스파크 클러스터 구축하기 -1

이창언

standalone 설정

스탠드 얼론 설정 참조 링크

http://spark.apache.org/docs/latest/spark-standalone.html

스파크 설정 파일 복사

1. 디렉토리: $SPARK_HOME/conf
2. spark-env.sh 파일복사: cp spark-env.sh.template spark-env.sh

spark-env.sh 설정 변경

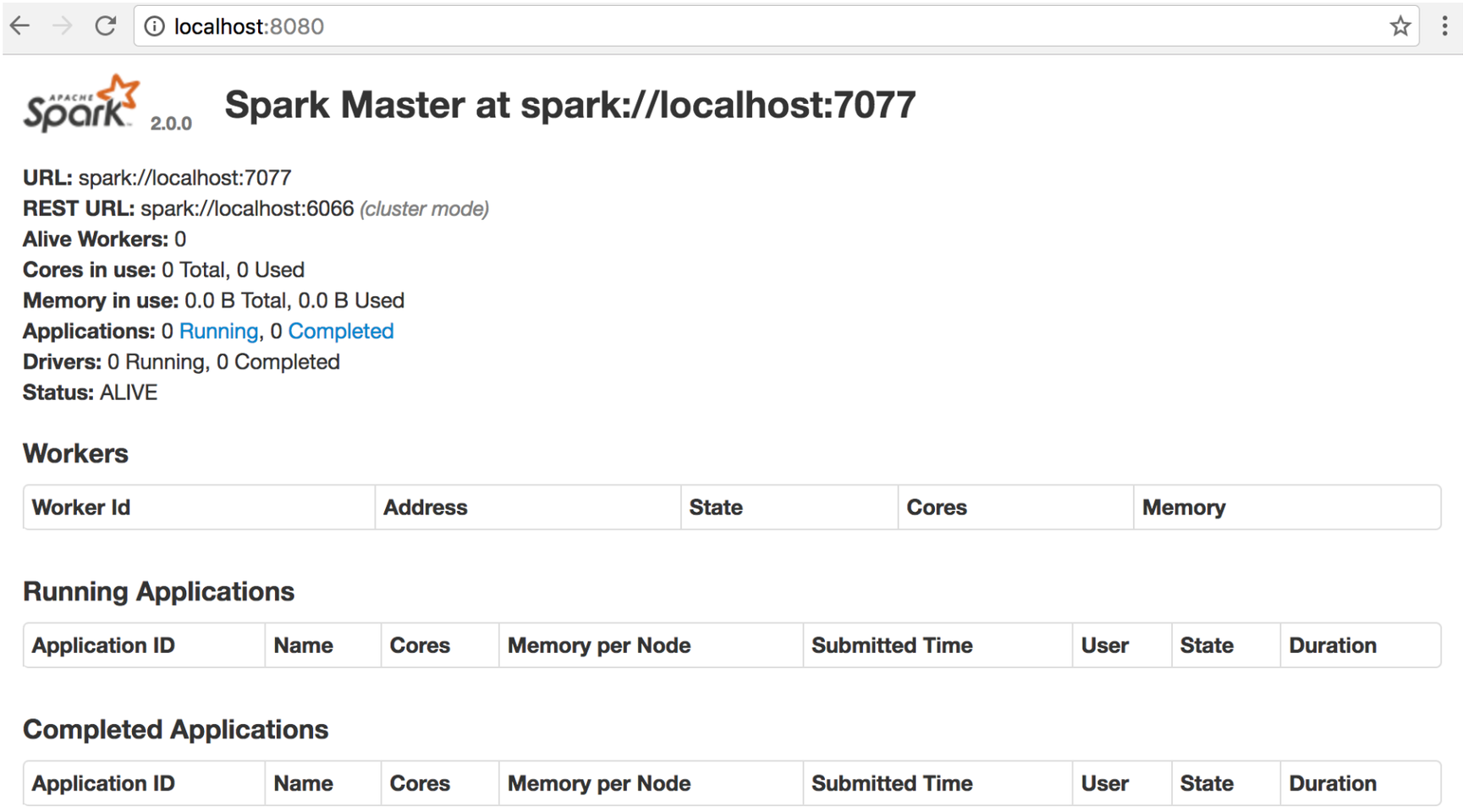
spark-env.sh: spark-submit, standAlone, yarn, memos에 관한 각종 설정을 하는 파일이다.

1. 파일열기: vim spark-env.sh
2. export SPARK_MASTER_HOST=호스트네임 (ex. localhost)
3. export SPARK_WORKER_CORES=워커당 코어수 (ex. 2)
4. export SPARK_WORKER_MEMORY=워커당 메모리용량 (ex. 1G)
5. export SPARK_WORKER_INSTANCES=워커 인스턴스 갯수 (ex. 3)

* 2~4번에 해당하는 설정을 실행 시 shell에서 옵션으로 입력할 수도 있다.
  - $SPARK_HOME/sbin/start-master.sh -h 호스트네임
  - $SPARK_HOME/sbin/start-slave.sh -c 코어수 -m 메모리

start-master.sh 실행

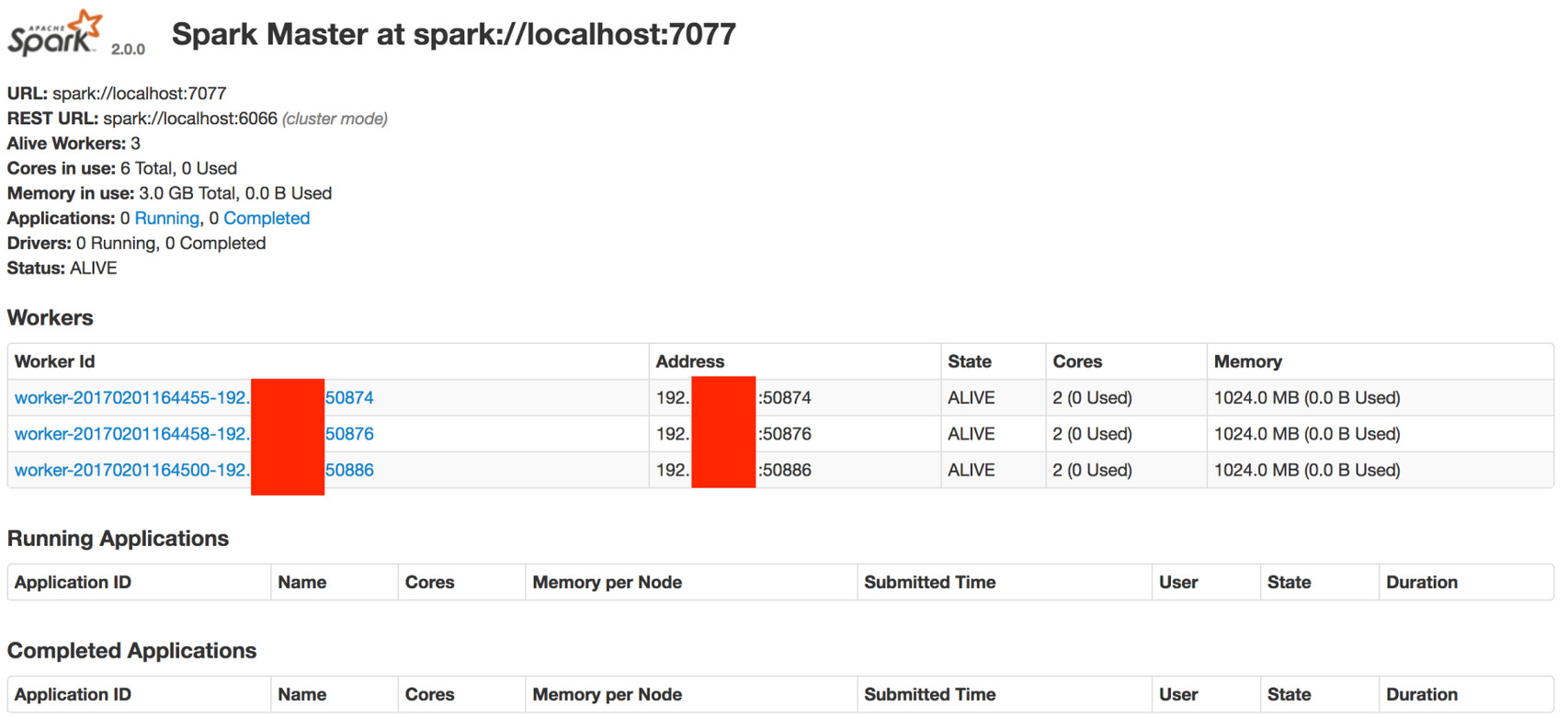
$SPARK_HOME/bin/start-master.sh 실행



start-slave.sh 실행

$SPARK_HOME/sbin/start-master.sh spark://localhost:7077

* spark://localhost:7077은 실행중인 master의 URL의 정보이다.



Spark Master at spark://localhost:7077

URL: spark://localhost:7077
REST URL: spark://localhost:6066 *(cluster mode)*
Alive Workers: 3
Cores in use: 6 Total, 0 Used
Memory in use: 3.0 GB Total, 0.0 B Used
Applications: 0 Running, 0 Completed
Drivers: 0 Running, 0 Completed
Status: ALIVE

Workers

Worker Id	Address	State	Cores	Memory
worker-20170201164455-192. 50874	192. :50874	ALIVE	2 (0 Used)	1024.0 MB (0.0 B Used)
worker-20170201164458-192. 50876	192. :50876	ALIVE	2 (0 Used)	1024.0 MB (0.0 B Used)
worker-20170201164500-192. 50886	192. :50886	ALIVE	2 (0 Used)	1024.0 MB (0.0 B Used)

Running Applications

Application ID	Name	Cores	Memory per Node	Submitted Time	User	State	Duration

Completed Applications

Application ID	Name	Cores	Memory per Node	Submitted Time	User	State	Duration

데이터셋 다운로드

https://grouplens.org/datasets/movielens
데이터셋 다운로드(ml-latest.zip)

recommended for education and development

MovieLens Latest Datasets

These datasets will change over time, and are not appropriate for reporting research results. We will keep the download links stable for automated downloads. We will not archive or make available previously released versions.

Small: 100,000 ratings and 1,300 tag applications applied to 9,000 movies by 700 users. Last updated 10/2016.

- README.html
- ml-latest-small.zip (size: 1 MB)

Full: 24,000,000 ratings and 670,000 tag applications applied to 40,000 movies by 260,000 users. Includes tag genome data with 12 million relevance scores across 1,100 tags. Last updated 10/2016.

- README.html
- ml-latest.zip (size: 224 MB)

Permalink: http://grouplens.org/datasets/movielens/latest/

로직 (스칼라)

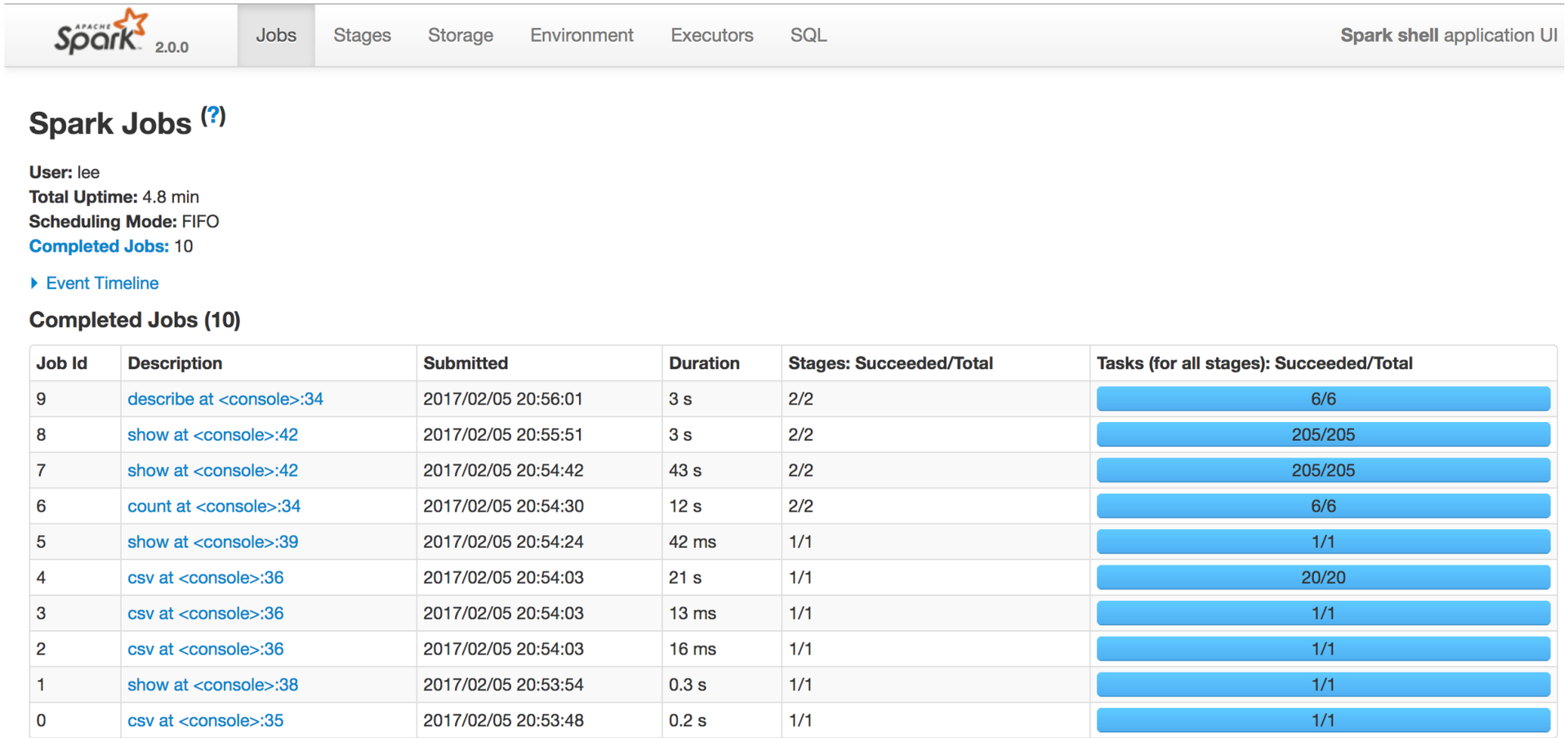
```
import org.apache.spark.sql.{DataFrame, Dataset, Row, SparkSession}
import org.apache.spark.sql.functions._

//스파크 세션 설정
val spark = SparkSession.builder
  .appName("standAlone-cluster-test")
  .getOrCreate
import spark.implicits._

// csv파일 읽기
val preview = spark
  .read
  .csv("/Users/lee/Downloads/ml-latest/ratings.csv")
preview.show

// option값 설정
val parsed = spark.read
  .option("header", "true") // 파일의 첫 줄을 필드 명으로 사용
  .option("nullValue", "?") // 필드 데이터를 변경( "?" => null )
  .option("inferSchema", "true") // 데이터 타입을 추론한다.
  .csv("/Users/lee/Downloads/ml-latest/ratings.csv")
parsed.show

parsed.count
parsed.cache
parsed
  .groupBy("movieId")
  .count
  .orderBy($"count".desc)
  .show

// createOrReplaceTempView(): 사용중인 DataFrame의 하나의 뷰를 생성한다.
val createView = parsed.createOrReplaceTempView("parks")
spark.sql("""
  SELECT movieId, COUNT(*) cnt
  FROM parks
  GROUP BY movieId
  ORDER BY cnt DESC
""").show

// describe() : numeric columns, including count, mean, stddev, min, and max의 통계를 리턴해준다.
val summary = parsed.describe()
summary.show
```

첫번재 환경: standalone - driver(1core)

두번째 환경: standalone - driver(6core)

세번째 환경: standalone - 3worker(6core)

standalone -driver(1core)



Stages for All Jobs

Completed Stages: 14

Completed Stages (14)

Stage Id	Description	Submitted	Duration	Tasks: Succeeded/Total	Input	Output	Shuffle Read	Shuffle Write
13	describe at <console>:34 +details	2017/02/05 20:56:04	7 ms	1/1			1160.0 B	
12	describe at <console>:34 +details	2017/02/05 20:56:01	3 s	5/5	292.7 MB			1160.0 B
11	show at <console>:42 +details	2017/02/05 20:55:53	1 s	200/200			1664.9 KB	
10	show at <console>:42 +details	2017/02/05 20:55:51	2 s	5/5	292.7 MB			1664.9 KB
9	show at <console>:42 +details	2017/02/05 20:55:23	1 s	200/200			1664.9 KB	
8	show at <console>:42 +details	2017/02/05 20:54:42	42 s	5/5	632.9 MB			1664.9 KB
7	count at <console>:34 +details	2017/02/05 20:54:41	29 ms	1/1			295.0 B	
6	count at <console>:34 +details	2017/02/05 20:54:30	12 s	5/5	632.9 MB			295.0 B
5	show at <console>:39 +details	2017/02/05 20:54:24	37 ms	1/1	64.0 KB			
4	csv at <console>:36 +details	2017/02/05 20:54:03	21 s	20/20	633.9 MB			
3	csv at <console>:36 +details	2017/02/05 20:54:03	9 ms	1/1	64.0 KB			
2	csv at <console>:36 +details	2017/02/05 20:54:03	11 ms	1/1	64.0 KB			
1	show at <console>:38 +details	2017/02/05 20:53:54	0.2 s	1/1	64.0 KB			
0	csv at <console>:35 +details	2017/02/05 20:53:48	0.1 s	1/1	64.0 KB			

Executors

Summary

	RDD Blocks	Storage Memory	Disk Used	Cores	Active Tasks	Failed Tasks	Complete Tasks	Total Tasks	Task Time (GC Time)	Input	Shuffle Read	Shuffle Write
Active(1)	9	292.8 MB / 366.3 MB	0.0 B	1	0	0	447	447	1.4 m (2.2 s)	2.4 GB	0.0 B	3.3 MB
Dead(0)	0	0.0 B / 0.0 B	0.0 B	0	0	0	0	0	0 ms (0 ms)	0.0 B	0.0 B	0.0 B
Total(1)	9	292.8 MB / 366.3 MB	0.0 B	1	0	0	447	447	1.4 m (2.2 s)	2.4 GB	0.0 B	3.3 MB

Executors

Executor ID	Address	Status	RDD Blocks	Storage Memory	Disk Used	Cores	Active Tasks	Failed Tasks	Complete Tasks	Total Tasks	Task Time (GC Time)	Input	Shuffle Read	Shuffle Write	Thread Dump
driver	[redacted]	Active	9	292.8 MB / 366.3 MB	0.0 B	1	0	0	447	447	1.4 m (2.2 s)	2.4 GB	0.0 B	3.3 MB	Thread Dump

standalone - driver(6core)

spark-submit으로 실행한 결과이다.

1. 로직 변경 : appName(“standAlone-cluster-test”).master("local[6]")

2. bin/spark-submit \
--master local \
—class 클래스경로 \
 배포파일.jar

Spark 2.0.0 | Jobs | Stages | Storage | Environment | Executors | SQL | **standAlone-cluster-test** application UI

Spark Jobs (?)

User: lee
Total Uptime: 1.4 min
Scheduling Mode: FIFO
Completed Jobs: 10

▸ Event Timeline

Completed Jobs (10)

Job Id	Description	Submitted	Duration	Stages: Succeeded/Total	Tasks (for all stages): Succeeded/Total
9	describe at StandAloneTest.scala:51	2017/02/05 22:19:22	5 s	2/2	7/7
8	show at StandAloneTest.scala:48	2017/02/05 22:19:18	3 s	2/2	206/206
7	show at StandAloneTest.scala:39	2017/02/05 22:18:44	33 s	2/2	206/206
6	count at StandAloneTest.scala:33	2017/02/05 22:18:33	10 s	2/2	7/7
5	show at StandAloneTest.scala:31	2017/02/05 22:18:33	62 ms	1/1	1/1
4	csv at StandAloneTest.scala:30	2017/02/05 22:18:16	17 s	1/1	20/20
3	csv at StandAloneTest.scala:30	2017/02/05 22:18:15	30 ms	1/1	1/1
2	csv at StandAloneTest.scala:30	2017/02/05 22:18:15	37 ms	1/1	1/1
1	show at StandAloneTest.scala:23	2017/02/05 22:18:15	0.2 s	1/1	1/1
0	csv at StandAloneTest.scala:22	2017/02/05 22:18:13	0.4 s	1/1	1/1

Stages for All Jobs

Completed Stages: 14

Completed Stages (14)

Stage Id	Description	Submitted	Duration	Tasks: Succeeded/Total	Input	Output	Shuffle Read	Shuffle Write
13	describe at StandAloneTest.scala:51 +details	2017/02/05 22:19:27	18 ms	1/1			1393.0 B	
12	describe at StandAloneTest.scala:51 +details	2017/02/05 22:19:22	5 s	6/6	317.8 MB			1393.0 B
11	show at StandAloneTest.scala:48 +details	2017/02/05 22:19:20	1 s	200/200			1923.3 KB	
10	show at StandAloneTest.scala:48 +details	2017/02/05 22:19:18	2 s	6/6	317.8 MB			1923.3 KB
9	show at StandAloneTest.scala:39 +details	2017/02/05 22:19:15	2 s	200/200			1923.3 KB	
8	show at StandAloneTest.scala:39 +details	2017/02/05 22:18:44	31 s	6/6	633.1 MB			1923.3 KB
7	count at StandAloneTest.scala:33 +details	2017/02/05 22:18:43	95 ms	1/1			354.0 B	
6	count at StandAloneTest.scala:33 +details	2017/02/05 22:18:33	10 s	6/6	633.1 MB			354.0 B
5	show at StandAloneTest.scala:31 +details	2017/02/05 22:18:33	43 ms	1/1	64.0 KB			
4	csv at StandAloneTest.scala:30 +details	2017/02/05 22:18:16	17 s	20/20	633.9 MB			
3	csv at StandAloneTest.scala:30 +details	2017/02/05 22:18:16	22 ms	1/1	64.0 KB			
2	csv at StandAloneTest.scala:30 +details	2017/02/05 22:18:15	27 ms	1/1	64.0 KB			
1	show at StandAloneTest.scala:23 +details	2017/02/05 22:18:15	0.2 s	1/1	64.0 KB			
0	csv at StandAloneTest.scala:22 +details	2017/02/05 22:18:13	0.3 s	1/1	64.0 KB			

Executors

Summary

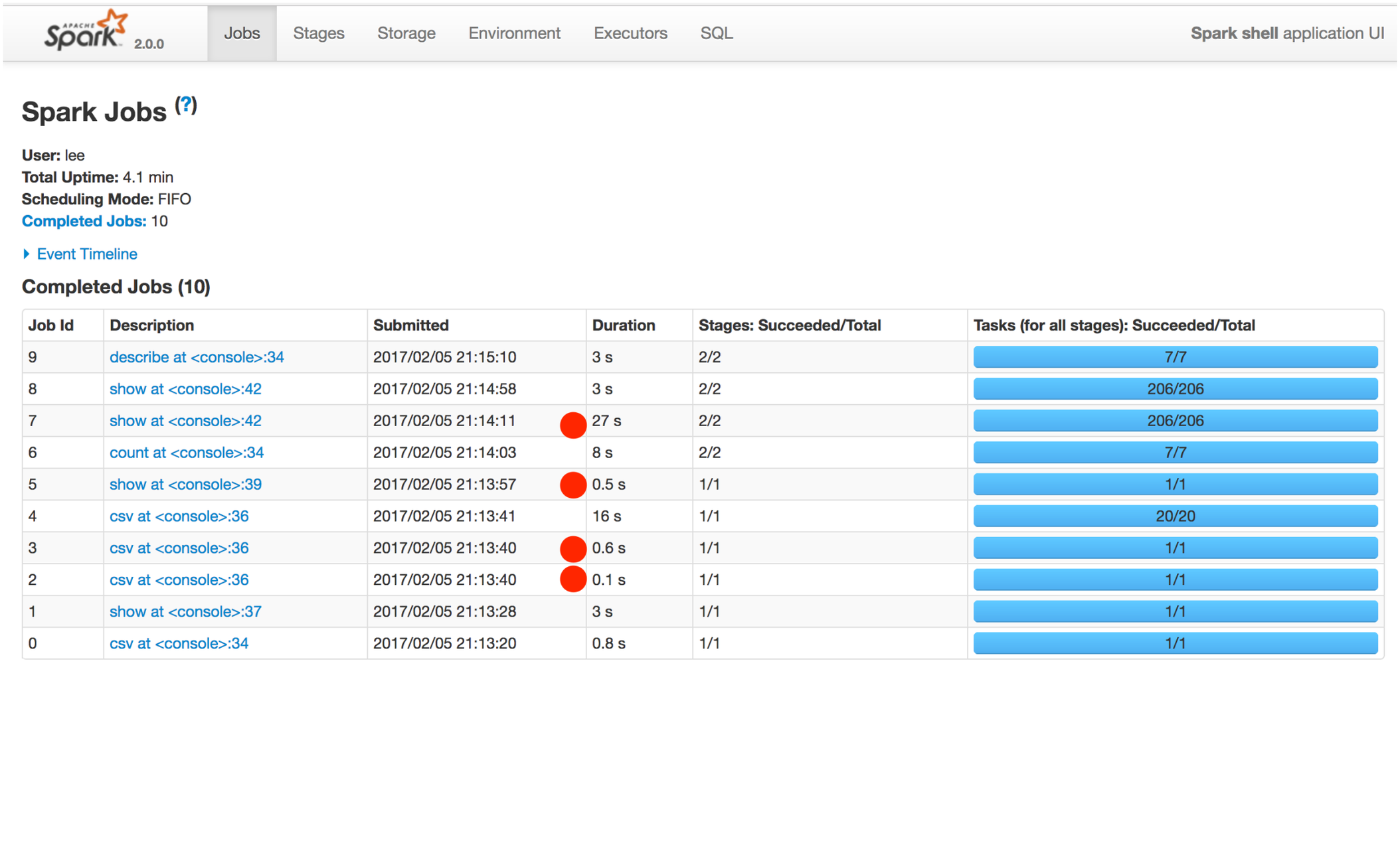
	RDD Blocks	Storage Memory	Disk Used	Cores	Active Tasks	Failed Tasks	Complete Tasks	Total Tasks	Task Time (GC Time)	Input	Shuffle Read	Shuffle Write
Active(1)	11	317.9 MB / 366.3 MB	0.0 B	6	0	0	451	451	6.6 m (11.9 s)	2.5 GB	0.0 B	3.8 MB
Dead(0)	0	0.0 B / 0.0 B	0.0 B	0	0	0	0	0	0 ms (0 ms)	0.0 B	0.0 B	0.0 B
Total(1)	11	317.9 MB / 366.3 MB	0.0 B	6	0	0	451	451	6.6 m (11.9 s)	2.5 GB	0.0 B	3.8 MB

Executors

Executor ID	Address	Status	RDD Blocks	Storage Memory	Disk Used	Cores	Active Tasks	Failed Tasks	Complete Tasks	Total Tasks	Task Time (GC Time)	Input	Shuffle Read	Shuffle Write	Thread Dump
driver	[redacted]	Active	11	317.9 MB / 366.3 MB	0.0 B	6	0	0	451	451	6.6 m (11.9 s)	2.5 GB	0.0 B	3.8 MB	Thread Dump

standalone -3worker(6 core)

특정 Stage에서 non 클러스터에 비해 클러스터로 실행한 시간이 상당히 감소했다.
(jobs에 빨간색으로 찍힌 점)
하지만 전체 실행 시간으로 봤을땐 큰 차이가 없어 메모리/코어를 증설해야 성능 향상이 될 것 같다.



Stages for All Jobs

Completed Stages: 14

Completed Stages (14)

Stage Id	Description		Submitted	Duration	Tasks: Succeeded/Total	Input	Output	Shuffle Read	Shuffle Write
13	describe at <console>:34	+details	2017/02/05 21:15:12	0.2 s	1/1			1393.0 B	
12	describe at <console>:34	+details	2017/02/05 21:15:10	2 s	6/6	317.8 MB			1393.0 B
11	show at <console>:42	+details	2017/02/05 21:15:00	2 s	200/200			1923.3 KB	
10	show at <console>:42	+details	2017/02/05 21:14:58	1 s	6/6	317.8 MB			1923.3 KB
9	show at <console>:42	+details	2017/02/05 21:14:35	3 s	200/200			1923.3 KB	
8	show at <console>:42	+details	2017/02/05 21:14:11	24 s	6/6	633.1 MB			1923.3 KB
7	count at <console>:34	+details	2017/02/05 21:14:11	0.2 s	1/1			354.0 B	
6	count at <console>:34	+details	2017/02/05 21:14:03	8 s	6/6	633.1 MB			354.0 B
5	show at <console>:39	+details	2017/02/05 21:13:57	0.4 s	1/1	64.0 KB			
4	csv at <console>:36	+details	2017/02/05 21:13:41	16 s	20/20	633.9 MB			
3	csv at <console>:36	+details	2017/02/05 21:13:40	0.6 s	1/1	64.0 KB			
2	csv at <console>:36	+details	2017/02/05 21:13:40	99 ms	1/1	64.0 KB			
1	show at <console>:37	+details	2017/02/05 21:13:28	3 s	1/1				
0	csv at <console>:34	+details	2017/02/05 21:13:20	0.8 s	1/1	64.0 KB			

Executors

Summary

	RDD Blocks	Storage Memory	Disk Used	Cores	Active Tasks	Failed Tasks	Complete Tasks	Total Tasks	Task Time (GC Time)	Input	Shuffle Read	Shuffle Write
Active(4)	16	318.0 MB / 1465.2 MB	0.0 B	6	0	0	451	451	5.6 m (6.7 s)	2.5 GB	2.5 MB	3.8 MB
Dead(0)	0	0.0 B / 0.0 B	0.0 B	0	0	0	0	0	0 ms (0 ms)	0.0 B	0.0 B	0.0 B
Total(4)	16	318.0 MB / 1465.2 MB	0.0 B	6	0	0	451	451	5.6 m (6.7 s)	2.5 GB	2.5 MB	3.8 MB

Executors

Executor ID	Address	Status	RDD Blocks	Storage Memory	Disk Used	Cores	Active Tasks	Failed Tasks	Complete Tasks	Total Tasks	Task Time (GC Time)	Input	Shuffle Read	Shuffle Write	Logs	Thread Dump
2	[redacted]	Active	5	106.5 MB / 366.3 MB	0.0 B	2	0	0	153	153	1.9 m (2.1 s)	894.3 MB	839.5 KB	1325.4 KB	stdout stderr	Thread Dump
1		Active	4	104.9 MB / 366.3 MB	0.0 B	2	0	0	149	149	1.9 m (2.3 s)	818.8 MB	865.3 KB	1263.4 KB	stdout stderr	Thread Dump
0		Active	4	106.5 MB / 366.3 MB	0.0 B	2	0	0	149	149	1.9 m (2.3 s)	822.8 MB	859.1 KB	1259.5 KB	stdout stderr	Thread Dump
driver		Active	3	54.4 KB / 366.3 MB	0.0 B	0	0	0	0	0	0 ms (0 ms)	0.0 B	0.0 B	0.0 B		Thread Dump

Q & A