CONTINUOUS HIERARCHICAL ROBOT TASK PLANNING IN SMART ENVIRONMENTS

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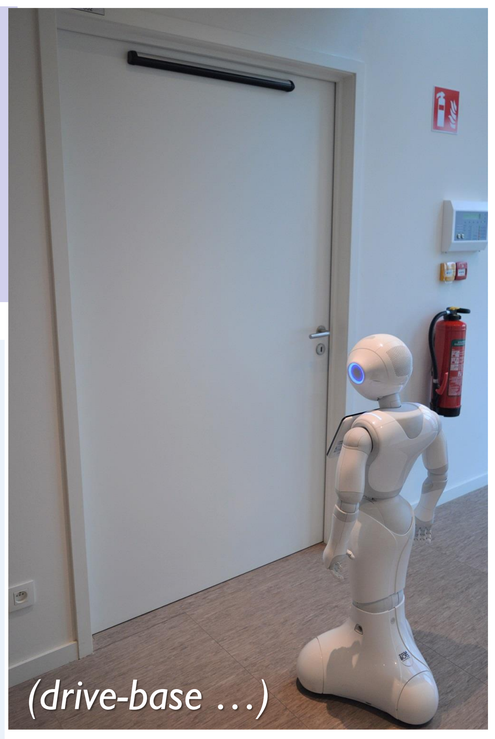
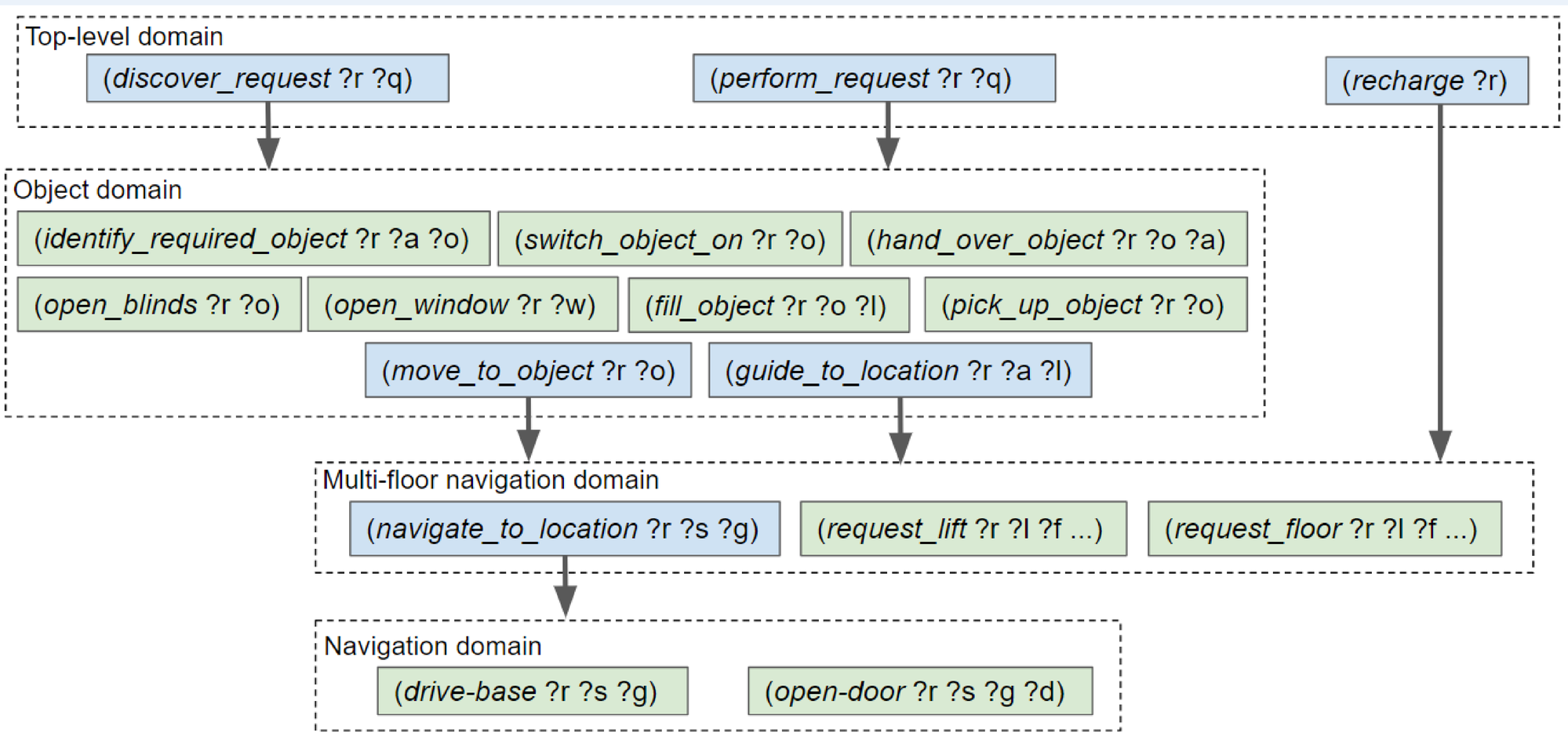
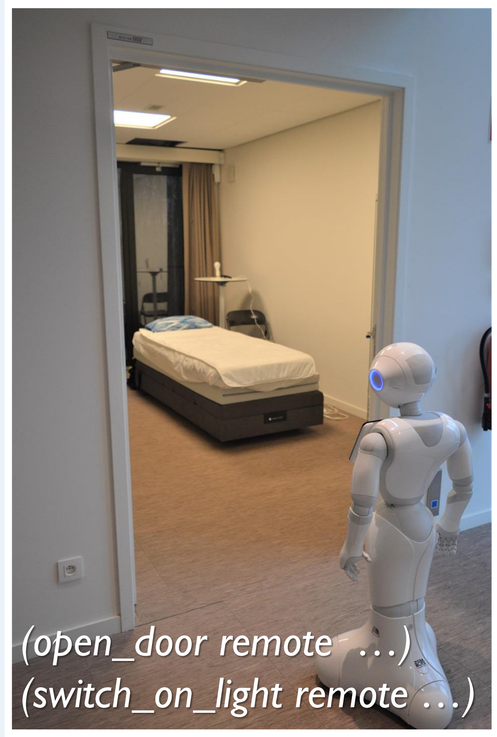
Aim: In smart environments state changes are detected sooner and more often causing robots to re-plan frequently. Therefore we aim to speed-up continuous planning in smart environments, and develop cleaner, more re-usable PDDL. To do this we investigate using Hierarchical Continuous Planning in the Now.

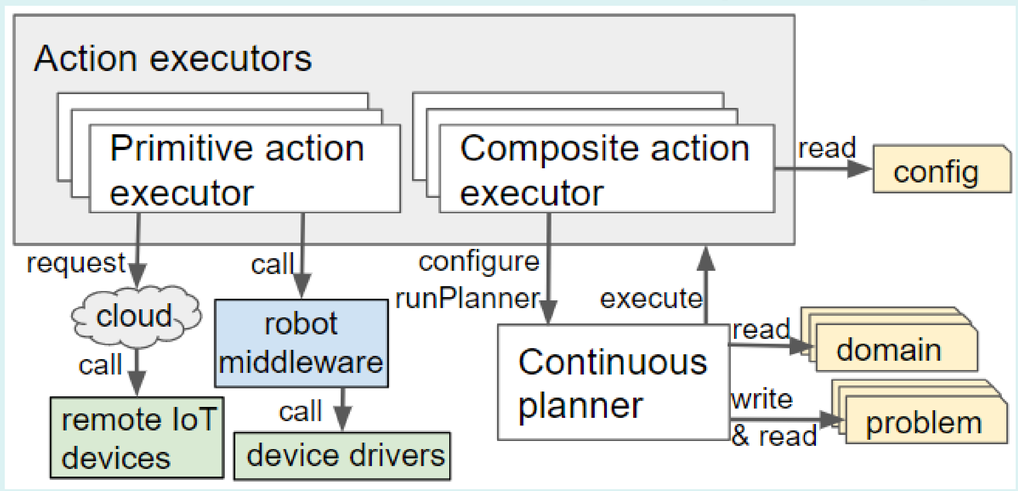


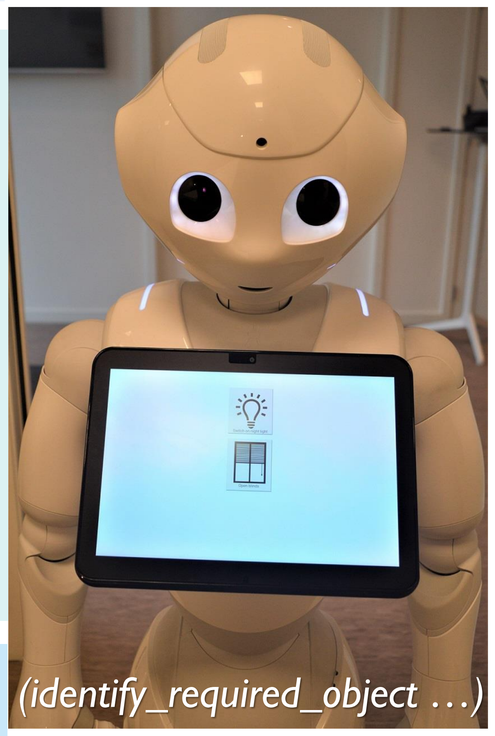
PDDL design: Domain knowledge is split-up across multiple re-usable PDDL domain files. Actions in higher levels of the hierarchy are more generic and abstract the details of the lower level actions.





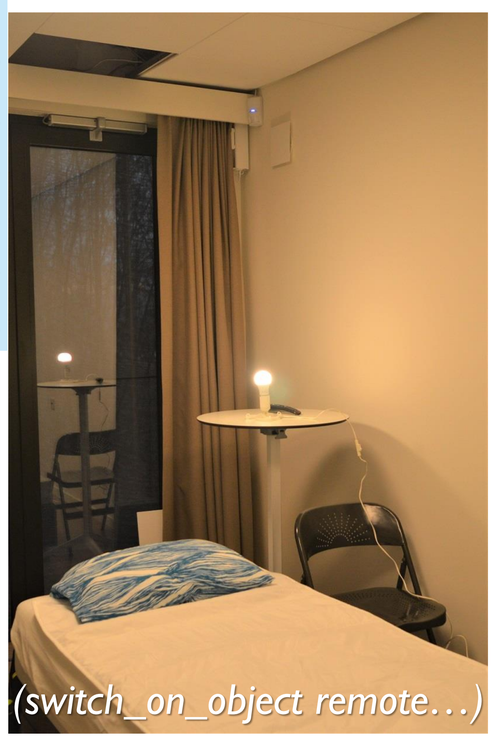
Framework: The continuous planner generates a plan which is executed by action executors. Primitive action executors send commands to the robot middleware (e.g. ROS) and remote actions to the cloud. Composite action executors trigger the continuous planner to generate a sub-plan.





Results: The impact increasing the number of layers used has on the number of states TFD generates and the planning time when navigating a multi-floor environment.

	70 objects				130 objects			
	DF1	DF2	DF3	DF4	DF1	DF4	DF3	DF4
Planning time before 1st primitive action is executed(s)	10.66	6.05	7.10	6.14	77.07	21.82	15.64	6.52
Number of generated states	2537	1126	1034	347	13045	5905	4684	413
Total planning time (s)	10.66	12.46	13.95	14.93	77.07	53.89	47.70	16.33



References:

- H. Harman, et al. Architecture for incorporating IoT sensors and actuators into robot task planning in dynamic environments, in: IEEE-IRIS2017.
- C. Dornhege, A. Hertle, Integrated symbolic planning in the tidyup-robot project., in: AAAI Spring Symposium: Designing Intelligent Robots, 2013.

Videos:

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