Planning for Transportation Problems

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Introduction

Our goal is to design *domain-specific* planners for several variants of the *Transport* domain, used in International Planning Competitions (IPC).

Transport domain:

- road network with items located at specified locations
- items are to be delivered to their destinations
- using a fleet of (different) vehicles
- *Goal*: deliver all items with the least total cost or duration

Materials & Methods

Our planners are compared to those taking part in past IPCs. Experiments were run using:

- 30 minutes of CPU time
- 4 GB of RAM
- limited to one core per planner
- run on the clusters of MetaCentrum

Sequential planners:

MSFA3	Meta-heuristically weighted SFA with package and vehicle distance
MSFA5	Meta-heuristically weighted SFA with the general marking heuristic
RRAPN	Rand. Restart Around Path Nearby

Temporal planners:

MSFA5Sched	Scheduled MSFA5
RRAPNSched	Scheduled RRAPN
TRRAPN	Temporal RRAPN

TransportEditor

Editor for transportation problem analysis and planner design [3].

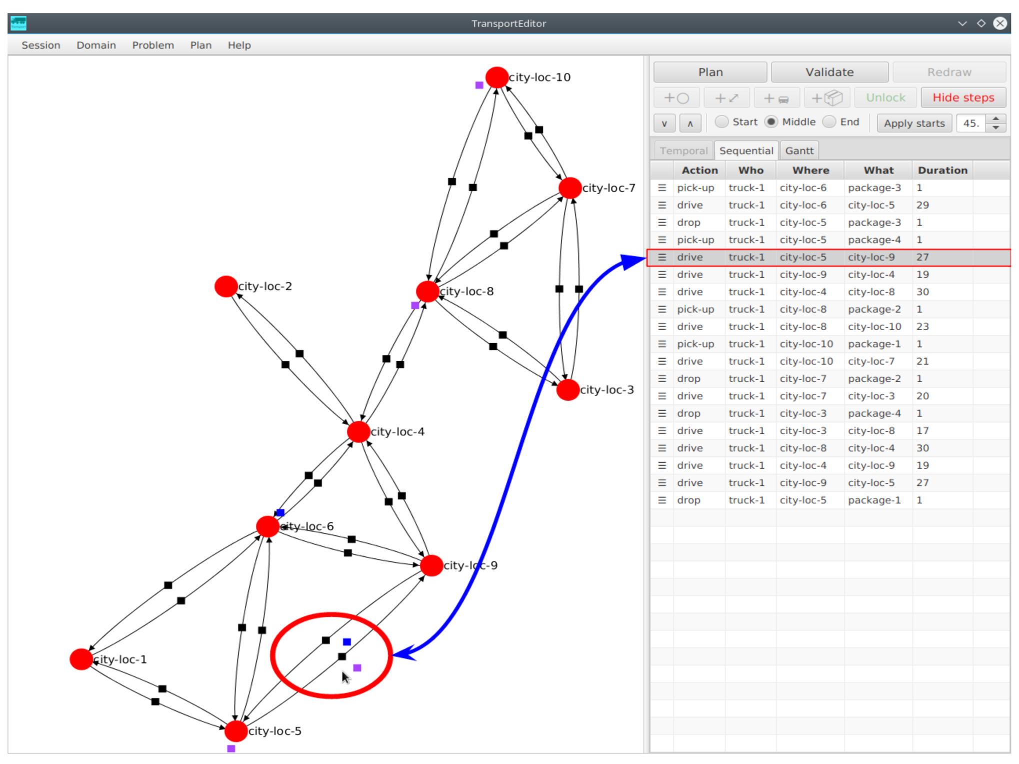

Figure 5: Tracing a plan in TransportEditor.

Will be presented at the System Demonstrations track of ICAPS 2017.

Results

We have designed Transport planners that are able to beat all planners from the:

- sequential and temporal tracks of IPC 2008 (Figure 1 and 2)
- sequential track of IPC 2011 (Figure 3)

In the 2014 IPC (Figure 4), we would have attained second place, behind the impressive result of Mercury (domain-independent).

Our planners perform well across datasets, as can be observed in Table 1 and 2.

Figures only show the three best planners from IPC on each dataset.

Planner	Avg. quality
MSFA3	0.923
MSFA5	**0.924**
RRAPN	0.894

Table 1: Average quality on sequential datasets.

Planner	Avg. quality
MSFA5Sched	0.483
RRAPNSched	0.905
TRRAPN	**0.934**

Table 2: Average quality on the temporal dataset.

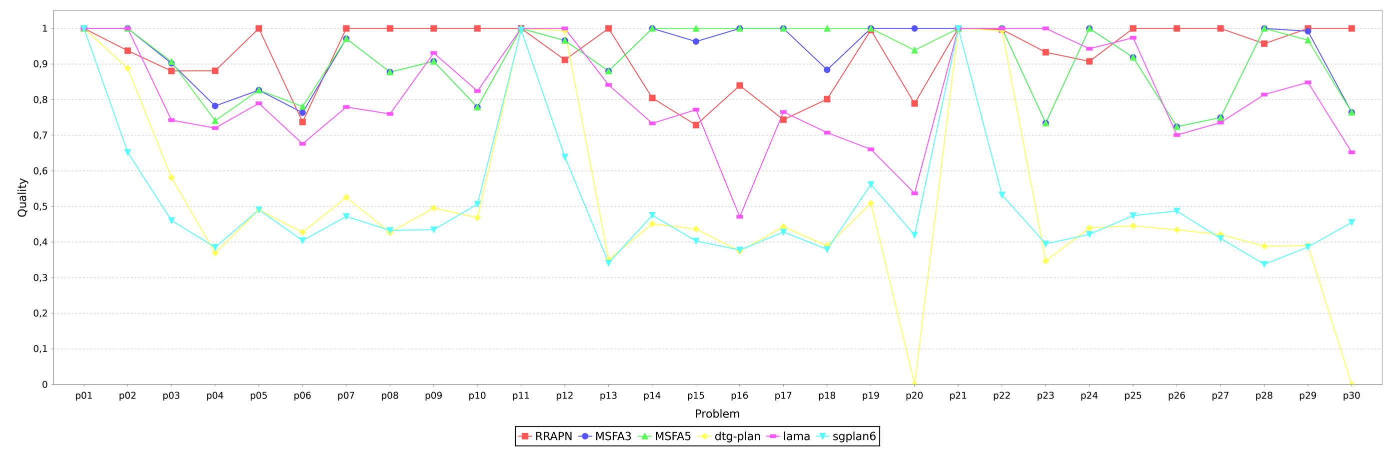

Figure 1: IPC 2008 Sequential satisficing

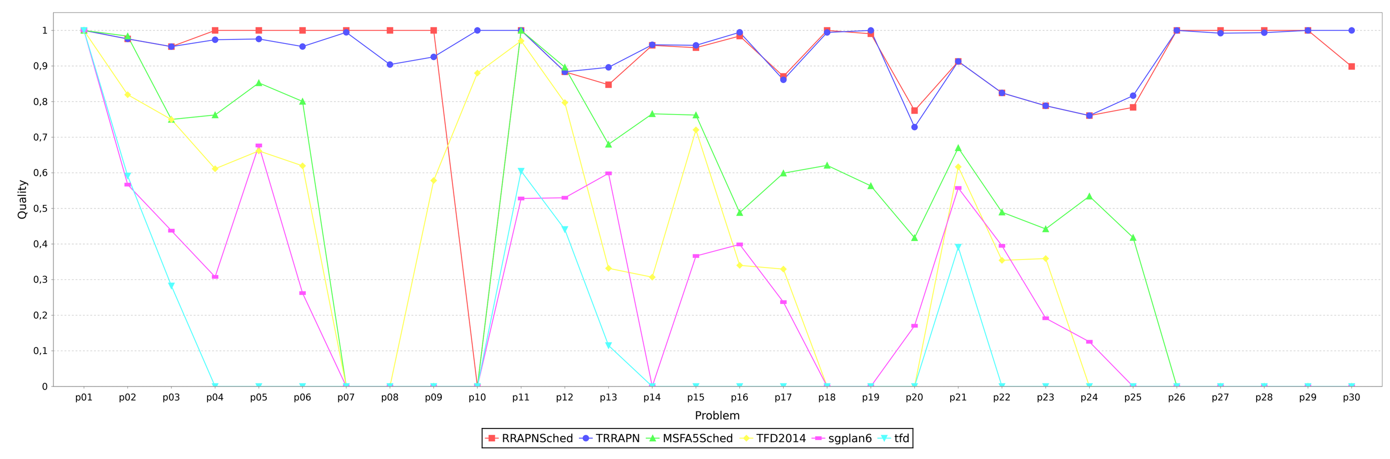

Figure 2: IPC 2008 Temporal satisficing

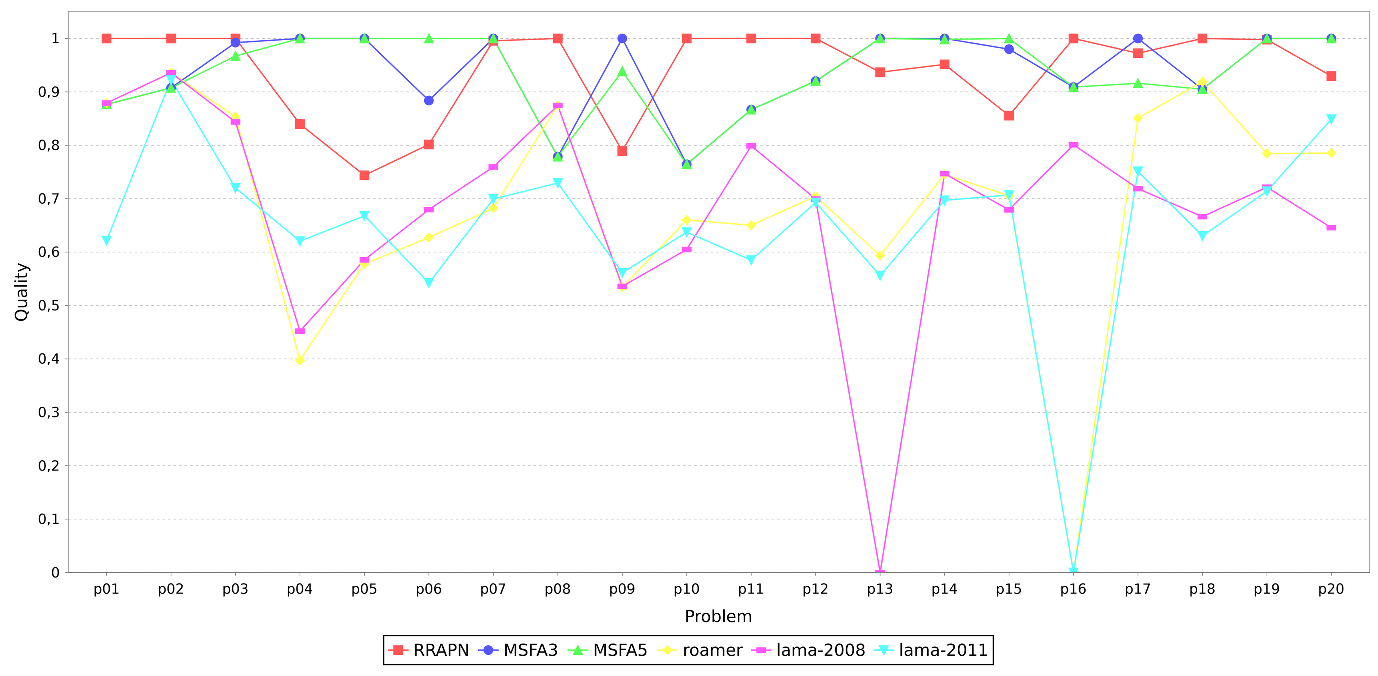

Figure 3: IPC 2011 Sequential satisficing

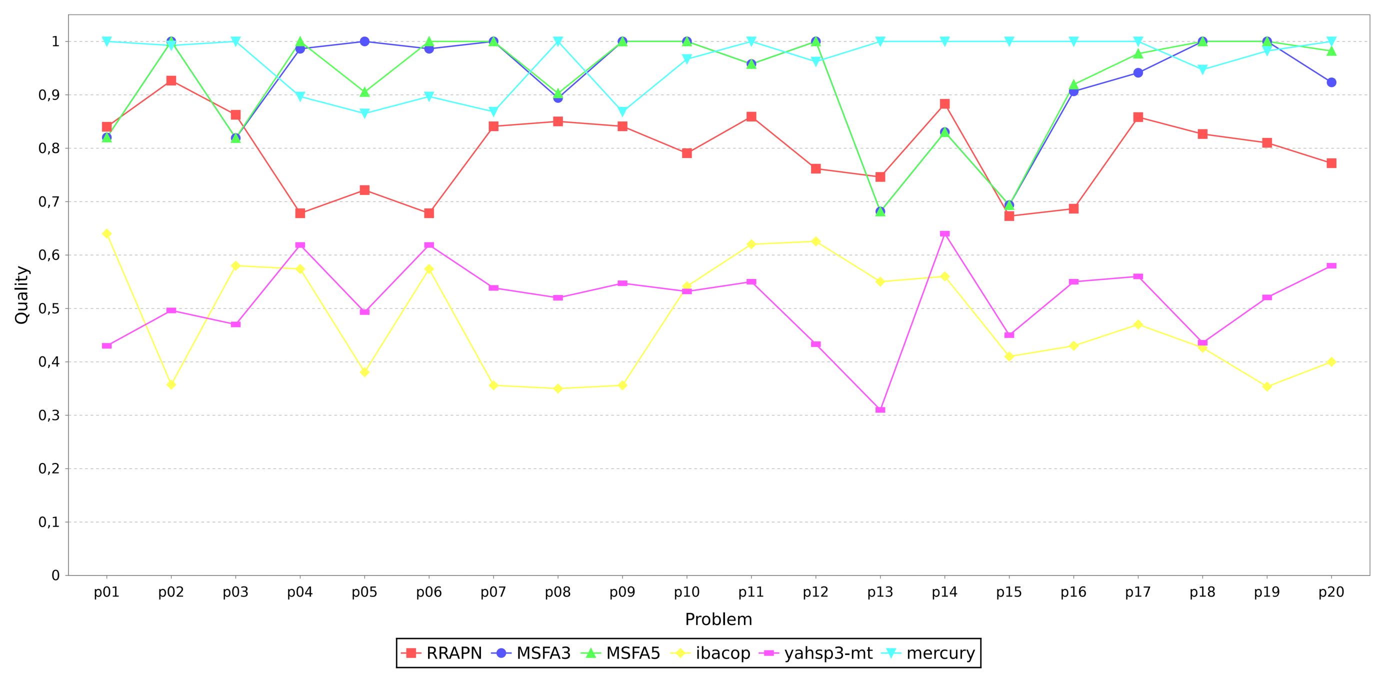

Figure 4: IPC 2014 Sequential satisficing

Conclusion

- **Domain knowledge** can be **effectively used** to generate better plans faster.
- State-of-the-art **domain-independent planners** are often very **effective** even without domain knowledge.

Further Information

github.com/oskopek/TransportEditor
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WWW oskopek.com/docs/bc-thesis.pdf

References

[1] International Planning Competition, 2008, 2011, 2014. URL: `http://ipc.icaps-conference.org`.
[2] Malik Ghallab et al. *Automated Planning: Theory and Practice*. Elsevier, 2004.
[3] Ondrej Škopek and Roman Barták. TransportEditor: Creating and Visualising Transportation Problems and Plans. System Demonstrations track, ICAPS 2017.

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