



A lightweight task submission and management infrastructure

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Experiments n IHEP

❖ Current experiments

- BESIII
- DYB
- YBJ

❖ New experiments

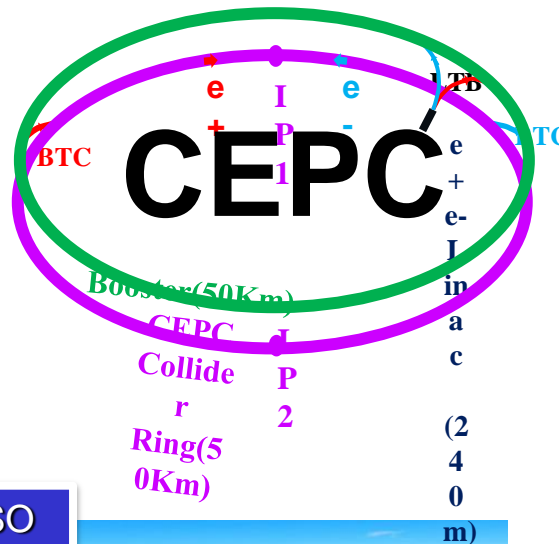
- JUNO
- LHAASO
- HXMT
- CEPC

BESIII

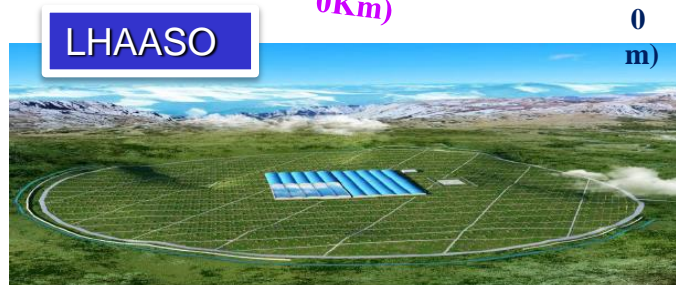
BESIII (Beijing Spectrometer III at BEPCII)



DYB (Daya Bay Reactor Neutrino Experiment)



JUNO (Jiangmen Underground Neutrino Observatory)



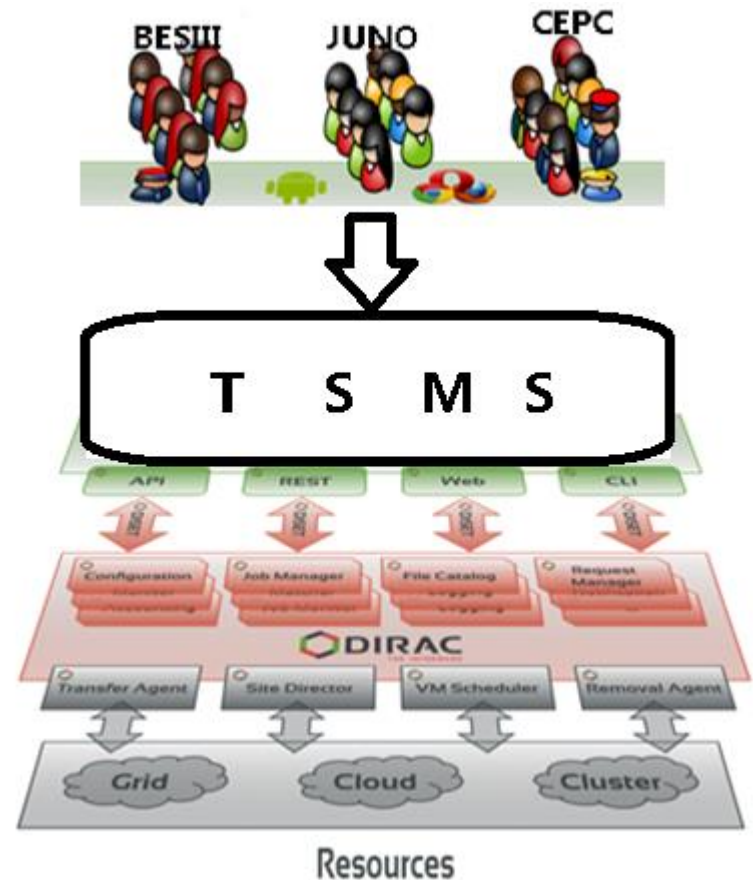
Large High Altitude Air Shower Observatory



Hard X-Ray Moderate Telescope

Multi-VO distributed computing

- ❖ More than one experiments express interests on using or evaluating distributed computing resources
- ❖ DIRAC was adopted to build distributed computing system for BESIII in 2012
- ❖ Multi-VO supports has been extended in one set-up to run JUNO and CEPC jobs
- ❖ Task Submission and Management System (TSMS) is one of the necessary steps for new experiments to have a try and use in their early stages



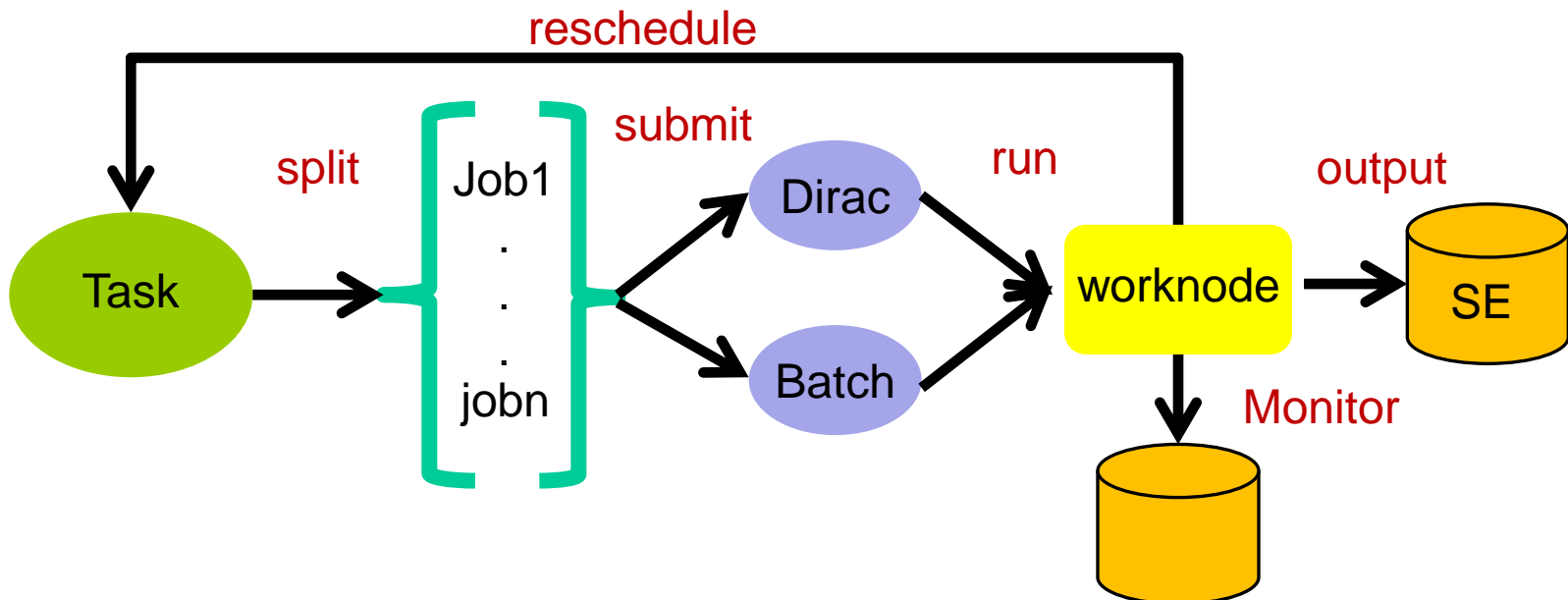
JSUB

❖ Goals:

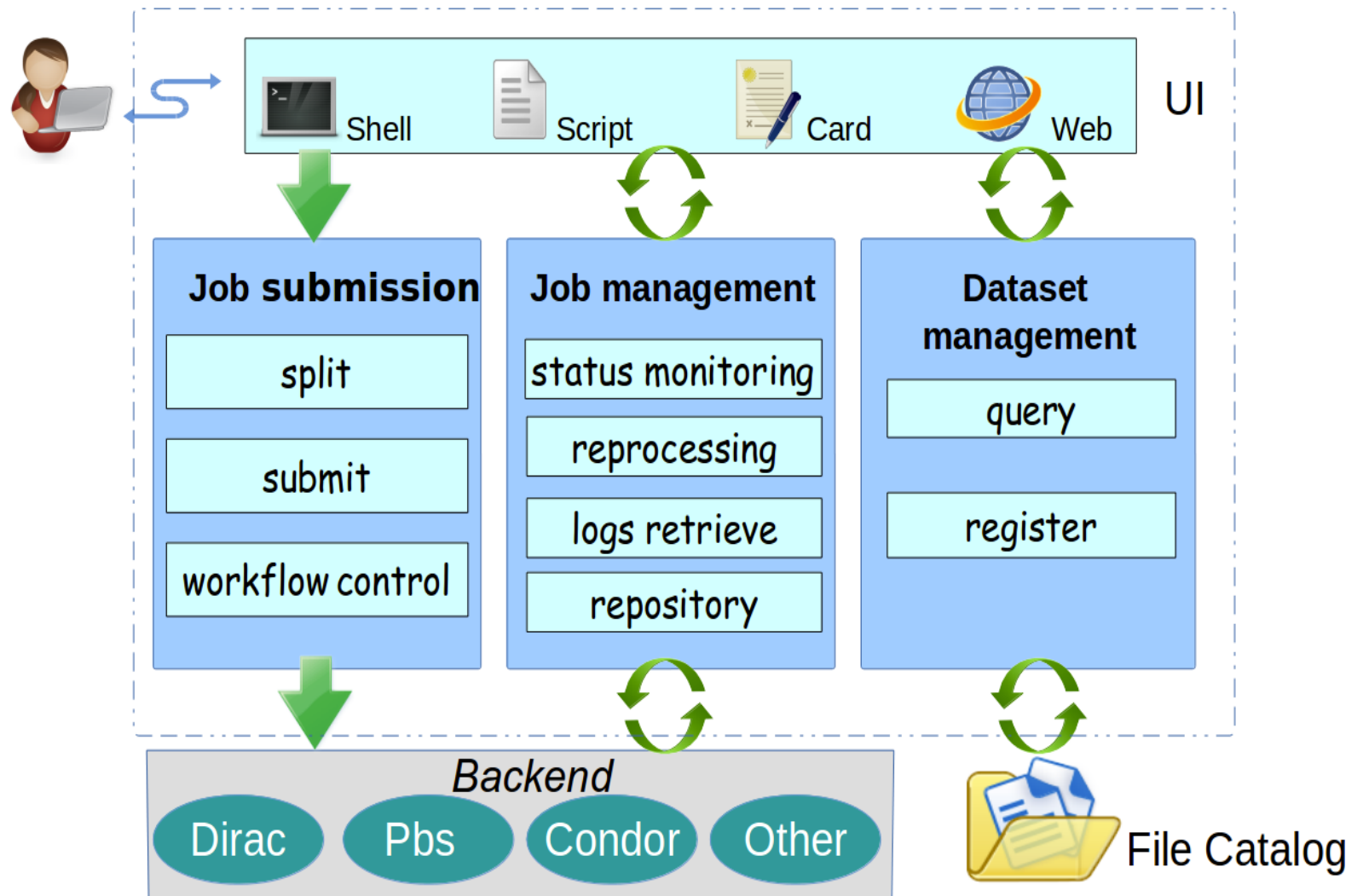
- Automatically manage massive jobs
- Highly extensible for new experiments
- Ease the procedure to use heterogeneous resources

❖ Life cycle of a task (a batch of jobs in one submission)

- split->submit->run->status monitor->output retrieval -> reschedule



JSUB Architecture



User Interface

- ❖ YAML used to describe tasks
 - simple, clear, friendly with python
 - Data transformed into tree-like dictionary
- ❖ Shell commands are provided

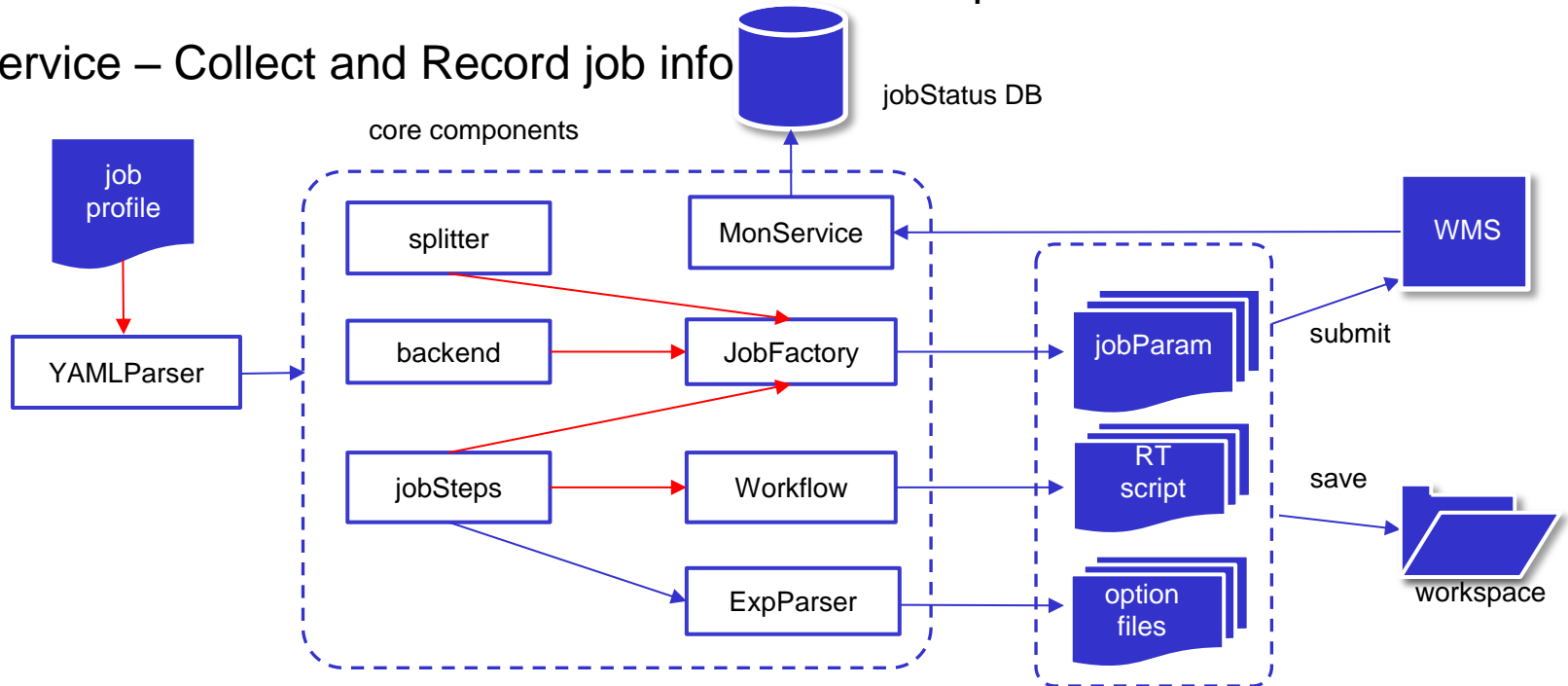
```
Country:
  Name: Liechtenstein
  Rank: 1
  Year: 2008
  Gdp: 141100
  Neighbor:
    - Name: Austria
      Direction: E
    - Name: Switzerland
      Direction: W
```

```
-bash-3.2$ ls -l
jsub_remove
jsub_resubmit
jsub_status
jsub_submit
-bash-3.2$ jsub_submit -h
usage: jsub_submit <options> <job profile>
options:
  -h    show the help information
  -v    show JSUB version
job profile: the file where the parameters of master job are defined

-bash-3.2$ jsub_status -h
usage: jsub_status <options> <target>
options:
  -h    show the help information
  -v    show JSUB version
  -all  show the status of all the jobs the user ever submitted
target: could be JobID, JobGroup
```

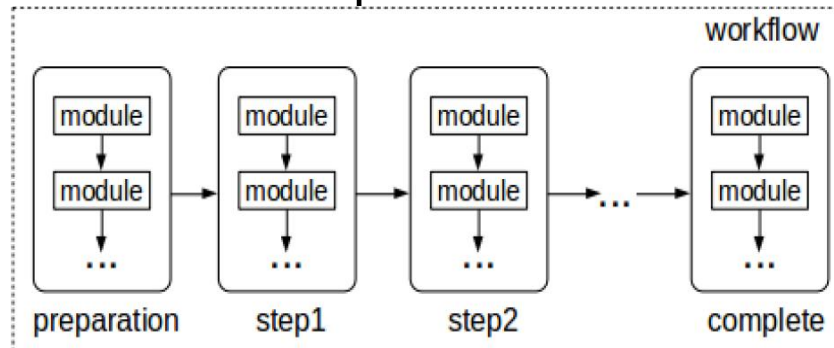
Job Split and Submit

- ❖ YAMLParser
- ❖ Splitter -- Split jobs with various way
- ❖ JobFactory -- Collect Job related parameters to generate Job submission scripts
- ❖ ExpParser -- Get runtime card or options for applications execution
- ❖ Workflow -- Define runtime workflow to create RT scripts
- ❖ MonService -- Collect and Record job info



Workflow control

- ❖ Adopt ideas from “DIRAC workflow”
 - Highly extensible and reusable
- ❖ Classes for organizing run-time operations
 - Workflow
 - Step
 - Group of modules to complete a process, eg. preparation, simulation, reconstruction, complete
 - Module
 - Basic units for one operation or command, eg. checkenv



Task monitor and management(1)

- ❖ TaskId uniquely identify the task, created after submitted
- ❖ Tasks can be monitored and controlled both through commands and web portal (next slide)
 - Jsub_list, list all the tasks and the status
 - Jsub_status <taskId>, show task progress and information
 - Jsub_resubmit <taskId>, reschedule all or failed jobs
 - Jsub_remove <taskId>, delete the whole task
- ❖ Detailed task info collected from each stage of task processing
 - Physicists can easily track down specific task



Name	Value
BossVersion	6.6.4.p02
CustomPackage	True
Dataset	User_zhanglei_3770_664p02_eff_r...
DecayCard	dd.dec
EventMax	10000
EventType	eff
GangaID	6
JobOptionAna	/besfs/groups/psipp/psippgroup/pub ...
JobOptionRec	/besfs/groups/psipp/psippgroup/pub ...
JobOptionSim	/besfs/groups/psipp/psippgroup/pub ...
JobType	sim + rec + ana
LocalRandomTrigger	True
OutputDirectory	/bes/user/z/zhanglei/File/3770/664...
OutputStep	ana
Platform	x86_64-slc5-gcc43-opt
RealTotalEventNum	2998216
Resonance	3770
Round	round03
RunFrom	11414
RunTo	23454
SE	IHEPD-USER
SeedStart	5000
SplitterType	UserSplitterByRun
StreamID	stream036
TotalEventNum	3000000

Task monitor and management(2)

Selectors

Status:

Ready Processing x NOT v

Finished Expired

Init

Owner:

OwnerGroup:

Time Span:

From:

To:

Reset Time Panel

TaskID(s):

Items per page: 25 Page 1 of 2 Updated: - Displaying topics 1 - 25 of 37

TaskId	TaskName	Status	Jobs	Progress (D F R W O)	CreationTime[UTC]	UpdateTime[UTC]	Site	
<input type="checkbox"/>	41	aws_test_c3	Processing	43/43	0 0 17 26 0	2015-06-01 02:09:59	2015-06-01 03:24:45	CLOUD.AWS.cn
<input type="checkbox"/>	40	aws_test_m3	Finished	43/43	34 9 0 0 0	2015-05-31 06:34:33	2015-06-01 03:24:45	CLOUD.AWS.cn
<input type="checkbox"/>	39	aws_test_c3	Finished	23/23	20 3 0 0 0	2015-05-29 03:42:35	2015-06-01 03:24:45	CLOUD.AWS.cn
<input type="checkbox"/>	38	aws_test	Finished	1/1	1 0 0 0 0	2015-05-26 04:43:41	2015-06-01 03:24:45	CLOUD.AWS.cn
<input type="checkbox"/>	37	aws_test	Expired	0/4	0 0 0 0 4	2015-05-26 04:42:23	2015-05-26 04:44:29	CLOUD.AWS.cn
<input type="checkbox"/>	34	aws_test_c3	Finished					
<input type="checkbox"/>	33	aws_test_c3	Finished					
<input type="checkbox"/>	31	aws_test_m3	Expired					
<input type="checkbox"/>	30	aws_test_m3	Expired					
<input type="checkbox"/>	29	aws_test_m3	Expired					
<input type="checkbox"/>	28	sra_rhopi	Expired					
<input type="checkbox"/>	27	aws_test_t2	Expired					
<input type="checkbox"/>	26	aws_test_t2	Expired					
<input type="checkbox"/>	25	sra_rhopi	Expired					
<input type="checkbox"/>	24	sra_rhopi	Expired					
<input type="checkbox"/>	23	sra_rhopi	Expired	0/13	0 0 0 0 13			
<input type="checkbox"/>	22	sra_rhopi	Expired	0/13	0 0 0 0 13			
<input type="checkbox"/>	21	sra_rhopi	Expired	0/0	0 0 0 0 0			
<input type="checkbox"/>	20	sra_rhopi	Expired	0/6	0 0 0 0 6			
<input type="checkbox"/>	19	sra_rhopi	Expired	0/6	0 0 0 0 6			
<input type="checkbox"/>	18	sra_rhopi	Expired	0/6	0 0 0 0 6	2015-05-07 05:13:43	2015-05-21 05:30:48	GRID.INFN-ReCas.it,GRID.JINR.ru
<input type="checkbox"/>	17	sra_rhopi	Expired	0/6	0 0 0 0 6	2015-05-07 04:53:47	2015-05-21 05:48:48	CLUSTER.UCAS.cn

Progress

Information

History

Show Jobs

Jobs Information

Activate

Rename

Reschedule Failed Jobs

Reschedule All Jobs

Delete

Information for task 41

Name	Value
BossVersion	6.6.4.p03
CustomPackage	True
Dataset	Prod_ipsi_664p03_rhopi_round02_9947_9970_stream063_root
DecayCard	rhopi.dec
EventMax	10000
EventType	rhopi
GangaID	
JobOptionAna	
JobOptionRec	
JobOptionSim	
JobType	
LocalRandomTrigger	
OutputDirectory	/rhopi/round02/stream...
OutputStep	
Platform	

Progress for task 41

Job Status	Job Number
Total	43
Done	0
Failed	0
Running	17
Waiting	26
Deleted	0

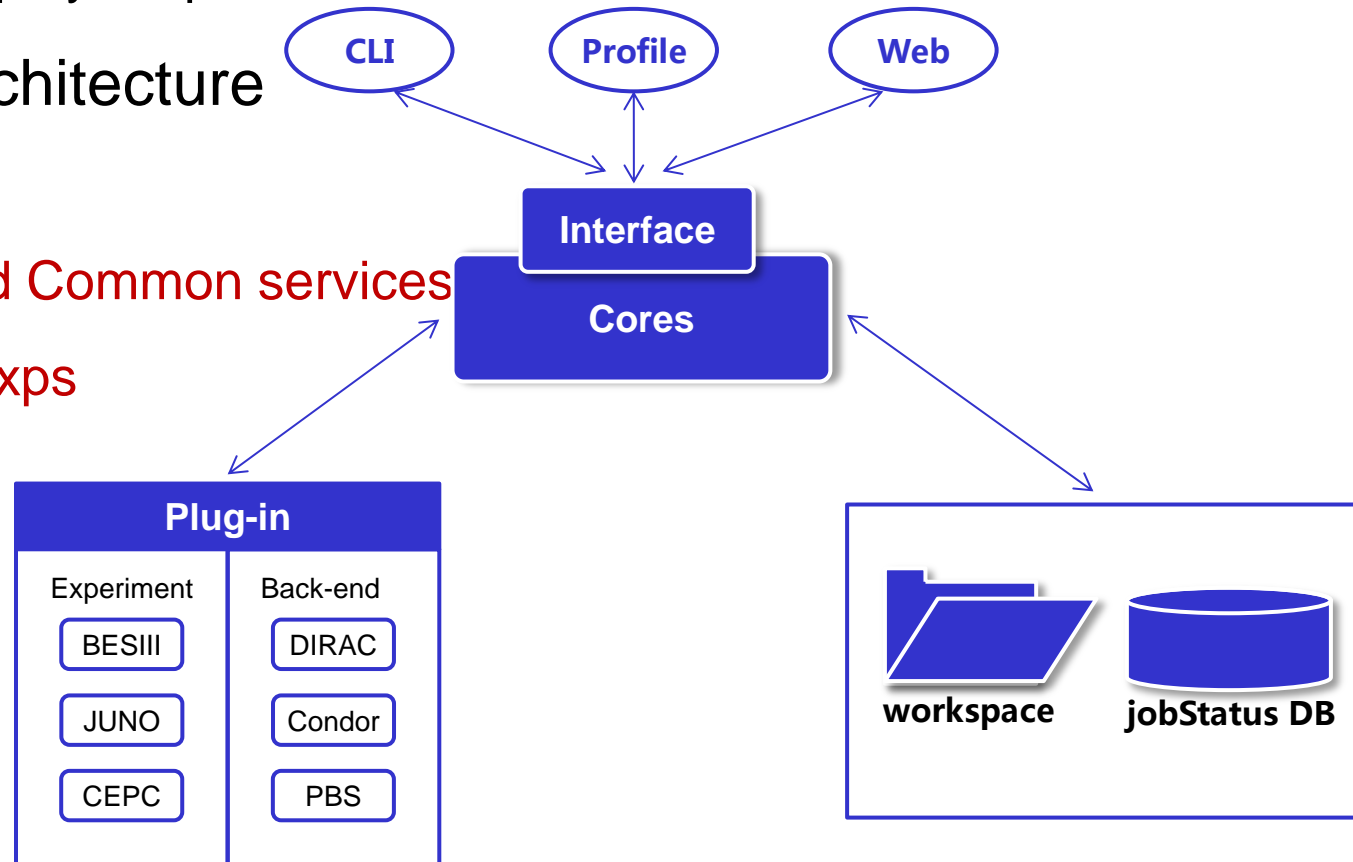
Dataset management



- ❖ Dirac File Catalog(DFC) used to build metadata and replica catalog
- ❖ Dataset class is built to contact with DFC
 - Query dataset with conditions or name
 - Register dataset for output of jobs
- ❖ Users can simply use Dataset as input data of task, move bulks of data by dataset

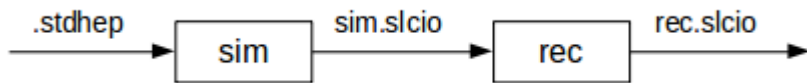
Implementation and Extensions

- ❖ Develop in python
- ❖ Object-oriented programming are used to make it reusable
 - Inheritance, polymorphism, reflection
- ❖ Main code architecture
 - Cores
 - Interface and Common services
 - Plug-in for Exps

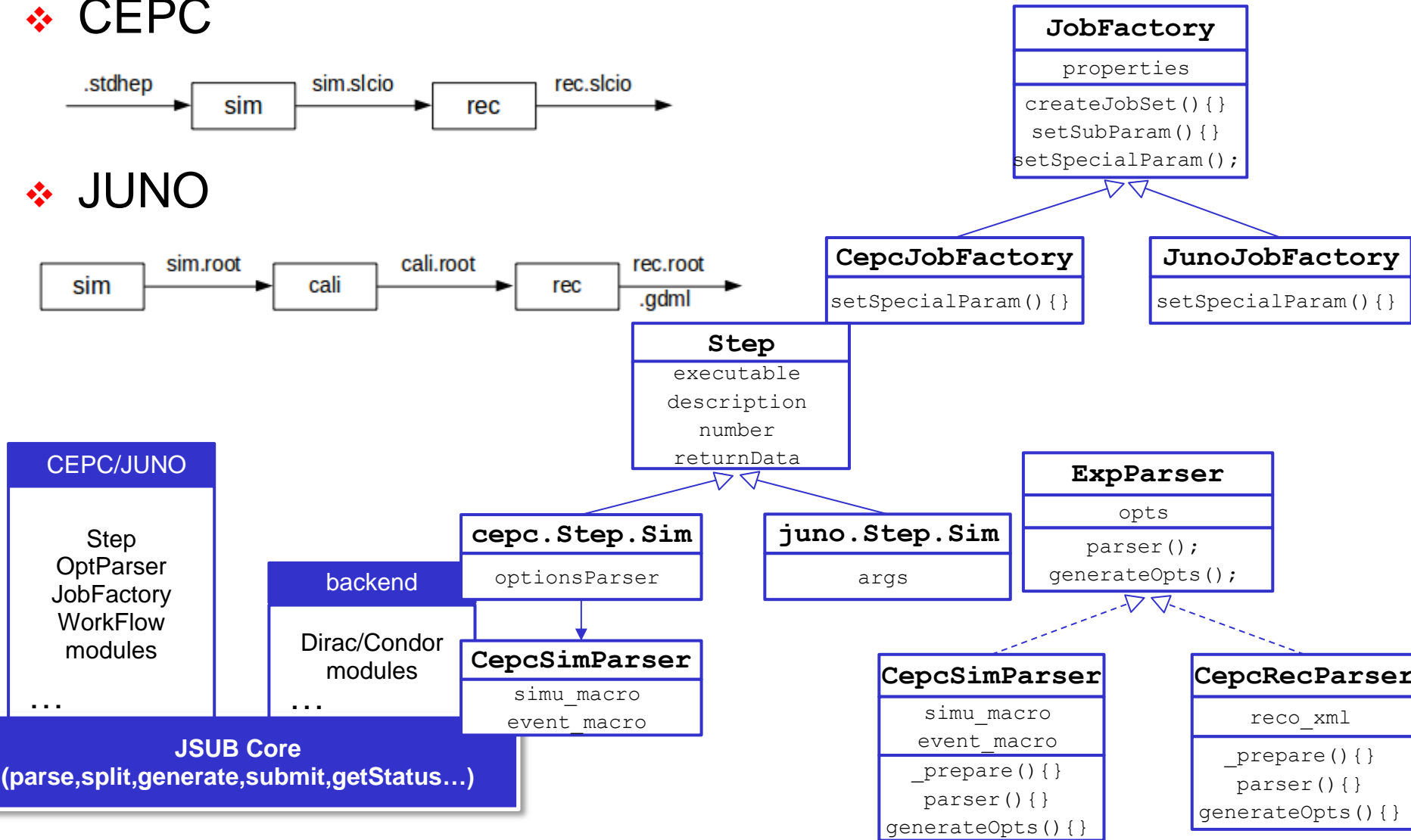
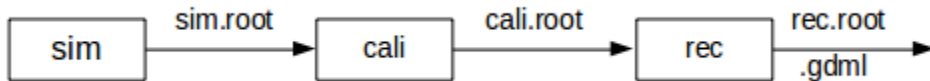


CEPC and JUNO case (1)

❖ CEPC



❖ JUNO



CEPC/JUNO

Step
OptParser
JobFactory
WorkFlow
modules
...

backend

Dirac/Condor
modules
...

JSUB Core
(parse,split,generate,submit,getStatus...)

CEPC and JUNO case (2)

CEPC_test.yaml

Experiment:

Name: `cepc`

JobSteps:

- Type: `Sim`
Executable: `Mokka`
JobOption: `/home/cc/suob/jsub/workfiles/sim`
ReturnData: `true`
- Type: `Rec`
Executable: `Marlin`
JobOption: `/home/cc/suob/jsub/workfiles/rec`
ReturnData: `true`

Splitter:

Type: `ByFile`
EventMaxPerJob: `20`
SeedStart: `auto`
InputData: `./stdhep.list`

Backend:

Name: `dirac`
Site:

- `CLOUD.IHEP.cn`
- `GRID.JINR.ru`

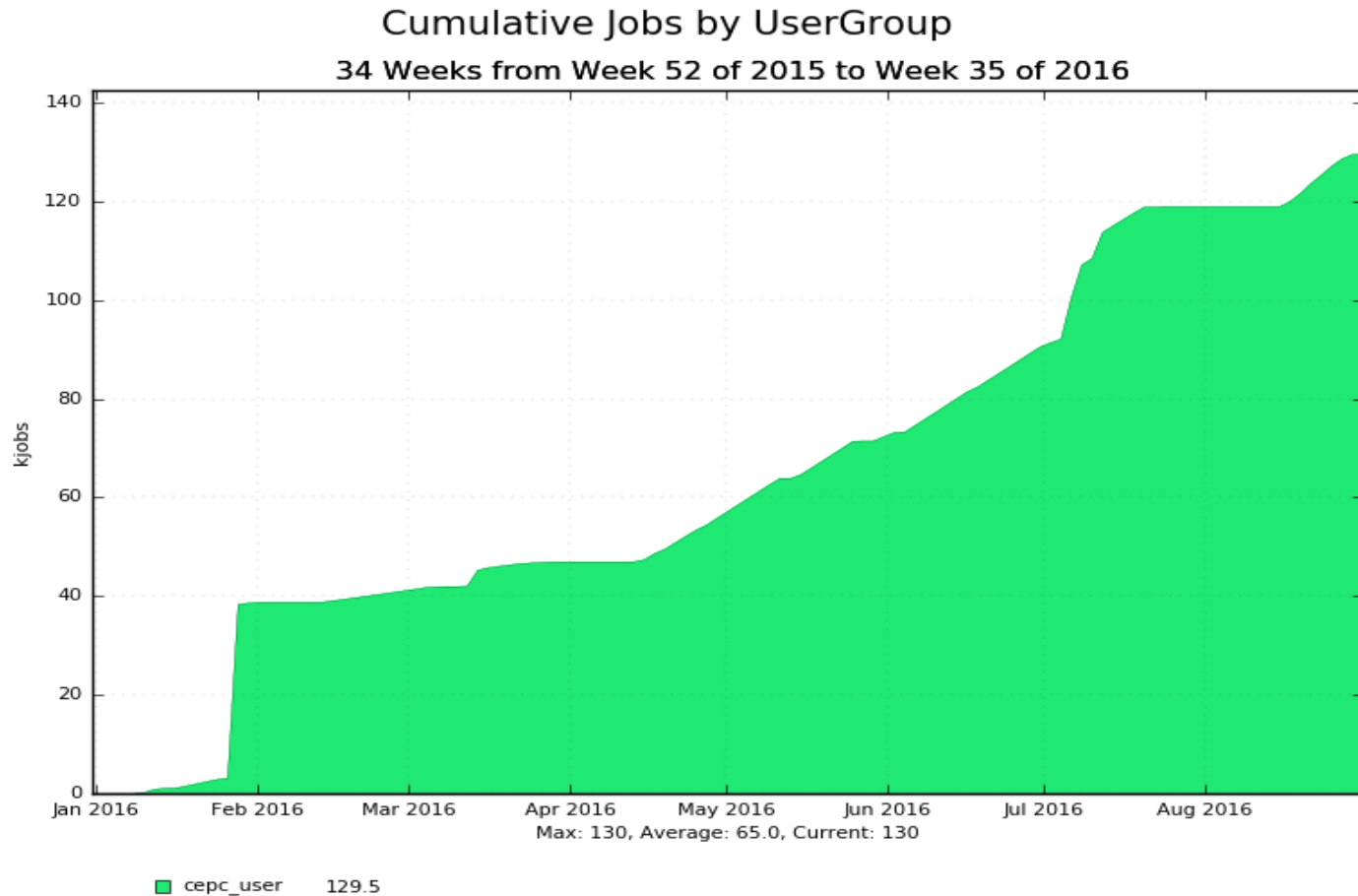
JobGroup: `suob160302_7`
OutputSe: `WHU-USER`
OutputDir: `/test/cepc/0302_7`

```
suo@suo-Lenovo:/home/suo
/home/cc/suob/jsub/jsub/scripts:/usr/kerberos/bin:/bin:/opt/d-cache/srm/bin:/opt/d-cache/dcap/bin:/usr/bin:/usr/externals/bin:/usr/sbin:/usr/local/bin:/usr/local/bin:/usr/bin:/usr/java/latest/bin
-bash-3.2$ vim cepc_test.yaml
-bash-3.2$ jsub_
jsub_remove  jsub_resubmit  jsub_status  jsub_submit
-bash-3.2$ jsub_submit cepc_test.yaml
Submitting suob160302_7 to DIRAC...
Job cepc_v1_90_1 submitted successfully. ID=1150313
Job cepc_v1_90_2 submitted successfully. ID=1150314
Job cepc_v1_90_3 submitted successfully. ID=1150315
Job cepc_v1_90_4 submitted successfully. ID=1150316
Job cepc_v1_90_5 submitted successfully. ID=1150317
Job cepc_v1_90_6 submitted successfully. ID=1150318
Job cepc_v1_90_7 submitted successfully. ID=1150319
Job cepc_v1_90_8 submitted successfully. ID=1150320
Job cepc_v1_90_9 submitted successfully. ID=1150321
Job cepc_v1_90_10 submitted successfully. ID=1150322
Job cepc_v1_90_11 submitted successfully. ID=1150323
Job cepc_v1_90_12 submitted successfully. ID=1150324
```

```
suo@suo-Lenovo:/home/suo
-bash-3.2$ pwd
/home/cc/suob/jsub-repo/workspace
-bash-3.2$ ls
0  13  18  22  27  31  36  40  45  5  54  59  63  68  72  77  81  90
1  14  19  23  28  32  37  41  46  50  55  6  64  69  73  78  82
10 15  2  24  29  33  38  42  47  51  56  60  65  7  74  79  83
11 16  20  25  3  34  39  43  48  52  57  61  66  70  75  8  84
12 17  21  26  30  35  4  44  49  53  58  62  67  71  76  80  9
-bash-3.2$ ls 90/
1  12  15  2  5  8
10 13  16  3  6  9
11 14  17  4  7  PandoraLikelihoodData9EBin.xml
-bash-3.2$ ls 90/1
event.macro  modules.tgz  reco.xml  runtimeScript.py  simu.macro
-bash-3.2$
```

CEPC and JUNO case (3)

- ❖ In 2016, about 130K CEPC jobs have been successfully submitted through JSUB



Summary



- ❖ JSUB is a lightweight and extensible task submission and management tool
 - Small experiments or experiments in early stage can extend it for quickly access of distributed resources for massive production
- ❖ JSUB has been implemented in Python
 - Dirac and Condor supported
- ❖ Real cases of CEPC and JUNO experiments have shown its extensibility and simplicity
- ❖ CEPC usage in 2016 has proved its stability