Software Defined Infrastructure

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# Spark Multi-User Benchmark

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# Agenda

- Spark Multi-User Benchmark
  - Benchmark Objectives
  - Use Cases
  - SMB Stage 1 Description
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# Spark Multi-User Benchmark Objective

- **Spark Multi-User Benchmark (SMB)** is designed to measure **resource manager performance under multi-user conditions**:
    - Multiple users run jobs on the systems, managed by the resource manager, concurrently
    - Each user submits a sequence of jobs
        - The total number of jobs is the same for every user
    - The total number of users running jobs on the system is increased until a desired number is reached
    - The system reaches and retains steady state
    - As user job sequences complete the overall system utilization decreases
    - SMB measures resource manager's scheduling efficiency and ability to maintain QoS for users

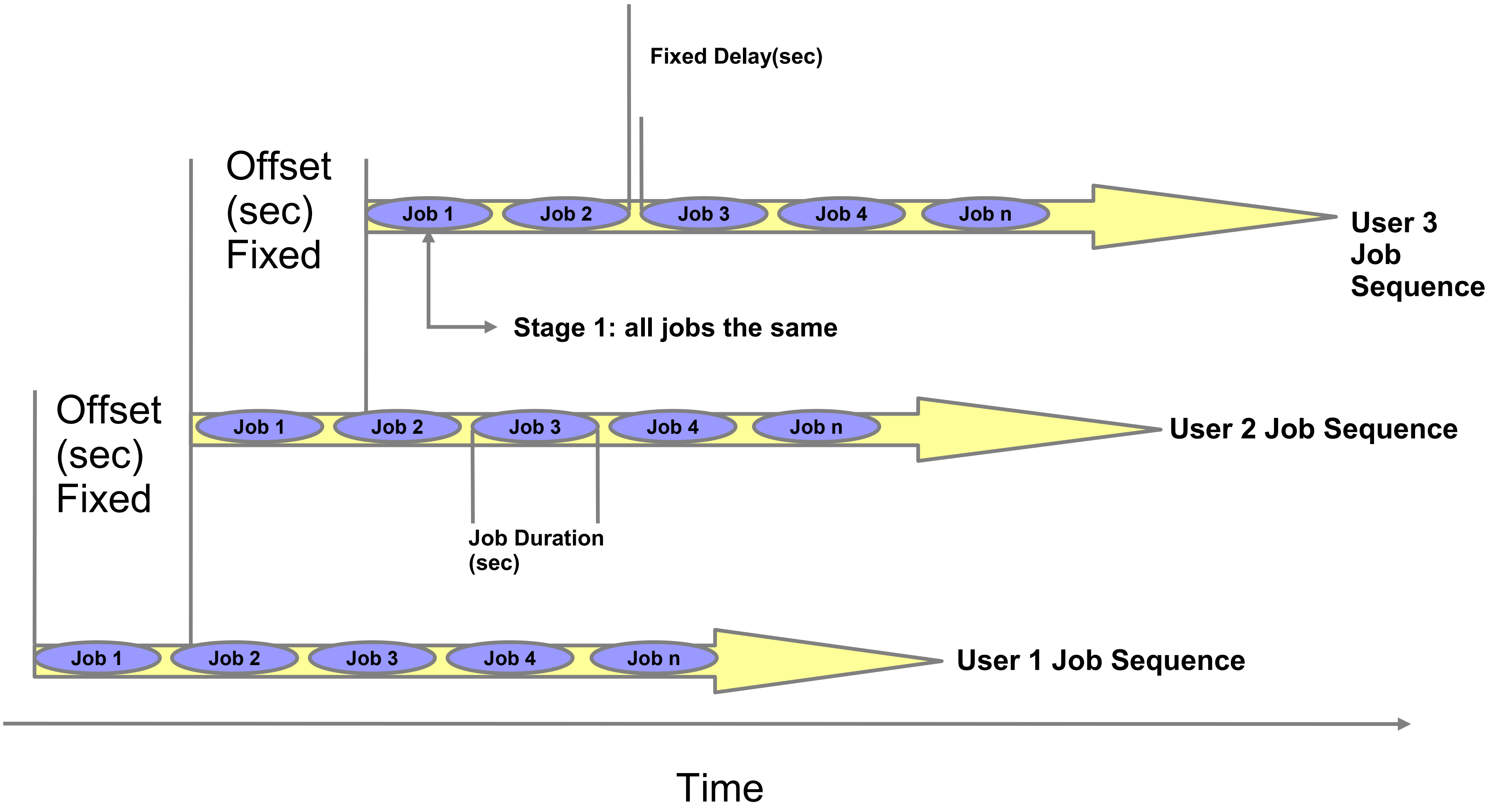
# Use Case 1: End-Of-Year/Quarter/Month Analytics

- **Major bank needs to publish end-of-year/quarter/month report**
  - Analysts run multiple types of analytic jobs to analyze sales performance
    - Reports by product category
    - Reports by geography
    - Reports by customer demographic
  - As the deadline approaches the number of analysts running jobs on the cluster increases
  - As the deadline passes the number o analysis running jobs on the cluster decreases
  - At peak, the cluster is heavily utilized and in steady-state

# Use Case 2: On-Line Trading Site

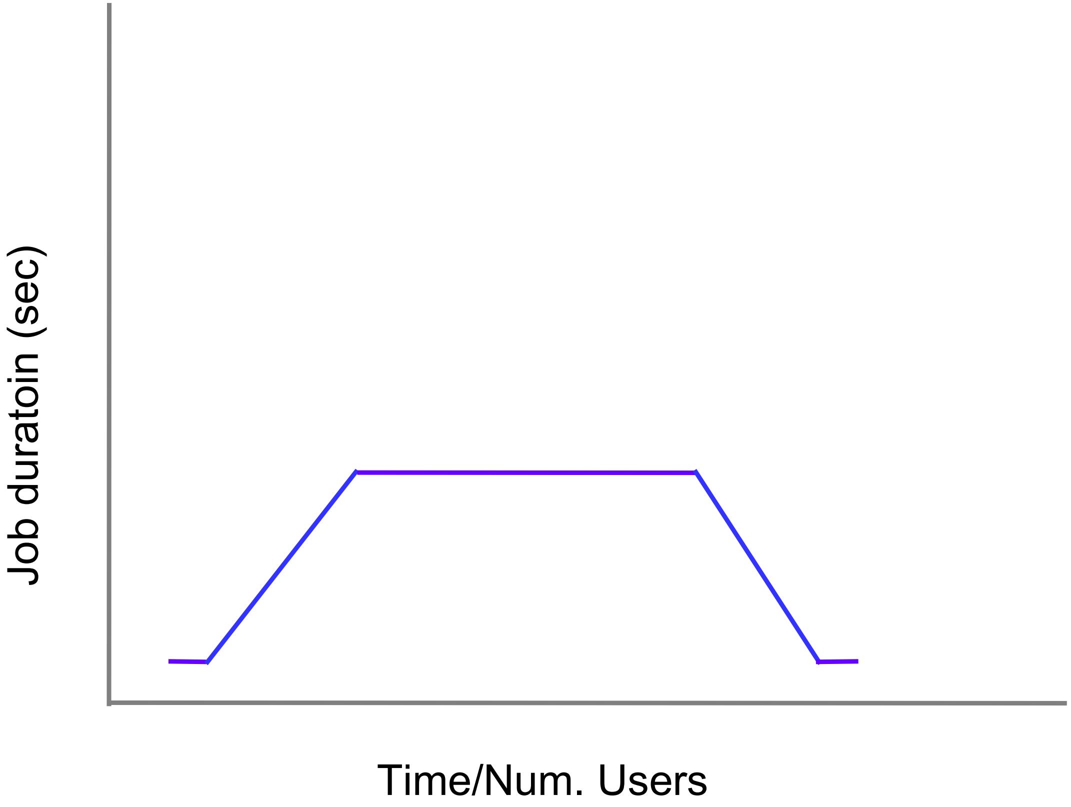
- **Major brokerage runs an on-line trading site, with Spark analytics**
  - Spark analytics are used to analyze trader's profile and search or sort applicable trades
  - During high-volume trading days the number of traders on the site increases until the analytic cluster is fully utilized
  - The cluster remains in steady-state heavy operation until the high-volume trading day – e.g. triple-witching day – is over, and the load on the analytic cluster gradually decreases

# SMB-1Benchmark

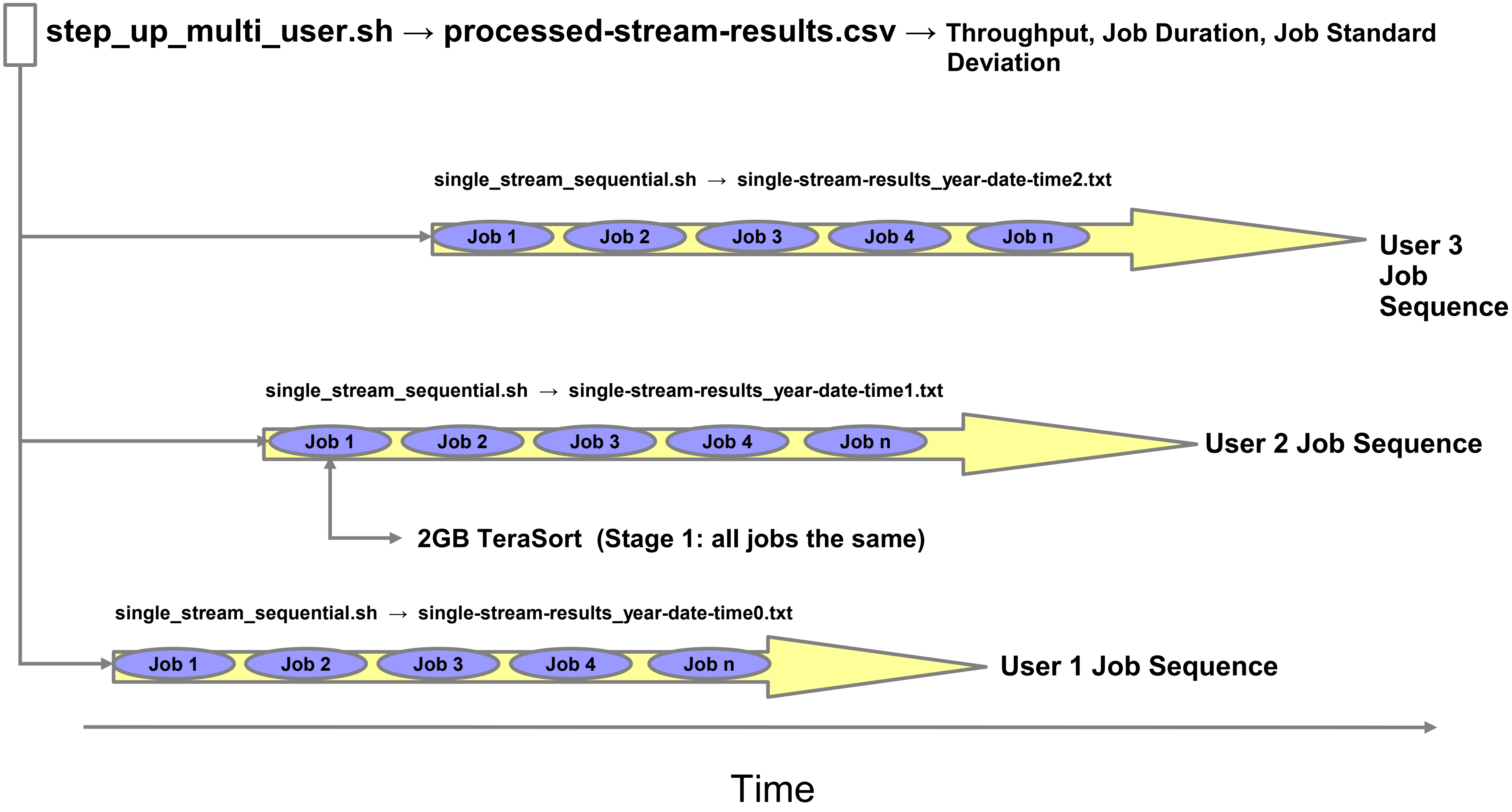


# SMB Benchmark Theory

- Duration of each job executed is proportional to resources allocated by the resource manager
- Plot of job duration for all jobs vs. test duration should show a pattern simiar to figure on the right
- Job duration data can be used to calculate key metrics related to resource manager efficiency:
  1) Throughput
  2) Job duration
  3) Job duration variance



# SMB-1 Benchmark Implementation



step_up_multi_user.sh → processed-stream-results.csv → Throughput, Job Duration, Job Standard Deviation

single_stream_sequential.sh → single-stream-results_year-date-time2.txt

Job 1 Job 2 Job 3 Job 4 Job n

User 3 Job Sequence

single_stream_sequential.sh → single-stream-results_year-date-time1.txt

Job 1 Job 2 Job 3 Job 4 Job n

User 2 Job Sequence

2GB TeraSort (Stage 1: all jobs the same)

single_stream_sequential.sh → single-stream-results_year-date-time0.txt

Job 1 Job 2 Job 3 Job 4 Job n

User 1 Job Sequence

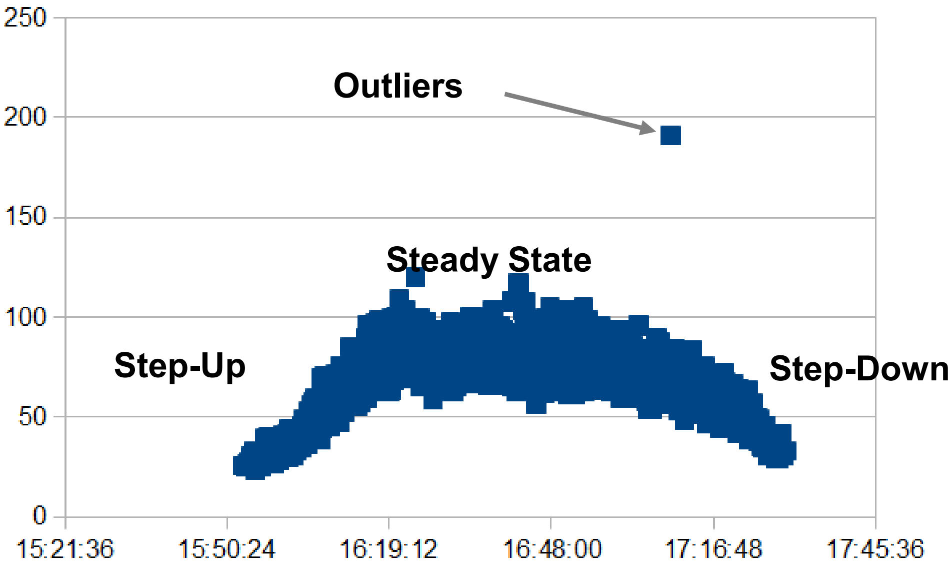
Time

# SMB-1 Example Benchmark Environment

- **SMB-1 environment specs:**
  - 1 master node + 10 compute/data nodes in the cluster
  - Each node is a IBM System x3630 M4 server with Intel Xeon Processor E5-2450 at 2.10GHz, 32 vcores (2 CPU, 8 physical cores per CPU, 2 hyperthreads per core), 96 GB RAM
  - RHEL 7.1 on all nodes
  - The master node has 1 local disk for OS and software install.
  - Each compute/data node uses 12 local disks, 1 for OS and software installs, 11 for data disks of Spark, HDFS, and YARN
  - 10 GbE network
  - NFS for Spark history log

# SMB-1 Benchmark Metrics And Analysis

- **Throughput:**
  - Measured in jobs/hr
  - All jobs which successfully completed during the step-up, steady-state and step-down phases are counted
- **Job duration:**
  - Measures 90th percentile job duration in sec
  - All jobs which successfully completed during the step-up, steady-state and step-down phases are counted
- **Job standard deviation:**
  - Measure of variance, or scatter of the data
  - Measures differences in job duration in sec
  - All jobs which successfully completed during the step-up, steady-state and step-down phases are counted



Plot of the job duration data points shows how fairly the resource manager distributes resources among jobs