

Building Business Systems with *DSLs* atop OpenResty

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2016.9



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set_by_lua

ssl_certificate_by_lua

body_filter_by_lua

rewrite_by_lua

init_by_lua

init_worker_by_lua

log_by_lua

content_by_lua

header_filter_by_lua

access_by_lua

lua-resty-string
lua-resty-dns
lua-resty-beanstalkd
lua-resty-session
lua-resty-qless lua-resty-postgres
lua-resty-upstream-healthcheck
lua-resty-lrucache
lua-resty-scrypt lua-resty-cassandra
lua-resty-template
lua-resty-stack lua-resty-lock
lua-resty-hmac lua-resty-smtp
lua-resty-rabbitmqstomp lua-resty-mongo
lua-resty-uuid lua-resty-random
lua-resty-libcjson
lua-resty-http-simple lua-resty-handlersocket
lua-resty-ssdb lua-resty-websocket
lua-resty-http lua-resty-logger-socket
lua-resty-upload
lua-resty-redis
lua-resty-core
lua-resty-memcached
lua-resty-mysql

♥ NGINX + LuaJIT

♥ The *all-inclusive* philosophy

Simple
Small
Fast
Flexible

Synchronously *nonblocking*

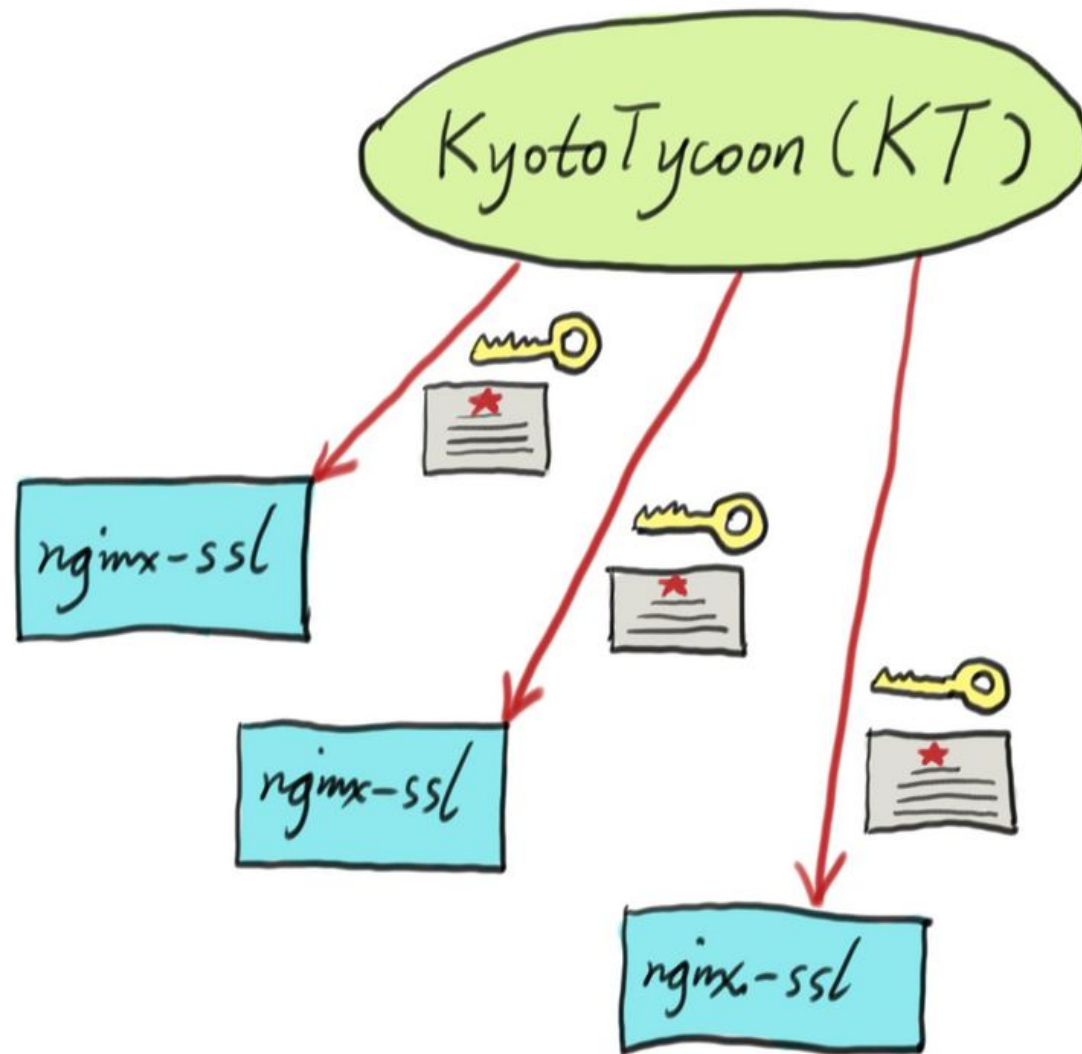
Light *threads* & semaphores

Cosockets

Timers and Sleeping

Shm-based dictionaries and queues

Dynamic SSL Handshakes



Dynamic Load Balancers

```
upstream {  
    server 0.0.0.1;    # just a place holder  
  
    balancer_by_lua_block {  
        local balancer = require "ngx.balancer"  
        local host, port = my_load_backend_addr()  
        assert(balancer.set_cur_peer(host, port))  
    }  
}
```

ngx_stream_lua_module (TCP & UDP)

Advanced *debugging* & *profiling* tools
based on gdb & systemtap

C2000K

Web *API* and Microservices

(real-time stock market info/weather)

Web Gateways

(HTTP/HTTPS/TCP/UDP, CDN)

Web Applications

(e-commerce/ad platforms/push systems/web sites)

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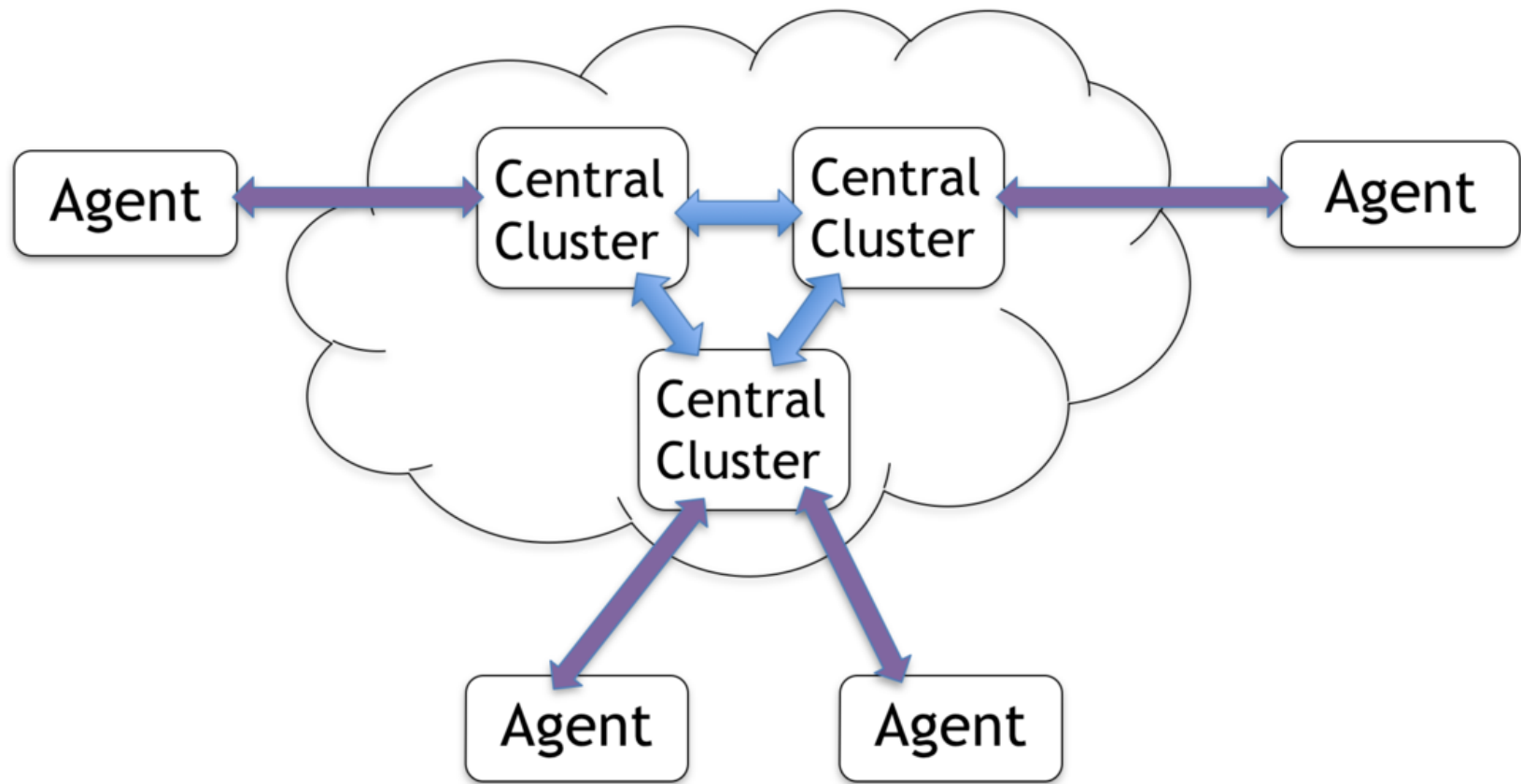
Distributed Storage Systems

Datanet is coming

Find @jaksprats on twitter

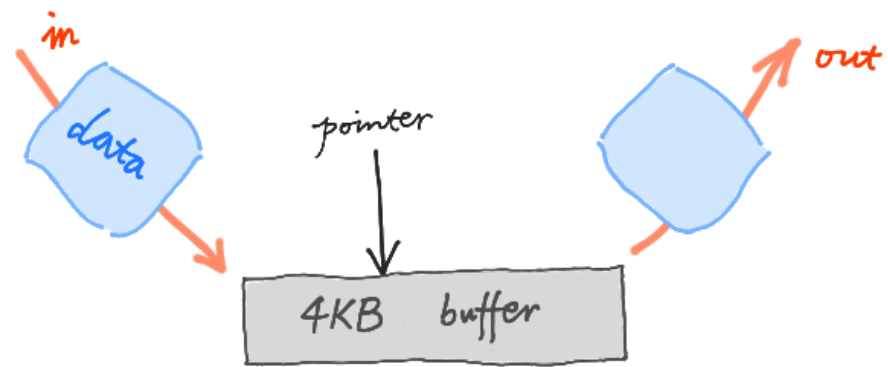
Conflict-free Replicated Data Types

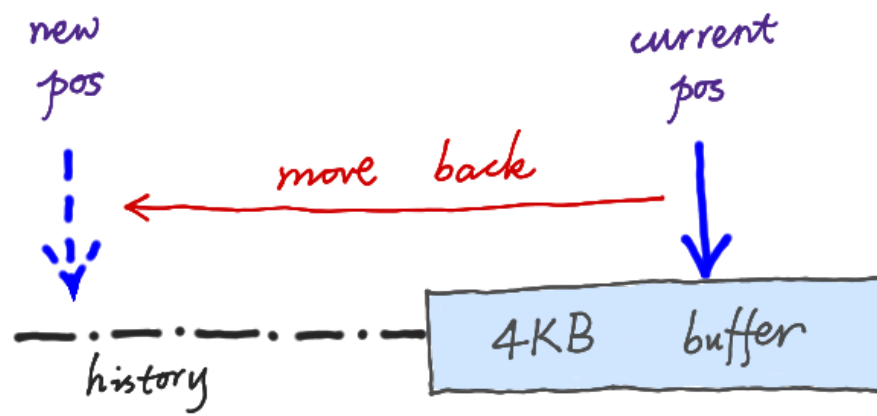
CRDT



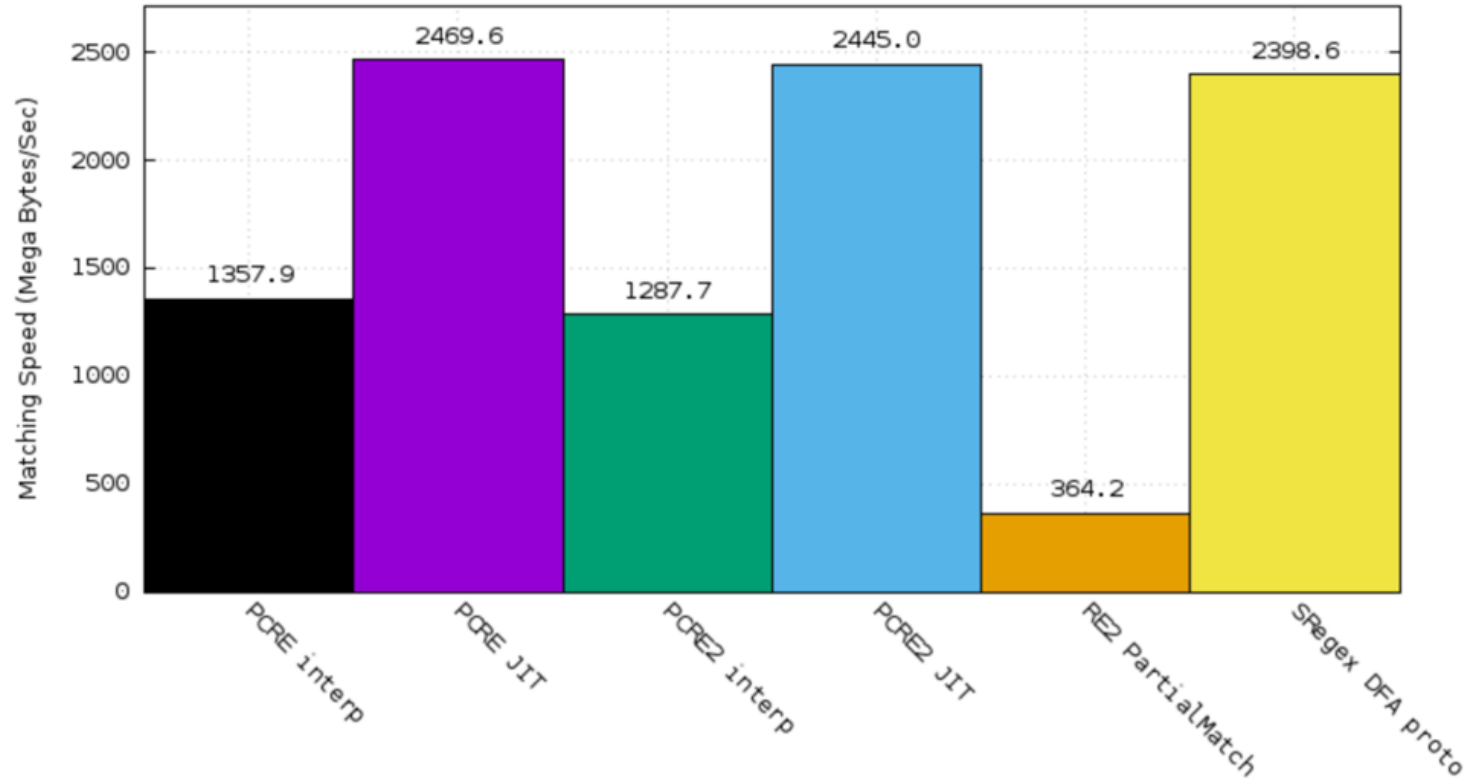
♥ The *sregex* regex engine



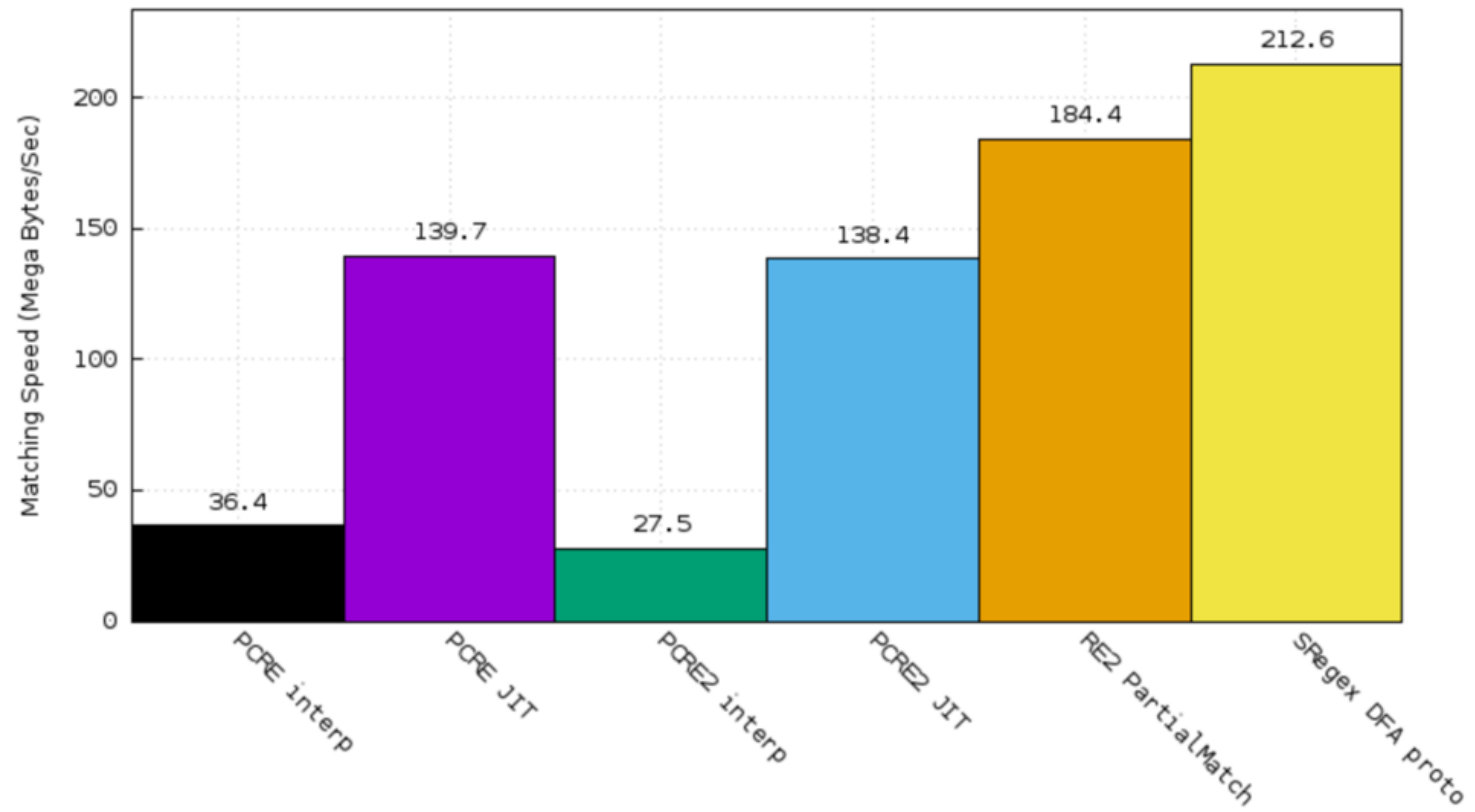




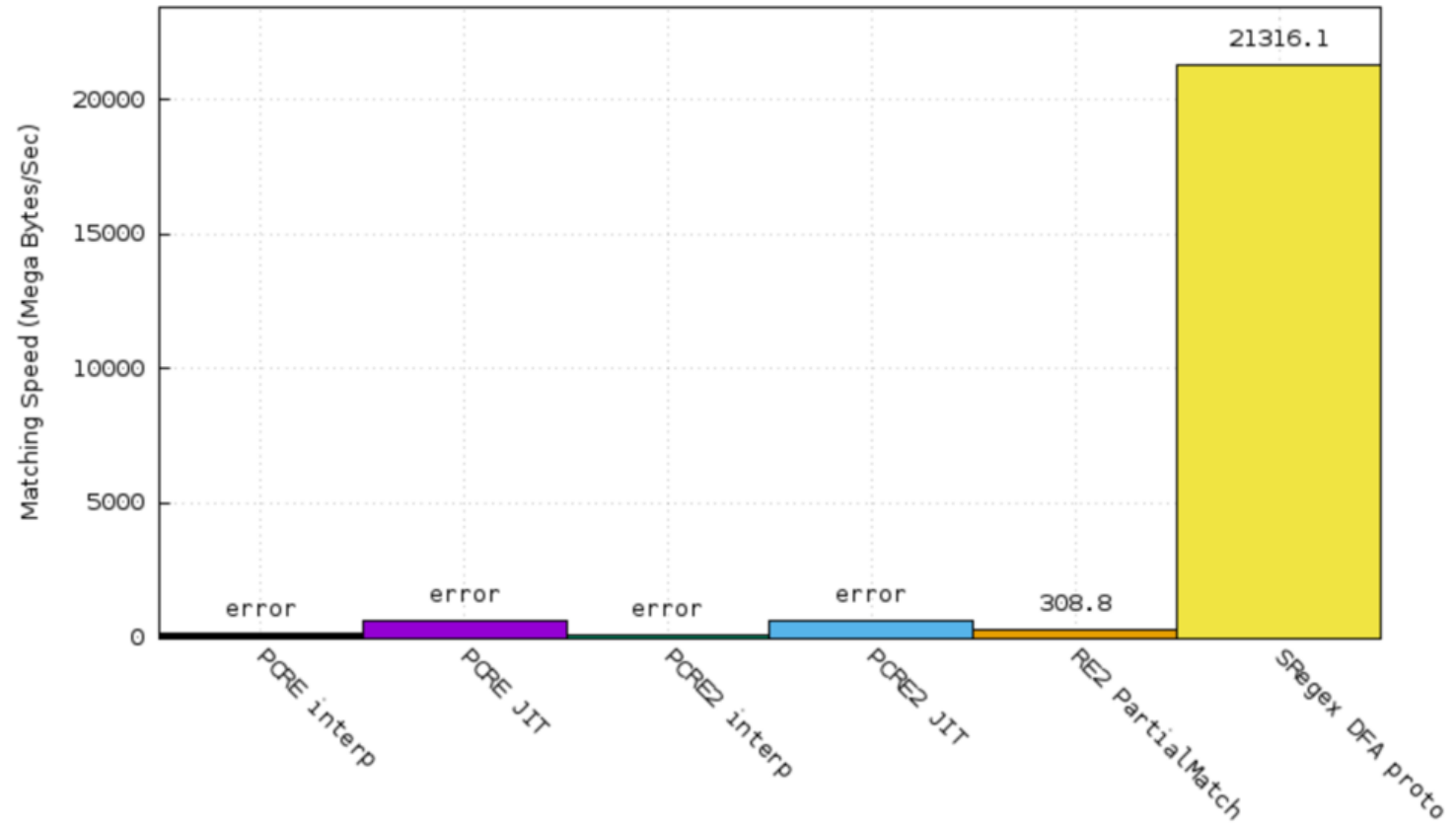
Benchmarking regex /ddd|fff|eee|ggg|hhh|iii|jjj|kkk|[l-n]mm|ooo|ppp|qqq
|rrr|sss|ttt|uuu|vvv|www|[x-z]yy/ matching file abc.txt of size 25.0 MB



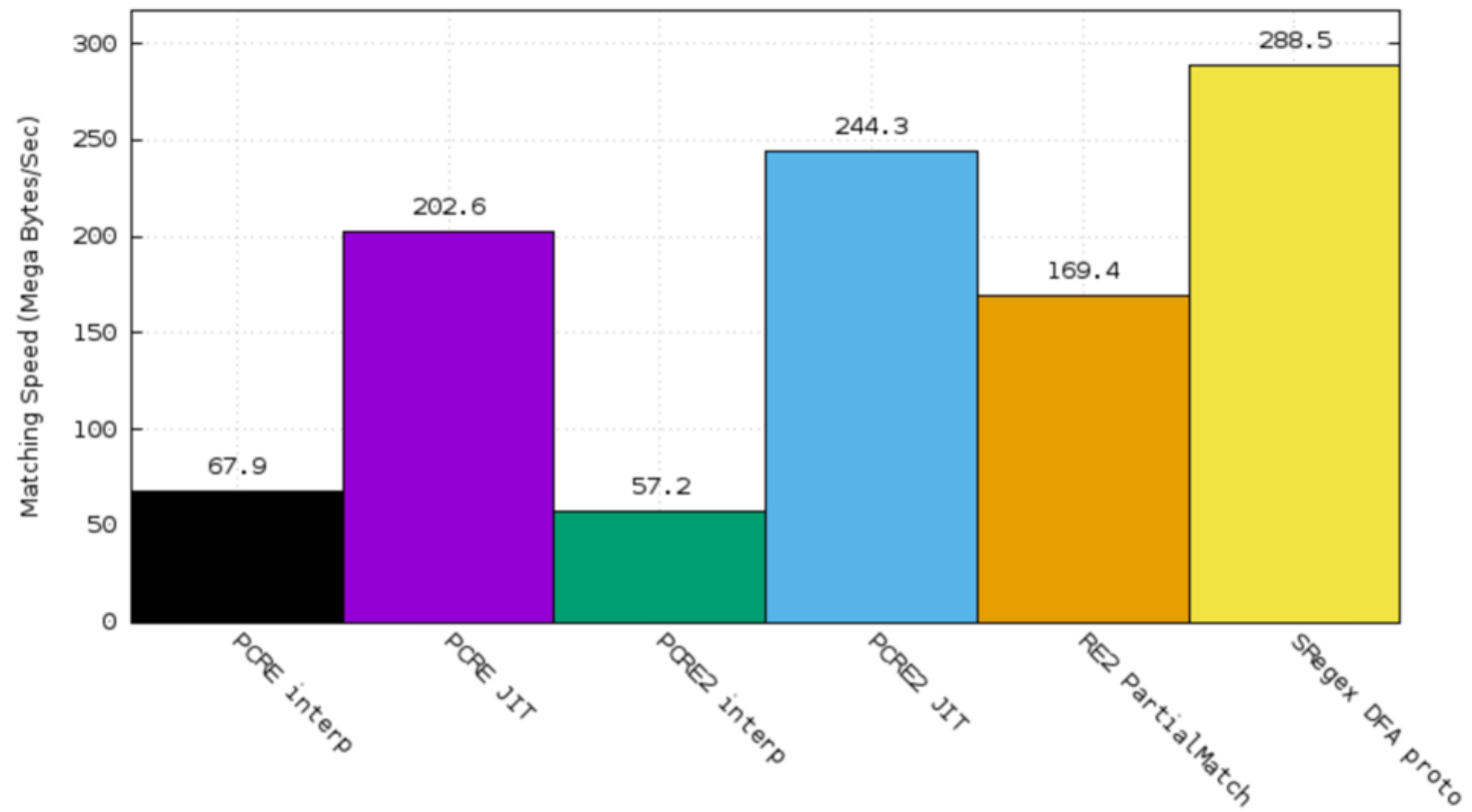
Benchmarking regex `/(?:a|b)aa(?:aa|bb)cc(?:a|b)abcabcbabd/` matching file
rand-abc.txt of size 10.0 MB



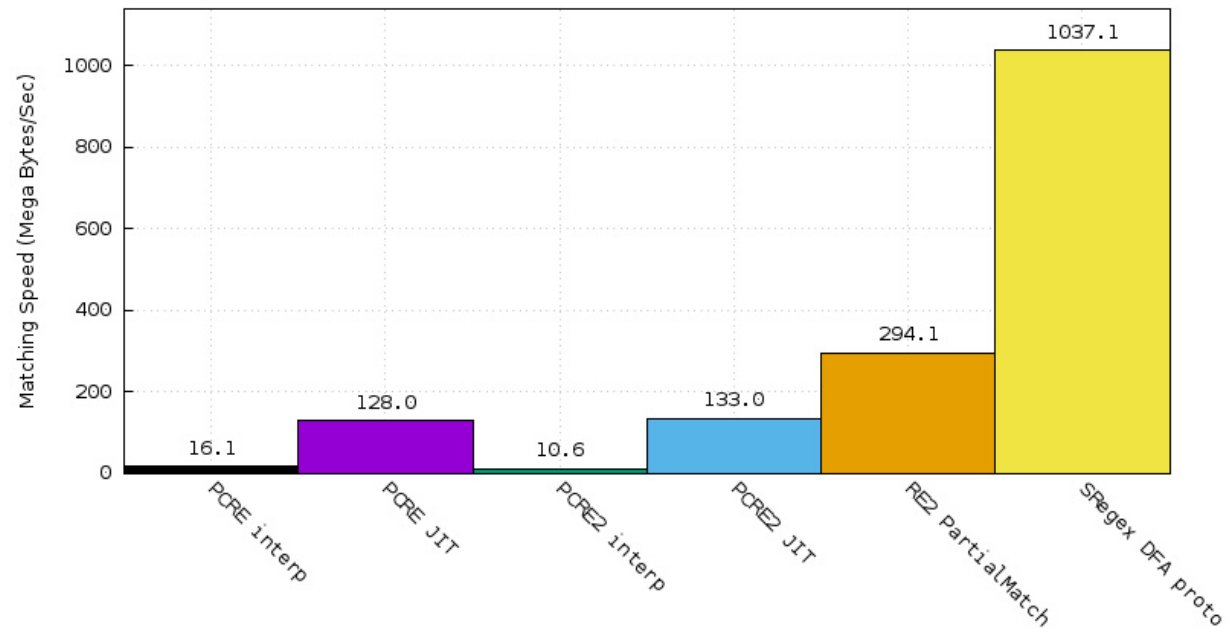
Benchmarking regex /d.*?d/ matching file delim.txt of size 10.0 MB



Benchmarking regex `/\s[a-zA-Z]{0,12}\ing\s/` matching file `mtent12.txt`
of size 19.1 MB



Benchmarking regex `/(?i)(?:merge.*?using\s*\(|)(execute\s*?immediate\s*?[\\"'\x60''`
])|(?:\W\d*?\s*?having\s*?[^\\-])|(?:match\s*?[\w(),+-]+\s*?against
\\s*?\(|/
matching file regex/misc/5/text.txt of size 0.0 MB`



♥ A web platform as a *virtual machine*

lz.taobao.com

FileEditViewHistoryBookmarksToolsHelp

http://lz.taobao.com/

Google

量子恒道统计

量子恒道统计

http://lz.taobao.com

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密码

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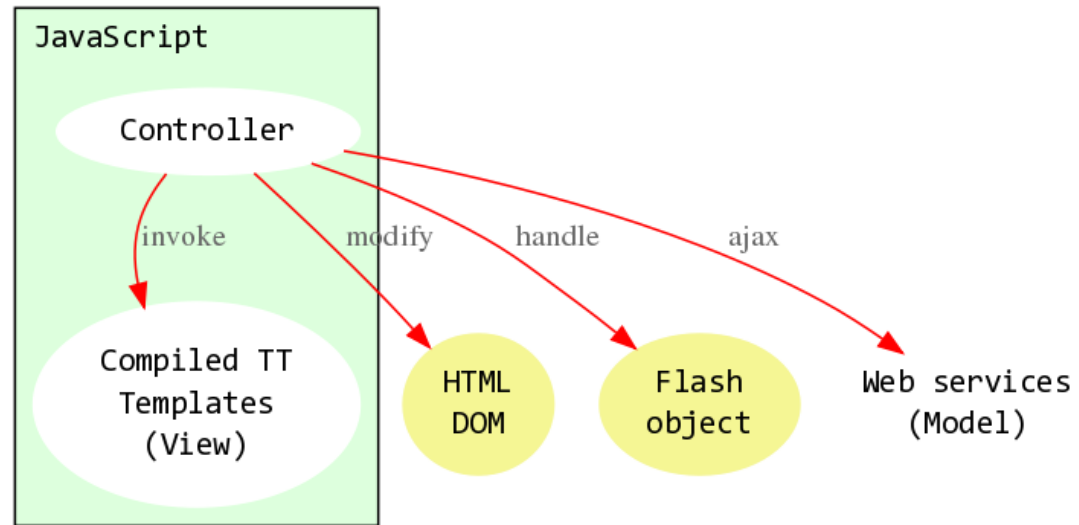
Done

FoxyProxy: Disabled

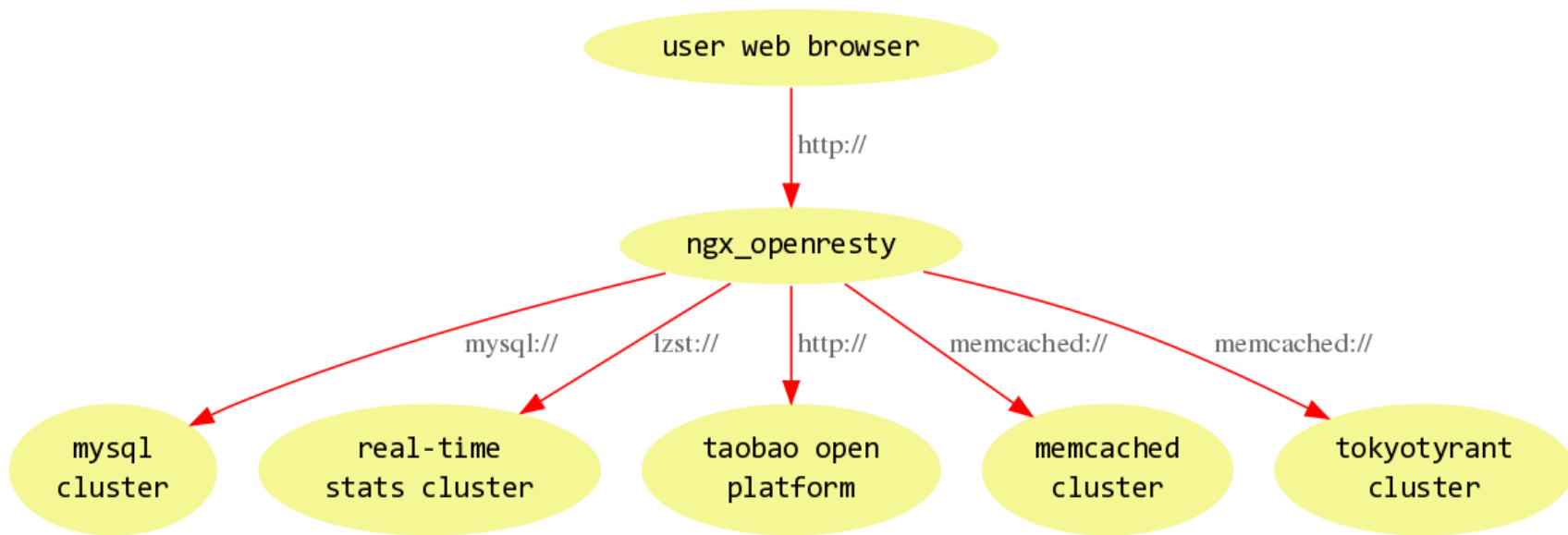
110.75.2.3







What's inside the user web browser



Architecture Diagram for `lz.taobao.com`

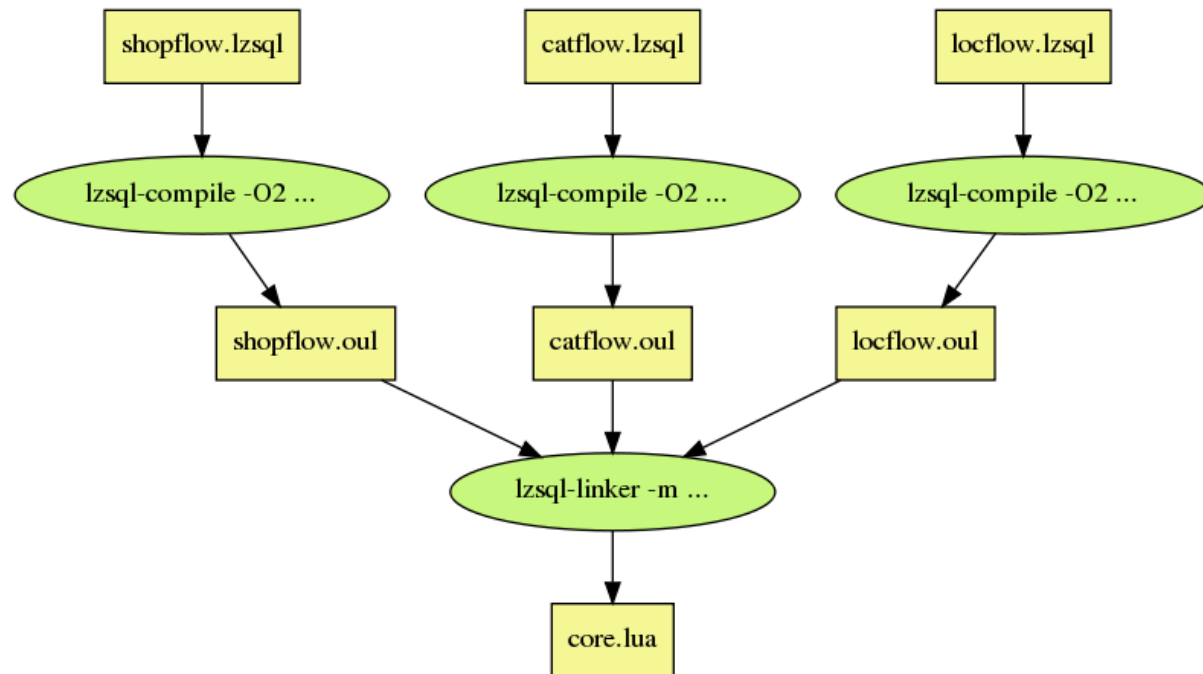
I invented the *LZSQL* language
for the core business system.

```
-- /=/view/itemdailyflow/type/trend
int          $uid;
text         $begin, $end, $today, $url_index;
symbol       $db;
location     $lz_report;

@hist :=
    select ...
    from LZDB.dpunit_purl_result($db, $begin, $end, $uid) as a
    ...
    at $lz_report;

@rt :=
    select name, count(name)
    from LZRTI.getPurl($end as day, $uid)
    group by name
    ...

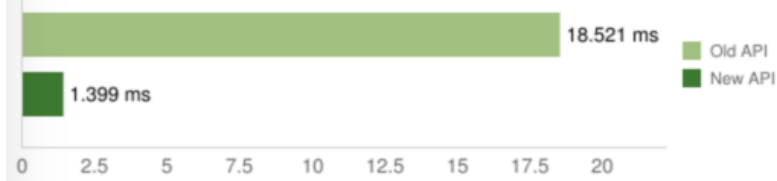
return select ... from @hist union all @rt ...
```



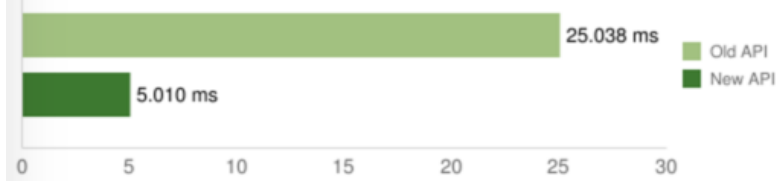
```
$ lzsql-compile -c -O2 -n src/*.lzsql
```

```
$ lzsql-link -m lightface.core \  
             -o lightface/core.lua src/*.oul
```

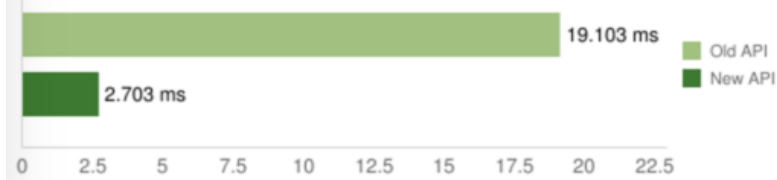
121916 /=/view/p4p/area/map?batch=1&days=2010-08-10..2010-08-31&provinceid=11



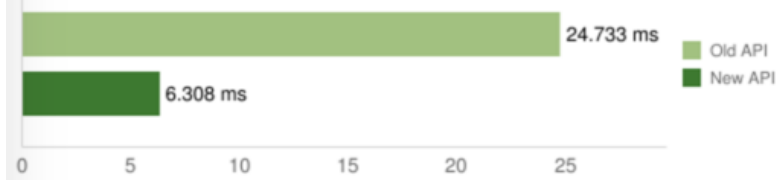
121916 /=/view/p4p/area/map?batch=1&days=2010-08-10..2010-08-31&provinceid=65



121916 /=/view/p4p/area/trend?days=2010-08-10..2010-08-31&batch=1&provinceid=471&cityname=%E4%B9%8



121916 /=/view/p4p/area/trend?days=2010-08-10..2010-08-31&batch=0&provinceid=255&cityname=%E6%B1%9



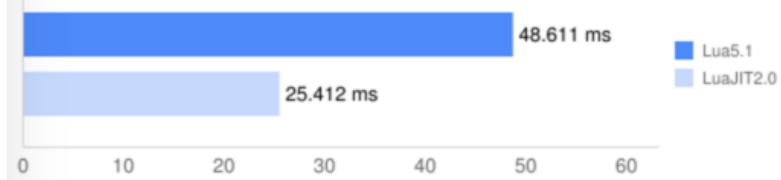
1509 /=/view/sellerbasic/~/~



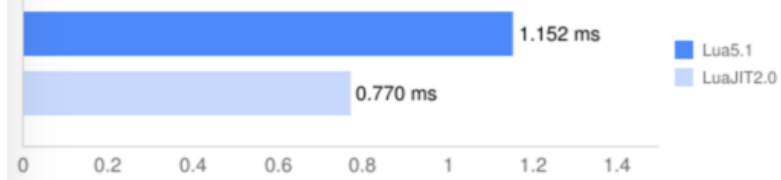
1509 /=/view/recent/~/~?offset=0&limit=10&p4p=0



1509 /=/view/recent/~/~?p4p=0&offset=0&limit=125



1509 /=/view/shopflow/type/hourly?day=2010-09-01



♥ The LZSQL *compiler* was written in
just 4000 lines of Perl.

LZSQL *Parser*

LZSQL *AST*

LZSQL *Optimizers*

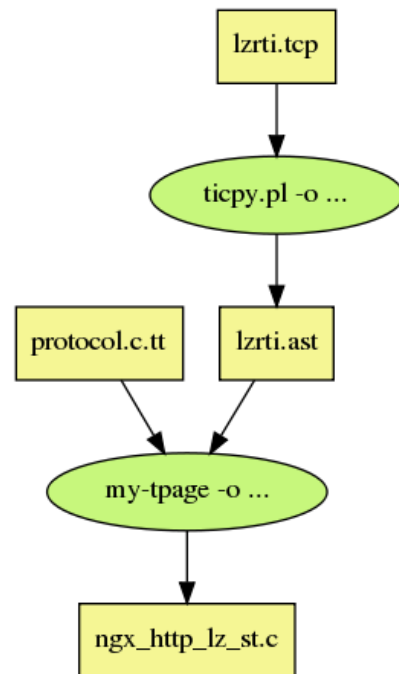
LZSQL *Code Emitter*

♥ We *can* generate Lua code,
so why not *C*?

♥ The ngx_lz_st module was generated *automatically* from the real-time stats engine's TCP protocol **documentation**.

♡ The documentation had been originally
written in wiki format
and then ported over to a declarative little *language*
named **Ticpy** designed by myself.

```
// File lzrti.tcp
...
// fid=7
// @desc: obtain info for a specific shop and a specific visitor
// @param uid: unit_id
// @param uv: visitor cookie
// @param all_sessions: whether return p4p hits: 1 is yes; 0 otherwise
getUv(uid:4, uv:s, all_sessions:4): (
    login_time:8, // session start time
    login_url:s, // session entry page
    login_title:s, // session entry page title
    stay_time:4, // current session elapsed time
    page_deep:4, // current session's access depth
    im:s, // user's IM account
    ip:s, // ip address
    location_id:4, // address id
    ...
)
```



```
$ wc -l lzrti.tcp protocol.c.tt ngx_http_lz_st.c
  345 lzrti.tcp
  464 protocol.c.tt
12478 ngx_http_lz_st.c
13287 total
```

♡ So...I'd rather write
programs to write programs
to write **programs**...

♥ *Test* our nginx **C** modules by
our open source *Perl* module *Test::Nginx*!

<http://search.cpan.org/perldoc?Test::Nginx>


```
use Test::Nginx::Socket 'no_plan';
run_tests();
```

```
DATA
```

```
=== TEST 1: sanity
```

```
--- config
```

```
    location /main {
        echo_subrequest GET /sub;
    }
    location /sub {
        echo hello;
    }
```

```
--- request
```

```
    GET /main
```

```
--- response_body
```

```
hello
```

♥ *Test* the application **web serives** by *Perl*.

```
use t::LZ;  
plan tests => 1 * blocks();  
run_tests();
```

DATA

```
=== TEST 1: lzers
```

```
--- url
```

```
/=/view/lzers/~/~
```

```
--- res
```

```
[  
  {  
    "cnt" : 911619  
  }  
]
```

```
=== TEST 5: sellerbasic
```

```
--- uid: 1509
```

```
--- url
```

```
/=/view/sellerbasic/~/~
```

```
--- res
```

```
[
```

```
{
```

```
    "uv_times" : 257
```

```
},
```

```
{
```

```
    "login_title" : "店内搜索页",
```

```
    "login_url" : "http://xiaowangpu...",
```

```
...
```

♥ Generate *test databases* from rules
by my open source **Cheater** utility
written by *Perl*.

<http://search.cpan.org/perldoc?Cheater>

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http://search.cpan.org/~agent/Cheater-0.10/lib/Cheater-0.10/ Cheater - search.cpan...

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[agentzh \(章亦春\)](#) > [Cheater-0.10](#) > Cheater [permlink](#)

Module Version: 0.10 [Source](#)

NAME
VERSION
DESCRIPTION
INSTALLATION
AUTHOR
COPYRIGHT & LICENSE

 Download: [Cheater-0.10.tar.gz](#)
[Dependencies](#)

Done FoxyProxy: Disabled 199.15.176.161

♥ The OpenResty *Model* Language

♥ The OpenResty *View* Language

Jemplate & Lemplate

♥ The OpenResty *Controller* Language

```
uri-prefix("/foo/"), !uri-arg("_t")
```

```
=>
```

```
    redirect("/bar/"),
```

```
    done;
```

```
uri-suffix(".jpg", ".gif", ".png")
```

```
=>
```

```
    exit(403);
```

```
resp-filter {  
    # skip C/C++ string literals:  
    rx{ ' (?: \ [^\n] | [^'\n] )* ' } -> $0;  
    rx{ " (?: \ [^\n] | [^"\n] )* " } -> $0;  
  
    # remove all those ugly C/C++ comments:  
    rx{ /\* .*? \*/ | // [^\n]* } -> '';  
}
```

♥ *WAF* on the Controller Language.

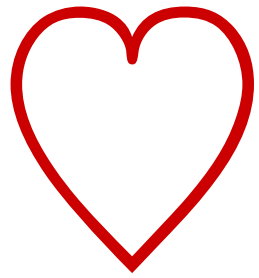
♥ ModSecurity is a *horrible* DSL.

```
SecRule ARGS "(?i)([\\s\\\"'`;/0-9\\|=]+on\\w+\\s*=)"
" id: '973337', phase: 2, t: none, rev: '1', ver: 'OWASP_CRS/2.2.9',
maturity: '1', accuracy: '8', t: urlDecodeUni, t: htmlEntityDecode,
t: jsDecode, t: cssDecode, log, capture,
msg: 'XSS Filter - Category 2: Event Handler Vector',
tag: 'OWASP_CRS/WEB_ATTACK/XSS', tag: 'WASCTC/WASC-8',
tag: 'WASCTC/WASC-22', tag: 'OWASP_TOP_10/A2',
tag: 'OWASP_AppSensor/IE1', tag: 'PCI/6.5.1',
logdata: 'Matched Data: %{TX.0} found within %{MATCHED_VAR_NAME}: %
{MATCHED_VAR}',
severity: '2', setvar: 'tx.msg=%{rule.msg}',
setvar: tx.xss_score=+ %{tx.critical_anomaly_score},
setvar: tx.anomaly_score=+ %{tx.critical_anomaly_score},
setvar: tx.%{rule.id}-OWASP_CRS/WEB_ATTACK/XSS-%{matched_var_name}=%{tx.0}"
```

😊 *Model* (Data analytics, Microservices)

😊 *View* (Web pages)

😊 *Controller* (CDN, WAF, Microservices)



SportLang

♥ The *Y* Language

`gdb/python`

`lldb/python`

`systemtap`

`bcc/ebpf`

`luajit/ebpf`



CoffeeScript

♥ The *meta* domain specific language

A DSL for creating all the DSLs (including itself).

♡ Clean *separation* between
business representation and business implementation

♥ *Compiling*-style Web Frameworks

♥ The *best* language is the business language.

♡ Machine truly *understands* your business logic.

😊 *Any questions?* 😊

