

cmssh

CMS-aware shell

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Tutorial

- *Do I need cmssh*
- *What is cmssh*
- *How to install cmssh*
- *How to use cmssh as a shell*
- *How to use cmssh as a notebook*

Do I need cmssh?

- *Can you find CMS data from command line?*
- *Can you copy LFN to your destination?*
- *Can you install CMSSW on your laptop (Mac or Linux)*
- *Can you replace your daily operational tasks with single programming language, e.g. python?*
- *Can you bookkeep your activity and share it with your colleagues?*

What is cmssh?

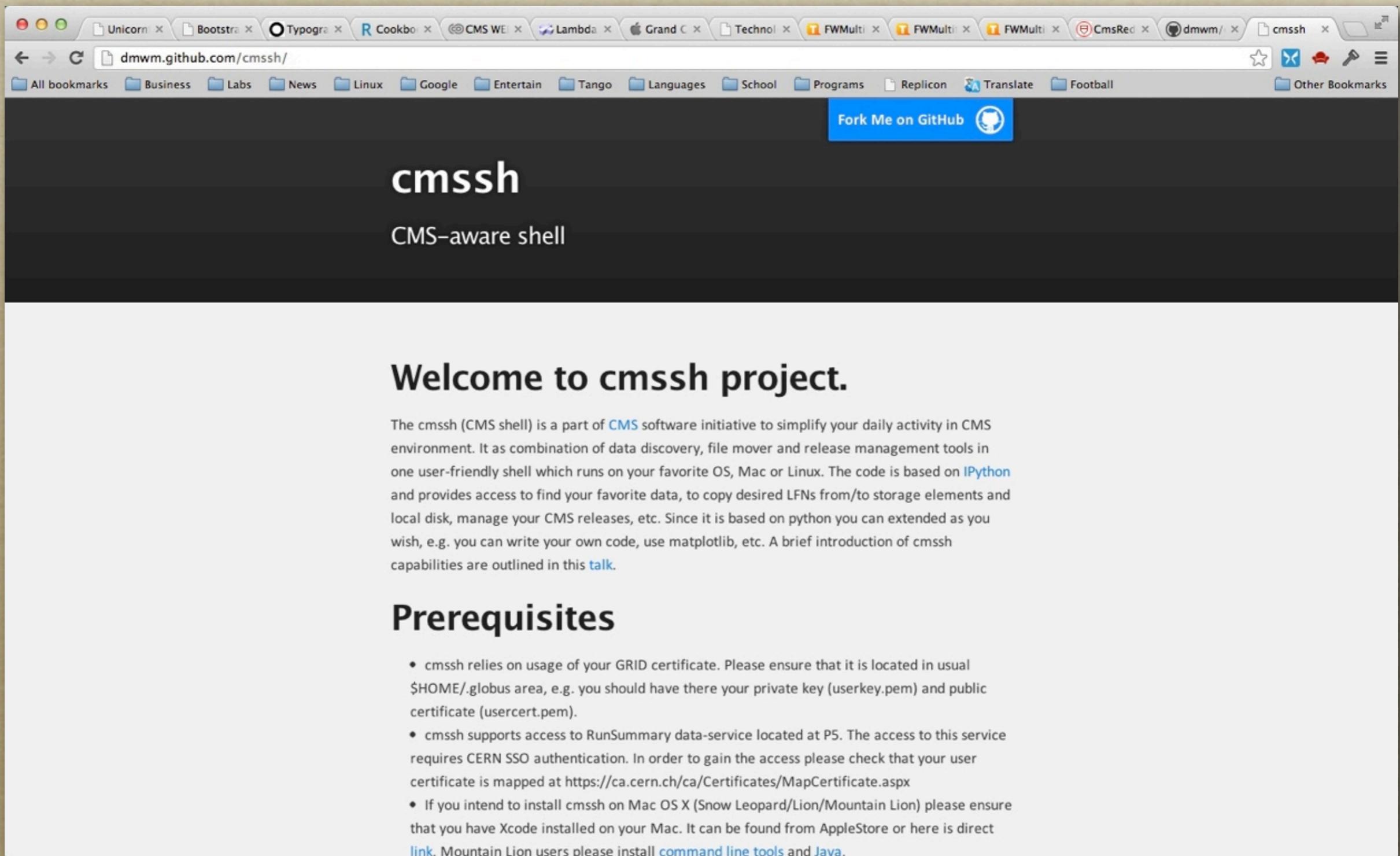
- *Shell environment where you can*
 - *search for CMS data*
 - *copy files to/from SE/local disks*
 - *install and run CMSSW releases*
 - *program your tasks*
 - *perform analysis tasks*
- *Run on Linux/Mac, lxplus or laptop*

Motivation

- *CMS software management is quite complex*
 - *multiple OSes, architectures, releases*
- *Site installation requires a lot of expertise*
 - *laptop installation is left to end-users*
- *Finding data is not that trivial*
 - *Lots of web page crawling*

cmssh project

<http://dmwm.github.com/cmssh/>



The screenshot shows a web browser window with the URL <http://dmwm.github.com/cmssh/> in the address bar. The page title is "cmssh" and the subtitle is "CMS-aware shell". A "Fork Me on GitHub" button is visible. The main content area features a large heading "Welcome to cmssh project." followed by a detailed description of the tool's purpose and capabilities. Below this is a section titled "Prerequisites" with a bulleted list of requirements.

The cmssh (CMS shell) is a part of CMS software initiative to simplify your daily activity in CMS environment. It is a combination of data discovery, file mover and release management tools in one user-friendly shell which runs on your favorite OS, Mac or Linux. The code is based on IPython and provides access to find your favorite data, to copy desired LFNs from/to storage elements and local disk, manage your CMS releases, etc. Since it is based on python you can extend it as you wish, e.g. you can write your own code, use matplotlib, etc. A brief introduction of cmssh capabilities are outlined in this [talk](#).

Prerequisites

- cmssh relies on usage of your GRID certificate. Please ensure that it is located in usual \$HOME/.globus area, e.g. you should have there your private key (userkey.pem) and public certificate (usercert.pem).
- cmssh supports access to RunSummary data-service located at P5. The access to this service requires CERN SSO authentication. In order to gain the access please check that your user certificate is mapped at <https://ca.cern.ch/ca/Certificates/MapCertificate.aspx>
- If you intend to install cmssh on Mac OS X (Snow Leopard/Lion/Mountain Lion) please ensure that you have Xcode installed on your Mac. It can be found from AppleStore or here is direct [link](#). Mountain Lion users please install [command line tools](#) and [Java](#).

Prerequisites

- *Mac OSX: Snow Leopard & (Mountain) Lion*
 - *Xcode required*
- *Linux SLC5 or compatible*
 - *CMSSW releases on other Linux distros require proper set of core libraries*
- *python 2.6 or above for install script*
- *OpenAFS <http://www.openafs.org/> for /afs access on your system (optional)*

Installation

- *Download installer from github*

```
curl -O -k https://raw.githubusercontent.com/dmwm/cmssh/master/cmssh\_install.py
```

- *Stand-alone mode, e.g. Mac laptop*

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

- *Multi-user environment with existing CMSSW area, e.g. lxplus*

```
python26 cmssh_install.py --install --dir=$PWD  
--arch=slc5_amd64_gcc462 --cmssw=/afs/cern.ch/cms  
--multi-user
```

Installation options

```
# 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 cmssh and its dependencies
- u, --upgrade upgrade cmssh
- version=VERSION get specific version of cmssh, e.g. master
- 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

Installation output

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

Quick start

- `/path/soft/bin/cmssh`
 - *will start cmssh, load required CMS dependencies as well as pylab/matplotlib/numpy environment*
- `/path/soft/bin/cmssh notebook`
 - *starts cmssh in notebook mode (browser)*

Demo

- *If you want to try it out please login to lxplus and run the following command:*

`/afs/cern.ch/user/v/valya/workspace/public/soft/bin/cmssh`

- *Disclaimer:*
 - *it is intended for demonstration only*
 - *I can re-install and/or delete cmssh over there at any time*
 - *See install instructions to install it in your area*

```
test_cmssh — python
vk@localhost(15:11:10)> ./soft/bin/cmssh
Welcome to cmssh, master@2012-10-25 20:14:37 GMT
Loading dependencies:..... DONE

cmssh+pylab Python environment [backend: MacOSX] .

Your identity: /DC=org/DC=doegrids/OU=People/CN=Valentin Kuznetsov 357683
Creating temporary proxy Done
Contacting voms.fnal.gov:15015 [/DC=org/DC=doegrids/OU=Services/CN=http/voms.fnal.gov] "cms" Done
Creating proxy Done
Your proxy is valid until Tue Oct 30 03:11:15 2012

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 service
das_json   query DAS and return data in JSON format
jobs      status of job queue or CMS jobs
read      read URL/local file content
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, accepts <list|all> args
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, accept <list|all> args
scram     CMSSW scram command
cmsRun   cmsRun command for release in question

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

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

List cmssh commands : commands
cmssh command help : cmshelp <command>
Install python software: pip <search|(un)install> <package>

cms-sh|1>
```

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')
```

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
```

Deal with DBS instances

```
cms-sh|1> dbs_instance
DBS instance is set to: cms_dbs_prod_global

Available DBS instances:
cms_dbs_prod_global
cms_dbs_caf_analysis_01
cms_dbs_ph_analysis_01
cms_dbs_ph_analysis_02

cms-sh|2> 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|3> dbs_instance cms_dbs_ph_analysis_02
Switch to cms_dbs_ph_analysis_02 DBS instance

Available DBS instances:
cms_dbs_prod_global
cms_dbs_caf_analysis_01
cms_dbs_ph_analysis_01
cms_dbs_ph_analysis_02

cms-sh|4> find dataset=/*Zee_M20*
/Zee_M20_CTEQ66-powheg/mwlebour-EwkElZee-bf4eca3bebb622d8c3d0843e0631d2a9/USER
/Zee_M20_CTEQ66-powheg/Summer10-START36_V9_S09-v1/GEN-SIM-RECO
/Zee_M20_CTEQ66-powheg/Summer10-START36_V9_S09-v1/GEN-SIM-Raw
/Zee_M20_CTEQ66-powheg/Summer09-MC_31X_V3_7TeV-v1/GEN
/Zee_M20_CTEQ66-powheg/Spring10-START3X_V26-v2/GEN-SIM-Raw
```

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
```

Managing user based files (files produced by CRAB and NOT registered in PhEDEx)

```
cms-sh|2> ls /store/user/wteo/HT/ht_run2011a_423_may24/20326b140932d3d385b525b7ba01d6d3/PAT_423_run2011a_ht_may24_3_1_fFq.root
bytes          : 38256137
created        : 2011-05-26 20:28:36 GMT
createdby      : /DC=ch/DC=cern/OU=Organic Units/OU=Users/CN=wteo/CN=678140/CN=Wee Don Teo
dbs_instance   : cms_dbs_ph_analysis_02
logical_file_name: /store/user/wteo/HT/ht_run2011a_423_may24/20326b140932d3d385b525b7ba01d6d3/PAT_423_run2011a_ht_may24_3_1_fFq.root
modified       : 2011-05-26 20:28:36 GMT
modifiedby     : /DC=ch/DC=cern/OU=Organic Units/OU=Users/CN=wteo/CN=678140/CN=Wee Don Teo
nevents        : 748
pfn            : srm://osg-se.cac.cornell.edu:8443/srm/v2/server?SFN=/xrootdfs/cms/store/user/wteo/HT/ht_run2011a_423_may24/20326b140932d3d385b525b7ba01d6d3/PAT_423_run2011a_ht_may24_3_1_fFq.root
se             : osg-se.cac.cornell.edu
size           : 36.5MB

cms-sh|3> cp /store/user/wteo/HT/ht_run2011a_423_may24/20326b140932d3d385b525b7ba01d6d3/PAT_423_run2011a_ht_may24_3_1_fFq.root .
WARNING: No replicas found in PhEDEx, will try to get original SE from DBS
INFO: Original LFN site osg-se.cac.cornell.edu
Download in progress: 100%
STATUS: success

cms-sh|4> ls
PAT_423_run2011a_ht_may24_3_1_fFq.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
drwxr-xr-x owner defaultgroup      0 Fri Jun  1 20:21:45 CEST 2012 .
-rwxr-xr-x owner defaultgroup 5490199 Fri Jun  1 20:21:47 CEST 2012 186585EC-024D-DD11-B747-000423D94AA8.
root
drwxr-xr-x owner defaultgroup      0 Wed Jun  9 22:23:51 CEST 2010 Cosmics
drwxr-xr-x owner defaultgroup      0 Sat May 22 18:20:21 CEST 2010 darren
drwxr-xr-x owner defaultgroup      0 Fri Apr 27 17:08:57 CEST 2012 foo
```

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 https://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/valya/foo
      status=SRM_DUPLICATION_ERROR
      explanation=already exists

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
drwxr-xr-x owner defaultgroup          0 Fri Jun  8 17:01:00 CEST 2012 .
-rw xr-xr-x owner defaultgroup 5490199 Fri Jun  1 20:21:47 CEST 2012 186585EC-024D-DD11-B747-000423D94AA8.
root
drwxr-xr-x owner defaultgroup          0 Wed Jun  9 22:23:51 CEST 2010 Cosmics
drwxr-xr-x owner defaultgroup          0 Sat May 22 18:20:21 CEST 2010 darren
drwxr-xr-x owner defaultgroup          0 Fri Jun  8 17:01:00 CEST 2012 foo
```

File copy from/to local disk/SE

```
cms-sh|21> ls
CMSSW_4_2_8 CMSSW_5_2_0 CMSSW_5_2_4 README cmssh_install.py file.root log soft soft.orig

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
drwxr-xr-x owner defaultgroup          0 Fri Jun  08 17:03:48 CEST 2012 .
-rwxr-xr-x owner defaultgroup 5490199 Fri Jun  01 20:21:47 CEST 2012 186585EC-024D-DD11-B747-000423D94AA8.
root
drwxr-xr-x owner defaultgroup          0 Wed Jun  09 22:23:51 CEST 2010 Cosmics
drwxr-xr-x owner defaultgroup          0 Sat May 22 18:20:21 CEST 2010 darren
-rwxr-xr-x owner defaultgroup 5490199 Fri Jun  08 17:03:51 CEST 2012 file.root
drwxr-xr-x owner defaultgroup          0 Fri Jun  08 17:01:00 CEST 2012 foo

cms-sh|24> rm file.root

cms-sh|25> ls
CMSSW_4_2_8 CMSSW_5_2_0 CMSSW_5_2_4 README cmssh_install.py log soft soft.orig

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

STATUS: success

cms-sh|27> ls -l
total 5413
drwxr-xr-x 15 valya zh    2048 May  9 17:15 CMSSW_4_2_8
drwxr-xr-x 15 valya zh    2048 May  3 22:34 CMSSW_5_2_0
drwxr-xr-x 15 valya zh    2048 Apr 27 17:04 CMSSW_5_2_4
-rw-r--r--  1 valya zh     181 Apr 25 20:20 README
-rwxr-xr-x  1 valya zh   30615 Jun  8 16:16 cmssh_install.py
-rw-r--r--  1 valya zh 5490199 Jun  8 17:05 file.root
-rw-r--r--  1 valya zh    5375 Jun  8 16:23 log
drwxr-xr-x 15 valya zh   4096 Jun  8 16:23 soft
drwxr-xr-x 15 valya zh   4096 May 28 23:25 soft.orig
```

ls, rm, cp work transparently

```
cms-sh|27> ls -l
total 5413
drwxr-xr-x 15 valya zh    2048 May   9 17:15 CMSSW_4_2_8
drwxr-xr-x 15 valya zh    2048 May   3 22:34 CMSSW_5_2_0
drwxr-xr-x 15 valya zh    2048 Apr  27 17:04 CMSSW_5_2_4
-rw-r--r--  1 valya zh     181 Apr  25 20:20 README
-rwxr-xr-x  1 valya zh  30615 Jun   8 16:16 cmssh_install.py
-rw-r--r--  1 valya zh 5490199 Jun   8 17:05 file.root
-rw-r--r--  1 valya zh   5375 Jun   8 16:23 log
drwxr-xr-x 15 valya zh    4096 Jun   8 16:23 soft
drwxr-xr-x 15 valya zh    4096 May  28 23:25 soft.orig
```

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

STATUS: success

```
cms-sh|29> ls T3_US_Cornell:/store/user/valya
drwxr-xr-x owner defaultgroup      0 Fri Jun  8 17:09:12 CEST 2012 .
-rwxr-xr-x owner defaultgroup 5490199 Fri Jun  1 20:21:47 CEST 2012 186585EC-024D-DD11-B747-000423D94AA8.
root
drwxr-xr-x owner defaultgroup      0 Wed Jun  9 22:23:51 CEST 2010 Cosmics
drwxr-xr-x owner defaultgroup      0 Sat May 22 18:20:21 CEST 2010 darren
drwxr-xr-x owner defaultgroup      0 Fri Jun  8 17:01:00 CEST 2012 foo
```

```
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
drwxr-xr-x owner defaultgroup      0 Fri Jun  8 17:09:12 CEST 2012 .
-rwxr-xr-x owner defaultgroup 5490199 Fri Jun  1 20:21:47 CEST 2012 186585EC-024D-DD11-B747-000423D94AA8.
root
drwxr-xr-x owner defaultgroup      0 Wed Jun  9 22:23:51 CEST 2010 Cosmics
drwxr-xr-x owner defaultgroup      0 Sat May 22 18:20:21 CEST 2010 darren
drwxr-xr-x owner defaultgroup      0 Fri Jun  8 17:01:00 CEST 2012 foo
```

copy in background

```
cms-sh|4> cp /store/data/CRUZET3/Cosmics/Raw/v1/000/050/832/186585EC-024D-DD11-B747-000423D94AA8.root . &
STATUS: accepted

cms-sh|5> cp /store/data/CRUZET3/Cosmics/Raw/v1/000/050/796/4E1D3610-E64C-DD11-8629-001D09F251FE.root . &
STATUS: accepted

cms-sh|6> jobs

INFO: Local data transfer
In progress: 0 jobs
Waiting      : 2 jobs
Finished     : 0 jobs
```

```
cms-sh|7> jobs list

INFO: Local data transfer
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|8> jobs list

INFO: Local data transfer
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|9> ls
186585EC-024D-DD11-B747-000423D94AA8.root
4E1D3610-E64C-DD11-8629-001D09F251FE.root
smash_notebook.ipynb
```

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
```

Query DAS

```
cms-sh|10> das dataset=/ZMM*
/ZMM_14TeV/Summer12-DESIGN42_V17_SLHCTk-v1/GEN-SIM
/ZMM/Summer11-DESIGN42_V11_428_SLHC1-v1/GEN-SIM

cms-sh|11> das_json dataset=/ZMM*
{u'ctime': 0.0463128,
 u'data': [{u'_id': u'505a1b3b0ec3dc11f71d0321',
            u'cache_id': [u'505a1b3b0ec3dc11f71d031f'],
            u'das': {u'condition_keys': [u'dataset.name'],
                     u'empty_record': 0,
                     u'expire': 1348086091.115351,
                     u'instance': u'cms_dbs_prod_global',
                     u'primary_key': u'dataset.name',
                     u'system': [u'dbs'],
                     u'ts': 1348082491.599345},
            u'das_id': [u'505a1b3b0ec3dc11f71d031d'],
            u'dataset': [{u'created_by': u'/DC=ch/DC=cern/OU=computers/CN=wmagent/vocms216.cern.ch',
                         u'creation_time': u'2012-02-24 01:40:40',
                         u'datatype': u'mc',
                         u'modification_time': u'2012-02-29 21:25:52',
                         u'modified_by': u'/DC=org/DC=doegrids/OU=People/CN=Alan Malta Rodrigues 4861',
                         u'name': u'/ZMM_14TeV/Summer12-DESIGN42_V17_SLHCTk-v1/GEN-SIM',
                         u'nblocks': 4,
                         u'nevents': 10616,
                         u'nfiles': 4,
                         u'size': 6271126523,
                         u'status': u'VALID',
                         u'tag': u'DESIGN42_V17::All'}],
            u'qhash': u'9b53de29b94aadb283d1e435f17a98b6'}},
```

Find out integrated luminosity

```
cms-sh|1> lumi dataset=/Photon/Run2012A-29Jun2012-v1/AOD
Delivered luminosity 187.934708373 (/pb)
Delivered luminosity wrt CMS JSON: 131.639337747 (/pb)

cms-sh|2> lumi block=/Photon/Run2012A-29Jun2012-v1/AOD#3e33ce8e-c44d-11e1-9a26-003048f0e1c6
Delivered luminosity 527.818700379 (/nb)
Delivered luminosity wrt CMS JSON: 507.171898805 (/nb)

cms-sh|3> lumi file=/store/data/Run2012A/Photon/AOD/29Jun2012-v1/0000/001B241C-ADC3-E111-BD1D-001E673971C
A.root
Delivered luminosity 122.911397778 (/nb)
Delivered luminosity wrt CMS JSON: 104.420625653 (/nb)

cms-sh|4> lumi run=190704
Delivered luminosity 25.1459988775 (/nb)
Delivered luminosity wrt CMS JSON: 25.1459988775 (/nb)

cms-sh|5> lumi {190704:[1,2,3,4], 201706:[1,2,3,67]}
Delivered luminosity 140.040383831 (/nb)
Delivered luminosity wrt CMS JSON: 106.18159916 (/nb)
```

CRAB support

- *cmssh supports crab command*
 - *under Linux it is done natively*
 - *under Mac cmssh will tar your area and submit it via lxplus (this is required since worker nodes run Linux OS)*

Use python 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'>
```

```
cms-sh|2> arr = [i for i in range(0,10)]
cms-sh|3> for element in arr:
...:     print element
...:
0
1
2
3
4
5
6
7
8
9

cms-sh|4>
```

```
def test():
    ...:     "My test function"
    ...:     return "Hello world!"
    ...:

test()
Out[5]: 'Hello world!'

test?
Type:     function
Base Class: <type 'function'>
String Form:<function test at 0x105ed2500>
Namespace: Interactive
File:     /Users/vk/CMS/test_cmssh/<ipython-input-4-bf89f3100b48>
Definition: test()
Docstring: My test function

cms-sh|7>
```

Useful commands

- *cmssh help*

```
cmssh> cmshelp ls
```

- *Python help*

```
cmssh> help(os)
```

- *Exit cmssh shell*

```
cmssh> exit
```

Useful commands

Access python documentation, source code and modules, e.g

```
cmssh> import json
```

```
cmssh> json? # will show module documentation
```

```
cmssh> json?? # will show module source code
```

Tabbing is supported for python modules, e.g.

```
cmssh> json.<tab> # show members of json module
```

```
json.JSONDecoder  json.decoder
```

```
json.scanner
```

```
json.dumps
```

```
json.load
```

```
json.JSONEncoder  json.dump
```

```
json.encoder
```

```
json.loads
```

More fun (IPython tricks)

```
cmssh> edit      # start coding in your editor  
cmssh> edit -p # start coding where you left  
cmssh> !cmd      # invoke cmd in plain UNIX shell, e.g. ls  
cmssh> r=!ls     # store results from UNIX ls command into r  
cmssh> history -n # show numbered commands history  
cmssh> _iN        # invoke N-th input  
cmssh> _N         # invoke N-th output  
cmssh> rerun N-M  # rerun command N through M
```

- *There are plenty of other useful commands at your disposal which can be checked out from IPython documentation*

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).

Learn code

```
cms-sh|21> pwd  
Out[21]: u'/Users/vk/CMS/cmssh/ttt'
```

```
cms-sh|22> ls  
repo.py
```

```
cms-sh|23> import repo
```

```
cms-sh|24> repo??
```

```
Type: module  
String Form:<module 'repo' from 'repo.py'>  
File: /Users/vk/CMS/cmssh/ttt/repo.py  
Source:  
#!/usr/bin/env python  
#-*- coding: ISO-8859-1 -*-  
"""  
File: repo.py  
Author: Valentin Kuznetsov <vkuznet@gmail.com>  
Description:  
"""  
  
# system modules  
import os  
import sys  
import urllib  
import urllib2  
import re  
  
def root_rpms(arch='osx106_amd64_gcc461'):  
    "Fetch available ROOT RPMS"  
    pat = re.compile('.*lcg\+root\+[5-9].*')  
    url = 'http://cmsrep.cern.ch/cmssw/cms/RPMS/%s/' % arch  
    data = urllib2.urlopen(url)  
    drivers = []  
    for line in data.readlines():  
        if pat.match(line):  
            line = line.split('</a>')[0].split('>')[-1]  
            print line.replace('.%s.rpm' % arch, '')
```

Magic functions (real power)

```
cms-sh|25> lsmagic
Available line magics:
%alias %alias_magic %apt %arch %autocall %autoindent %automagic %bookmark %cd %chmod %cmsRun %
%cmsenv %cmshelp %cmsrel %cmsrun %colors %config %cp %cpaste %crab %cvs %das %das_json %dbs_in-
stance %debug %debug_http %dhist %dirs %doctest_mode %dqueue %du %echo %ed %edit %env %find %
%git %grep %gui %hist %history %info %install %install_default_config %install_ext %install_profiles %
%kdestroy %killbgscripts %kinit %klist %load %load_ext %loadpy %logoff %logon %logstart %
%logstate %logstop %ls %lsmagic %macro %magic %mkdir %notebook %page %paste %pastebin %pdb %pd-
ef %pdoc %pfile %pinfo %pinfo2 %pip %popd %pprint %precision %profile %prun %psearch %psource %
%pushd %pwd %pycat %pylab %python %quickref %recall %rehashx %releases %reload_ext %rep %rerun %
%reset %reset_selective %rm %rmdir %root %run %save %sc %scram %ssh %store %svn %sx %sys-
tem %tail %tar %tb %ticket %tickets %time %timeit %unalias %unload_ext %verbose %vim %vomsinf-
o %vomsinit %who %who_ls %whos %xdel %xmode %xrdfcp %zip

Available cell magics:
%%! %%bash %%capture %%file %%perl %%prun %%script %%sh %%sx %%system %%timeit

Automagic is ON, % prefix IS NOT needed for line magics.
```

```
cms-sh|15> %%
.....: hostname -f
.....: ssh lxplus.cern.ch "hostname -f"
.....: pwd
.....: ls | wc
.....
Out[15]:
['dastest.cern.ch',
 'lxplus407.cern.ch',
 '/afs/cern.ch/user/v/valya/workspace/public',
 ' 12      12     157']
```

cms-sh|16>

Run cell magic function which executes series of bash commands and returns results back to cms-sh

Python 3d party packages

- *Within cmssh you can easily search and install any python 3d party packages*
 - *no need to ask for admin privileges to install your favorite python package*
- *Full access to PyPI (the Python Package Index, <http://pypi.python.org/pypi>)*

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
....:
....:
```

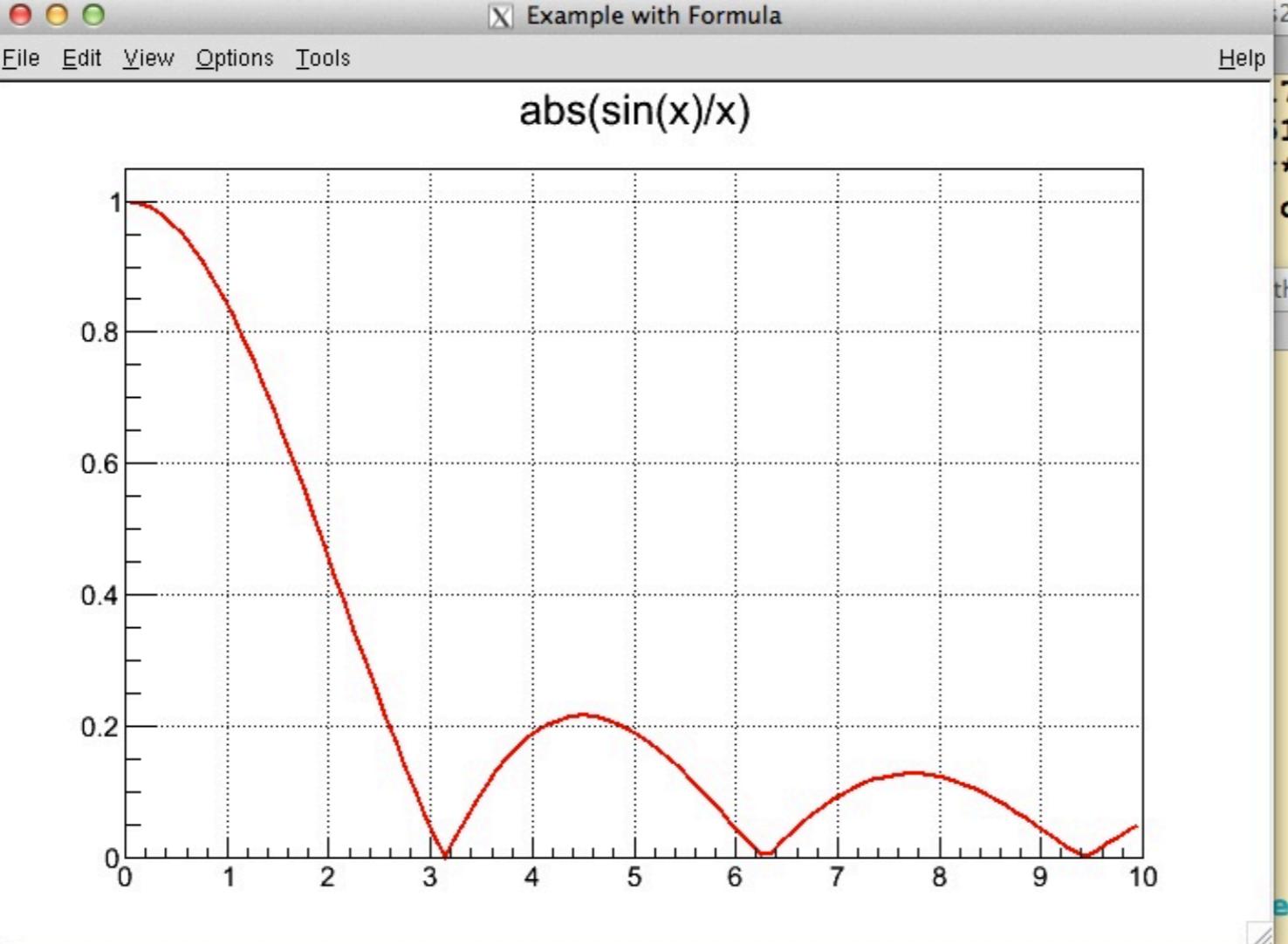
```
cms-sh|14> import simpleyaml

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

cmssh is suitable for analysis

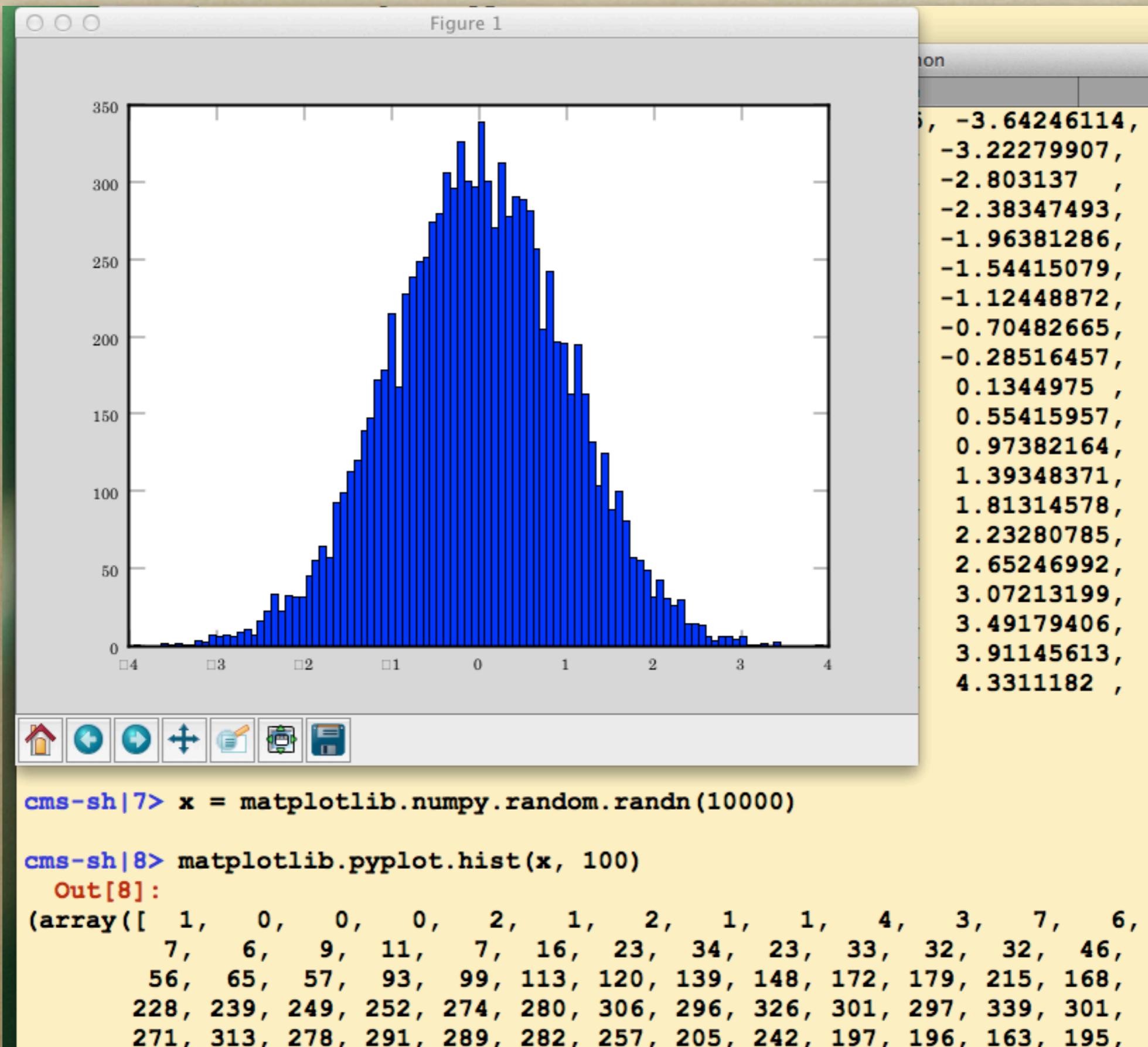
- *cmssh will install python ROOT module and you can easily access your ROOT files from the shell, but it can do more*
- *Installation comes with numpy & matplotlib libraries*
 - *install OSX friendly versions*
 - *Need statistical tools, look at python data analysis library, e.g. pip install pandas*

Access ROOT from cmssh



```
File Edit View Options Tools Help
abs(sin(x)/x)
70
1-32.twcny.res.rr.co
*****computing rules.
thon
e>
cms-sh|1> from ROOT import gROOT, TCanvas, TF1
(Bool_t)1
cms-sh|2> gROOT.Reset()
cms-sh|3> c1 = TCanvas( 'c1', 'Example with Formula', 200, 10, 700, 500 )
cms-sh|4> fun1 = TF1( 'fun1', 'abs(sin(x)/x)', 0, 10 )
cms-sh|5> c1.SetGridx()
cms-sh|6> c1.SetGridy()
cms-sh|7> fun1.Draw()
cms-sh|8> c1.Update()
```

Access matplotlib/numpy libraries



cmssh notebook

IP[y]: Notebook cmsssh notebook Last saved: Jul 05 10:49 AM

File Edit View Insert Cell Kernel Help

Code

In [2]: `plt.plot(x, y, 'ro-')`

Out[2]: [`<matplotlib.lines.Line2D at 0x108434610>`]

A line plot showing a red line with circular markers connecting points (2.0, 20), (3.0, 30), and (4.0, 40). The x-axis ranges from 1.0 to 5.0 with ticks every 0.5 units. The y-axis ranges from 10 to 50 with ticks every 5 units.

x	y
2.0	20
3.0	30
4.0	40

Look-up CMS LFN

```
In [3]: ls /store/data/CRUZET3/Cosmics/RAW/v1/000/050/832/186585EC-024D-DD11-B747-000423D94AA8.root

bytes          : 5490199
created        : 2008-07-09 11:24:52 GMT
createdby      : /DC=ch/DC=cern/OU=computers/CN=vocms39.cern.ch
logical_file_name: /store/data/CRUZET3/Cosmics/RAW/v1/000/050/832/186585EC-024D-DD11-B747-000423D94AA8.root
modified       : 2009-04-16 19:19:14 GMT
modifiedby     : /DC=ch/DC=cern/OU=computers/CN=vocms39.cern.ch
nevents        : 130
pfn            : srm://ccsrm.in2p3.fr:8443/srm/managerv2?SFN=/pnfs/in2p3.fr/data/cms/data/store/data/CRUZET3/Cosmics/RAW/v1/000/050/832/186585EC-024D-DD11-B747-
000423D94AA8.root, srm://srm-cms.cern.ch:8443/srm/managerv2?SFN=/castor/cern.ch/cms/store/data/CRUZET3/Cosmics/RAW/v1/000/050/832/186585EC-024D-DD11-B747-
000423D94AA8.root
se              : ccsrm.in2p3.fr, srm-cms.cern.ch
size           : 5.2MB
stale          : 2.5MB
age            : 00:00:00.000000000
root           : 000423D94AA8.root
```

Learn more about notebook mode

<http://www.youtube.com/watch?v=HaS4NXxL5Qc>

Bugs/issues

<https://github.com/vkuznet/cmssh/issues>

The screenshot shows the GitHub Issues page for the repository `vkuznet/cmssh`. The URL in the address bar is <https://github.com/vkuznet/cmssh/issues?direction=desc&sort=created&state=open>. The page title is "vkuznet / cmssh". The navigation bar includes links for Labs, News, Feeds, Linux, Google, Entertain, Tango, Languages, School, Programs, Replicon, and Translate. The user profile for `vkuznet` is shown with 14 notifications. The main navigation tabs are Code, Network, Pull Requests (0), Issues (5, highlighted), Wiki (0), and Graphs. Below the tabs, there are buttons for Admin, Unwatch, Fork, Pull Request, and metrics (2 issues, 1 pull request). The sidebar on the left shows filters for Browse Issues (selected) and Milestones, and lists Everyone's Issues (5), Assigned to you (5), Mentioning you (0), and No milestone selected. It also shows Labels: core development (3), ipython issues (1), and user interface (1), with a Manage Labels button. A search bar at the top right allows filtering by Issues & Milestones... and a New Issue button. The main content area displays 5 open issues, each with a title, description, and author. The issues are:

- #15 unit tests core development by vkuznet 9 days ago
- #9 rename dqueue into jobs user interface by vkuznet 21 days ago
- #8 Implement du SE:/path core development by vkuznet 21 days ago
- #4 Setup magic functions for edm utilities core development by vkuznet 21 days ago
- #3 Integrate cmssh with notebook ipython issues by vkuznet 21 days ago

At the bottom of the issue list, it says "5 open issues in this view".

Caveats

- *This project relies on CMSSW software stack*
 - *we’re always behind newest distributions*
 - *Xcode is required on Mac OSX to provide dev environment, e.g. make*
 - *Linux distributions other than SLC may not work out of the box (but with your cooperation it can be done)*

Summary

- *cmssh is programmable shell*
 - *based on IPython (worth to learn besides cmssh)*
- *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 may install CMSSW on your laptop*
- *You can search CMS data, run CMSSW and program in python in shell environment*
- *Runs on Linux/Mac/lxplus/laptop....*

Plans

- Add support for CRAB Mac OSX 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



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*

Final words

- *It is a pilot project, but*
- *If you like it, it can grow into official project*
- *If you need to run it on specific distribution, file
github issue ticket and provide details of your
distribution*
- *I need to install VM with your OS and fix
outstanding problems*