Planning.Domains

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Tutorial Overview

(5min)	Introduction to Planning.Domains
(15min)	api.planning.domains
(10min)	solver.planning.domains
(15min)	editor.planning.domains
(5min)	*Break*
(40min)	Putting it all together

- Three initiatives; one platform.
- Strong focus on planning problems.
- Tools for (and by) the community.

- Three initiatives; one platform.
- Strong focus on planning problems.
- Tools for (and by) the community.

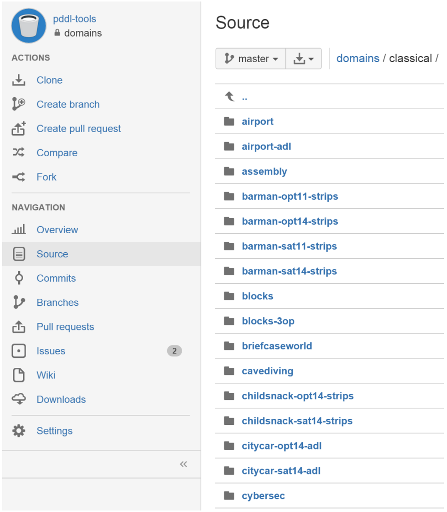
Thanks! The planning.domains services are graciously supported by the ICAPS organization and community.

Wouldn´t it be cool if...

...we had a central repository for PDDL files.

API

- Open repository of over 125 domains



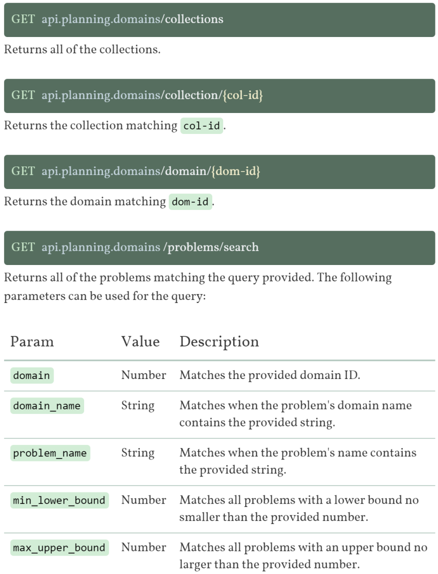
Source

master | domains / classical /

..
airport
airport-adl
assembly
barman-opt11-strips
barman-opt14-strips
barman-sat11-strips
barman-sat14-strips
blocks
blocks-3op
briefcaseworld
cavediving
childsnack-opt14-strips
childsnack-sat14-strips
citycar-opt14-adl
citycar-sat14-adl
cybersec

API

- Open repository of over 125 domains
- API access for:
  - Collections
  - Domains
  - Problems



```
GET  api.planning.domains/collections
```

Returns all of the collections.

```
GET  api.planning.domains/collection/{col-id}
```

Returns the collection matching `col-id`.

```
GET  api.planning.domains/domain/{dom-id}
```

Returns the domain matching `dom-id`.

```
GET  api.planning.domains /problems/search
```

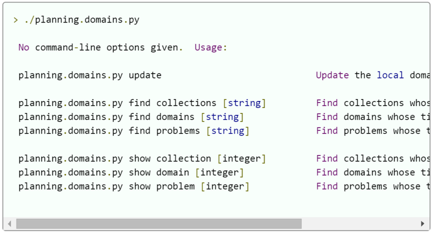
Returns all of the problems matching the query provided. The following parameters can be used for the query:

Param	Value	Description
`domain`	Number	Matches the provided domain ID.
`domain_name`	String	Matches when the problem's domain name contains the provided string.
`problem_name`	String	Matches when the problem's name contains the provided string.
`min_lower_bound`	Number	Matches all problems with a lower bound no smaller than the provided number.
`max_upper_bound`	Number	Matches all problems with an upper bound no larger than the provided number.

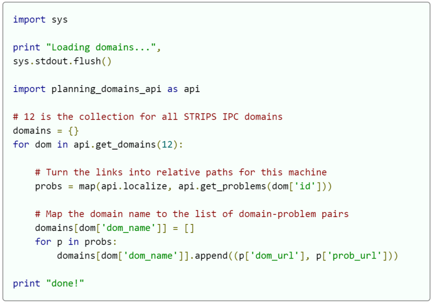
Courtesy of Ramirez, Lipovetzky, Haslum, ...

API

- Open repository of over 125 domains
- API access for:
  - Collections
  - Domains
  - Problems
- Python library and command utility



```
> ./planning.domains.py

 No command-line options given.  Usage:

 planning.domains.py update                                   Update the local doma

 planning.domains.py find collections [string]                Find collections whos
 planning.domains.py find domains [string]                    Find domains whose ti
 planning.domains.py find problems [string]                   Find problems whose t

 planning.domains.py show collection [integer]                Find collections whos
 planning.domains.py show domain [integer]                    Find domains whose ti
 planning.domains.py show problem [integer]                   Find problems whose t
```

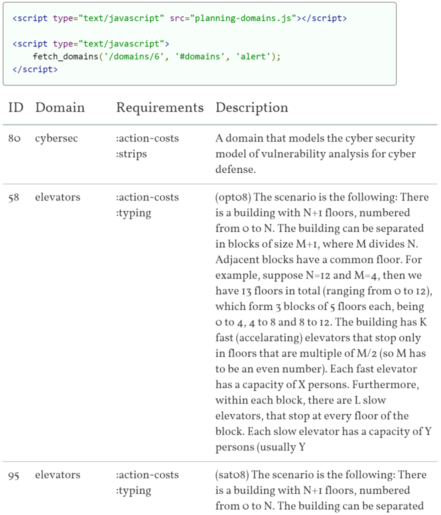


```
import sys

print "Loading domains...",
sys.stdout.flush()

import planning_domains_api as api

# 12 is the collection for all STRIPS IPC domains
domains = {}
for dom in api.get_domains(12):

    # Turn the links into relative paths for this machine
    probs = map(api.localize, api.get_problems(dom['id']))

    # Map the domain name to the list of domain-problem pairs
    domains[dom['dom_name']] = []
    for p in probs:
        domains[dom['dom_name']].append((p['dom_url'], p['prob_url']))

print "done!"
```

Courtesy of Andrew Coles.

API

- Open repository of over 125 domains
- API access for:
  - Collections
  - Domains
  - Problems
- Python library and command utility
- JavaScript library



```
<script type="text/javascript" src="planning-domains.js"></script>

<script type="text/javascript">
    fetch_domains('/domains/6', '#domains', 'alert');
</script>
```

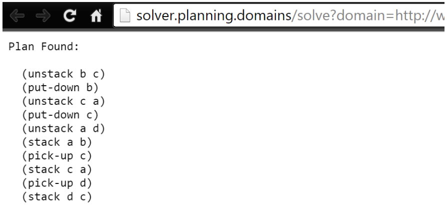
ID	Domain	Requirements	Description
80	cybersec	:action-costs :strips	A domain that models the cyber security model of vulnerability analysis for cyber defense.
58	elevators	:action-costs :typing	(opt08) The scenario is the following: There is a building with N+1 floors, numbered from 0 to N. The building can be separated in blocks of size M+1, where M divides N. Adjacent blocks have a common floor. For example, suppose N=12 and M=4, then we have 13 floors in total (ranging from 0 to 12), which form 3 blocks of 5 floors each, being 0 to 4, 4 to 8 and 8 to 12. The building has K fast (accelarating) elevators that stop only in floors that are multiple of M/2 (so M has to be an even number). Each fast elevator has a capacity of X persons. Furthermore, within each block, there are L slow elevators, that stop at every floor of the block. Each slow elevator has a capacity of Y persons (usually Y
95	elevators	:action-costs :typing	(sat08) The scenario is the following: There is a building with N+1 floors, numbered from 0 to N. The building can be separated

Wouldn’t it be cool if...

...we had a planner in the cloud.

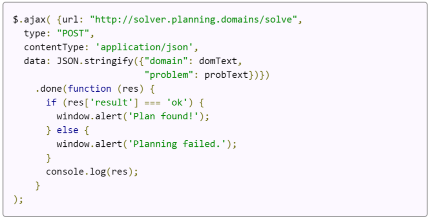
Solver

- Call via a URL
- Call using JSON



solver.planning.domains/solve?domain=http://w

```
Plan Found:

  (unstack b c)
  (put-down b)
  (unstack c a)
  (put-down c)
  (unstack a d)
  (stack a b)
  (pick-up c)
  (stack c a)
  (pick-up d)
  (stack d c)
```

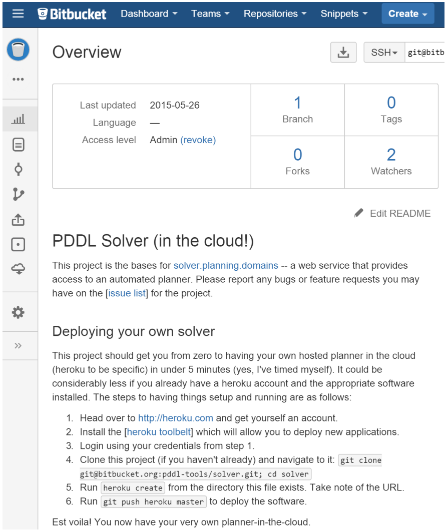


```
$.ajax( {url: "http://solver.planning.domains/solve",
  type: "POST",
  contentType: 'application/json',
  data: JSON.stringify({"domain": domText,
                        "problem": probText})})
    .done(function (res) {
      if (res['result'] === 'ok') {
        window.alert('Plan found!');
      } else {
        window.alert('Planning failed.');
      }
      console.log(res);
    }
);
```

Solver

- Call via a URL
- Call using JSON

- FOSS project to deploy your own



Last updated	2015-05-26
Language	—
Access level	Admin (revoke)

1 Branch	0 Tags
0 Forks	2 Watchers

PDDL Solver (in the cloud!)

This project is the bases for solver.planning.domains -- a web service that provides access to an automated planner. Please report any bugs or feature requests you may have on the [issue list] for the project.

Deploying your own solver

This project should get you from zero to having your own hosted planner in the cloud (heroku to be specific) in under 5 minutes (yes, I've timed myself). It could be considerably less if you already have a heroku account and the appropriate software installed. The steps to having things setup and running are as follows:

1. Head over to http://heroku.com and get yourself an account.
2. Install the [heroku toolbelt] which will allow you to deploy new applications.
3. Login using your credentials from step 1.
4. Clone this project (if you haven't already) and navigate to it: `git clone git@bitbucket.org:pddl-tools/solver.git; cd solver`
5. Run `heroku create` from the directory this file exists. Take note of the URL.
6. Run `git push heroku master` to deploy the software.

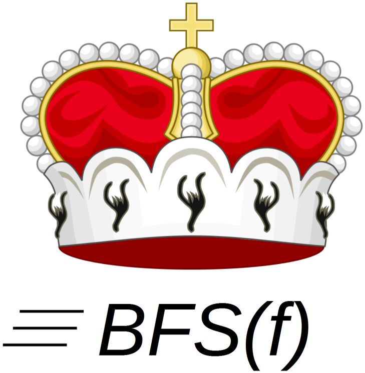
Est voila! You now have your very own planner-in-the-cloud.

Solver

- Call via a URL
- Call using JSON

- FOSS project to deploy your own

- Ultra-agile track for king-of-the-hill

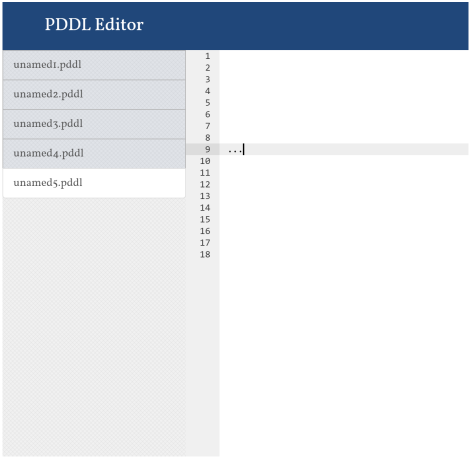


Wouldn’t it be cool if...

...we had a dedicated editor for PDDL.

Editor

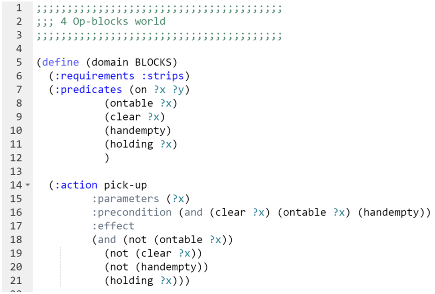
- Online editor



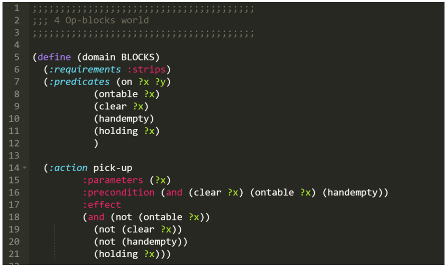
Kudos to Volker Strobel

Editor

- Online editor
- Syntax highlighting



```
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; 4 Op-blocks world
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(define (domain BLOCKS)
  (:requirements :strips)
  (:predicates (on ?x ?y)
           (ontable ?x)
           (clear ?x)
           (handempty)
           (holding ?x)
           )

  (:action pick-up
         :parameters (?x)
         :precondition (and (clear ?x) (ontable ?x) (handempty))
         :effect
         (and (not (ontable ?x))
           (not (clear ?x))
           (not (handempty))
           (holding ?x)))
```



```
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; 4 Op-blocks world
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(define (domain BLOCKS)
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  (:predicates (on ?x ?y)
           (ontable ?x)
           (clear ?x)
           (handempty)
           (holding ?x)
           )

  (:action pick-up
         :parameters (?x)
         :precondition (and (clear ?x) (ontable ?x) (handempty))
         :effect
         (and (not (ontable ?x))
           (not (clear ?x))
           (not (handempty))
           (holding ?x)))
```
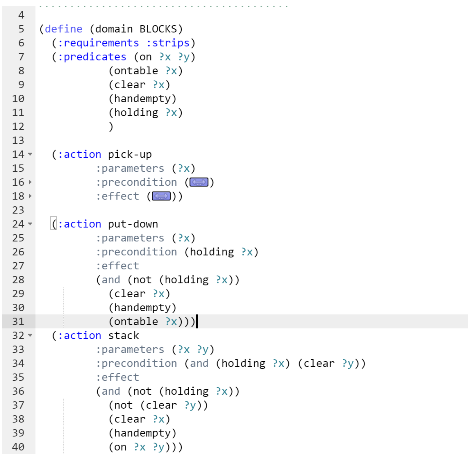

Editor

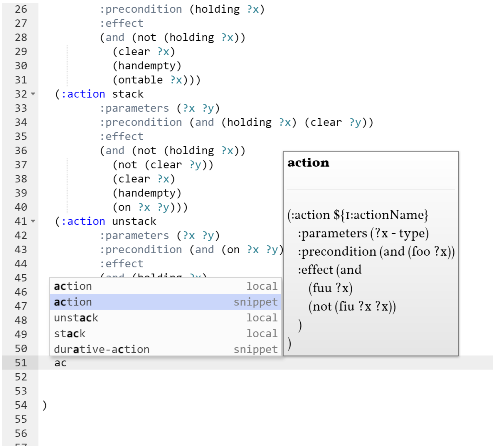
- Online editor
- Syntax highlighting
- Bracket folding



```

(define (domain BLOCKS)
  (:requirements :strips)
  (:predicates (on ?x ?y)
           (ontable ?x)
           (clear ?x)
           (handempty)
           (holding ?x)
           )

  (:action pick-up
         :parameters (?x)
         :precondition (⟺)
         :effect (⟺))

  (:action put-down
         :parameters (?x)
         :precondition (holding ?x)
         :effect
         (and (not (holding ?x))
           (clear ?x)
           (handempty)
           (ontable ?x)))
  (:action stack
         :parameters (?x ?y)
         :precondition (and (holding ?x) (clear ?y))
         :effect
         (and (not (holding ?x))
           (not (clear ?y))
           (clear ?x)
           (handempty)
           (on ?x ?y)))
```

Editor

- Online editor
- Syntax highlighting
- Bracket folding
- Auto-completion



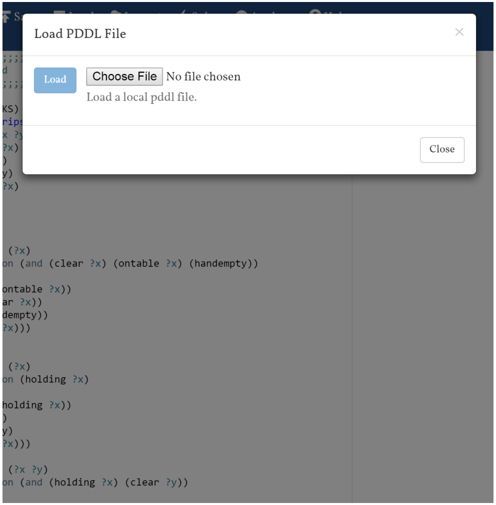
```
        :precondition (holding ?x)
        :effect
        (and (not (holding ?x))
          (clear ?x)
          (handempty)
          (ontable ?x)))
  (:action stack
        :parameters (?x ?y)
        :precondition (and (holding ?x) (clear ?y))
        :effect
        (and (not (holding ?x))
          (not (clear ?y))
          (clear ?x)
          (handempty)
          (on ?x ?y)))
  (:action unstack
        :parameters (?x ?y)
        :precondition (and (on ?x ?y)
        :effect
        (and (holding ?x)
  ac


)
```

```
action            local
action            snippet
unstack           local
stack             local
durative-action   snippet
```

```
action

(:action ${1:actionName}
  :parameters (?x - type)
  :precondition (and (foo ?x))
  :effect (and
    (fuu ?x)
    (not (fiu ?x ?x))
  )
)
```

Editor

- Online editor
- Syntax highlighting
- Bracket folding
- Auto-completion
- Save/load locally



Load PDDL File

Load | Choose File No file chosen

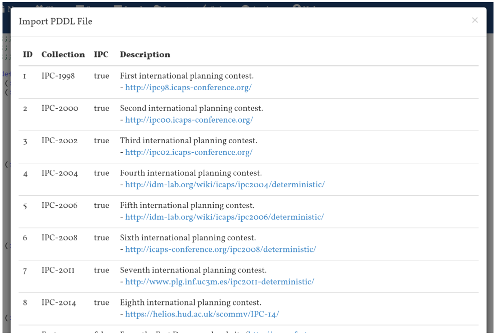
Load a local pddl file.

Close

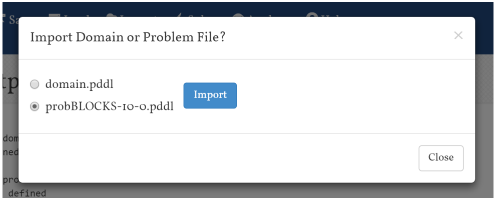
```
;;;;
d
;;;;
KS)
rips
x ?y
?x)
)
y)
?x)



 (?x)
on (and (clear ?x) (ontable ?x) (handempty))

ontable ?x))
ar ?x))
dempty))
?x)))


 (?x)
on (holding ?x)

holding ?x))
)
y)
?x)))

 (?x ?y)
on (and (holding ?x) (clear ?y))
```

Editor

- Online editor
- Syntax highlighting
- Bracket folding
- Auto-completion
- Save/load locally
- Import via the API


Import PDDL File

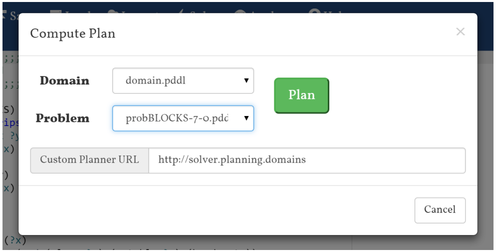
ID	Collection	IPC	Description
1	IPC-1998	true	First international planning contest. - http://ipc98.icaps-conference.org/
2	IPC-2000	true	Second international planning contest. - http://ipc00.icaps-conference.org/
3	IPC-2002	true	Third international planning contest. - http://ipc02.icaps-conference.org/
4	IPC-2004	true	Fourth international planning contest. - http://idm-lab.org/wiki/icaps/ipc2004/deterministic/
5	IPC-2006	true	Fifth international planning contest. - http://idm-lab.org/wiki/icaps/ipc2006/deterministic/
6	IPC-2008	true	Sixth international planning contest. - http://icaps-conference.org/ipc2008/deterministic/
7	IPC-2011	true	Seventh international planning contest. - http://www.plg.inf.uc3m.es/ipc2011-deterministic/
8	IPC-2014	true	Eighth international planning contest. - https://helios.hud.ac.uk/scommv/IPC-14/


Import Domain or Problem File?

( ) domain.pddl
(●) probBLOCKS-10-0.pddl

Editor

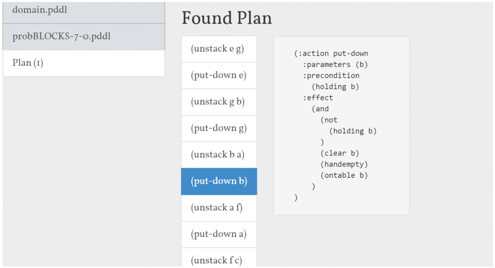
- Online editor
- Syntax highlighting
- Bracket folding
- Auto-completion
- Save/load locally
- Import via the API
- Compute plans via the online solver


Compute Plan

Domain: domain.pddl

Problem: probBLOCKS-7-0.pdd

Custom Planner URL: http://solver.planning.domains



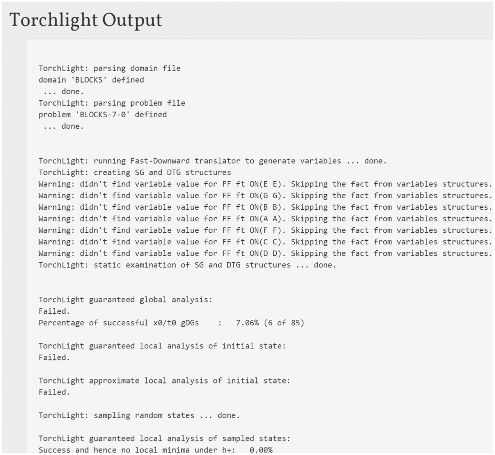
Found Plan

(unstack e g)
(put-down e)
(unstack g b)
(put-down g)
(unstack b a)
(put-down b)
(unstack a f)
(put-down a)
(unstack f c)

```
(:action put-down
  :parameters (b)
  :precondition
    (holding b)
  :effect
    (and
      (not
        (holding b)
      )
      (clear b)
      (handempty)
      (ontable b)
    )
)
```

Editor

- Online editor
- Syntax highlighting
- Bracket folding
- Auto-completion
- Save/load locally
- Import via the API
- Compute plans via the online solver
- Analyze using TorchLight


Torchlight Output

```
TorchLight: parsing domain file
domain 'BLOCKS' defined
 ... done.
TorchLight: parsing problem file
problem 'BLOCKS-7-0' defined
 ... done.


TorchLight: running Fast-Downward translator to generate variables ... done.
TorchLight: creating SG and DTG structures
Warning: didn't find variable value for FF ft ON(E E). Skipping the fact from variables structures.
Warning: didn't find variable value for FF ft ON(G G). Skipping the fact from variables structures.
Warning: didn't find variable value for FF ft ON(B B). Skipping the fact from variables structures.
Warning: didn't find variable value for FF ft ON(A A). Skipping the fact from variables structures.
Warning: didn't find variable value for FF ft ON(F F). Skipping the fact from variables structures.
Warning: didn't find variable value for FF ft ON(C C). Skipping the fact from variables structures.
Warning: didn't find variable value for FF ft ON(D D). Skipping the fact from variables structures.
TorchLight: static examination of SG and DTG structures ... done.


TorchLight guaranteed global analysis:
Failed.
Percentage of successful x0/t0 gDGs    :   7.06% (6 of 85)

TorchLight guaranteed local analysis of initial state:
Failed.

TorchLight approximate local analysis of initial state:
Failed.

TorchLight: sampling random states ... done.

TorchLight guaranteed local analysis of sampled states:
Success and hence no local minima under h+:   0.00%
```

Editor

- Online editor
- Syntax highlighting
- Bracket folding
- **Auto-completion**
- Save/load locally
- Import via the API
- **Compute plans via the online solver**
- **Analyze using TorchLight**

Anatomy of a Plugin (JavaScript file)

```
define(function () {
  return {
    name: "Plan-o-matic␣1000",
    author: "John␣Smith",
    email: "yeah@right.com",
    description: "A␣plugin␣template.",

    // Called when loaded or enabled
    initialize: function() { },

    // Called when disabled
    disable: function() { },

    // Used to save settings
    save: function() { return {}; },

    // Restore any previous settings
    load: function(settings) { }
  };
});
```

planning.domains

1. **api.planning.domains**
   - Central PDDL repository
   - API interface to all benchmarks
   - Suite of tools to interface with API
2. **solver.planning.domains**
   - Planner in the cloud
   - Open source project
   - Rolling ultra-agile contest
3. **editor.planning.domains**
   - Custom PDDL editor
   - Tie-in to the API and Solver
   - TorchLight and other analysis soon

API Outline

- **JSON read and write API**
- ~~Python interface~~
- ~~JavaScript widgets~~
- ~~Command-line utility~~

API: Constructing a URL

```
http://api.planning.domains
```

The start of every API call

API: Constructing a URL

```
http://api.planning.domains
      /<format>
```

Can be **json** or **xml** (ommitted for `POST`)

API: Constructing a URL

```
http://api.planning.domains
      /<format>
      /<genre>
```

For now, can only be **classical**
(*FOND, RDDL, RMPL, etc coming soon*)

API_PATH: `api.planning.domains/json/classical`

API: Constructing a URL

```
http://api.planning.domains
      /<format>
      /<genre>
      /[collection|domain|problem](s)
```

Depends on if you want a list or single object

API: Constructing a URL

```
http://api.planning.domains
      /<format>
      /<genre>
      /[collection|domain|problem](s)
      /<id>|search?option=val|...
```

Options vary after this point...

Collections

```
api.planning.domains/json/classical/collection/12
{
  "error": false ,
  "message": "Success!",
  "result": {
    "collection_id": 12,
    "collection_name": "All-IPC (STRIPS)",
    "description": "A selection of STRIPS...",
    "domain_set": "[8,14,17,19,24,27,...,129]",
    "tags": "[]"
  }
}
```

Domains

```
api.planning.domains/json/classical/domain/13
{
  "error": false ,
  "message": "Success!",
  "result": {
    "domain_id": 13,
    "domain_name": "transport",
    "description": "(opt11) Each vehicle...",
    "tags": "[\":action-costs\",\":typing\"]"
  }
}
```

Problems

api.planning.domains/json/classical/problem/13

```
{ "error": false ,
  "message": "Success!",
  "result": {
    "problem_id": 13,
    "domain_id": 4,
    "domain": "sokoban",
    "problem": "p06.pddl",
    "domain_url": "http://www.haz.ca/planning-domains/...",
    "problem_url": "http://www.haz.ca/planning-domains/...",
    "domain_path": "classical/sokoban-opt08-strips/p06-domain.pddl",
    "problem_path": "classical/sokoban-opt08-strips/p06.pddl",
    "tags": "[]",
    "lower_bound": 5,
    "upper_bound": 11,
    "average_effective_width": null ,
    "max_effective_width": null ,
    "lower_bound_description": "haslum/pd-missing-hlb/...",
    "upper_bound_description": "Resetting the upper bounds",
    "average_effective_width_description": " ",
    "max_effective_width_description": " "
  }
}
```

Demo!

Submitting Attributes

Note: For now, modifications require special access

- Can update the attribute of any type:
  - `POST` **`API_PATH`**`/updatecollection/{col-id}`
  - `POST` **`API_PATH`**`/updatedomain/{dom-id}`
  - `POST` **`API_PATH`**`/updateproblem/{prob-id}`
- Following parameters are required:

`user`	Email address
`password`	Provided by admins
`key`	Attribute name
`value`	New value
`desc`	Description indicating source

API Null Attributes

To find all problems that have a particular attribute set to **null**. For example, all problems missing an upper bound:

```
GET API_PATH/nullattribute/upper_bound
```

```
{ "error": false ,
  "message": "Success!",
  "result": (
    {
      "id": 3027,
      "domain_path": "classical/pathways/domain_p02.pddl",
      "problem_path": "classical/pathways/p02.pddl"
    },
    {
      "id": 485,
      "domain_path": "classical/floortile-opt11-strips/domain.pddl",
      "problem_path": "classical/floortile-opt11-strips/opt-p09-018.pd
    },
    ...
}
```

API Tags

Examples: PDDL Requirements, Unsolvables, Invertables

Note: For now, modifications require special access

- Listing all tags:
  - `GET` **`API_PATH`**`/tags`
- Adding tags:
  - `POST` **`API_PATH`**`/tagcollection/{col-id}`
  - `POST` **`API_PATH`**`/tagdomain/{dom-id}`
  - `POST` **`API_PATH`**`/tagproblem/{prob-id}`
- Removing tags:
  - `POST` **`API_PATH`**`/untagcollection/{col-id}`
  - `POST` **`API_PATH`**`/untagdomain/{dom-id}`
  - `POST` **`API_PATH`**`/untagproblem/{prob-id}`

Plans

Incumbent can be submitted and retrieved

- GET **API_PATH**/plan/{prob-id}

```
{ "error": false ,
  "message": "Success!",
  "result": {
    "plan": "(move player-01 pos-6-4 pos-6-3 dir-up)\n..."
  }
}
```

- POST **API_PATH**/submitplan/{prob-id}

plan	String of IPC-style plan
email	User email (for the glory)

Note: No special access required!

Demo!

Solver Outline

- **JSON API access**
- ~~Open source project~~
- ~~Ultra-agile track~~

Solver API

Three main `POST` endpoints for solving and validating:

```
solver.planning.domains/solve
solver.planning.domains/validate
solver.planning.domains/solve-and-validate
```

`domain`	Either URL or raw PDDL for domain
`problem`	Either URL or raw PDDL for problem
`probID`	API ID to supersede `domain` and `problem`
`is_url`	Set to **true** if using URLs
`plan`	IPC format plan (just for `/validate`)

Solver API

Returned parameters if plan is computed:

`length`	Number of actions
`output`	Planner output
`parse_status`	Status of the plan parsing (e.g., **ok**)
`type`	Either **simple** or **full**
`plan`	...

Returned parameters if VAL is called:

`cost`	Total plan cost
`val_stdout`	VAL standard output
`val_stderr`	VAL standard error
`val_status`	Either **valid** or **err**
`error`	Indication of any VAL error

Solver API: Returned Plan

(**full**)
Ground action info included

Array of objects

`name`	Ground action name
`action`	Full ground action

```
"plan": [
  { "action":
      "  (:action move\n...",
    "name":
      "(move player-01..." },
  { "action":
      "  (:action move\n...",
    "name":
      "(move player-02..." },
  ...
] }
```

(**simple**)
Parser was unable to ground

Array of strings

```
"plan": [
 "(move player-01 pos-6-4...",
 "(move player-02 pos-3-5...",
 "(move player-01 pos-6-3...",
   ...
}
```

Over 14k plans computed since announcing at ICAPS!

Demo!

Editor Outline

- Editor Usage
- Editor Plugin Architecture

Demo!

Editor Plugin Structure

```
define(function () {
  return {
    name: "Plan-o-matic 1000",
    author: "John Smith",
    email: "yeah@right.com",
    description: "A plugin template.",

    // Called when loaded or enabled
    initialize: function() { },

    // Called when disabled
    disable: function() { },

    // Used to save settings
    save: function() { return {}; },

    // Restore any previous settings
    load: function(settings) { }
  };
});
```

Editor Meta Plugin Structure

```
define(function () {
  return {
    // Mandatory flag
    meta: true,

    // List of meta / normal plugins
    plugins: {
      "plugin1":
        {url: "http://path.to.plugin/1",
         settings: {} },
      "plugin2":
        {url: "http://path.to.plugin/2",
         settings: {option: "value"} },
      // ...
    };
  };
});
```

Editor API: Menu Interface

add_menu(name,id ,icon)

`name`	Name for the menu
`id`	HTML ID for reference
`icon`	Bootstrap glyphicon

remove_menu_button(id)

`id`	HTML ID for menu/button

add_menu_button(/*args*/)

`name`	Name for the menu
`id`	HTML id for later reference
`icon`	Bootstrap glyphicon string[1]
`cb_string`	String of function call (no " permitted)
`parent_menu`	(optional) ID for parent menu

Editor API: Creating New Tabs

`new_tab(name, callback)`

`name`	Name for the new tab
`callback`	Function that is called with the new view's HTML ID (shown when tab is selected)

```
window.new_tab("My Tab",
  function(editor_name) {
    var newHTML = "<p>I'm in a tab!</p>";
    $("#"+editor_name).html(newHTML);
  }
);
```

Editor API: Code Snippets

```
add_snippet(snippet, trigger)
```

`snippet`	Cloud9 style snippet
`trigger`	Text to trigger the auto-complete

```
window.add_snippet(
    "(when ${1:(and ())}\n\
      (${2}))",
    "condeff"
)
```

Editor API: File Chooser

```
register_file_chooser(name, settings)
setup_file_chooser(btnName, desc)
```

`name`	Slug or nickname for the chooser
`settings`	Object including `showChoice` and `selectChoice` functions
`btnName`	Name of the button for submission
`desc`	Description for the top of the dialog

```
window.register_file_chooser('planner',
  {
      showChoice: function() {
        window.setup_file_chooser('Plan','Compute Plan');
        $('#plannerURL').val(window.solverURL);
      },
      selectChoice: findPlan // Called when selected
  });
```

Editor API: Injecting CSS / Making Toast

```
inject_styles(css_style)
```

`css_style`	String of CSS to be included

```
window.inject_styles(
    ".some-divs { float: left; }\
     #some-other-div { padding: 13px; }"
)
```

```
window.toastr.success("Hurray!")
window.toastr.info("Things are happening...")
window.toastr.warning("Uh oh.")
window.toastr.error("I give up :(")
```

5min Break...

...plugin from
start-to-finish