ONLINEATPS

A CLIENT FOR THE TPTP WORLD

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The tool

Abstract

OnlineATPs is a Haskell program open source for connects to the web service SystemOnTPTP of the TPTP World. This new tool allows us to use ATPs without installing any of them. We can install it on Linux, Windows or Mac. With OnlineATPs you are capable to test a problem against at least sixty ATPs, check for unsatisfability, get some proofs and others functions.

OnlineATPs connects to **SystemOnTPTP** and allows us to take advantage of using **ATPs** **without installing** any of them.

- ○ Is an open source project located on `Github`.
  - ○ You are free to contribute, fork, everything.
  - ○ Indeed, now there are some issues open.
- ○ Is a software written on `Haskell`
  - ○ Tested with `GHC 7.6.3, 7.8.4, 7.10.3, 8.0.1`.
- ○ Is a command-line application cross-platform:
  - ○ OSX, Linux, Windows.
- ○ **Apia** has full supports for **OnlineATPs**.

SystemOnTPTP is a website and interface for solving problems using **ATPs**. The url address is
www.cs.miami.edu/~tptp/cgi-bin/SystemOnTPTP.
Other services you can find there:

- ○ TPTP Library of Problems.
- ○ SystemB4TPTP for prepare problems.
- ○ SystemOnTSTP to process solutions.

Keywords of the project

○ **ATP** Systems

○ **TPTP** World

○ `SystemOnTPTP` interface

○ Theorem proving

Automated Theorem Proving deals with the development of computer programs that show that some statement -the conjecture- is a logical consequence of a set of statements -the axioms and hypotheses-[1].

$$A_1, A_2, \cdots, A_n \overset{?}{\vDash} C. \tag{1}$$

ATP systems are used in a wide variety of domains.
Examples: logic, mathematics, computer science, engineering, and social science.

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[1]http://www.cs.miami.edu/~tptp/OverviewOfATP.html

Automatic Theorem Provers

Table: Some **ATPs** for PROP, FOF, and HOL

ATP	Version	Update	PROP	FOF	SMT 2.0	TPTP In	TSTP Out
CVC4	1.4	15/07/14	✓	✓	✓	✓	-
EProver	1.9	14/7/15	✓	✓	-	✓	✓
Equinox	6.0.1	5/7/12	✓	✓	-	✓	-
iProver	0.8.1	-/-/10	✓	✓	✓	✓	-
leanCoP	2.1	1/1/15	✓	✓	-	✓	-*
Metis	2.3	9/11/10	✓	✓	-	✓	✓
Prover9	2009-11A	4/11/09	✓	✓	-	-*	-
SPASS	3.7	23/02/10	✓	✓	-	✓	-
Vampire	2.6	-/-/11	✓	✓	-	✓	✓
Z3	4.4.1	5/10/15	✓	✓	✓	-	-

Installing one ATP

Did you try installing some **ATP** before with success at first try?

○ **EProver** Is one of those easy guys.

```
1   $ cd /home/jonaprieto
2   $ wget http://wwwlehre.dhbw-stuttgart.
      de/~sschulz/WORK/E_DOWNLOAD/V_1.9.1/
      E.tgz
3   $ tar -xzf E.tgz
4   $ cd E
5   $ ./configure --bindir=/home/jonaprieto
      /bin
6   $ make
7   $ make install
```

○ Done! And if you want to install more than one or three **ATPs** ?

○ Did you try installing with SPASS, Metis, Vampire?

○ Installation failures?

○ Instead you can install **OnlineATPs** !

Installing `OnlineATPs`

OnlineATPs

```
1 $ git clone https://github.com/jonaprieto
     /onlineatps
2 $ cd ~/onlineatps
3 $ cabal install
```

○ In the future (make a PR):

```
1 $ cabal install onlineatps
```

About the I/O of **ATPs**

- ○ Input files
- ○ Output files

The input format for some ATPs

TPTP is a standard format to write problems in different formalisms like first order logic or high order logic.

```
$ cat basic.tptp
fof(a1, axiom, a).
fof(a2, axiom, b).
fof(a3, axiom, (a & b) => z).
fof(a4, conjecture, z).
```

Theorem

$\{a, b, a \land b \rightarrow z\} \vdash z$

Proof.

Natural deduction proof.

$$\cfrac{\cfrac{\cfrac{a \qquad b}{a \land b} \text{ (}\land\text{-intro)} \qquad a \land b \rightarrow z}{z} \text{ (}\rightarrow\text{-Elim)}}{(a \land b \rightarrow z) \rightarrow z} \text{ (}\rightarrow\text{-Intro)}$$

□

Using EProver to get an answer

The output from the problem later using EProver .

```
1  $ eprover --auto --tptp3-format basic.tptp
2  # Proof found!
3  # SZS status Theorem
```
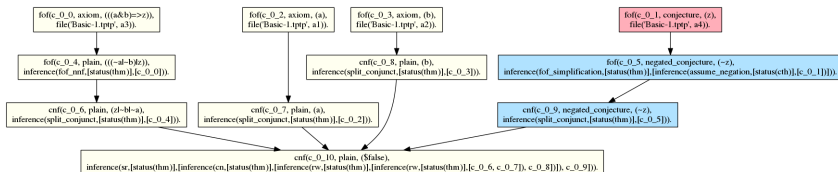
EProver can output a graph (.dot format) of the proof.

Figure: Proof graph of the threorem 1

A few **ATPs** use **TSTP** format.

Table: Some examples of outputs when an ATP finishes successfully

ATP	Version Tested	Sucess
CVC4	1.4	SZS status Theorem
EProver	1.9	Proof found
Equinox	5.0alpha	+++ RESULT: Theorem
ileanCoP	1.3 beta1	Intuitionistic Theorem
Metis	2.3	SZS status Theorem
SPASS	3.7	Proof found
Vampire	0.6	Termination reason: Refutation
Z3	4.4.1	unsat

Future work

- ○ Close the issues (17) open on `Github`.
- ○ We want to give full support for all features of TPTP World.
    - ○ Customize the commands arguments you send for the `ATPs`.
    - ○ Recommend Systems.
- ○ More features focus on `Apia` needs.
- ○ YAML Configure files.
- ○ Async calls.

Let's check some challenges inside the code!

- ○ `OnlineATPs.CheckOutput`
- ○ `OnlineATPs.Consult`
- ○ `OnlineATPs.Options`
- ○ `OnlineATPs.SystemATP`
- ○ `OnlineATPs.SystemOnTPTP`
- ○ `OnlineATPs.Urls`
- ○ `OnlineATPs.Utils.Yaml`

The goodbye

Thanks