



Introducing hardware planning and troubleshooting

Apache Cassandra:
Core Concepts, Skills, and Tools

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Learning Objectives

- **Introduce best practices in hardware implementation**
- Introduce troubleshooting resources

What general guidelines define good Cassandra hardware?

- DataStax Enterprise Best Practices white paper
 - <http://www.datastax.com/wp-content/uploads/2014/04/WP-DataStax-Enterprise-Best-Practices.pdf>
- DataStax Enterprise Reference Architecture white paper
 - <http://www.datastax.com/wp-content/uploads/2014/01/WP-DataStax-Enterprise-Reference-Architecture.pdf>

What general guidelines define good Cassandra hardware?

- **Memory**

- large key cache reduces disk I/O
- large MemTables reduce SSTable flushing and volume

- **Recommendations**

- **Dedicated machines**

- price-performance sweet spot is 16GB to 64GB
- minimum is 8GB

- **Virtual machines**

- optimal range may be 8GB to 16GB
- minimum is 4GB

- **Light workload testing**

- virtual machines as small as 256MB

What general guidelines define good Cassandra hardware?

- **CPU**

- Write-heavy loads are CPU bound, not memory bound
- Cassandra uses all available cores

- **Recommendations**

- **Dedicated machines**
 - sweet spot is 8 core processors
 - minimum is single-core, but ...
- **Virtual machines**
 - seek vendors that support CPU bursting

What general guidelines define good Cassandra hardware?

- **Disk**
 - Size-tiered compaction needs 50% free disk space
 - Leveled compaction needs 10% free disk space
- **Recommendations**
 - 500gb to 1tb per node (maximum 3tb to 5tb per node)
 - Two drives: one for Data, one for Commit Log
 - Solid State Drives encouraged
- Poorly-planned storage is the leading cause of Cassandra failures

See the Hardware Planning documentation for significant additional detail

What general guidelines define good Cassandra hardware?

- **Network**

- Cassandra is a distributed data store, so network capacity is critical
- Internal storage uses *listen_address*, Thrift/RPC uses *rpc_address*
- Cassandra seeks closest nodes for replication

- **Recommendations**

- Bind interfaces to separate NICs
- Gigabit ethernet or greater

What anti-patterns guide good choices?

- To succeed with Cassandra, avoid the following
 - Hardware and configuration
 - Network attached storage
 - Shared network file systems
 - Excessive heap space size
 - Unnecessary use of multiple racks
 - Lack of familiarity with Linux
 - Application development
 - SELECT ... IN CQL queries
 - Reading before writing
 - Load balancers
 - Insufficient testing

Learning Objectives

- Introduce best practices in hardware implementation
- **Introduce troubleshooting resources**

What are some common warning signs?

- Watch for the following
 - Reads are getting slower while writes are still fast
 - Nodes seem to freeze after some period of time
 - Nodes are dying with OOM errors
 - Nodetool or JMX connections failing on remote nodes
 - View of ring differs between some nodes
 - Java reports an error saying there are too many open files
 - Insufficient user resource limits errors
 - Cannot initialize class `org.xerial.snappy.Snappy`

See the [Troubleshooting documentation](#) for significant additional detail

How do you backup Cassandra data?

- *DataStax OpsCenter* provides thorough backup and restore functionality via a visual interface
- *Apache Cassandra nodetool* enables snapshots

```
./nodetool snapshot --cf <table> -t <tag> <keyspace>
```

- all keyspaces on a node

```
./nodetool snapshot -t 2014.06.24 music
```

- all tables in one or more keyspaces

```
./nodetool snapshot mykeyspace music
```

- a single table

```
./nodetool snapshot -cf playlists music
```

Exercise I: perform a one-node snapshot



What learning resources are available?

- Planet Cassandra
 - <http://planetcassandra.org/>
- DataStax Software Downloads
 - <http://www.datastax.com/download>
- DataStax Cassandra Documentation
 - <http://www.datastax.com/docs>
- DataStax Cassandra Dev Blog
 - <http://www.datastax.com/dev/blog>
- Cassandra Support Forum
 - <http://stackoverflow.com/questions/tagged/cassandra>
- Apache Cassandra Wiki
 - <http://wiki.apache.org/cassandra/>
- Apache Cassandra Project
 - <http://cassandra.apache.org/>

Summary

- 16gb to 64gb memory, 8gb minimum
- 8 core processors or CPU bursting VMs
- 500gb to 1tb disk space per node
- Gigabit ethernet between nodes
- Avoid network attached storage
- Avoid excessive heap size
- Watch for the listed warning signs
- Unless using DSE, use *nodetool snapshot* to perform backups

Review Questions

- Should network attached storage be used with Cassandra?
- Should you use the maximum possible heap size?
- What is the leading cause of failed Cassandra implementations?
- What are some common Cassandra warning signs?
- Who do you call if you need help?

