Speeding up MetaPRL Refiner

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presenting joint work with Jason Hickey

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Sources of the speedup

- OCaml native code compiler
- Modularity
- Compilation of rewrites to bytecode
- Efficient term module
- Various other improvements

Term Module

```
module type TermSig = sig
    (* Types and constructors: *)
    type term, bound_term
    val mk_term : opname → param list → bound_term list → term
    val mk_bterm : string list → term → bound_term
    val mk_var_term : string → term

    (* Destructors and other operations: *)
    val dest_term : term → opname * param list * bound_term list
    val dest_bterm : bound_term → string list * term
    val is_var_term : term → bool
    val dest_var_term : term → string
    val subst : (string * term) list → term → term
    val free_vars : term → string list
    val alpha_equal : term → term → bool
end
```

Speeding up the Term Module

- Be lazy!
- Delayed substitutions
  - Only substitute for occuring variables
- Free variable computation
  - Lazy
  - Using efficient set representation
- Special representation for common terms
  - Variables
  - Sequents

Other Improvements

- Sharing preservation
- Fast HigherC convertional
- Imprecise exceptions
- Comparing opnames first

Sharing Preservation

```
let rec filter f = function
      [] → []
    | h::t →
        if f h then
            h::(filter f t)
        else
            filter f t
```

becomes

```
let rec filter f = function
      [] → []
    | (h::t) as l →
        if f h then
            let rem = filter f t in
            if rem == t then l else h::rem
        else
            filter f t
```

Some Numbers

Pigeon – Hole Principle

Configuration	Tactic	Problem size 2	3	4	Memory (Max MB)
Term_std	pigeonT	<0.1	2.46	93.8	170
Term_ds	pigeonT	<0.1	0.59	15.1	32
Nuprl4	pigeonT	0.5	89	>1800	
Term_std	propDecideT	0.28	233	>1800	
Term_ds	propDecideT	0.11	54	>1800	
Nuprl4	propDecideT	21.9	>1800	>1800	

Factorial

Configuration	Argument value 100	250	400	650
Term_std	0.35	2.25	6.0	17.5
Term_ds	0.4	2.7	7.5	21
Nuprl4	55	330	*	*

Evaluation in Nuprl - 22 sec