

CS300 Couchbase NoSQL Server Administration

July 26th , 2016



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Labs – Day 4



Lab #7 (Advanced XDCR & Backup/Restore):

- Study optimistic replication in detail
- Write 100,000 items under the optimistic threshold
- Write 100,000 items over the optimistic threshold
- Demonstrate that XDCR replication keeps occurring even after a node failure
- Use vBucketkeygen tool to write 1 key to each of the 1024 vBuckets
- Use cbbackup and cbrestore

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Labs – Day 4



Lab #8 (Performance & Compaction):

- Examine high water mark and low water mark
- Understand how ejection works
- Learn about the Not-Recently-Used metadata setting
- Learn about the item pager
- Become familiar with how Couchbase manages memory
- Learn about Disk reads vs RAM reads
- Understand how different traffic patterns require different Couchbase settings
- Understand the 'resident %' in memory metric
- Detect out of memory (OOM) errors
- Displaying metrics via cbstats and studying item expiration
- Display timing metrics with "cbstat timings"
- Learn about Compaction

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Backup and Restore

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Backup and Restore



2 techniques for backups:

cbackup & cbrestore

- enables you to back up a single node, single buckets, or the entire cluster into a flexible backup structure that allows for restoring the data into the same, or different, clusters and buckets. Can be performed live. (this is the recommended way)

File copies

- A running or offline cluster can be backed up by copying the files on each of the nodes. Using this method you can only restore to a cluster with an identical configuration.

Warning: Due to the active nature of Couchbase Server it is impossible to create a complete in-time backup and snapshot of the entire cluster. Because data is always being updated and modified, it would be impossible to take an accurate snapshot.

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It is a best practice to backup and restore your entire cluster to minimize any inconsistencies in data. Couchbase is always per-item consistent, but does not guarantee total cluster consistency or in-order persistence.

cbackup goes node to node... so you'll see high CPU on one node at a time.

It backs up the actual data in the views as well

Backup and Restore



Combinations of types of backups that cbbackup can do:

- Single bucket on a single node
- All the buckets on a single node
- Single bucket from an entire cluster
- All the buckets from an entire cluster

Backups can be performed either locally, by copying the files directly on a single node, or remotely by connecting to the cluster and then streaming the data from the cluster to your backup location.

The cbbackup command takes the following arguments:

```
# cbbackup [options] [source] [backup_dir]
```

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Backup and Restore



```
# cbbackup http://HOST:8091 /backups/backup-2012-0501 \
-u Administrator -p password \
-b default \

[#####] 100.0 % (231726/231718 msgs)
bucket: default, msgs transferred...
      :      total |      last | per sec
batch :          5294 |      5294 | 617.0
  byte : 10247683 | 10247683 | 1194346.7
    msg :     231726 |     231726 | 27007.2
done
[#####] 100.0 % (11458/11458 msgs)
bucket: default, msgs transferred...
      :      total |      last | per sec
batch :          5943 |      5943 | 15731.0
  byte : 11474121| 11474121| 30371673.5
    msg :        84 |        84 | 643701.2
done
```

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When backing up multiple buckets, a progress report, and summary report for the information transferred will be listed for each bucket backed up. The msgs count shows the number of documents backed up. The byte shows the overall size of the data document data.

The source specification in this case is the URL of one of the nodes in the cluster. The backup process will stream data directly from each node in order to create the backup content. The initial node is only used to obtain the cluster topology so that the data can be backed up.

Filtering Keys during Backup



```
# cbbackup http://HOST:8091 /backups/backup-  
2012-0501 \  
    -u Administrator -p password \  
    -b default \  
    -k '^object.*'
```

The cbbackup command includes support for filtering the keys that are backed up into the database files you create.

This can be useful if you want to specifically backup a portion of your dataset, or you want to move part of your dataset to a different bucket.

The specification is in the form of a regular expression, and is performed on the client-side within the cbbackup tool.

This means that the entire bucket contents must be accessed by the cbbackup command and then discarded if the regular expression does not match.

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The regular expression match is performed client side. This means that the entire bucket contents must be accessed by the cbbackup command and then discarded if the regular expression does not match.

Restore



The basic format of the cbrestore command is as follows:

```
# cbrestore [options] [source] [destination]
```

The cbrestore command takes the information that has been backed up via the cbbackup command and streams the stored data into a cluster.

It allows for a number of different scenarios to be executed on the data that has been backed up:

- You want to restore data into a cluster of a different size and configuration.
- You want to transfer/restore data into a different bucket on the same or different cluster.
- You want to restore a selected portion of the data into a new or different cluster, or the same cluster but a different bucket.

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Restore



To restore the bucket data to a different bucket on the cluster:

```
> cbrestore \
  /backups/backup-2012-05-10 \
  http://Administrator:password@HOST:8091 \
  --bucket-source=XXX \
  --bucket-destination=YYY
[########################################] 100.0% (231726/231726 msgs)
bucket: default, msgs transferred...
      :          total |       last |     per sec
batch :            232 |        232 |      33.1
byte  :        10247683 |    10247683 | 1462020.7
msg   :        231726 |      231726 | 33060.0
done
```

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The msg count in this case is the number of documents restored back to the bucket in the cluster.

Filtering Keys during Restore



```
> cbrestore /backups/backup-20120501 http://HOST:8091 \
-u Administrator -p password \
-b default \
-k '^object.*'

2013-02-18 10:39:09,476: w0 skipping msg with key: sales_7597_3783_6
...
2013-02-18 10:39:09,476: w0 skipping msg with key: sales_5575_3699_6
2013-02-18 10:39:09,476: w0 skipping msg with key: sales_7597_3840_6
[                                         ] 0.0% (0/231726 msgs)
bucket: default, msgs transferred...
:          total |      last |    per sec
batch :           1 |        1 |       0.1
byte  :           0 |        0 |       0.0
msg   :           0 |        0 |       0.0
done
```

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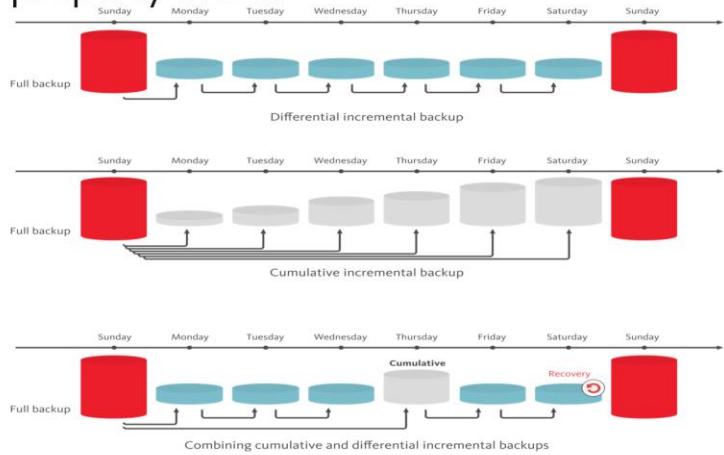
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The above will copy only the keys matching the specified prefix into the default bucket. For each key skipped, an information message will be supplied. The remaining output shows the records transferred and summary as normal.

Incremental Backup

- Couchbase 3.0 supports incremental backups by taking advantage of the ordered property in DCP

- Major advantages:
 - Shorter backup times
 - Smaller backup size



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Example

The following example requests a full backup of all the data on the specified cluster:

```
cbbbackup -m full http://example.com:8091 /backups/backup-1
```

After an initial full backup, incremental backups can be performed. This example requests a differential incremental backup of all the data on the specified cluster:

```
cbbbackup -m diff http://example.com:8091 /backups/backup-1
```

This example requests a cumulative incremental backup of all the data on the specified cluster:

```
cbbbackup -m accu http://example.com:8091 /backups/backup-1
```

Software Upgrade Plan online/offline or swap



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Online upgrades

You can upgrade your cluster without taking your cluster down and so your application keeps running during the upgrade process. There are two ways you can perform this process: as a standard online upgrade, or as a swap rebalance. We highly recommend using a swap rebalance for online upgrade so that cluster capacity is always maintained. The standard online upgrade should only be used if swap rebalance is not possible.

Using the standard online upgrade, you take down one or two nodes from a cluster, and rebalance so that remaining nodes handle incoming requests. This is an approach you use if you have enough remaining cluster capacity to handle the nodes you remove and upgrade. You will need to perform rebalance twice for every node you upgrade: the first time to move data onto remaining nodes, and a second time to move data onto the new nodes.

Standard online upgrades may take a while because each node must be taken out of the cluster, upgraded to a current version, brought back into the cluster, and then rebalanced. However since you can upgrade the cluster without taking the cluster down, you may prefer this upgrade method.

For swap rebalance, you add a node to the cluster then perform a swap rebalance to

shift data from an old node to a new node. You might prefer this approach if you do not have enough cluster capacity to handle data when you remove an old node. This upgrade process is also much quicker than performing a standard online upgrade because you only need to rebalance each upgraded node once.

3 methods of Software upgrade



- 1) Off line couchbase** **stop couchbase, upgrade, restart couchbase**
- 2) Online with No Spares** **remove node, rebalance, upgrade, balance swap in/out, repeat(as necessary), last one in rebalance**
- 3) Online with spares** **upgrade spares, balance swap in/out(as necessary)**

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Lab #7 (Advanced XDCR & Backup/Restore)



- Study optimistic replication in detail
- Write 100,000 items under the optimistic threshold
- Write 100,000 items over the optimistic threshold
- Demonstrate that XDCR replication keeps occurring even after a node failure
- Use vBucketkeygen tool to write 1 key to each of the 1024 vBuckets
- Use cbbackup and cbrestore



Time: 1 hour

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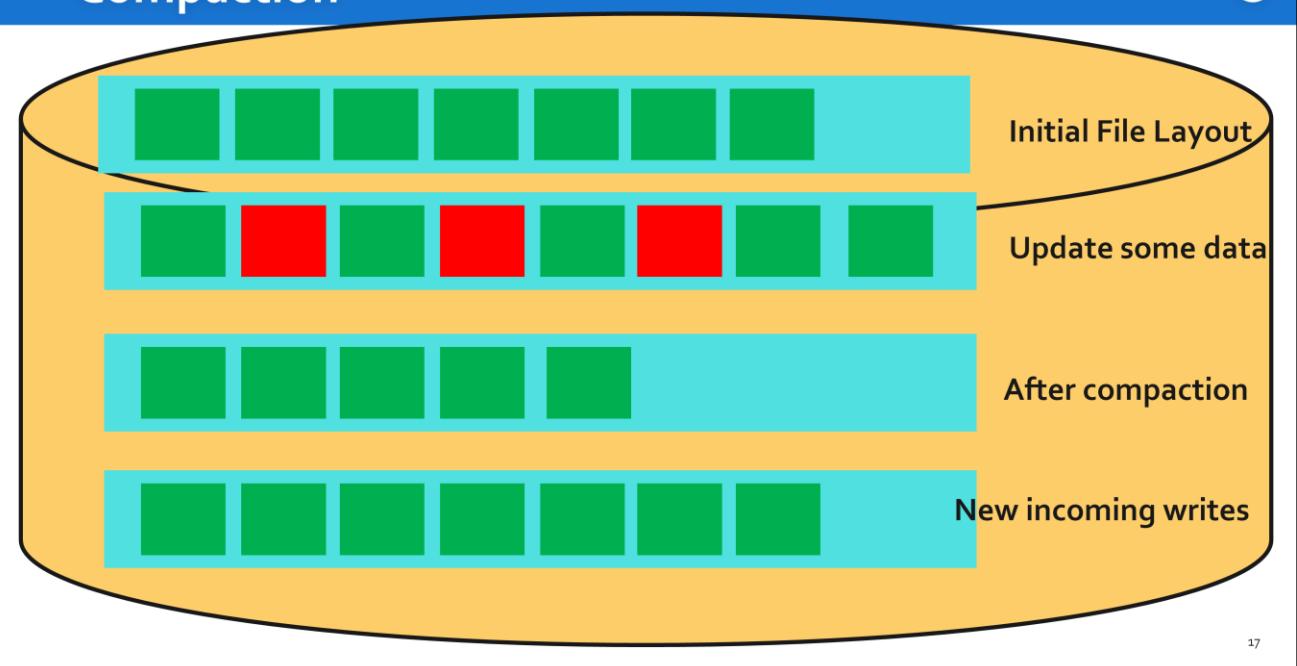
Compaction

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Compaction



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Append-only file format puts all new/updated/deleted items at the end of the on-disk file.

Better performance and reliability

No more fragmentation!

This can lead to invalidated data in the “back” of the file.

Need to compact data.

The compaction process operates incrementally on a per-vbucket basis, and is controlled by both a fragmentation threshold and a time of day setting. It works by creating a new file with just the latest data and then switching over from the main one to the new one when complete.

Compaction Operation



- Compaction creates a new file
 - **Available disk space is checked (need twice current data size)**
- Existing data is written to new file
 - **Existing file is used until compaction has completed**
 - **Data file extension is numeric; new version has uses next increment (i.e. current data in 1.couch.12 is compacted to 1.couch.13)**
- Once compaction is complete, old file disabled, new file enabled, old files deleted
- Compaction may not complete
 - **In write-intensive situations**
 - **Compaction may never 'catch-up' with**
- Compaction is both disk and CPU intensive

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Compaction of write-heavy databases

It is not a good idea to attempt compaction on a database node that is near full capacity for its write load. The problem is the compaction process may never catch up with the writes if they never let up, and eventually it will run out of disk space.

Compaction should be attempted when the write load is less than full capacity. Read load won't affect its ability to complete, however. To have the least impact possible on clients, the database remains online and fully functional to readers and writers. It is a design limitation that database compaction can't complete when at capacity for write load. It may be reasonable to schedule compactions during off-peak hours.

Identifying Compaction



- Check docs fragmentation percentage
- Check views fragmentation percentage
- Compare docs and views disk size and data size



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doc fragmentation %

Document fragmentation of persisted data as stored on disk.

Auto-Compaction



Configure Bucket

Bucket Settings

Bucket Name: default

Bucket Type: Couchbase Memcached

Memory Size

Per Node RAM Quota: 1024 MB Cluster quota (1024 MB)
Other Buckets (0 B) This Bucket (1024 MB) Free (0 B)

Total bucket size = 1024 MB (1024 MB x 1 node)

Access Control

Standard port (TCP port 11211, ASCII protocol or Binary auth-less)
 Dedicated port (supports ASCII protocol and is auth-less)
Protocol Port: 0

Replicas

Enable Number of replica (backup) copies
 Index replicas

Auto-Compaction

The Auto-Compaction daemon compacts databases and their respective view indexes when all the condition parameters are satisfied.

Override the default autocompaction settings?

Flush

Enable

Buttons: Delete, Cancel, Save

← Auto-Compaction

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Auto-compaction



Auto-Compaction

The Auto-Compaction daemon compacts databases and their respective view indexes when all the condition parameters are satisfied.

- Override the default autocompaction settings?

Database Fragmentation

- % at which point compaction is triggered
 MB at which point compaction is triggered

View Fragmentation

- % at which point compaction is triggered
 MB at which point compaction is triggered
 Time Period HH : MM - HH : MM during which compaction is allowed
 Abort compaction if run time exceeds the above period
 Process Database and View compaction in parallel

Metadata Purge Interval (0.04 (1h) - 60days): 3

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Auto-compaction



Settings

Cluster Update Notifications Auto-Failover Alerts Auto-Compaction Sample Buckets Account Management

Auto-Compaction

The Auto-Compaction daemon compacts databases and their respective view indexes when all the condition parameters are satisfied.

Database Fragmentation

- 30 % at which point compaction is triggered
 MB at which point compaction is triggered

View Fragmentation

- 30 % at which point compaction is triggered
 MB at which point compaction is triggered
 Time Period HH : MM - HH : MM during which compaction is allowed
 Abort compaction if run time exceeds the above period
 Process Database and View compaction in parallel

Metadata Purge Interval (0.04 (1h) - 60days): [What's this?](#)

Save

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Manual Compaction



- Start Manual Compaction from Data Buckets page

The screenshot shows the 'Data Buckets' section of the Couchbase interface. At the top, there's a 'Create New Data Bucket' button. Below it is a table for 'Couchbase Buckets' with one row for the 'default' bucket. The table columns are: Bucket Name, Nodes, Item Count, Ops/sec, Disk Fetches/sec, RAM/Quota Usage, and Data/Disk Usage. The 'default' row shows 1 node, 1 item, 0 ops/sec, 0 disk fetches/sec, 2.11MB / 1024MB RAM usage, and 523KB / 537KB data/disk usage. Below the table, status information includes 'Access Control: None', 'Replicas: 1 replica copy', and 'Compaction: Not active'. There are 'Compact' and 'Edit' buttons at the bottom right.

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Auto-Compaction



- Optimizes disk file usage/fragmentation
- Occurs in the background
- Triggered by:
 - Data file fragmentation percentage or MB
 - View file fragmentation percentage or MB
- Can be time-limited
- Can be stopped automatically if not complete within limits
- Default auto-compaction applies to all buckets
- Per-bucket auto-compaction allows for per bucket config

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Compaction



Compaction takes place as a background process while Couchbase Server is running.

Make sure you perform compaction:

- **on every server**
- **during off-peak hours**
- **with adequate disk space**

Compaction activity is reported in the Couchbase Server log.

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Compaction from web UI kicks it off on all nodes in parallel...

Compaction operates on only a single server within your Couchbase Server cluster. You will need to perform compaction on each node in your cluster, on each database in your cluster.

Because compaction occurs by creating new files and updating the information, you may need as much as twice the disk space of your current database and index files for compaction to take place.



Performance

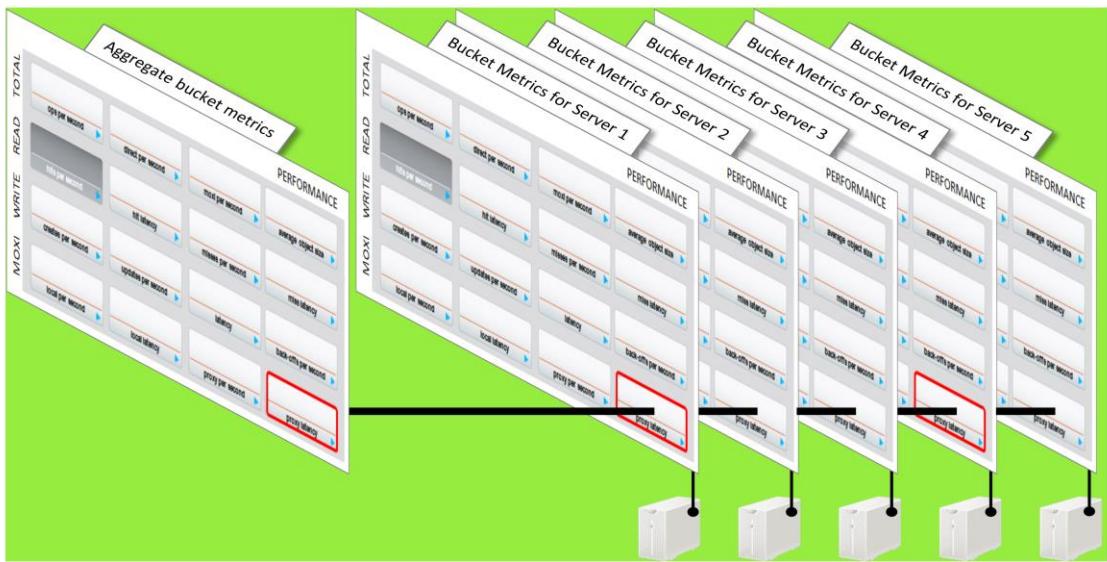
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Aggregate versus per-server stats



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Aggregate versus per-server stats



across all nodes



on one server



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Server Resources

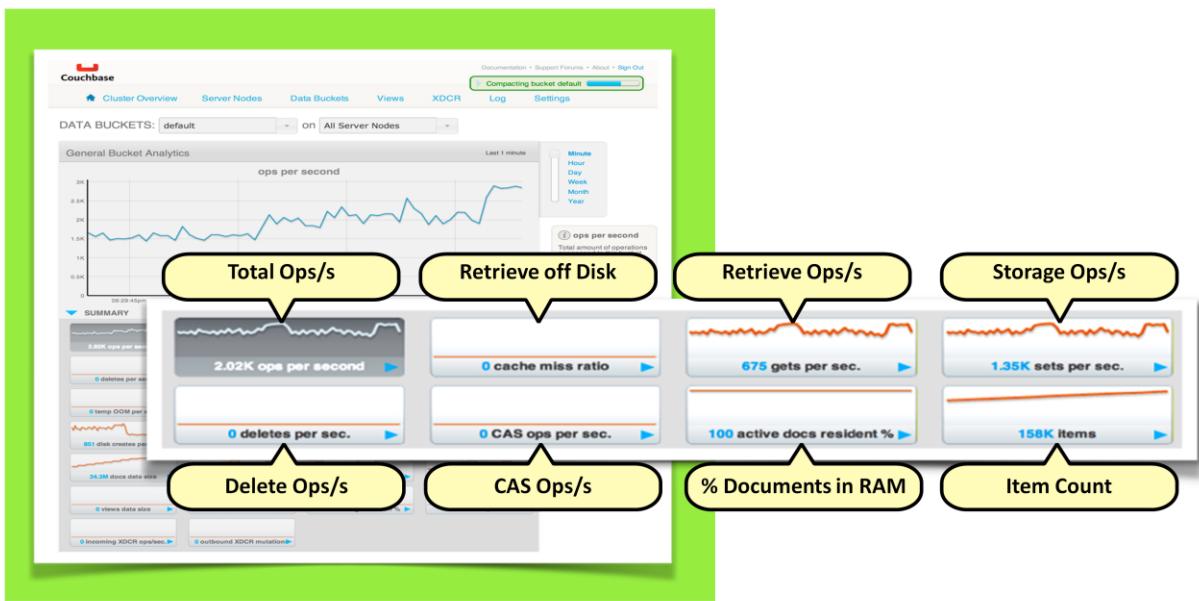


- Free RAM
- CPU
- Swap usage
- Connections

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Store and Retrieve Operations



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Store and Retrieve Operations



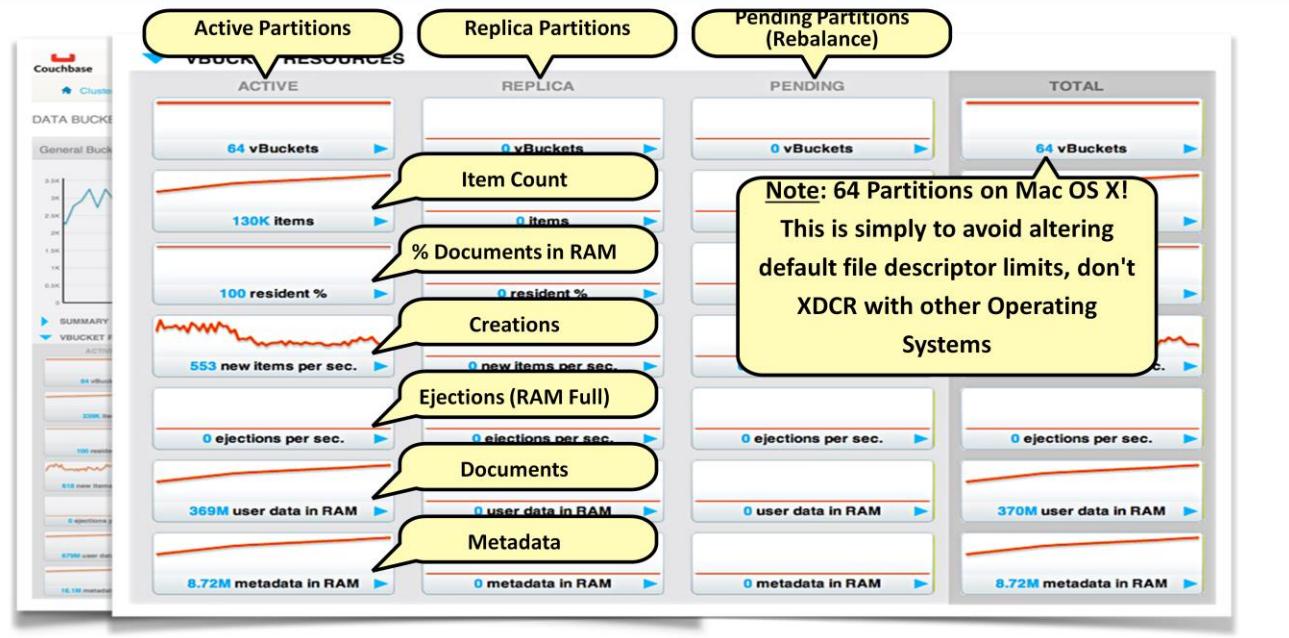
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Store and Retrieve Operations



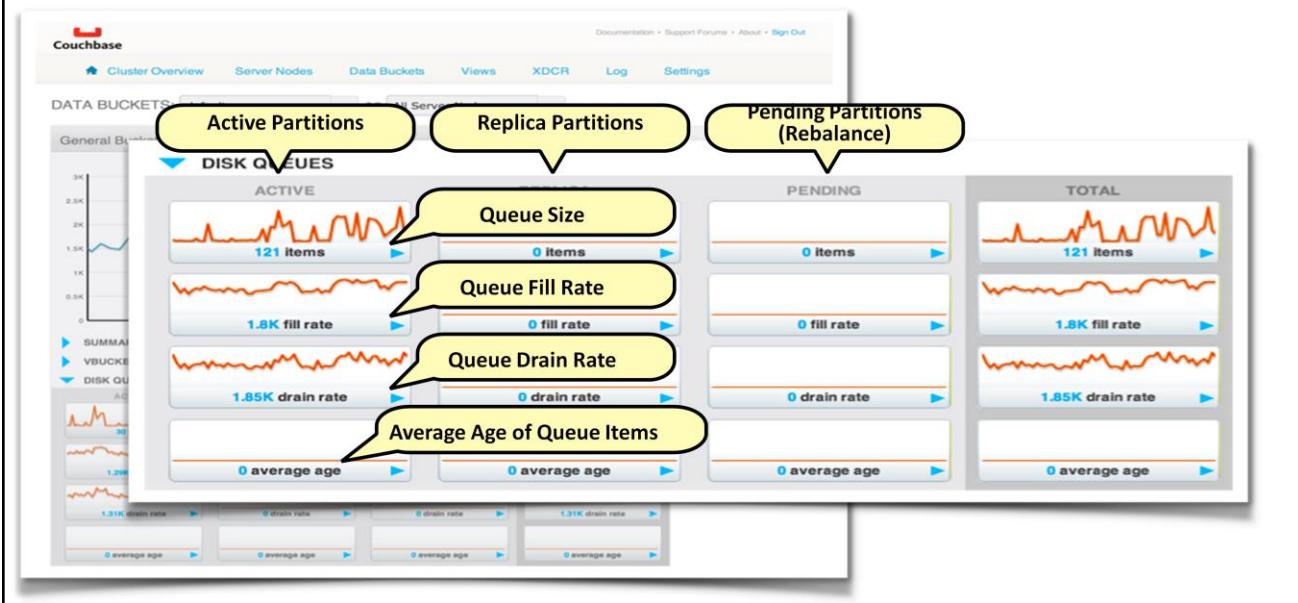
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Partition (vbucket) Details



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Disk IO Information



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Bucket monitoring — summary statistics



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Bucket monitoring — summary statistics

Perry blog: “*disk write queue*”: This is **the** metric for understanding whether there is sufficient disk IO on a node. While there are many processes that contend for disk IO (data writing, compaction, views, XDCR, local backups, etc), we use the “*disk write queue*” as a general meter as insufficient IO will cause items to be written to disk slower. Anything approaching 1M items per-bucket per-node should be cause for concern, though many applications expect it to be much lower for their workload. This should be expected to be higher during a rebalance.”

Perry blog: ““*temp OOM per sec.*” is a measure of how many write operations are failing due to an “out of memory” situation within the node/bucket. It will only occur if “memory used” reaches 90% of the total bucket quota.”

Perry blog: ““*cache miss ratio*”: This is a percentage of the number of reads being served from disk as opposed to from RAM. A value of 0 means all reads are coming from RAM, while anything higher than that indicates some reads are coming from disk. For applications that expect everything to be served from RAM, this should always be 0. For applications that expect this to be non-0, it should ideally be as low as possible, most deployments are under 1% but some accept upwards of 10%. SSD’s versus spinning disks have a big effect on what is a reasonable value.”

The following graph types are available:

ops per second- The total number of operations per second on this bucket.

cache miss ratio- Ratio of reads per second to this bucket which required a read from disk rather than RAM.

creates per second- Number of new items created in this bucket per second.

updates per second- Number of existing items updated in this bucket per second.

XDCR ops per sec- Number of XDCR related operations per second for this bucket.

disk reads per sec- Number of reads per second from disk for this bucket.

temp OOM per sec- Number of temporary out of memory conditions per second.

gets per second- Number of get operations per second.

sets per second- Number of set operations per second.

deletes per second- Number of delete operations per second.

Items- Number of items (documents) stored in the bucket.

disk write queue- Size of the disk write queue.

docs data size- Size of the stored document data.

docs total disk size- Size of the persisted stored document data on disk.

doc fragmentation %- Document fragmentation of persisted data as stored on disk.

XDC replication queue- Size of the XDCR replication queue.

total disk size- Total size of the information for this bucket as stored on disk, including persisted and view index data.

views data size- Size of the view data information.

views total disk size- Size of the view index information as stored on disk.

views fragmentation %- Percentage of fragmentation for a given view index.

view reads per second- Number of view reads per second.

memory used- Amount of memory used for storing the information in this bucket.

high water mark- High water mark for this bucket (based on the configured bucket RAM quota).

low water mark- Low water mark for this bucket (based on the configured bucket RAM quota).

disk update time- Time required to update data on disk.

monitoring — summary statistics



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Perry blog: ““active docs resident %”: This is the percentage of items currently cached in RAM. 100% means all items are cached in RAM while anything less than that indicates some items have been ejected.

Some applications expect that this is always 100% and will alert if it goes below. Other applications expect this to be something lower than 100%, but the actual value is up to you. I would generally recommend not going below 30% unless your application is quite comfortable with it.”

The vBucket statistics provide information for all vBucket types within the cluster across three different states. Within the statistic display the table of statistics is organized in four columns, showing the Active, Replica and Pending states for each individual statistic. The final column provides the total value for each statistic.

The Active column displays the information for vBuckets within the Active state. The Replica column displays the statistics for vBuckets within the Replica state (i.e. currently being replicated). The Pending columns shows statistics for vBuckets in the Pending state, i.e. while data is being exchanged during rebalancing.

The individual statistics, one for each state, shown are:

vBuckets- The number of vBuckets within the specified state.

Items- Number of items within the vBucket of the specified state.

resident %- Percentage of items within the vBuckets of the specified state that are resident (in RAM).

new items per sec.- Number of new items created in vBuckets within the specified state.

Note that new items per second is not valid for the Pending state.

ejections per second- Number of items ejected per second within the vBuckets of the specified state.

user data in RAM- Size of user data within vBuckets of the specified state that are resident in RAM.

metadata in RAM- Size of item metadata within the vBuckets of the specified state that are resident in RAM.

monitoring — summary statistics



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The Disk Queues statistics section displays the information for data being placed into the disk queue. Disk queues are used within Couchbase Server to store the information written to RAM on disk for persistence. Information is displayed for each of the disk queue states, Active, Replica and Pending.

The Active column displays the information for the Disk Queues within the Active state. The Replica column displays the statistics for the Disk Queues within the Replica state (i.e. currently being replicated). The Pending columns shows statistics for the disk Queues in the Pending state, i.e. while data is being exchanged during rebalancing.

The displayed statistics are:

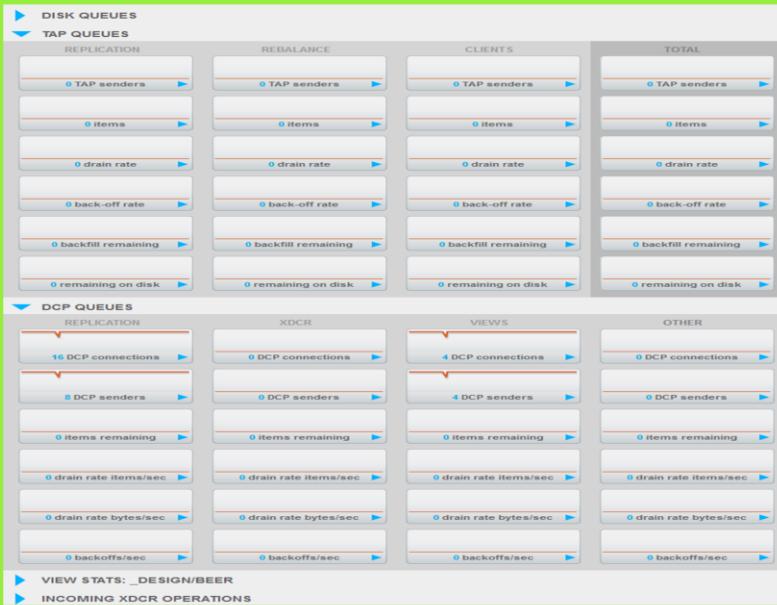
Items- The number of items waiting to be written to disk for this bucket for this state.

fill rate- The number of items per second being added to the disk queue for the corresponding state.

drain rate- Number of items actually written to disk from the disk queue for the corresponding state.

average age- The average age of items (in seconds) within the disk queue for the specified state.

monitoring — summary statistics



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Perry's blog: "The main value that we use within Couchbase to ensure a healthy network is related to the inter-node replication queue. While not present in the above "Summary", this is known casually as the "TAP queue" and is represented by "*items*" within the "TAP QUEUES" section of the UI. This value will almost always be 0 and even a few above 0 is not cause for concern. If this should rise to over 200 per-node, and especially if it continues rising, may indicate either a networking problem or something else within the cluster slowing down the replication."

The TAP queues statistics are designed to show information about the TAP queue activity, both internally, between cluster nodes and clients. The statistics information is therefore organized as a table with columns showing the statistics for TAP queues used for replication, rebalancing and clients.

The statistics in this section are detailed below:

TAP senders- Number of TAP queues in this bucket for internal (replica), rebalancing or client connections.

Items- Number of items in the corresponding TAP queue for this bucket.

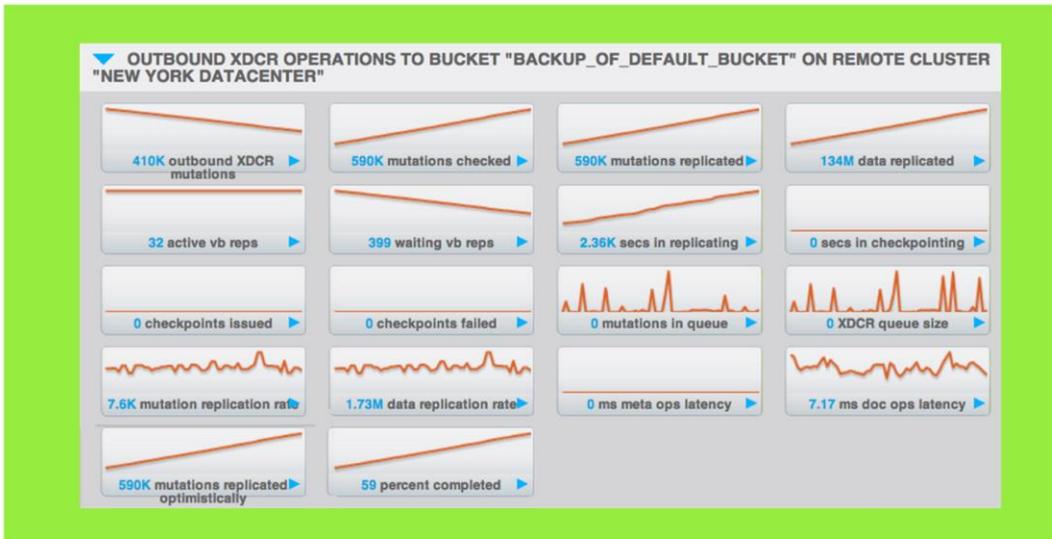
drain rate- Number of items per second being sent over the corresponding TAP queue connections to this bucket.

back-off rate- Number of back-offs per second sent when sending data through the corresponding TAP connection to this bucket.

backfill remaining- Number of items in the backfill queue for the corresponding TAP connection for this bucket.

remaining on disk- Number of items still on disk that need to be loaded in order to service the TAP connection to this bucket.

monitoring — summary statistics



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Perry blog: “If you’re using XDCR with Couchbase, the most important metric to keep an eye on is the XDCR mutation queue - “*outbound XDCR mutations*”. This is an indication of how many items are waiting to be replicated to buckets that are acting as destinations of this one. Like the disk write queue, this is expected to grow and shrink under load but is important to ensure eventually gets near zero over time and does not continuously grow higher and higher.”

The statistics shown are:

outbound XDCR mutation

Number of changes in the queue waiting to be sent to the destination cluster.

mutations checked

Number of document mutations checked on source cluster.

mutations replicated

Number of document mutations replicated to the destination cluster.

data replicated

Size of data replicated in bytes.

active vb reps

Number of parallel, active vBucket replicators. Each vBucket has one replicator which can be active or waiting. By default you can only have 32 parallel active replicators at once per node. Once an active replicator finishes, it will pass a token to a waiting replicator.

waiting vb reps

Number of vBucket replicators that are waiting for a token to replicate.

secs in replicating

Total seconds elapsed for data replication for all vBuckets in a cluster.

secs in checkpointing

Time working in seconds including wait time for replication.

checkpoints issued

Total number of checkpoints issued in replication queue. By default active vBucket replicators issue a checkpoint every 30 minutes to keep track of replication progress.

checkpoints failed

Number of checkpoints failed during replication. This can happen due to timeouts, due to network issues or if a destination cluster cannot persist quickly enough.

mutations in queue

Number of document mutations waiting in replication queue.

XDCR queue size

Amount of memory used by mutations waiting in replication queue. In bytes.

mutation replication rate

Number of mutations replicated to destination cluster per second.

data replication rate

Bytes replicated to destination per second.

ms meta ops latency

Weighted average time for requesting document metadata. In milliseconds.

mutations replicated optimistically

Total number of mutations replicated with optimistic XDCR.

ms docs ops latency

Weighted average time for sending mutations to destination cluster. In milliseconds.

percent completed

Percent of total mutations checked for metadata.

monitoring — summary statistics



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The statistics shown are:

metadata reads per sec.

Number of documents XDCR scans for metadata per second. XDCR uses this information for conflict resolution.

sets per sec.

Set operations per second for incoming XDCR data.

deletes per sec.

Delete operations per second as a result of the incoming XDCR data stream.

total ops per sec.

Total of all the operations per second.

monitoring — summary statistics



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The View statistics show information about individual design documents within the selected bucket. One block of stats will be shown for each production-level design document.

The statistics shown are:

data size

Size of the data required for this design document.

disk size

Size of the stored index as stored on disk.

view reads per sec.

Number of read operations per second for this view.



/opt/couchbase/var/lib/couchbase/stats

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The default stats file location is /opt/couchbase/var/lib/couchbase/stats, however, if you want to change the default stats file location, create a symlink location to the new directory.

Note

When creating a symlink, stop and restart the Couchbase service.

Monitoring Scripts: cbstats



```
Usage: cbstats [options] Monitoring Scripts: cbstats
Options:
-h, --help      show this help message and exit
-a             iterate over all buckets (requires admin u/p)
-b BUCKETNAME  the bucket to get stats from (Default: default)
-p PASSWORD    the password for the bucket if one exists
Usage: cbstats host:port all
or   cbstats host:port allocator
or   cbstats host:port checkpoint [vbid]
or   cbstats host:port config
or   cbstats host:port dispatcher [logs]
or   cbstats host:port hash [detail]
or   cbstats host:port items (memcached bucket only)
or   cbstats host:port keykeyname vbid
or   cbstats host:port klog
or   cbstats host:port kvstore
or   cbstats host:port kvtimings
or   cbstats host:port memory
or   cbstats host:port prev-vbucket
or   cbstats host:port raw argument
or   cbstats host:port reset
or   cbstats host:port slabs (memcached bucket only)
or   cbstats host:port tap
or   cbstats host:port tapagg
or   cbstats host:port timings
or   cbstats host:port vbucket
or   cbstats host:port vbucket-details
or   cbstats host:port vkey keyname vbid
or   cbstats host:port warmup
```

Commonly use "all", "dispatcher", "tap", "timings" and "reset"

Exhaustive list of stats available, full documentation:

<http://www.couchbase.com/docs/couchbase-manual-2.0/couchbase-monitoring-nodestats.html>

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To-do update link to 2.5

<http://www.couchbase.com/docs/couchbase-manual-2.0/couchbase-monitoring-nodestats.html>

cbstats 'all'



- 'cbstats all' is the most useful/common output:

```
/opt/couchbase/bin/cbstats localhost:11210 all
```

- Equivalent to 'stats' in the standard memcached protocol (includes many memcached stats as well)
- Many of the UI stats come from this output
- Easiest to know what you're looking for and 'grep' for a specific stat (or group):

- ```
/opt/couchbase/bin/cbstats localhost:11210 all | grep curr_items
curr_items: 4100025
curr_items_tot: 4100025
vb_active_curr_items: 4100025
vb_pending_curr_items: 0
vb_replica_curr_items: 0
```

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## Monitoring: warmup



```
$ cbstats localhost:11210 warmup
ep_warmup: enabled
ep_warmup_dups: 0
ep_warmup_estimate_time: 35
ep_warmup_estimated_key_count: 0
ep_warmup_estimated_value_count: 0
ep_warmup_key_count: 0
ep_warmup_keys_time: 689
ep_warmup_min_item_threshold: 100
ep_warmup_min_memory_threshold: 100
ep_warmup_oom: 0
ep_warmup_state: done
ep_warmup_thread: complete ← "running" or "complete"
ep_warmup_time: 776
ep_warmup_value_count: 0
```

← microseconds

## Monitor when server starts up or after a crash

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## Monitoring: expiration



```
/opt/couchbase/bin/cbstats localhost:11210 all
| grep exp
```

**ep\_expired:**

0

**ep\_item\_flush\_expired:**

0

**ep\_num\_expiry\_pager\_runs:**

28

once an hour

expired while persisting

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## cbstats 'timings'

```
/opt/couchbase/bin/cbstats localhost:11210 -b beer-sample timings
data_age (1 total)
 0 - 1s : (100.00%) 1 #####
disk_commit (3 total)
 0 - 1s : (100.00%) 3 #####
disk_insert (1 total)
 64us - 128us : (100.00%) 1 #####
disk_invalid_item_del (1 total)
 2us - 4us : (100.00%) 1 #####
get_cmd (1 total)
 64us - 128us : (100.00%) 1 #####
set_vb_cmd (1024 total)
 32us - 64us : (0.59%) 6 #
 64us - 128us : (91.70%) 933 #####
128us - 256us : (99.80%) 83 #####
256us - 512us : (99.90%) 1
1ms - 2ms : (100.00%) 1
storage_age (1 total)
 0 - 1s : (100.00%) 1 #####
store_cmd (1 total)
 128us - 256us : (100.00%) 1 #####
```

Displays  
histogram of time  
taken by various  
operations within  
server

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## <key> stats



- Use /opt/couchbase/bin/cbstats to get stats for key:

```
/opt/couchbase/bin/cbstats localhost:11210 vkey pkrug
```

```
316
```

```
verification for key pkrug
```

```
key_cas: 1
key_data_age: 0
key_dirtied: 0
key_exptime: 0
key_flags: 0
key_is_dirty: 0
key_last_modification_time: 1304276996
key_valid: valid
```

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## 3 underlying server processes

`beam.smp` (on linux) - responsible for monitoring and managing all other underlying server processes such as ongoing XDCR replications, cluster operations, and views.

There is a separate monitoring process running on each node. The process is small and simple and therefore unlikely to crash due to lack of memory. It is responsible for spawning and monitoring the second, larger process for cluster management, XDCR and views. It also spawns and monitors the processes for Moxi and memcached. If any of these three processes fail, the monitoring process will re-spawn them.

**Memcached** - This process is responsible for caching items in RAM and persisting them to disk.

**Moxi** - This process enables third-party memcached clients to connect to the server.

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Add the windows process name

# Disk write queue



- Disk writing is implemented as a 2-queue system and they are tracked by the stats
- The first queue is where mutations are immediately placed
- Whenever there are items in that queue, the “flusher” (disk writer) comes along and takes all the items off of that queue, places them into the other one and begins writing to disk
- Since disk performance is so dramatically different than RAM, this allows Couchbase to continue accepting new writes while it is (possibly slowly) writing new ones to the disk
- The flusher will process 250k items at a time, then perform a disk commit and continue this cycle until its queue is drained.
- **ep\_queue\_size** (where new mutations are placed)
- **flusher\_todo** (the queue of items currently being written to disk)

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Point out Disk Write Queue in statistics

# Troubleshooting Couchbase



- In general, Couchbase “just works”:
  - No periodic maintenance for performance or stability
  - Very little configuration changing after setup
  - Monitor for appropriate sizing
- Most issues come from:
  - Initial setup errors
  - Under-provisioning
  - Bugs (yes, we have them occasionally)
- Hardest is troubleshooting “slowness”:
  - Almost always related to RAM, network or disk

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# Troubleshooting Couchbase



| Logs                                                                                                                                                                            | and | Stats                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Very verbose</li><li>• Server startup</li><li>• Process exit/crash diagnosis</li><li>• Config changes</li><li>• Timing events</li></ul> |     | <ul style="list-style-type: none"><li>• Performance monitoring</li><li>• Traffic monitoring</li><li>• "External" monitoring</li><li>• Real-time state</li></ul> |

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# Logging



- Main logs are very verbose, but are still useful
- Best for:
  - Process exit/crash diagnosis
  - Memcached
  - moxi
  - Vbucketmigrator
  - Server startup issues
  - Permissions
  - disk space
- Search output for:
  - “ERROR”
  - “exited with”

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Stored in text format under:

/opt/couchbase/var/lib/couchbase/logs/

Node-specific

Size-limited and automatically rotated

Some will be compressed .gz

UI contains a small subset of the log detail for easier viewing

UI logs are aggregated across cluster

# Logs



| File            | Log Contents                                                                                                                                                                                                                                                                                                      |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| audit           | Security auditing for administrators.                                                                                                                                                                                                                                                                             |
| babysitter      | The babysitter process log captures when the larger processes are spawned for cluster management, cross data center replication, views, query, and N1QL.                                                                                                                                                          |
| couchdb         | Errors relating to the CouchDB subsystem that supports views, indexes, and related REST API issues.                                                                                                                                                                                                               |
| debug           | Debug level error messages related to the core server management subsystem, excluding information included in the couchdb, xdcr and stats logs.                                                                                                                                                                   |
| error           | Error level messages for all subsystems excluding cross datacenter replication.                                                                                                                                                                                                                                   |
| goxdcr          | Log messages related to Cross Datacenter Replication (XDCR) written in Go.                                                                                                                                                                                                                                        |
| http_access.log | The admin access log records server requests (including administrator logins) to the REST API or Couchbase Server web console. It is output in common log format and contains several important fields such as remote client IP, timestamp, GET/POST request and resource requested, HTTP status code, and so on. |

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# Logs



| File             | Log Contents                                                                                                                                                                   |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| info             | Information level error messages related to the core server management subsystem, excluding information included in the CouchDB, cross datacenter replication, and stats logs. |
| mapreduce_errors | JavaScript and other view-processing errors are reported in this file.                                                                                                         |
| memcached.log    | Contains information relating to the core memcached component, including vBucket and replica and rebalance data streams requests.                                              |
| ns-couchdb       | Contains information related to starting up the CouchDB subsystem..                                                                                                            |
| Projector        | Contains information for the projector process that runs on each KV node and sends requested index data to the index nodes.                                                    |
| reports.log      | Contains only progress report and crash reports for the Erlang processes.                                                                                                      |
| ssl_proxy        |                                                                                                                                                                                |

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# Logs



| File          | Log Contents                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| crash-log.bin | Used to pass service crash reports from the babysitter to the ns_server. For example, if the ns_server is available, any crash of the babysitter's child is passed directly to the special crash logger service within the ns_server. If the logger service is not attached to the babysitter, then the babysitter saves that crash report to the disk and the ns_server can later obtain and log it even if the babysitter is restarted. |
| stats         | Contains periodic reports of the core statistics..                                                                                                                                                                                                                                                                                                                                                                                        |
| tmpfail       | For XDCR, the destination cluster is not able to eject items fast enough to make room for new mutations. XDCR retries several times, without throwing errors, but after a fixed number of attempts the errors are shown to the user. Nevertheless, if a user waits long enough, XDCR eventually retries and can replicate the remaining data.                                                                                             |
| views         | Errors relating to the integration of the view system and the core server subsystem                                                                                                                                                                                                                                                                                                                                                       |
| xdcr          | Log messages related to starting up the cross datacenter replication subsystem..                                                                                                                                                                                                                                                                                                                                                          |
| xcdr_trace    | Cross datacenter replication trace messages                                                                                                                                                                                                                                                                                                                                                                                               |

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## Support Tool



```
/opt/couchbase/bin/cbcollect_info
<output_file>
```

- Gathers:
  - Logs
  - Couchbase stats snapshot
  - system level stats (netstat, df, top, etc)
- <output\_file> is zipped already
- Easy and small to send to Couchbase support

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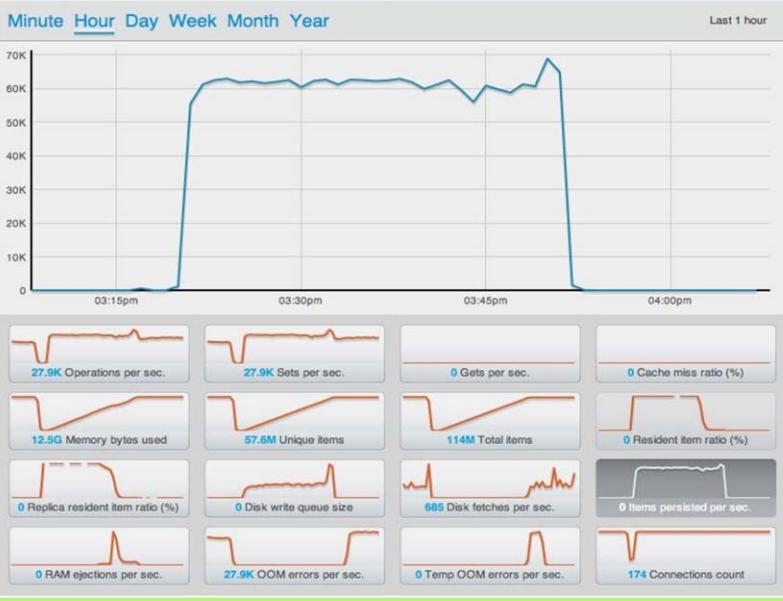
# Troubleshooting: Common Issues/Errors



- Installation/Setup:
  - Firewall/AV
  - Permissions
  - ulimit
  - Conflicting software (hello puppet!)
- Client connectivity:
  - Firewall again
  - Use telnet to check connectivity
  - Permissions
  - Moxi
- Loading/working with data:
  - Check response codes
  - "temp oom" and "oom"
  - Timeouts
  - Disk IO (queues and fetches)
  - RAM ejections
- Clustering:
  - Firewall, again
  - Node versioning
- XDCR:
  - All nodes must talk to all other nodes
- Indexing:
  - Logs will show errors
  - Check for invalid document handling
- Rebalancing:
  - Network bandwidth
  - Disk IO
  - Performance during rebalancing
  - "wait\_for\_memcached" failed
- Memory usage:
  - OOM killer
  - Metadata
- Disk Usage
  - High update/disk writes don't allow compaction to complete
  - Auto-compaction window too short
  - Parallel compaction of data/views increases disk I/O

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# Troubleshooting: Scenario



**Problem:** 'sets' are failing

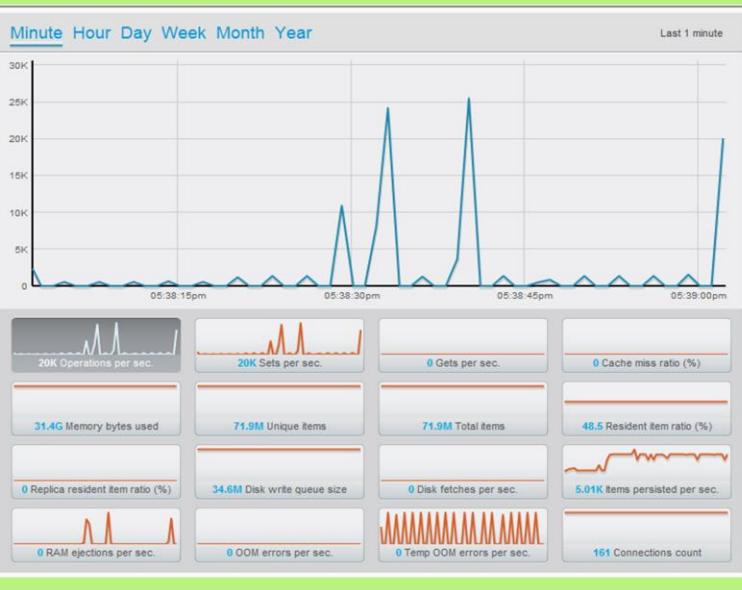
## Symptoms:

- OOM Errors
- Resident Item Ratio
- o Disk write queue
- o RAM ejections

**Diagnosis:**  
**RAM is full with metadata**

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# Troubleshooting: Scenario



**Problem:** 'sets' are failing

## Symptoms:

- Temp OOM Errors
- Resident Item Ratio
- High Disk write queue
- Periodic RAM ejections
- Items being written

## Diagnosis:

- “working” set is changing too rapidly
- data can’t be written fast enough to be ejected

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## Lab #8 (Performance & Compaction)



- Understanding high water mark and low water mark
- Understand how ejection works
- Learn about the Not-Recently-Used metadata setting
- Learn about the item pager
- Become familiar with how Couchbase manages memory
- Learn about Disk reads vs RAM reads
- Examine that different traffic patterns require different Couchbase settings
- Understand the 'resident %' in memory metric
- Learn how to detect out of memory (OOM) errors
- Displaying metrics via cbstats and studying item expiration
- Display timing metrics with "cbstat timings"
- Learn about Compaction



Time: 1 hour

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# Couchbase

## Learning Services

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