cmssh
programmable shell for CMS

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Outlines

- *Introduction*
- *Installation*
- *Usage*
- *Summary*
- *Plans*

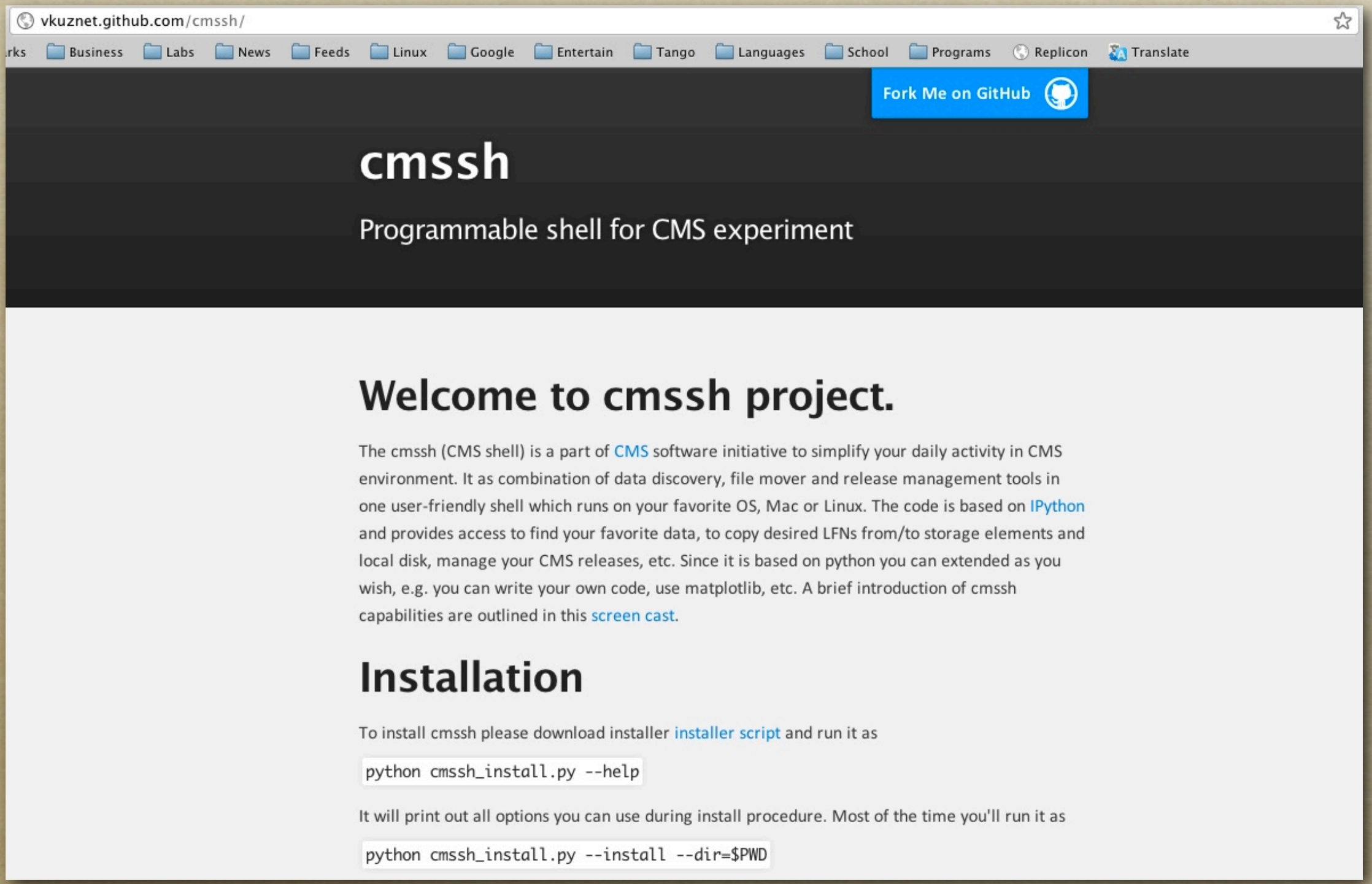
Introduction

- *CMS software management is quite complex*
- *Site installation requires some expertise*
- *Users left on their own while dealing with CMS software, e.g. local installation, run CMS soft on laptop, etc.*
- *Can we fix that?*

Target

- *Aim to have simple shell environment where you can*
  - *search for data*
  - *cp files to/from SE/local disks*
  - *install CMSSW releases*
  - *run your favorite CMS software*
- *Run on Linux/Mac, lxplus or laptop*

cmssh project http://vkuznet.github.com/cmssh/



Installation

```
# curl -k https://raw.github.com/vkuznet/cmssh/master/cmssh_install.py > cmssh_install.py

# python cmssh_install.py --help
Usage: cmssh_install.py [options]

Options:
  -h, --help            show this help message and exit
  -v DEBUG, --verbose=DEBUG
                        verbose output
  -d INSTALL_DIR, --dir=INSTALL_DIR
                        install directory
  -i, --install         install command
  --dev                 get cmssh code from development branch
  --arch=ARCH           CMSSW architectures: [list on your platform]
  --cmssw=CMSSW         specify location of CMSSW install area
  --multi-user          install cmssh in multi-user environment
  --unsupported         enforce installation on unsupported platforms, e.g.
                        Ubuntu

# python cmssh_install.py --install --dir=$PWD
```

Installation (output)

```
Checking CMSSW ...
Installing Globus
Installing Myproxy
Installing VOMS
Installing expat
Installing PythonUtilities
Installing WMCore
Installing LCG info
Installing certificates
Installing SRM client
Installing pip
Installing IPython
Installing Routes
Installing readline
Installing httplib2
Installing paramiko
Installing cmssh
Create matplotlibrc
Create configuration
Create vomses area
Create cmssh
Clean-up ...
Congratulations, cmssh is available at /afs/cern.ch/work/v/valya/public/soft/bin/cmssh
```

cmssh

```
Available cmssh commands:
find          search CMS meta-data (query DBS/Phedex/SiteDB)
dbs_instance  show/set DBS instance, default is DBS global instance
mkdir/rmdir   mkdir/rmdir command, e.g. mkdir /path/foo or rmdir T3_US_Cornell:/store/user/foo
ls            list file/LFN, e.g. ls local.file or ls /store/user/file.root
rm            remove file/LFN, e.g. rm local.file or rm T3_US_Cornell:/store/user/file.root
cp            copy file/LFN, e.g. cp local.file or cp /store/user/file.root .
info          provides detailed info about given CMS entity, e.g. info run=160915
das           query DAS
das_json      query DAS and return data in JSON format
dqueue        status of download queue, list files which are in progress.
root          invoke ROOT
du            display disk usage for given site, e.g. du T3_US_Cornell

Available CMSSW commands (once you install any CMSSW release):
releases      list available CMSSW releases
install       install CMSSW release, e.g. install CMSSW_5_0_0
cmsrel        switch to given CMSSW release and setup its environment
arch          show or switch to given CMSSW architecture
scram         CMSSW scram command
cmsRun        cmsRun command for release in question

Available GRID commands: <cmd> either grid or voms
<cmd>init     setup your proxy (aka <cmd>-proxy-init)
<cmd>info     show your proxy info (aka <cmd>-proxy-info)

Query results are accessible via results() function:
   find dataset=/*Zee*
   for r in results(): print r, type(r)

Help is accessible via cmshelp <command>

To install python software use pip <search|(un)install> <package>

cms-sh|1>
```

Data look-up

```
cms-sh|1> find dataset=/*Zee_M20*
/Zee_M20_CTEQ66-powheg/Summer09-MC_31X_V3_7TeV-v1/GEN
/Zee_M20-powheg/Summer09-MC_31X_V3_7TeV-v1/GEN

cms-sh|2> cmshelp find

    Perform lookup of given query in CMS data-services.
```

```
cms-sh|3> find file dataset=/Zee_M20_CTEQ66-powheg/Summer09-MC_31X_V3_7TeV-v1/GEN
/store/generator/Summer09/Zee_M20_CTEQ66-powheg/GEN/MC_31X_V3_7TeV-v1/0000/E0375567-2331-DF11-AC84-000423
D94D98.root
/store/generator/Summer09/Zee_M20_CTEQ66-powheg/GEN/MC_31X_V3_7TeV-v1/0000/C4FAD1C9-2431-DF11-A575-003048
7C8D02.root
/store/generator/Summer09/Zee_M20_CTEQ66-powheg/GEN/MC_31X_V3_7TeV-v1/0000/889C1F05-2231-DF11-B779-001617
C35598.root
/store/generator/Summer09/Zee_M20_CTEQ66-powheg/GEN/MC_31X_V3_7TeV-v1/0000/6AC1690E-2231-DF11-B8AE-000423
D99B46.root
/store/generator/Summer09/Zee_M20_CTEQ66-powheg/GEN/MC_31X_V3_7TeV-v1/0000/541C16FF-2131-DF11-9DF3-003048
7C8CD8.root
```

```
cms-sh|5> info /Zee_M20_CTEQ66-powheg/Summer09-MC_31X_V3_7TeV-v1/GEN
bytes     : 555066322
created   : 2010-03-16 16:26:18 GMT
createdby : /DC=ch/DC=cern/OU=Organic Units/OU=Users/CN=vdutta/CN=696509/CN=Valentina Dutta
dataset   : Summer09-MC_31X_V3_7TeV-v1
datatype  : mc
modified  : 2010-06-09 21:01:06 GMT
modifiedby: /DC=ch/DC=cern/OU=Organic Units/OU=Users/CN=vdutta/CN=696509/CN=Valentina Dutta
nblocks   : 1
nevents   : 2200000
nfiles    : 5
size      : 529.4MB
status    : VALID
```

File management

```
cms-sh|4> ls /store/generator/Summer09/Zee_M20_CTEQ66-powheg/GEN/MC_31X_V3_7TeV-v1/0000/E0375567-2331-DF1
1-AC84-000423D94D98.root
bytes             : 111015578
created           : 2010-03-16 18:30:57 GMT
createdby         : /DC=ch/DC=cern/OU=Organic Units/OU=Users/CN=vdutta/CN=696509/CN=Valentina Dutta
logical_file_name: /store/generator/Summer09/Zee_M20_CTEQ66-powheg/GEN/MC_31X_V3_7TeV-v1/0000/E0375567-23
31-DF11-AC84-000423D94D98.root
modified          : 2010-03-17 22:30:52 GMT
modifiedby        : /DC=ch/DC=cern/OU=Organic Units/OU=Users/CN=vdutta/CN=696509/CN=Valentina Dutta
nevents           : 440000
pfn               : srm://srm-cms.cern.ch:8443/srm/managerv2?SFN=/castor/cern.ch/cms/store/generator/Summe
r09/Zee_M20_CTEQ66-powheg/GEN/MC_31X_V3_7TeV-v1/0000/E0375567-2331-DF11-AC84-000423D94D98.root
se                : srm-cms.cern.ch
size              : 105.9MB
```

```
cms-sh|6> ls
CMSSW_5_2_4  README  cmssh_install.py  cmssh_install.py~  soft

cms-sh|7> rm -rf CMSSW_5_2_4

cms-sh|8> ls
README  cmssh_install.py  cmssh_install.py~  soft

cms-sh|9> cmsrel CMSSW_5_2_4
CMSSW_5_2_4 is ready, cwd: /afs/cern.ch/work/v/valya/public/CMSSW_5_2_4/src

cms-sh|10> ls

cms-sh|11> cp /store/data/CRUZET3/Cosmics/RAW/v1/000/050/832/186585EC-024D-DD11-B747-000423D94AA8.root fi
le.root
Download in progress: 100%
Status success

cms-sh|12> ls
file.root
```

SE management

```
cms-sh|14> ls T3_US_Cornell
cust_dest_bytes    : 0
cust_dest_files    : 0
cust_node_bytes    : 0
cust_node_files    : 0
default_path       : /xrootdfs/cms/store/user
name               : T3_US_Cornell
noncust_dest_bytes: 378935611820
noncust_dest_files: 192
noncust_node_bytes: 78781361423
noncust_node_files: 54
nonsrc_node_bytes : 0
nonsrc_node_files : 0
pfn_path           : srm://osg-se.cac.cornell.edu:8443/srm/v2/server?SFN=/xrootdfs/cms/store/user
src_node_bytes     : 0
src_node_files     : 0
```

```
cms-sh|15> ls T3_US_Cornell:/store/user/valya
data: /xrootdfs/cms/store/user/valya
type: directory

data: /xrootdfs/cms/store/user/valya/darren
type: directory

data: /xrootdfs/cms/store/user/valya/foo
type: directory

data: /xrootdfs/cms/store/user/valya/Cosmics
type: directory
```

Directory management

```
cms-sh|16> mkdir T3_US_Cornell:/store/user/valya/foo
srm-mkdir srm://osg-se.cac.cornell.edu:8443/srm/v2/server?SFN=/xrootdfs/cms/store/user/valya/foo
srm-mkdir   2.2.1.3.19   Wed Feb 23 10:09:34 PST 2011
BeStMan and SRM-Clients Copyright(c) 2007-2011,
Lawrence Berkeley National Laboratory. All rights reserved.
Support at SRM@LBL.GOV and documents at http://sdm.lbl.gov/bestman
SRM-CLIENT: Connecting to serviceurl httpg://osg-se.cac.cornell.edu:8443/srm/v2/server

SRM-DIR: Fri Apr 27 17:07:02 CEST 2012 Calling SrmMkdir
SRM-DIR: DirectoryPath(0)=srm://osg-se.cac.cornell.edu:8443/srm/v2/server?SFN=/xrootdfs/cms/store/user/va
lya/foo
        status=SRM_DUPLICATION_ERROR
        explanation=already existss

Status None

cms-sh|17> rmdir T3_US_Cornell:/store/user/valya/foo
srm-rmdir srm://osg-se.cac.cornell.edu:8443/srm/v2/server?SFN=/xrootdfs/cms/store/user/valya/foo
Status success
```

```
cms-sh|19> mkdir T3_US_Cornell:/store/user/valya/foo
srm-mkdir srm://osg-se.cac.cornell.edu:8443/srm/v2/server?SFN=/xrootdfs/cms/store/user/valya/foo
Status success

cms-sh|20> ls T3_US_Cornell:/store/user/valya
data: /xrootdfs/cms/store/user/valya
type: directory

data: /xrootdfs/cms/store/user/valya/darren
type: directory

data: /xrootdfs/cms/store/user/valya/foo
type: directory

data: /xrootdfs/cms/store/user/valya/Cosmics
type: directory
```

File copy from/to local disk/SE

```
cms-sh|21> ls
file.root

cms-sh|22> cp file.root T3_US_Cornell:/store/user/valya
Download in progress: 100%
Status success

cms-sh|23> ls T3_US_Cornell:/store/user/valya
data: /xrootdfs/cms/store/user/valya
type: directory

data: /xrootdfs/cms/store/user/valya/darren
type: directory

data: /xrootdfs/cms/store/user/valya/foo
type: directory

bytes: 5490199
data : /xrootdfs/cms/store/user/valya/file.root
type : file

data: /xrootdfs/cms/store/user/valya/Cosmics
type: directory
```

```
cms-sh|24> rm file.root

cms-sh|25> ls

cms-sh|26> cp T3_US_Cornell:/store/user/valya/file.root .
Download in progress: 100%
Status success

cms-sh|27> ls -l
total 5362
-rw-r--r-- 1 valya zh 5490199 Apr 27 17:11 file.root
```

ls, rm, cp work transparently

```
cms-sh|27> ls -l
total 5362
-rw-r--r-- 1 valya zh 5490199 Apr 27 17:11 file.root

cms-sh|28> rm T3_US_Cornell:/xrootdfs/cms/store/user/valya/file.root
Status success

cms-sh|29> ls T3_US_Cornell:/store/user/valya
data: /xrootdfs/cms/store/user/valya
type: directory

data: /xrootdfs/cms/store/user/valya/darren
type: directory

data: /xrootdfs/cms/store/user/valya/foo
type: directory

data: /xrootdfs/cms/store/user/valya/Cosmics
type: directory
```

```
cms-sh|30> cp /store/data/CRUZET3/Cosmics/RAW/v1/000/050/832/186585EC-024D-DD11-B747-000423D94AA8.root T3
_US_Cornell:/store/user/valya
Download in progress: 100%
Status success

cms-sh|31> ls T3_US_Cornell:/store/user/valya
data: /xrootdfs/cms/store/user/valya
type: directory

data: /xrootdfs/cms/store/user/valya/darren
type: directory

data: /xrootdfs/cms/store/user/valya/foo
type: directory

bytes: 5490199
data : /xrootdfs/cms/store/user/valya/186585EC-024D-DD11-B747-000423D94AA8.root
type : file
```

copy in background

```
cms-sh|32> cp /store/data/CRUZET3/Cosmics/RAW/v1/000/050/832/186585EC-024D-DD11-B747-000423D94AA8.root .
&
Status accepted

cms-sh|33> cp /store/data/CRUZET3/Cosmics/RAW/v1/000/050/796/4E1D3610-E64C-DD11-8629-001D09F251FE.root .
&
Status accepted

cms-sh|34> dqueue
In progress: 1 jobs
Waiting    : 1 jobs
Finished   : 0 jobs

cms-sh|35> dqueue list
In progress: 2 jobs
/store/data/CRUZET3/Cosmics/RAW/v1/000/050/796/4E1D3610-E64C-DD11-8629-001D09F251FE.root
/store/data/CRUZET3/Cosmics/RAW/v1/000/050/832/186585EC-024D-DD11-B747-000423D94AA8.root

Waiting    : 0 jobs
Finished   : 0 jobs
```

```
cms-sh|36> dqueue list
In progress: 0 jobs
Waiting    : 0 jobs
Finished   : 2 jobs
/store/data/CRUZET3/Cosmics/RAW/v1/000/050/796/4E1D3610-E64C-DD11-8629-001D09F251FE.root, exit code 0
/store/data/CRUZET3/Cosmics/RAW/v1/000/050/832/186585EC-024D-DD11-B747-000423D94AA8.root, exit code 0

cms-sh|37> ls -l
total 16218
-rw-r--r-- 1 valya zh 5490199 Apr 27 17:15 186585EC-024D-DD11-B747-000423D94AA8.root
-rw-r--r-- 1 valya zh 5625687 Apr 27 17:15 4E1D3610-E64C-DD11-8629-001D09F251FE.root
-rw-r--r-- 1 valya zh 5490199 Apr 27 17:11 file.root
```

Pick release and run your job

```
cms-sh|40> releases

Installed releases:
CMSSW_3_10_0/slc5_amd64_gcc434
CMSSW_3_10_0_pre1/slc5_amd64_gcc434
CMSSW_3_10_0_pre2/slc5_amd64_gcc434
```

```
cms-sh|9> cmsrel CMSSW_5_2_4
CMSSW_5_2_4 is ready, cwd: /afs/cern.ch/work/v/valya/public/CMSSW_5_2_4/src
```

```
cms-sh|41> arch
Current architecture: slc5_amd64_gcc462

Installed architectures:
slc5_amd64_gcc461
slc5_amd64_gcc434
bootstrap_slc5_amd64_gcc434.log
slc5_amd64_gcc451
slc5_amd64_gcc462
slc5_amd64_gcc470
```

```
cms-sh|49> ls
file.root  runevt.py

cms-sh|50> cat runevt.py
import FWCore.ParameterSet.Config as cms
process = cms.Process("Print")
process.source = cms.Source ("PoolSource",
   fileNames=cms.untracked.vstring('file:/afs/cern.ch/work/v/valya/public/CMSSW_5_2_4/src/file.root'))
process.out = cms.OutputModule("AsciiOutputModule")
process.outpath = cms.EndPath(process.out)

cms-sh|51> cmsrun runevt.py
27-Apr-2012 17:20:17 CEST  Initiating request to open file file:/afs/cern.ch/work/v/valya/public/CMSSW_5_
2_4/src/file.root
27-Apr-2012 17:20:18 CEST  Successfully opened file file:/afs/cern.ch/work/v/valya/public/CMSSW_5_2_4/src
/file.root
Begin processing the 1st record. Run 50832, Event 1, LumiSection 1 at 27-Apr-2012 17:20:18.364 CEST
>>> processing event # run: 50832 lumi: 1 event: 1 time: 5220640831140225246
```

Use and program in shell

```
cms-sh|53> info run=160915 | grep -i lumi
DeliveredLumi        : 428248.442318
components           : CASTOR CSC DAQ DCS DQM DT ECAL ES HCAL HFLUMI PIXEL SCAL TRACKER TRG
delivLumi            : 0.4273858
endLumi              : 45.2480583
initLumi             : 51.3312912
liveLumi             : 0.39515411
liveLumiFillBegin    : 640,388.06000000
liveLumiFillEnd      : 1,035,544.00000000
lumiFillBegin        : 826,122.94000000
lumiFillEnd          : 1,236,227.90000000
nLumiSections        : 360
recordedLumi         : 0.39515411
runLiveLumi          : 0.395154
runLumi              : 0.427386
```

```
cms-sh|55> for r in results(): print r.initLumi, type(r.initLumi), r.DeliveredLumi, type(r.DeliveredLumi)
51.3312912 <type 'float'> 428248.442318 <type 'float'>
```

Learn python

```
cms-sh|16> import os
```

```
cms-sh|17> os.walk?
```

```
Type:        function
Base Class: <type 'function'>
String Form:<function walk at 0x1002b87d0>
Namespace:  Interactive
File:        /Users/vk/CMS/test_cmssh/soft/install/lib/python2.6/os.py
Definition: os.walk(top, topdown=True, onerror=None, followlinks=False)
Docstring:
Directory tree generator.

For each directory in the directory tree rooted at top (including top
itself, but excluding '.' and '..'), yields a 3-tuple

    dirpath, dirnames, filenames

dirpath is a string, the path to the directory.  dirnames is a list of
the names of the subdirectories in dirpath (excluding '.' and '..').
filenames is a list of the names of the non-directory files in dirpath.
Note that the names in the lists are just names, with no path components.
To get a full path (which begins with top) to a file or directory in
dirpath, do os.path.join(dirpath, name).

If optional arg 'topdown' is true or not specified, the triple for a
directory is generated before the triples for any of its subdirectories
(directories are generated top down).  If topdown is false, the triple
for a directory is generated after the triples for all of its
subdirectories (directories are generated bottom up).
```

Explore/install python universe with a snap

```
cms-sh|10> pip search simpleyaml
simpleyaml                - YAML parser and emitter for Python

cms-sh|11> pip install simpleyaml
Downloading/unpacking simpleyaml
  Downloading simpleyaml-1.0.tar.gz (140Kb): 140Kb downloaded
  Running setup.py egg_info for package simpleyaml
Installing collected packages: simpleyaml
  Running setup.py install for simpleyaml
Successfully installed simpleyaml
Cleaning up...
```

```
cms-sh|12> s="""
     ....: name: CMS
     ....: type: experiment
     ....: soft: cmssh
     ....: version:
     ....:     - beta
     ....:     - shell
     ....:     """
     ....:
```

```
cms-sh|14> import simpleyaml

cms-sh|15> simpleyaml.load(s)
  Out[15]:
{'name': 'CMS',
 'soft': 'cmssh',
 'type': 'experiment',
 'version': ['beta', 'shell']}
```

Runs equally well on Linux or Mac, cluster or laptop

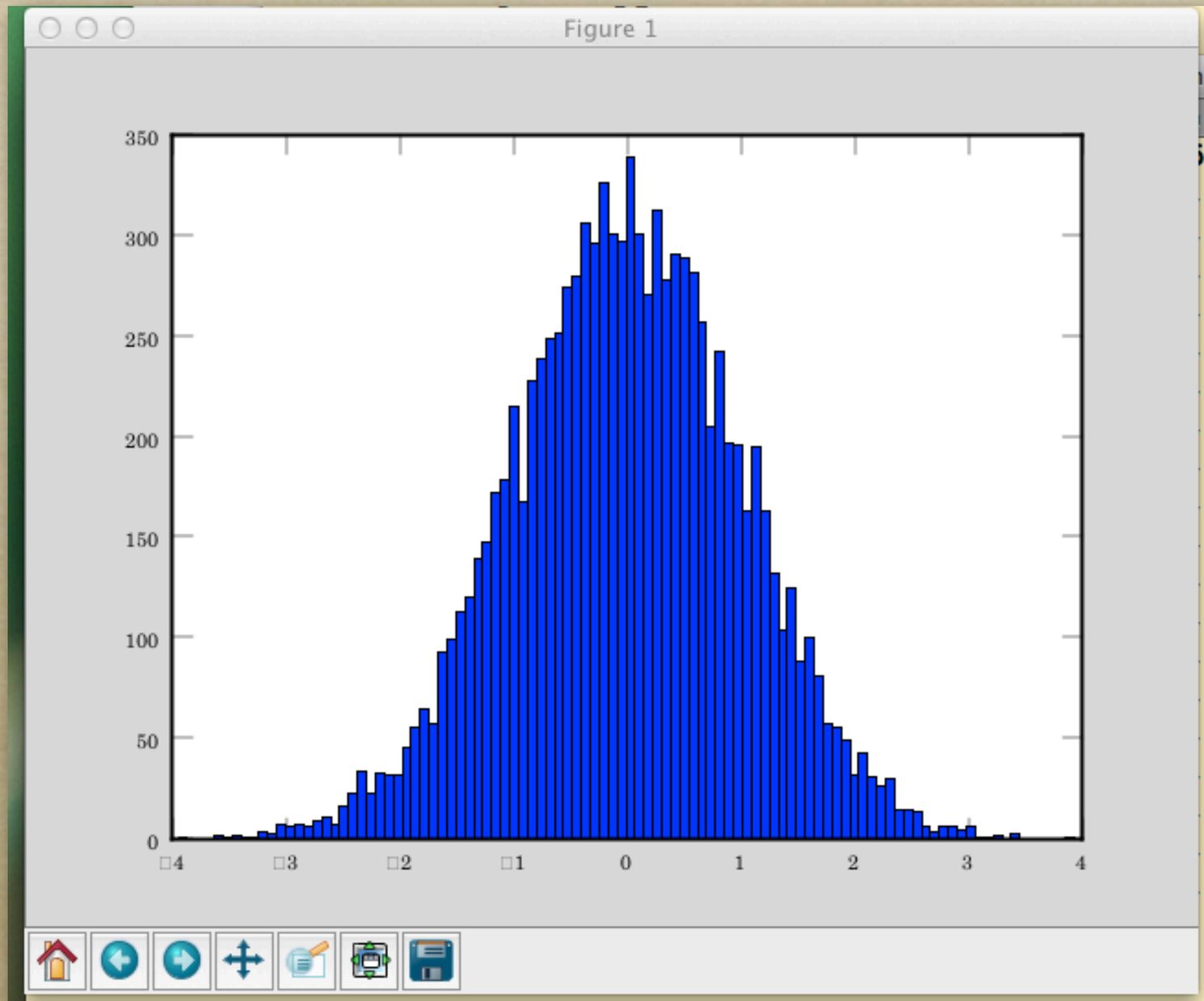
```
cms-sh|1> import os

cms-sh|2> os.uname()
  Out[2]:
('Linux',
 'lxvoadm05.cern.ch',
 '2.6.18-274.12.1.el5',
 '#1 SMP Wed Nov 30 08:57:58 CET 2011',
 'x86_64')
```

```
cms-sh|1> import os

cms-sh|2> os.uname()
  Out[2]:
('Darwin',
 'mr46.lns.cornell.edu',
 '11.3.0',
 'Darwin Kernel Version 11.3.0: Thu Jan 12 18:47:41 PST 2012; root:xnu-1699.24.23~1/RELEASE_X86_64',
 'x86_64')
```

It is python with matplotlib/numpy




```
, -3.64246114,
 -3.22279907,
 -2.803137   ,
 -2.38347493,
 -1.96381286,
 -1.54415079,
 -1.12448872,
 -0.70482665,
 -0.28516457,
  0.1344975 ,
  0.55415957,
  0.97382164,
  1.39348371,
  1.81314578,
  2.23280785,
  2.65246992,
  3.07213199,
  3.49179406,
  3.91145613,
  4.3311182 ,
```

```
cms-sh|7> x = matplotlib.numpy.random.randn(10000)

cms-sh|8> matplotlib.pyplot.hist(x, 100)
  Out[8]:
(array([  1,   0,   0,   0,   2,   1,   2,   1,   1,   4,   3,   7,   6,
         7,   6,   9,  11,   7,  16,  23,  34,  23,  33,  32,  32,  46,
        56,  65,  57,  93,  99, 113, 120, 139, 148, 172, 179, 215, 168,
       228, 239, 249, 252, 274, 280, 306, 296, 326, 301, 297, 339, 301,
       271, 313, 278, 291, 289, 282, 257, 205, 242, 197, 196, 163, 195,
```

Summary

- *cmssh is programmable shell*
  - *based on IPython (numpy, matplotlib are included)*
- *GRID middleware is incorporated*
- *UNIX operations, like ls, cp, rm, mkdir, rmdir, etc. work transparently for local files or LFNs*

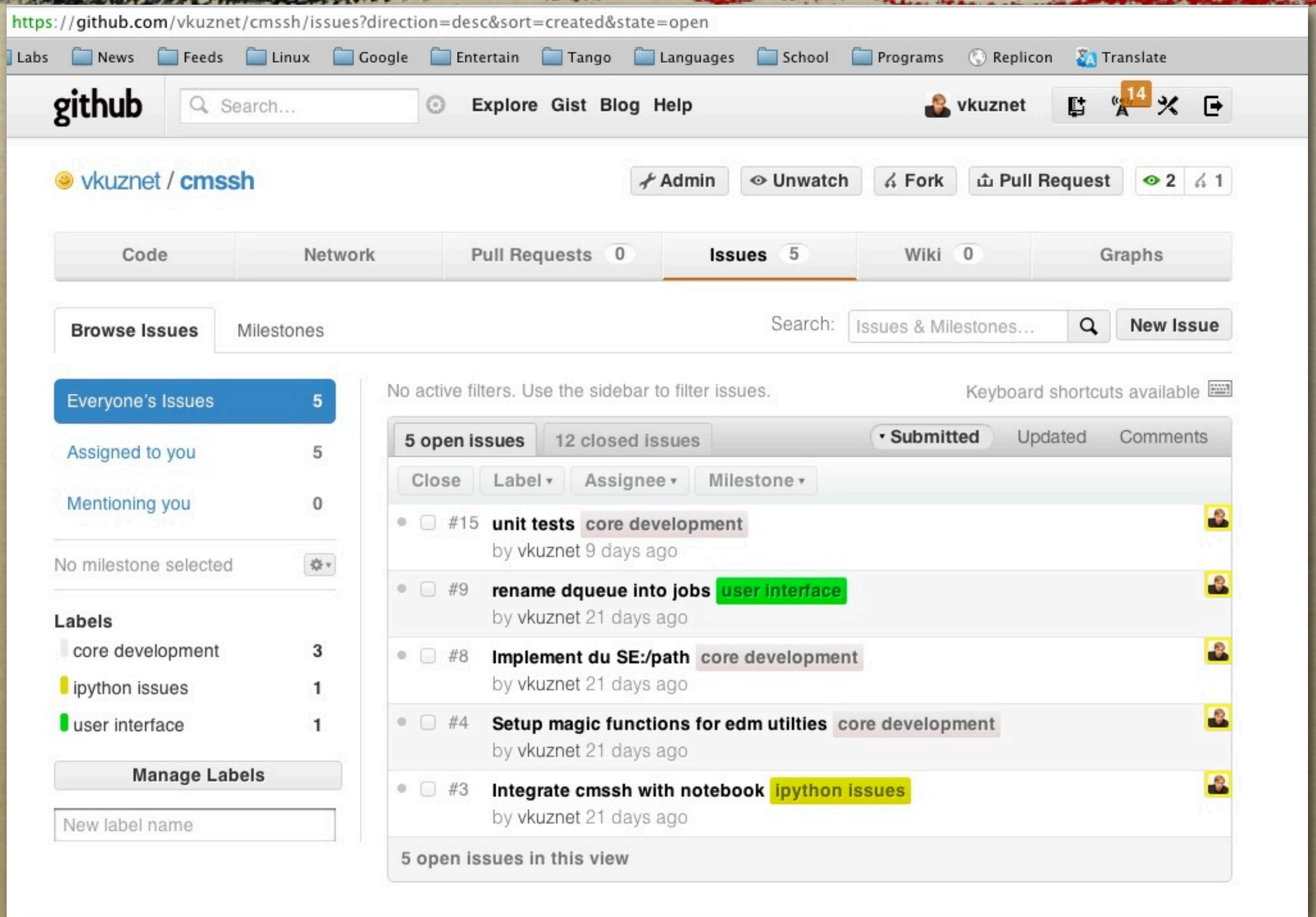
Summary

- *Convenient data discovery*
  - *find, info, das, das_json commands*
- *Simple releases management*
  - *cmssh can use local site setup or install CMSSW on your laptop*
- *It is shell where you can search, run and program*
- *Runs on Linux/Mac/lxplus/laptop....*

Plans

- *Add support for CRAB submission and dashboard monitoring*
- *Deep integration with CMSSW*
  - *edm utils, PAT, etc.*
- *User use cases*
  - *send me your use case and we will find a way to implement it*

Bugs/issues https://github.com/vkuznet/cmssh/issues



Disclaimer

- *Data transfer relies on your network*
  - *its utilization is your responsibility*
- *cmssh relies on many different pieces of software, see* **cmssh/licenences** *for details*
- *cmssh is still in active development phase*
  - *commands, features may likely to evolve*