Cassandra Performance Tuning

Apache Cassandra:
Summary

Learning objectives: solutions

- Revisit performance tuning methodology
- Outline easy performance tuning wins
- Outline Cassandra or environment anti-patterns

Question

DATASTAX

How does this all fit together?

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1. Understand performance and Cassandra at a high level.
2. Collect performance data on the following things:
   - Workflow and data model
   - Cluster and nodes
   - Operating system and hardware
   - Disk and compaction strategies
3. Parse the information gathered and begin formulating a plan.
   - Based on metrics collected, where are the bottlenecks?
   - What tools are available to fix issues that come up?
4. Apply solutions to any/all areas required and test solutions.
   - Using tools and knowledge gained, apply solutions.
   - Test solutions applied and start cycle again as needed.

Question

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What was that performance tuning methodology again?

Performance Tuning Methodology

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- Active Performance Tuning—Suspect there's a problem?
  - Determine if problem is in Cassandra, environment or both.
  - Isolate problem(s) using tools provided.
  - Verify problems and test for reproducibility.
  - Fix problems using tuning strategies provided.
  - Test, test, and test again.
    - Verify that your "fixes" did not introduce additional problems.
- Passive Performance Tuning—Regular system "sanity checks"
  - Regularly monitor key health areas in Cassandra/Environment using tools provided
  - Identify and tune for future growth/scalability.
  - Apply tuning strategies as needed.
  - Periodically apply the USE Method for a system health check.

Question

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What are some easy Cassandra performance tuning wins?

Easy Cassandra performance tuning wins

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- Increase Flushwriters, if blocked
- Decrease concurrent compactors
  - At 2 watch for CPU saturation
  - If saturated, drop to 1
- Increase concurrent reads and writes appropriately
- Nudge Cassandra to leverage OS cache to read based workloads
- Increase phi_convict_threshold for cloud deployments or those with bad network connectivity
- Increase compaction_throughput if disk I/O is available and compactions are falling behind
- Increase streaming_throughput to increase the pace of streaming

Easy data model performance tuning wins

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- Look at time series data modeling
  - http://planetcassandra.org/blog/getting-started-with-time-series-data-modeling/
- Avoid creating more than 500 tables in Cassandra.
- Keep wide rows under 100 MB or 100,000 columns.
- Leverage wide rows instead of collections for high granularity items.
- Avoid data modeling hotspots by choosing a partition key that ensures read/write workload is spread across cluster.
- Avoid tombstone build up by leveraging append only techniques.
- Use DESC sort to minimize impact of tombstones.
- Use inverted indexes to help where data duplication or nesting is not appropriate.

Easy cluster performance tuning wins

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- Use the DataStax or Astyanax driver to ensure coordinator workload is spread evenly across cluster.
- Do not put OpsCenter's database and production database on same cluster.
- Size the cluster for peak anticipated workload.
- Use vnodes if possible to help simplify scaling.
- Use a 10G network between nodes to avoid network bottlenecks.
- Use NTP.

Easy JMV/Memory performance tuning wins

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- Ensure there is adequate RAM to keep active data in memory.
- Understand how heap allocation affects performance.
- Look at how key cache affects performance.
- Understand bloom filters and their impact.
- Enable or disable swap as necessary.
- Look at the impact of memtables on performance.

Easy network performance tuning wins

- Use a 10G network.
- Avoid firewalls.
  - Firewalls can drop idle connections.

Easy client performance tuning wins

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- Token aware policies may cause hotspots on the cluster.
- Use DCAwareRoundRobin policies.
- Use local DC for affinity.
- Keep a session object open.
  - Use a singleton approach to sessions.
- Don't use batch statements unless you know what you are doing.

Question

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What are some Cassandra/ environment anti-patterns?

Cassandra anti-patterns

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- Network attached storage. Bottlenecks include:
  - Router latency
  - Network Interface Card (NIC)
  - NIC in the NAS device
- Shared network file systems
- Excessive heap space size
  - Can impair the JVM's ability to perform fluid garbage collection
- Load balancers
  - Harmful to performance, cost, availability, etc.

Cassandra anti-patterns, Cont.

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- Queues and queue-like datasets
  - Deletes do not remove rows/columns immediately.
  - Can cause overhead with RAM/disk because of tombstones.
  - Can affect read performance if data not modeled well.

Review Questions

- What are some easy performance tuning wins?
- How does the JVM and RAM negatively impact performance?
- How can a poorly designed data model negatively impact performance?
- What effect can a badly implemented compaction strategy have on performance?