NVIDIA DEEP LEARNING INSTITUTE

Georgia Tech

PRAIRIE VIEW A&M UNIVERSITY

DLI Accelerated Data Science Teaching Kit

Lecture 11.4 – RAPIDS and Spark

What is RAPIDS Accelerator for Spark?

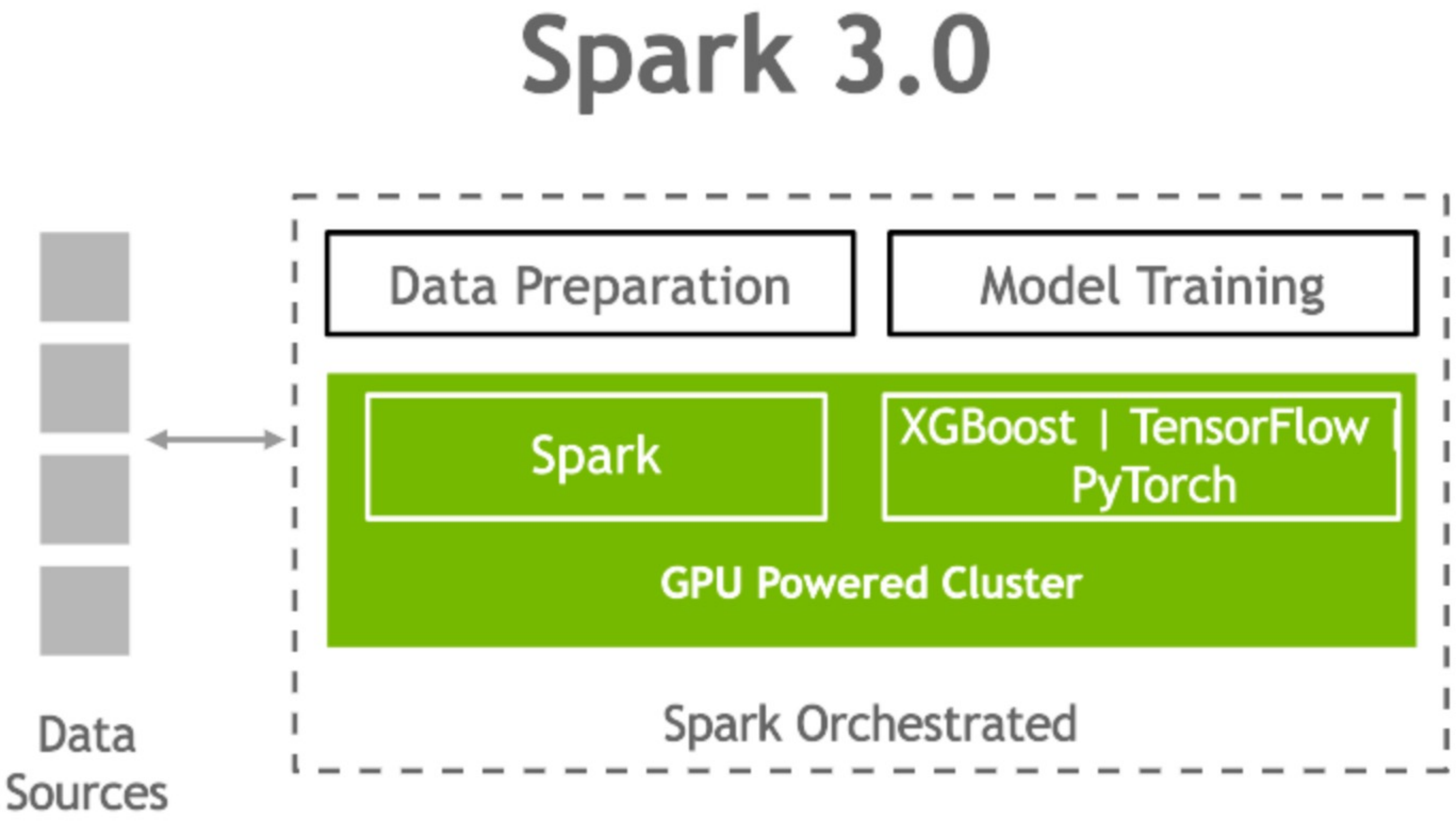
- Accelerate Spark distributed computing framework using GPUs, via
  - RAPIDS cuDF library
  - Accelerated shuffle based on UCX (GPU-to-GPU communication)
- Existing Spark applications run with no code change
  - Launch Spark with RAPIDS accelerator (plugin jar)
  - Enable configuration setting

```
spark.conf.set('spark.rapids.sql.enabled','true')
```

https://nvidia.github.io/spark-rapids/

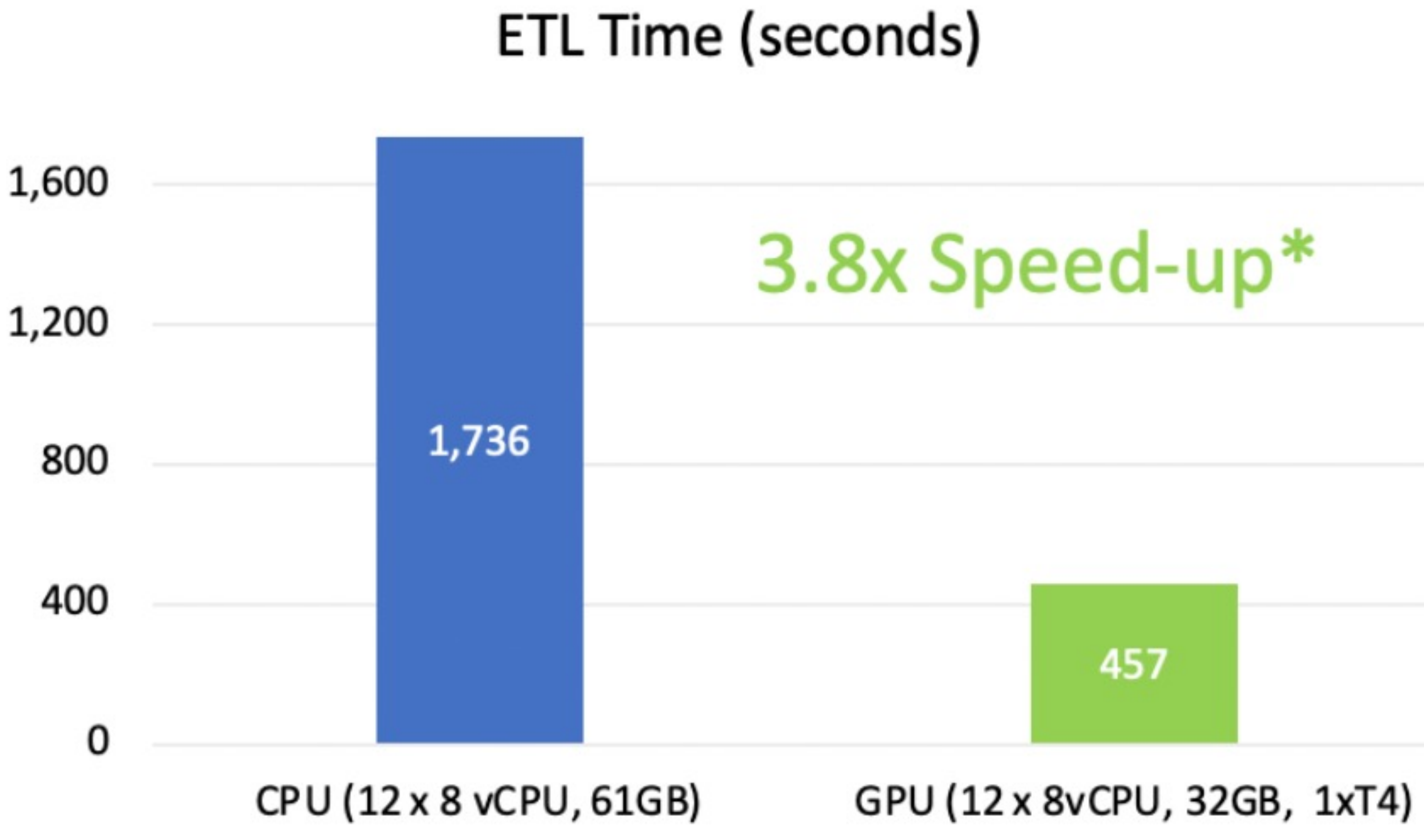
Spark 3.0 Offers Unified AI framework for ETL + ML/DL

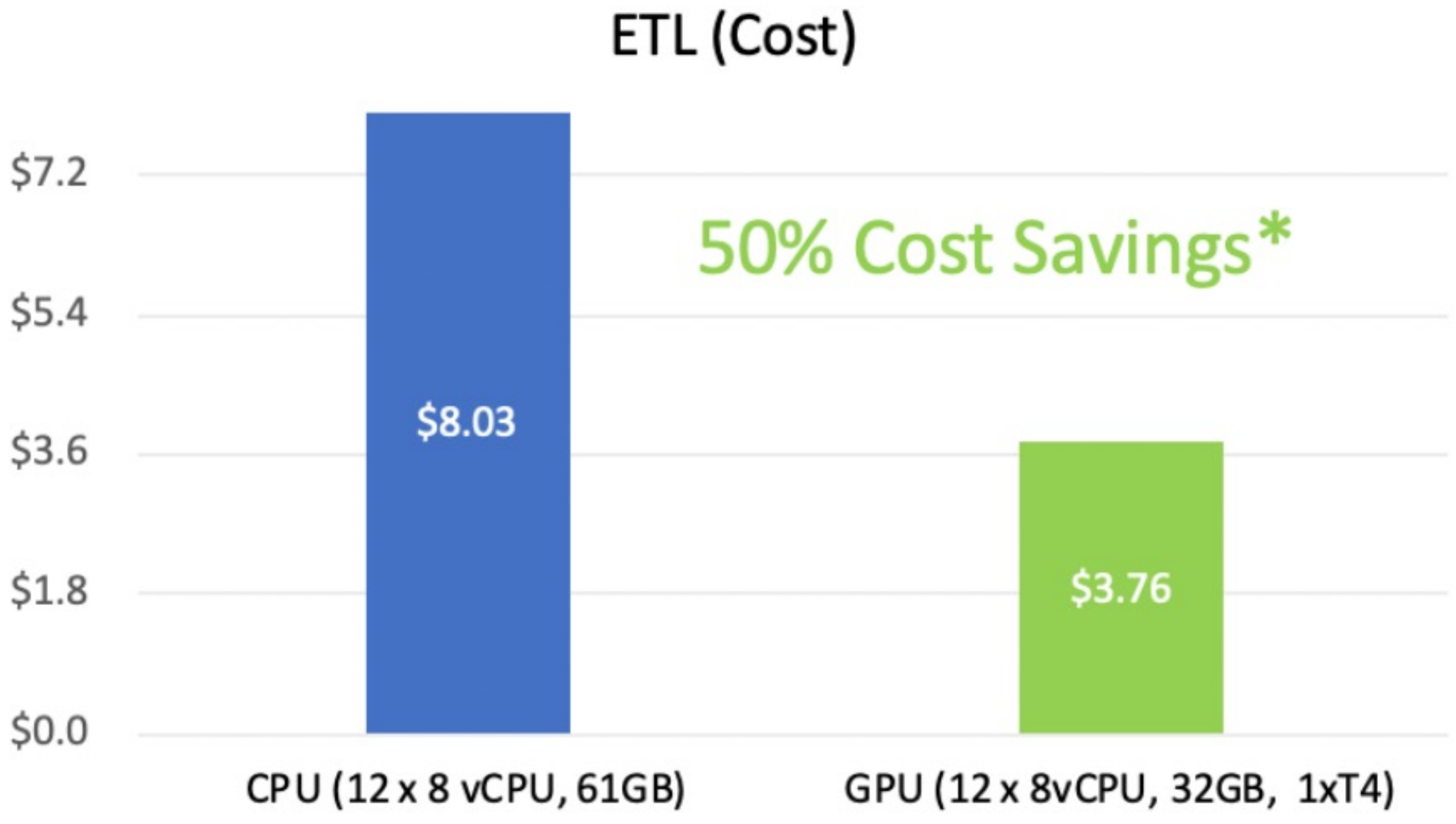
Single pipeline from data input to model training



Accelerating Spark with RAPIDS

Higher speed, and lower costs

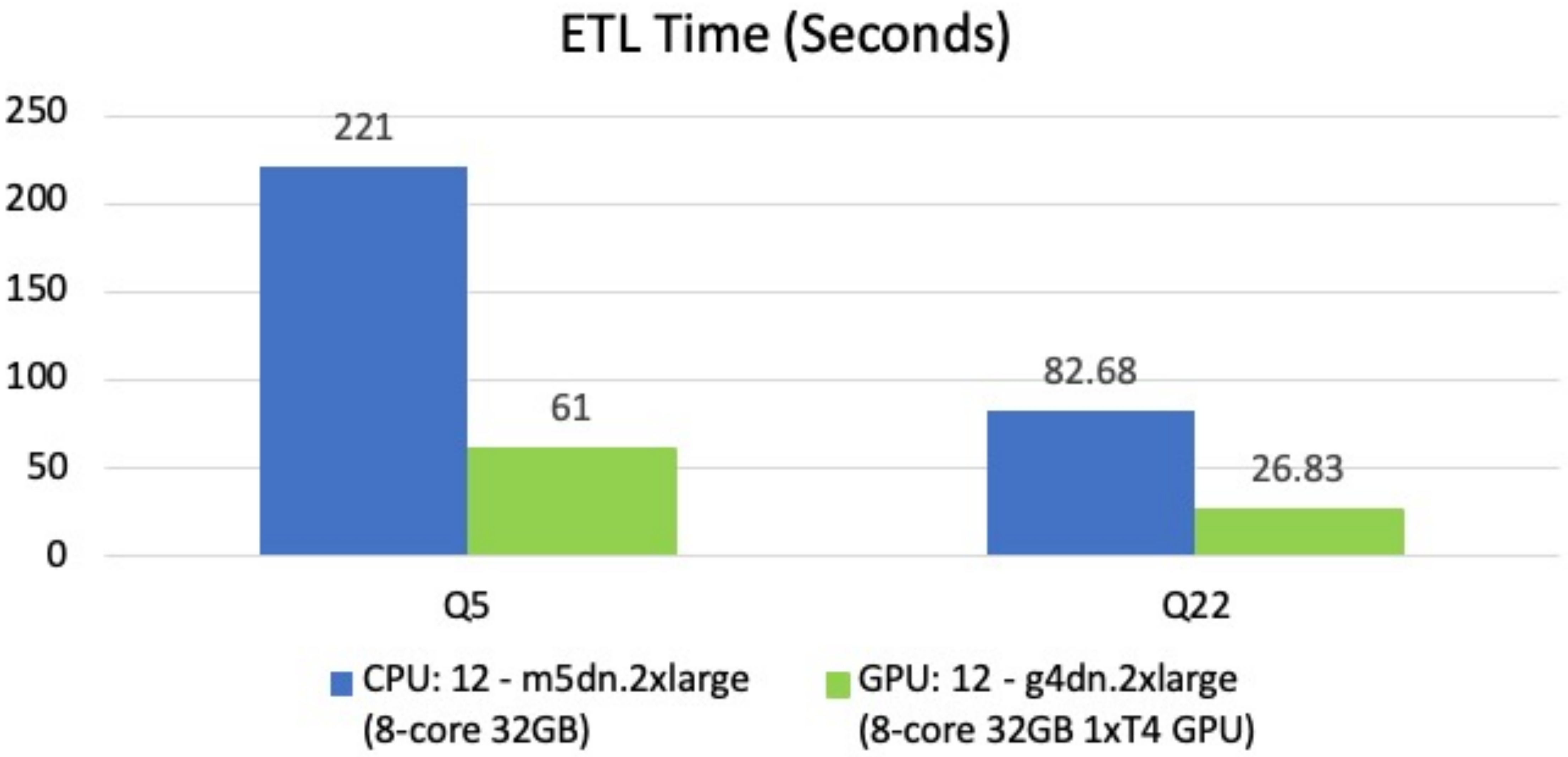




*ETL for FannieMae Mortgage Dataset (~200GB) as shown in our demo. Costs based on Cloud T4 GPU instance market price & V100 GPU price on Databricks Standard edition

Accelerating Spark with RAPIDS on AWS

Higher speed, and lower costs



~3.5x Speed-up
~40% Cost Savings

Based on TPCx-BB like Queries #5 & #22 with 1TB scale factor input

GPU Scheduling Example: Starting Code

```
./bin/spark-shell --master yarn --executor-cores 2 \
  --conf spark.driver.resource.gpu.amount=1 \
  --conf spark.driver.resource.gpu.discoveryScript=/opt/spark/getGpuResources.sh \
  --conf spark.executor.resource.gpu.amount=2 \
  --conf spark.executor.resource.gpu.discoveryScript=./getGpuResources.sh \
  --conf spark.task.resource.gpu.amount=1 \
  --files examples/src/main/scripts/getGpusResources.sh
```

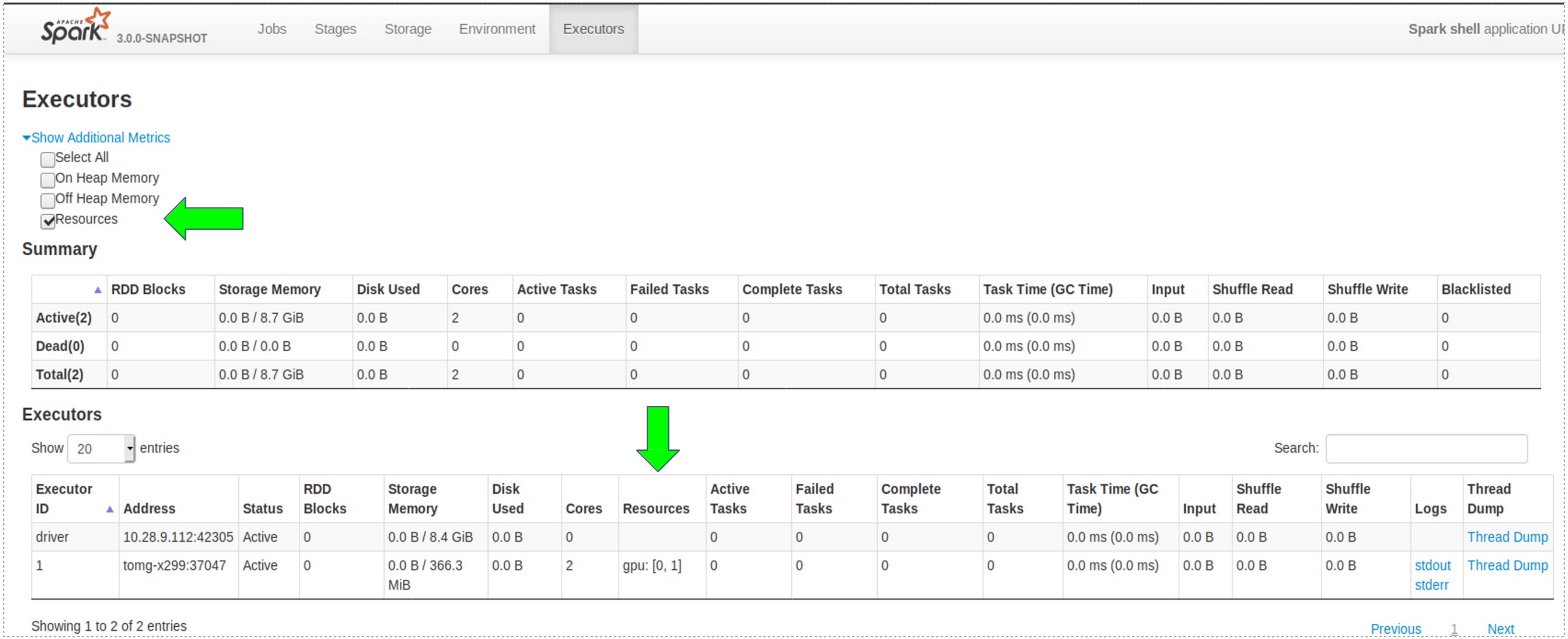
GPU Scheduling Example: Discovery Script

```
#!/bin/bash  #
# Outputs a JSON formatted string that is expected by the
# spark.{driver/executor}.resource.gpu.discoveryScript config.  #
# Example output: {"name": "gpu", "addresses":["0","1","2","3","4","5","6","7"]}

ADDRS=$(nvidia-smi --query-gpu=index --format=csv,noheader \
       | sed -e :a -e N -e'$!ba' -e 's/\n/","/g')
echo {\"name\": \"gpu\", \"addresses\":[\"$ADDRS\"]}
```

GPU Scheduling Example: Assignments API

```
// Task API
val context = TaskContext.get()
val resources = context.resources()
val assignedGpuAddrs = resources("gpu").addresses
// Pass assignedGpuAddrs into TensorFlow or other AI code

// Driver API
scala> sc.resources("gpu").addresses
Array[String] = Array(0)
```

GPU Scheduling Example: Schedule API



Executors

▾Show Additional Metrics

- □ Select All
- □ On Heap Memory
- □ Off Heap Memory
- ☑ Resources

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	Blacklisted
Active(2)	0	0.0 B / 8.7 GiB	0.0 B	2	0	0	0	0	0.0 ms (0.0 ms)	0.0 B	0.0 B	0.0 B	0
Dead(0)	0	0.0 B / 0.0 B	0.0 B	0	0	0	0	0	0.0 ms (0.0 ms)	0.0 B	0.0 B	0.0 B	0
Total(2)	0	0.0 B / 8.7 GiB	0.0 B	2	0	0	0	0	0.0 ms (0.0 ms)	0.0 B	0.0 B	0.0 B	0

Executors

Show 20 entries

Search:

Executor ID ▲	Address	Status	RDD Blocks	Storage Memory	Disk Used	Cores	Resources	Active Tasks	Failed Tasks	Complete Tasks	Total Tasks	Task Time (GC Time)	Input	Shuffle Read	Shuffle Write	Logs	Thread Dump
driver	10.28.9.112:42305	Active	0	0.0 B / 8.4 GiB	0.0 B	0		0	0	0	0	0.0 ms (0.0 ms)	0.0 B	0.0 B	0.0 B		Thread Dump
1	tomg-x299:37047	Active	0	0.0 B / 366.3 MiB	0.0 B	2	gpu: [0, 1]	0	0	0	0	0.0 ms (0.0 ms)	0.0 B	0.0 B	0.0 B	stdout stderr	Thread Dump

Showing 1 to 2 of 2 entries

Previous 1 Next

Sparks + RAPIDS Resources

- https://nvidia.github.io/spark-rapids/https://nvidia.github.io/spark-rapids/
- https://github.com/nvidia/spark-rapids/
- https://www.nvidia.com/en-us/deep-learning-ai/solutions/data-science/apache-spark-3/
- https://ngc.nvidia.com

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Questions?