

Introduction to Hadoop

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- You have already seen how to execute programs written in Java, PySpark, Hive, HBase, Pig.
- When you execute any program in Hadoop cluster, it is queued by Yarn resource manager
- You can examine what is running or queued on the Hadoop cluster from a command line with `yarn application --list`:

```
[ivy2@md01 ~]$ yarn application --list
WARNING: YARN_OPTS has been replaced by HADOOP_OPTS. Using value of YARN_OPTS.
Total number of applications (application-types: [], states: [SUBMITTED, ACCEPTED, RUNNING] and tags: []):5
Application-Id      Name              Type  User      Queue              State  Final-State  Progress  Tracking-URL
application_1568600009828_2148  pyspark-shell  SPARK  zzhao9    root.users.zzhao9  RUNNING  UNDEFINED  10%      http://md01.rcc.local:4042
application_1568600009828_2146  pyspark-shell  SPARK  zzhao9    root.users.zzhao9  RUNNING  UNDEFINED  10%      http://md01.rcc.local:4044
application_1568600009828_2141  pyspark-shell  SPARK  shermanw  root.users.shermanw  RUNNING  UNDEFINED  10%      http://md01.rcc.local:4040
application_1568600009828_2145  pyspark-shell  SPARK  zwang151  root.users.zwang151  RUNNING  UNDEFINED  10%      http://md01.rcc.local:4043
application_1568600009828_2142  pyspark-shell  SPARK  shermanw  root.users.shermanw  RUNNING  UNDEFINED  10%      http://md01.rcc.local:4041
```

- If you ssh to hadoop with `-Y` option and your ssh client supports X-forwarding (under Mac you might have to install XQuartz for that), you can run firefox there and point it to the Tracking-URL associated with each job to see more details about it.

- `yarn top` allows to understand how busy the cluster is and who uses how much resources:

```
[ivy2@md01 ~]$ yarn top
YARN top - 13:40:33, up 84d, 17:27, 0 active users, queue(s): root
NodeManager(s): 5 total, 5 active, 0 unhealthy, 0 decommissioned, 1 lost, 0 rebooted
Queue(s) Applications: 5 running, 2129 submitted, 0 pending, 2118 completed, 6 killed, 0 failed
Queue(s) Mem(GB): 0 available, 768 allocated, 1251 pending, 22 reserved
Queue(s) VCores: 0 available, 176 allocated, 278 pending, 5 reserved
Queue(s) Containers: 176 allocated, 278 pending, 5 reserved
```

APPLICATIONID	USER	TYPE	QUEUE	PRIOR	#CONT	#RCONT	VCORES	RVCORES	MEM	RMEM	VCORESECS	MEMSECS	%PRO
application_1568600009828_2141	shermanw	spark	root.users.shermanw			0	160	0	160	0	716G	0G	768515 341
application_1568600009828_2145	zwang151	spark	root.users.zwang151			0	7	0	7	0	28G	0G	27933 11
application_1568600009828_2146	zzhao9	spark	root.users.zzhao9			0	4	0	4	0	8G	0G	15901 338
application_1568600009828_2142	shermanw	spark	root.users.shermanw			0	4	0	4	0	14G	0G	54486 19
application_1568600009828_2149	zzhao9	spark	root.users.zzhao9			0	1	1	1	5	1G	22G	29829 1297

- This command works similar to the standard UNIX `top`, refreshing the screen every few seconds. To exit from it, press `Ctrl-C`
- The two most important lines from the above are:
 Queue(s) Mem(GB): 0 available, 768 allocated, 1251 pending, 22 reserved
 Queue(s) VCores: 0 available, 176 allocated, 278 pending, 5 reserved
- The first line says that 768 GB of memory is allocated and 0 are available
- The second line says that 176 CPU cores are allocated and 0 are available

- Therefore, if you start the job, it will not run for a while until enough memory and computing cores become available
- Notice, that if you use Spark interactively via Jupyter, you are holding cluster resources even if you are not running anything especially if you pin RDD or Data Frame to memory with `cache()`
- We have rather small Hadoop cluster and it is better to submit job to it in batch rather than lock resources using interactive Jupyter notebook
- There is a cronjob running on login node, killing jupyter notebooks and the corresponding pyspark jobs that spent in queue more than N hours. When this was written, N was 24 hours.
- It is very important to exit Jupyter notebook properly to release resources

- The cluster becomes particularly busy and unusable at the end of each semester when students are finishing their final projects
- To kill running job, use

```
yarn application -kill <Application ID>
```

- You can find application id using one of the previous commands
- To get logs for a particular application:

```
yarn logs -applicationId <Application ID>
```

- When you launch a batch job under Yarn, it runs in shell foreground, the shell will not return until the job is finished.
- To run it in a background, use standard UNIX way (see my Linux tutorial for details). For example:

```
nohup pyspark myscript.py > log.txt 2>&1 &
```