PDDLStream: Integrating Symbolic Planners and Blackbox Samplers via Optimistic Adaptive Planning

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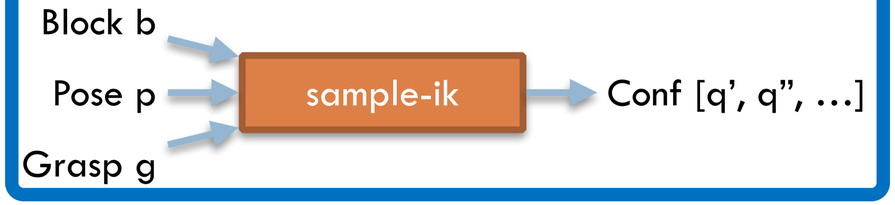
PDDLStream = PDDL + Samplers

Pick action

```
(:action pick
 :parameters (?b ?p ?g ?q)
 :precondition (and (Kin ?b ?p ?g ?q)
  AtConf ?q)(AtPose ?b ?p)(HandEmpty))
 :effect (and (AtGrasp ?b ?g)
  (not (AtPose ?b ?p))(not (HandEmpty))))
```

Inverse kinematics **stream** (sampler)

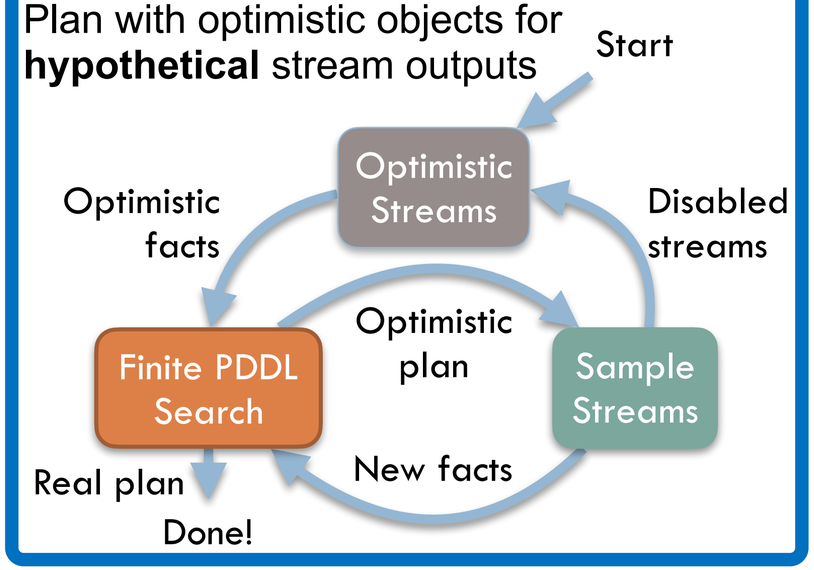
```
(:stream sample-ik
 :inputs (?b ?p ?g)
 :domain (and (Pose ?b ?p) (Grasp ?b ?g))
 :outputs (?q)
 :certified (and (Conf ?q) (Kin ?b ?p ?g ?q)))
```



Binding Algorithm

Plan **optimistically** before calling streams

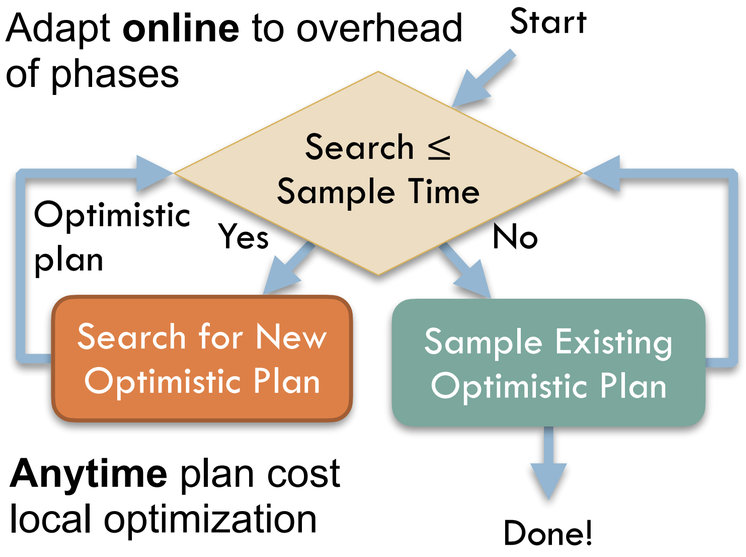
Plan with optimistic objects for **hypothetical** stream outputs



Adaptive Algorithm

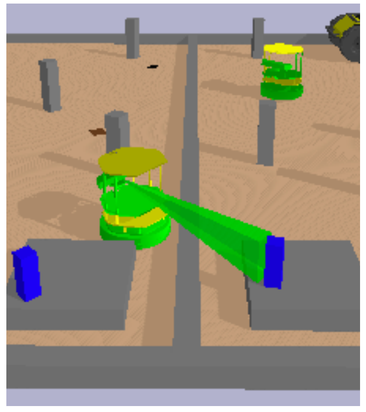
Balance searching and sampling time

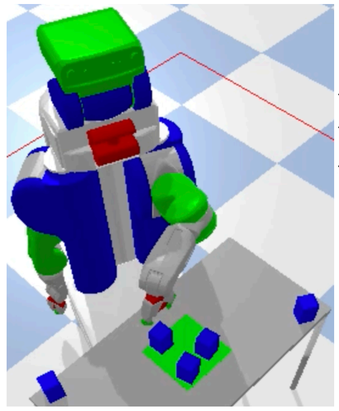
Adapt **online** to overhead of phases

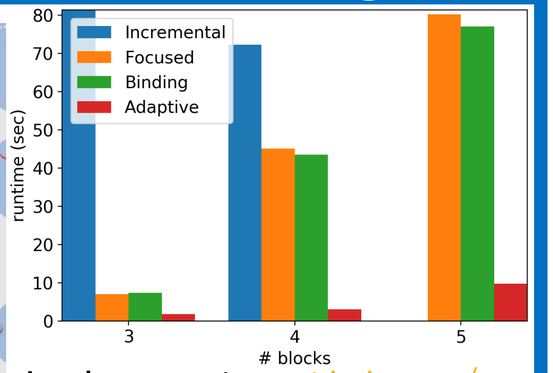


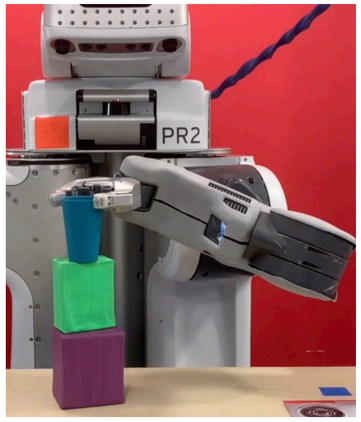
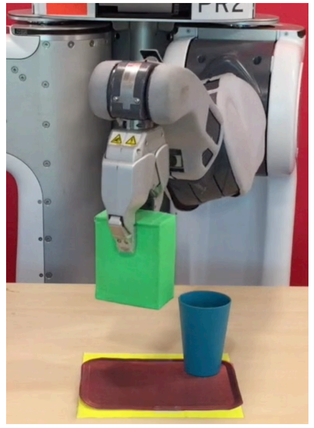
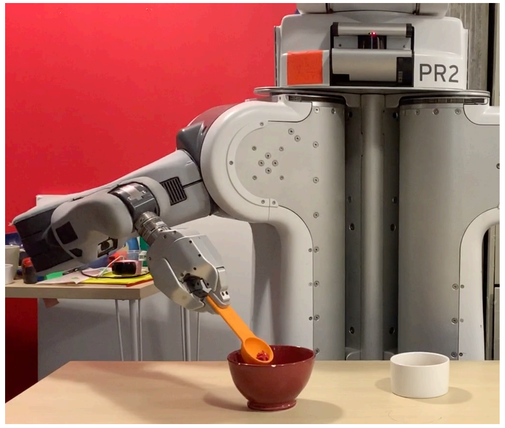
Anytime plan cost local optimization

Simulated Task and Motion Planning







Implementation: github.com/caelan/pddlstream

Real-World Videos (tinyurl.com/pddlstream)