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A Performance Evaluation of Apache Kafka in Support of Big Data Streaming Applications

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1. Context

- **Stream computing**: a new paradigm enabling real-time Big Data processing through 3 steps
  - Ingestion: Apache Kafka
  - Processing: Apache Spark / Flink
  - Storage: HDFS, Cassandra

- **Ingestion** can be a bottleneck for stream processing

2. Contribution

- Identify the impact of different parameter settings on Kafka’s overall performance
- **Experiment evaluation** of several configurations and performance metrics of Kafka
- Allow users to avoid bottlenecks and achieve good practice for stream processing

3. Kafka Architecture

4. Methodology

- Isolate the performance of each Kafka component
- Separated tests for Producers and Consumers
- Make correlations between configuration parameters, resource usage and performance metrics
- Experiments executed on Grid5000
  - Up to 32 nodes (16 cores per nodes, 28 GB RAM, 10 Gigabit Ethernet)

5. Results

Producer performances when modifying batch size for several number of nodes and a message size of 50B

6. Key metrics

**Parameters**:
- Message size
- Batch size
- Acquisition strategy
- Network and disk I/O threads
- Message replication
- Hardware

**Performance Metrics**:
- Throughput (MB/s, items/s)
- Latency
- CPU usage
- Disk usage
- Memory usage
- Network usage

7. Take-aways

- The variation of the batch size shows that there is a range of batches with a better performance.
- When varying the number of nodes in some scenarios: a sudden performance drop (probably due to the internal Kafka synchronizations as well as the underlying network).
- Future work: evaluating reference processing frameworks (Apache Spark and Flink)