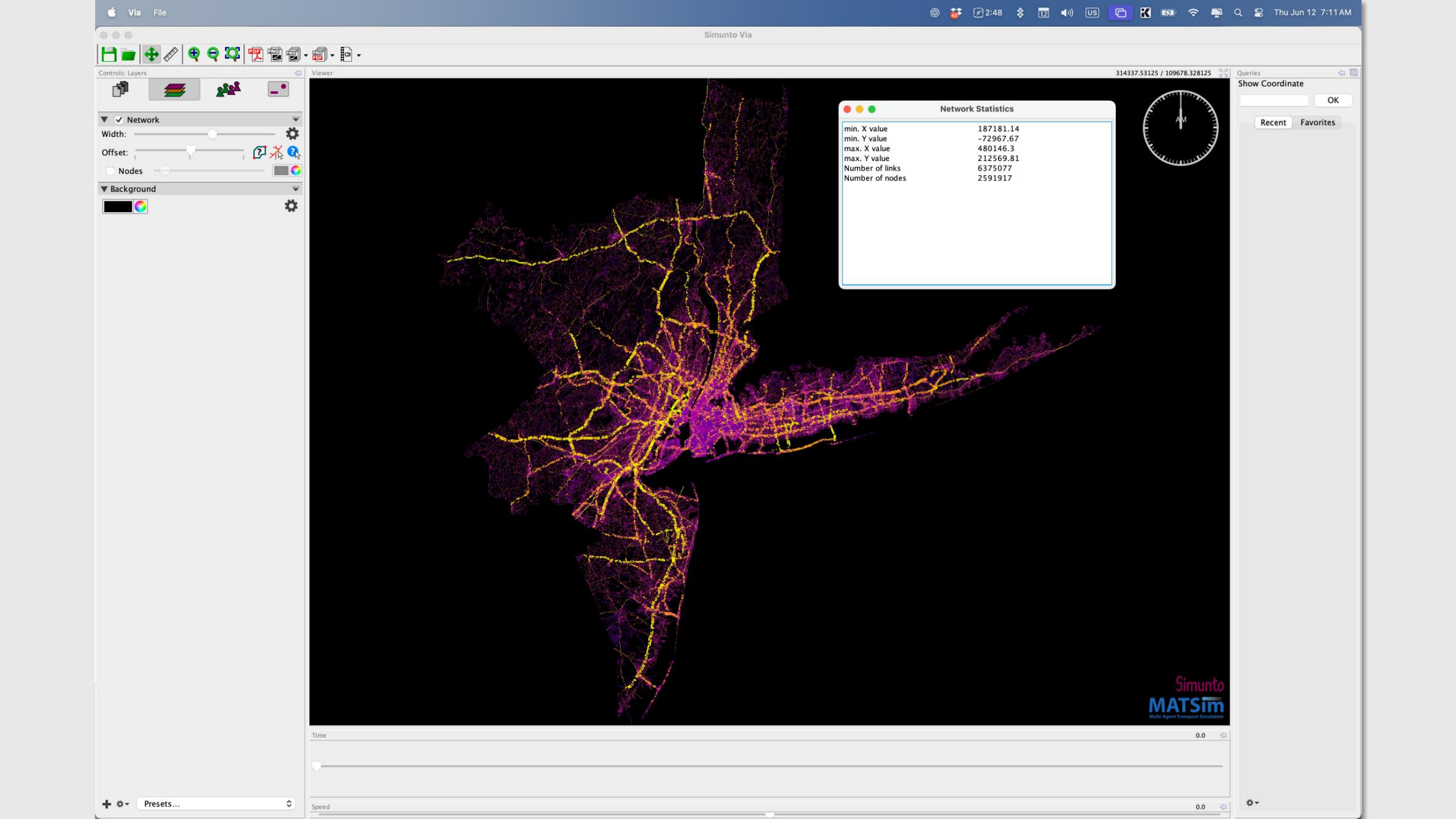
Hiroshima University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Simunto Via
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Width:
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Viewer
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min. Y value -72967.67
max. X value 480146.3
max. Y value 212569.81
Number of links 6375077
Number of nodes 2591917
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Simunto
MATSim
Multi-Agent Transport Simulation
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Speed
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Queries
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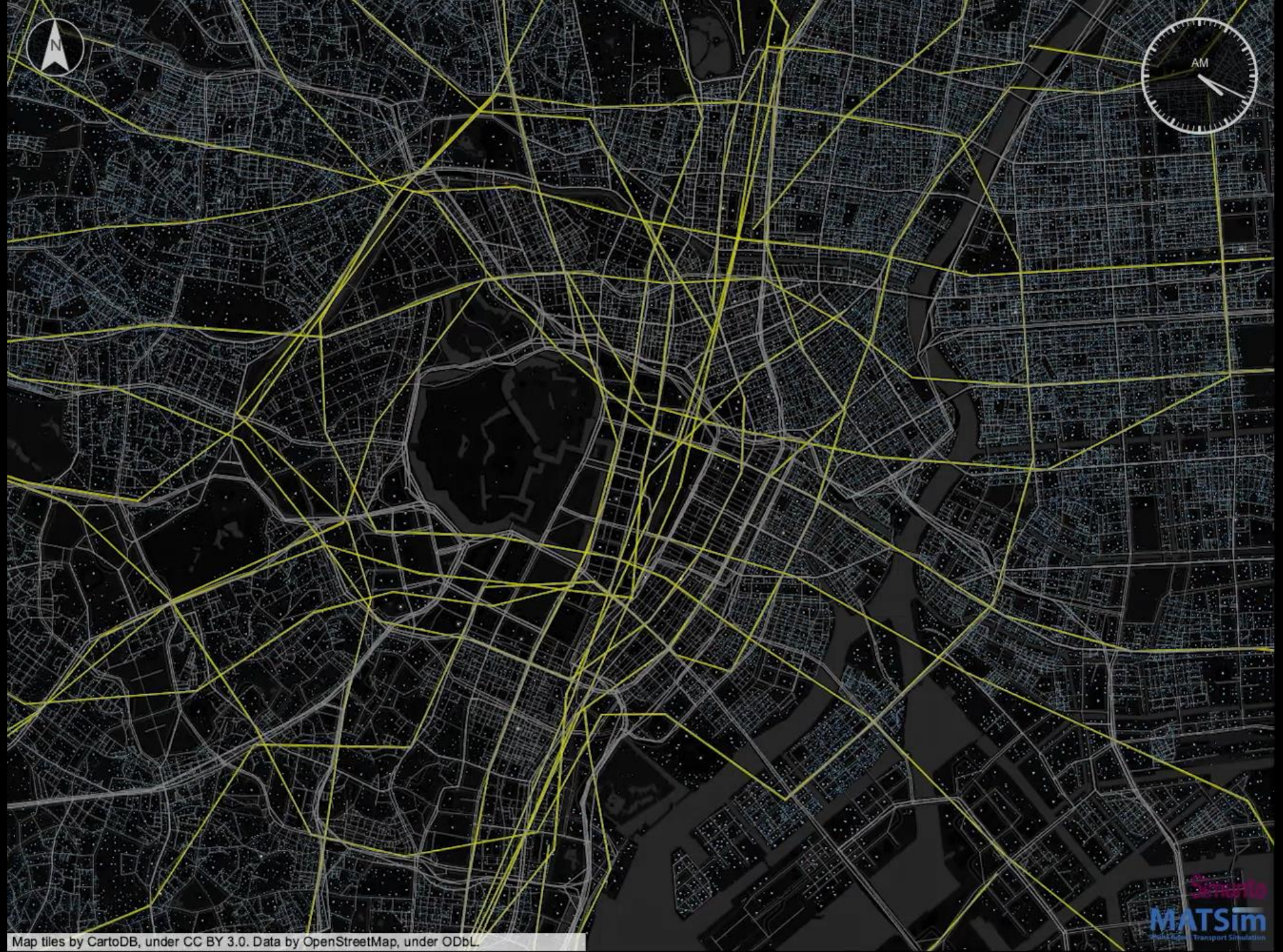
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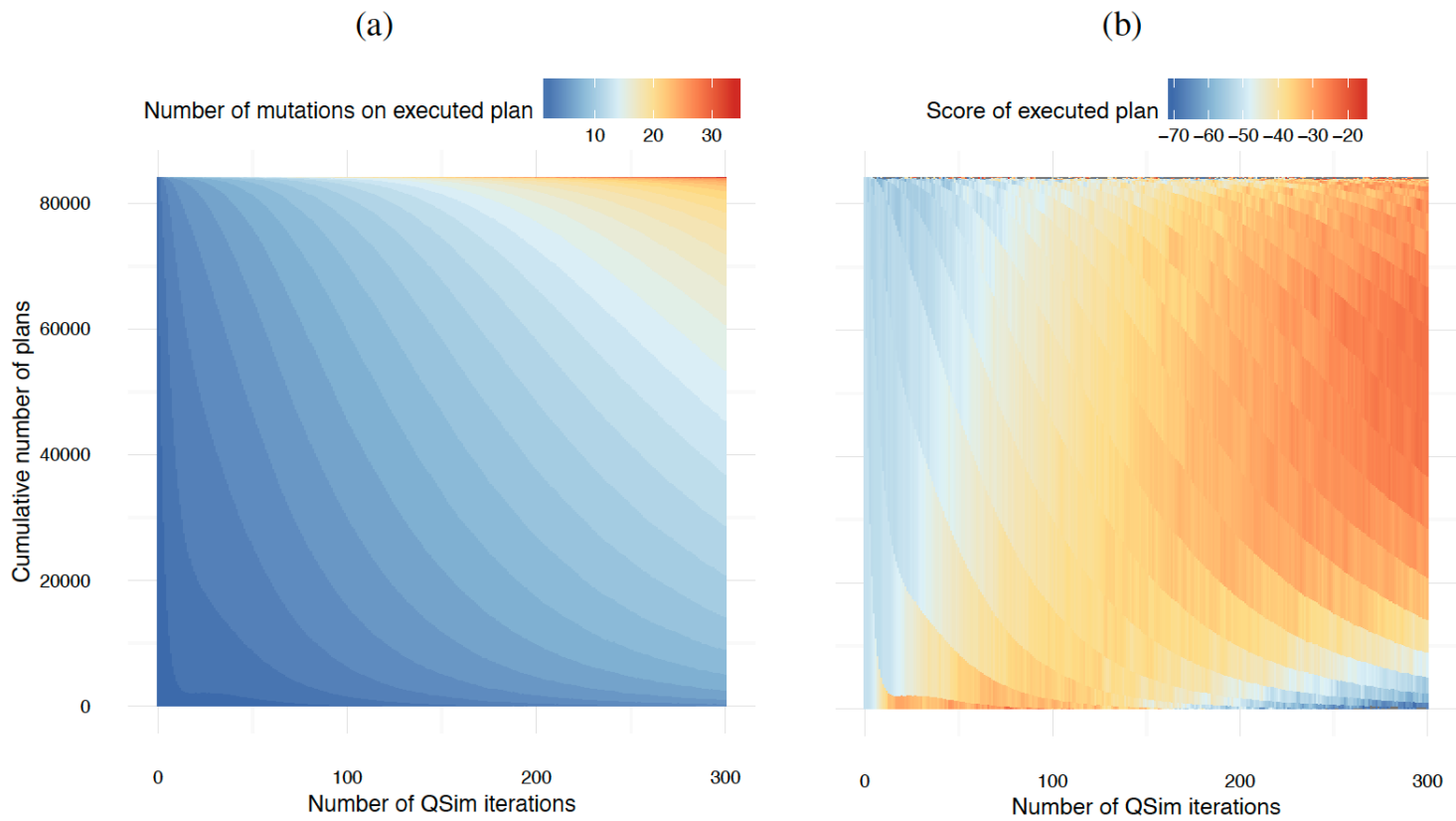
Motivation

- On-demand clusters are expensive
- Spot clusters are unreliable
- In-memory storage infeasible for large scenarios

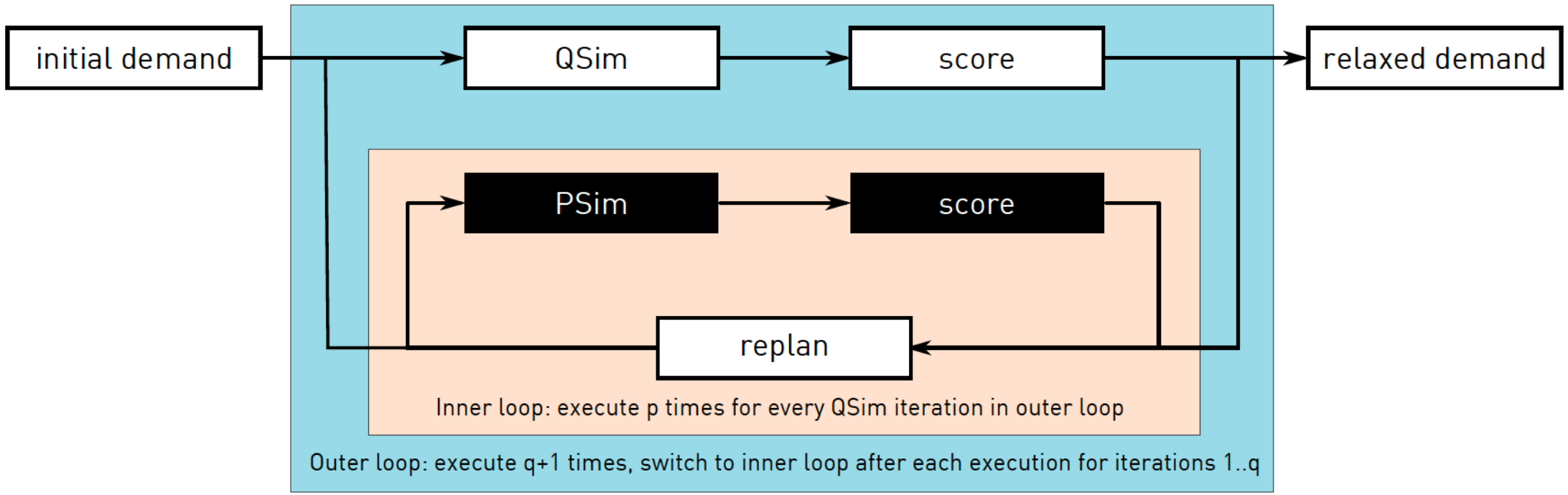
- How to run MATsim for very large scenarios, using any number of cheap nodes, asynchronously and with node failure tolerance?

Figure 6.1: Number of mutations vs score of executed plan over the course of 300 iterations, for the Sioux Falls scenario of Chakirov and Fourie (2014)



Scores on the right are for the same ordering of plans on the left, so any coordinate in either plot refers to the same executed plan.

Figure 6.2: Schematic illustration of the modified MATSim simulation process with pseudo-simulation.



link_id	time	avg_travel_time
1	900	80
2	900	....
...	...	...
10482894	84000	...

stop_id	time	waiting_time
1	900	122
2	900	....
...	...	...
n	84000	...

from_stop	to_stop	time	pt_travel_time
1	2	900	23
2	3	900	75
...		...	...
n	n-1	84000	...

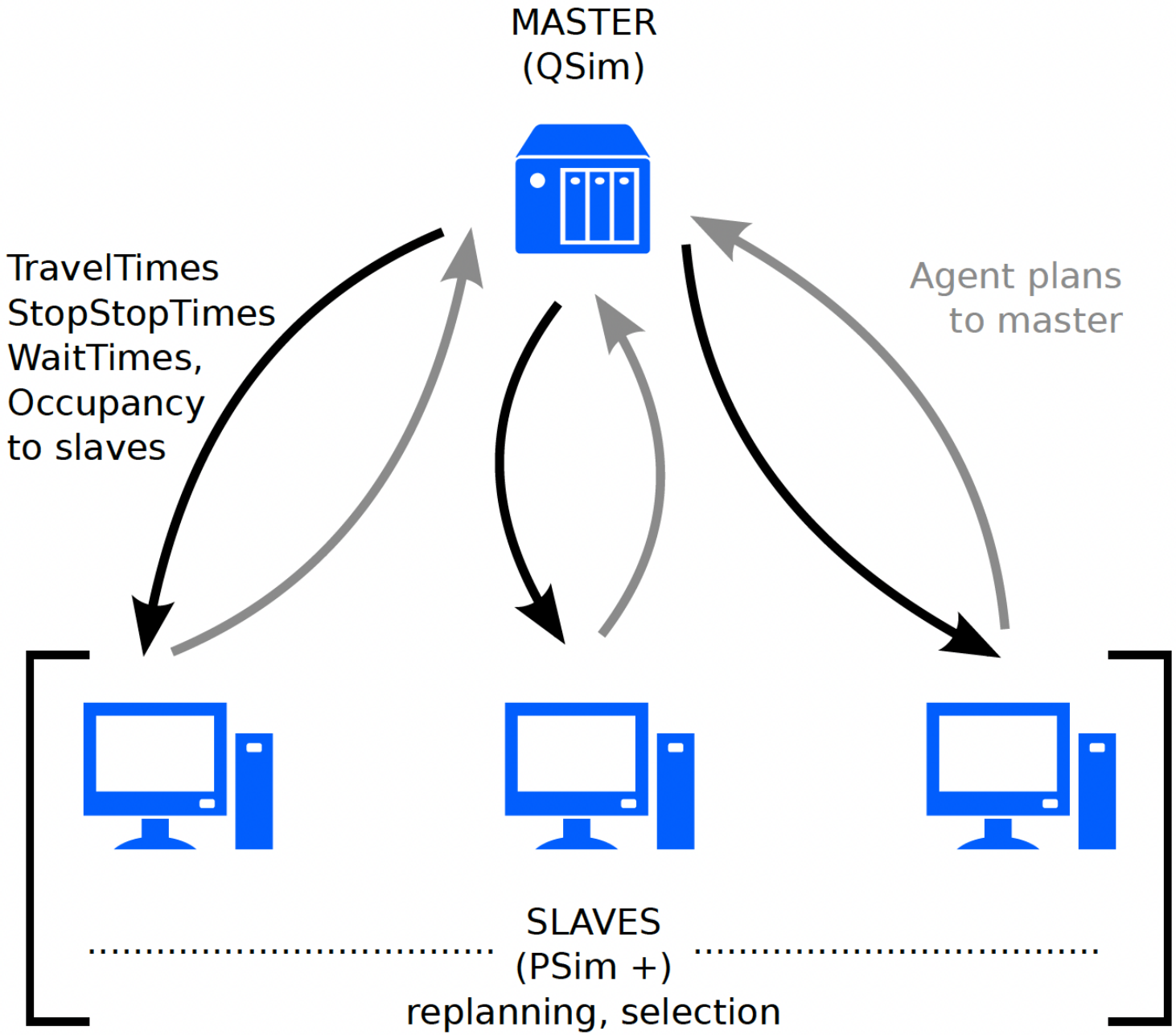
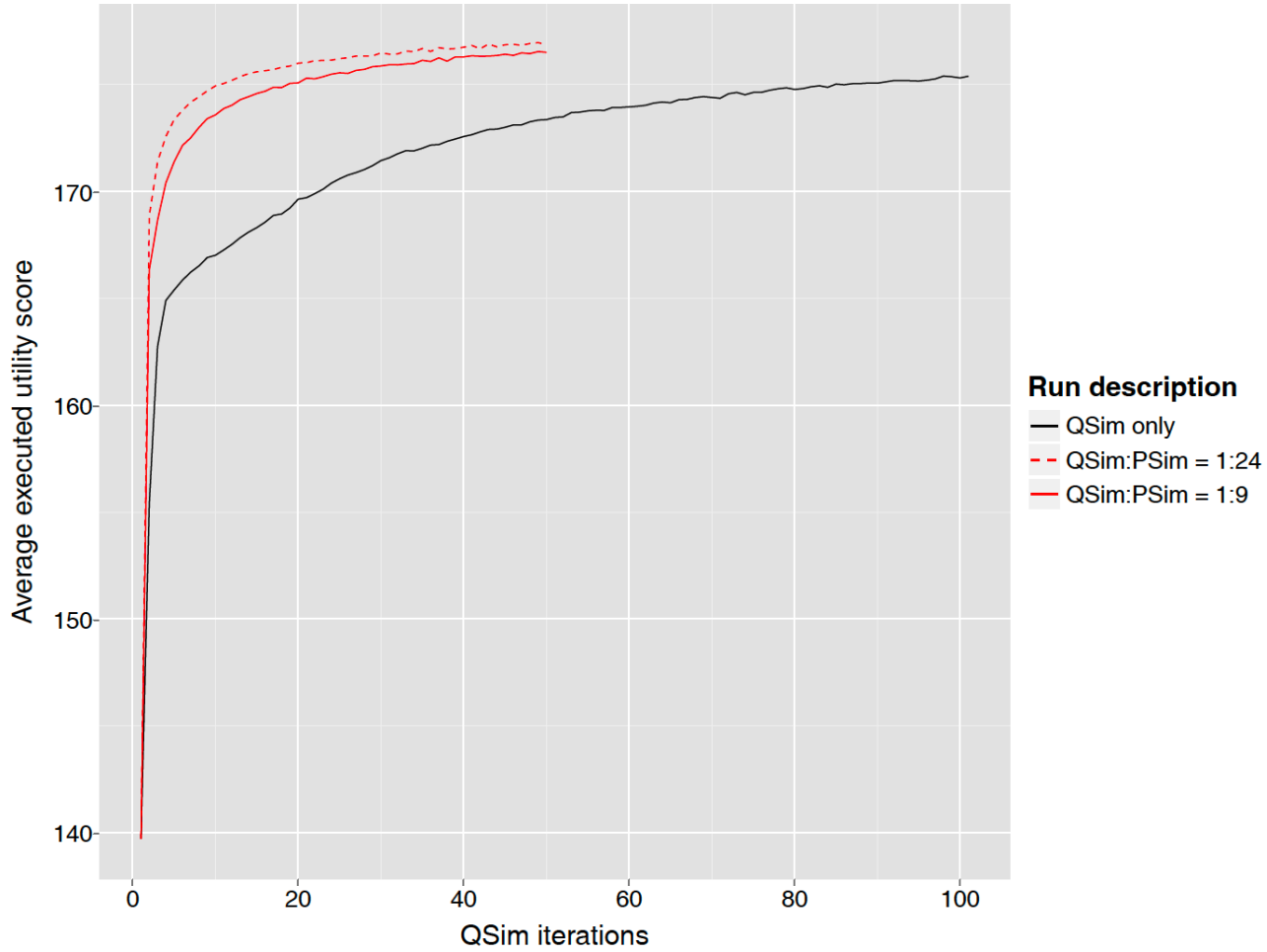
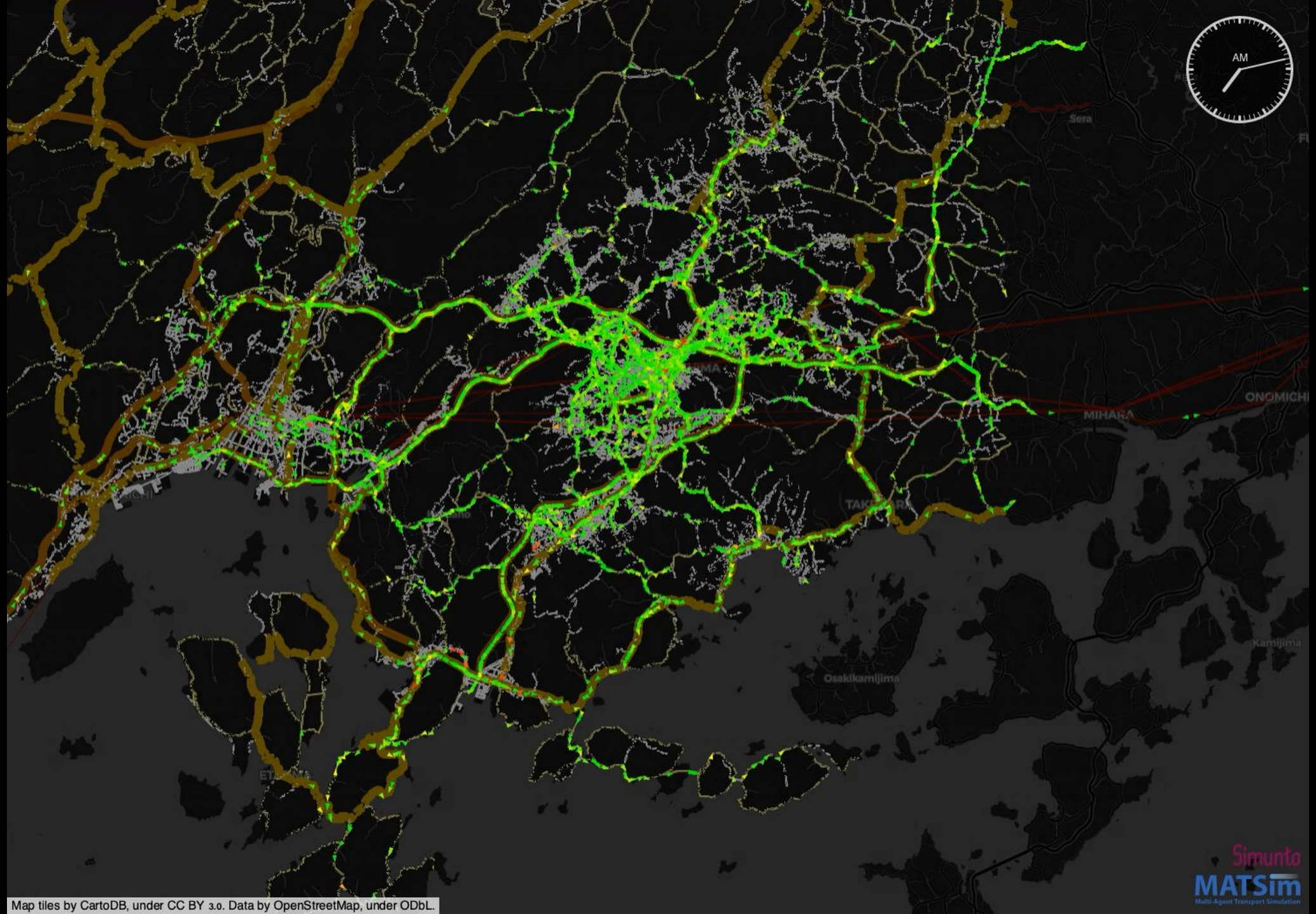

MASTER
(QSim)
TravelTimes
StopStopTimes
WaitTimes,
Occupancy
to slaves
Agent plans
to master
SLAVES
(PSim +)
replanning, selection

Figure 6.4: Average executed score versus QSim iterations comparing two ratios of QSim:PSim to a QSim-only run.




AM
Sera
MIHARA
ONOMICHI
Kamijima
Osakikamijima
Simunto
MATSim
Multi-Agent Transport Simulation
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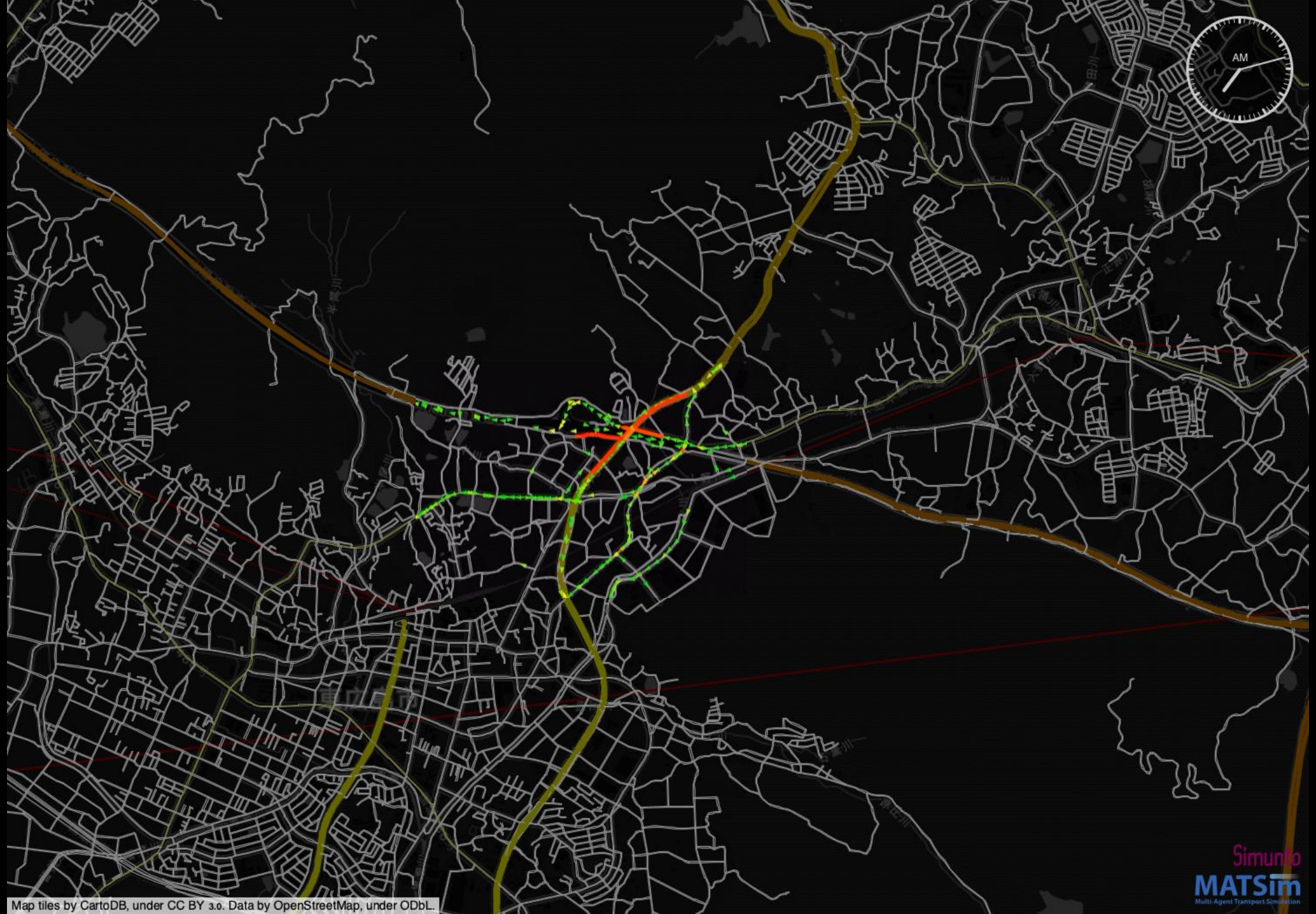
AM
Simunto
MATSim
Multi-Agent Transport Simulation
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link_id	subsim #	time	avg_travel_time	volume
1	1	900	80	2547
1	2	900	76	2219
1	5	900	72	2066
1	8	900	68	1835
2	43	900	....	...
...	...	...	...	...
10482894	2655	84000	...	...

```
<!-- ====================================================================== -->

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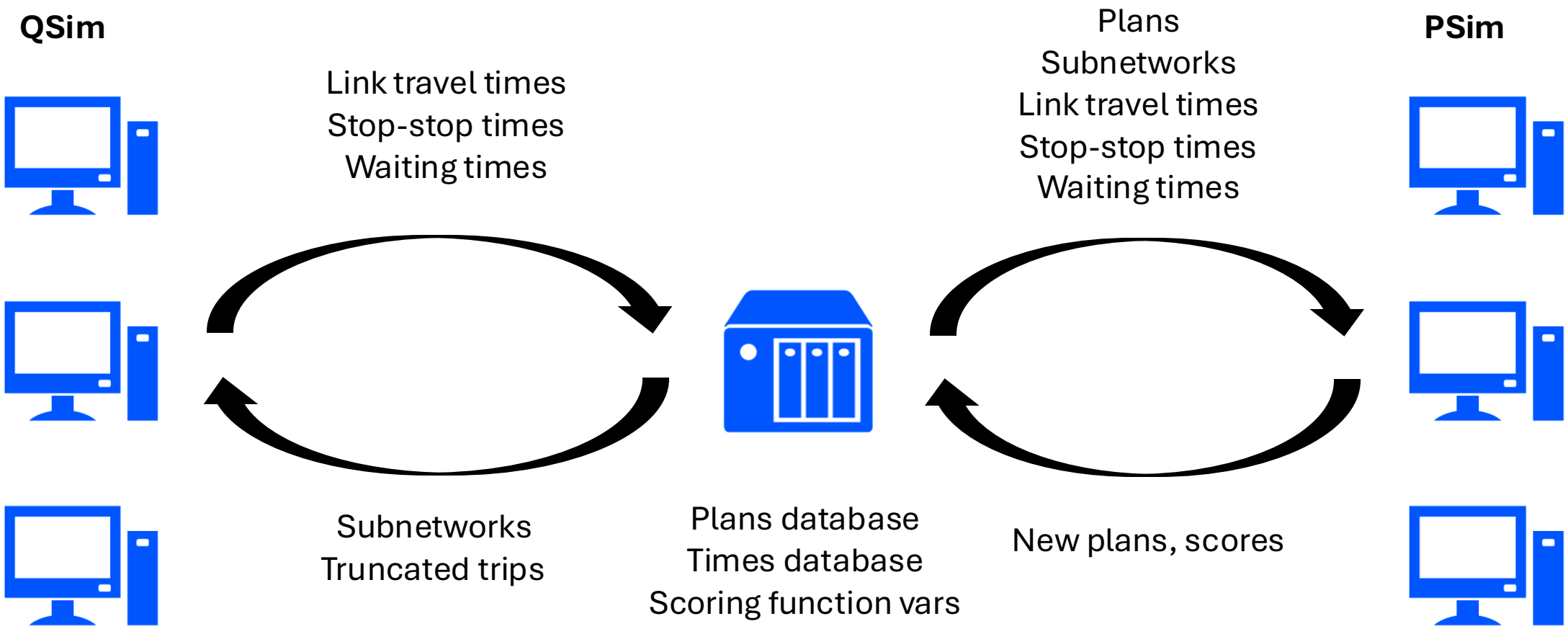
QSim
Link travel times
Stop-stop times
Waiting times
Plans
Subnetworks
Link travel times
Stop-stop times
Waiting times
PSim
Subnetworks
Truncated trips
Plans database
Times database
Scoring function vars
Network decomposition
Times reconciliation
Replan triggering
New plans, scores

Design questions

- Database choice: relational db or something fancier
- Decomposition algorithm: truncated trips or functional area with full trips e.g. IntraMax -> tracking
- Consensus mechanism: averaging? Volume weighted averaging?
- What is convergence if we don't have a single full run? Regular comparison of large patches vs small?
- At the very least we want to produce a plans and link travel times database that would allow for 'hot starts'
- Decomposing transit? Paratransit/DRT