



Couchbase

Architecture and Administration Basics

Workshop Day 1 - Labs

Agenda

- 1 Installation and configuration
- 2 Testing installation
- 3 Buckets Operations
- 4 Cluster Operations
- 5 Security
- 6 Backup and restore
- 7 XDCR

1

Installation & Configuration

Start a Node with Docker



Perform the following steps

- Start Docker container with Couchbase already installed

```
docker run -d --name couchbase-1 -p 8091-8094:8091-8094 \
-p 11210-11211:11210-11211 couchbase
```

- Get the IP of your first node with Docker

```
docker inspect couchbase-1 | grep IPAddress
```



Couchbase Docker Repository:
https://hub.docker.com/_/couchbase/

Setup new Cluster



<http://localhost:8091>



The image shows the Couchbase Server setup interface. It features a large red circular logo with a white 'C' in the center. Below the logo, the text "Couchbase Server" is displayed in a large, bold, black font. Underneath that, it says "Enterprise Edition 7.0.3 build 7031". At the bottom, there are two blue rectangular buttons with white text: "Setup New Cluster" and "Join Existing Cluster".

Couchbase Server
Enterprise Edition 7.0.3 build 7031

Setup New Cluster

Join Existing Cluster

Setup new Cluster



Password: couchbase

Couchbase > New Cluster

Cluster Name
WorkshopCouchbase

Create Admin Username
Administrator

Create Password
.....

Confirm Password
.....

< Back Next: Accept Terms

Setup new Cluster



Configure

Couchbase > New Cluster > Configure

Host Name / IP Address Fully-qualified domain name
172.17.0.2

enable node-to-node encryption ⓘ

IP Family Preference ⓘ
IPv4 IPv6 IPv4-only IPv6-only

Service Memory Quotas ⓘ Per service / per node

Service	Quota (MiB)
Data	512
Query	-----
Index	512
Search	256
Analytics	1024
Eventing	256
Backup	-----

TOTAL QUOTA 1280MiB

RAM Available 5939MiB Max Allowed Quota 4915MiB

Index Storage Setting
Standard Global Secondary
Memory-Optimized

Data Disk Path Path cannot be changed after creation
< Back Save & Finish

- **Hostname:** local docker IP address.
- **Data Service:** 512Mo
- **Index Service:** 512Mo
- **Search Service:** 256Mo
- **Analytics Service:** X (disabled)
- **Eventing:** X (disabled)
- **Backup:** X (disabled)
- **Index Storage Setting:** Standard Global Secondary (Plasma)
- **Data Disk Path:** /opt/couchbase/var/lib/couchbase/**data**
- **Indexes Disk Path:** /opt/couchbase/var/lib/couchbase/**index**

Setup new Cluster



Sample buckets

- Add the *travel-sample* bucket
- Edit the *travel-sample* bucket configuration and remove the replicas
- Create a bucket Administrator in Settings.
Username: couchbase
Password: couchbase
- Browse the UI and check Statistics.
(while *travel-sample* is loading)
- Check that Couchbase Server has started.

```
docker logs couchbase-1
```

The screenshot shows the Couchbase UI with the following details:

- Header:** WorkshopCouchbase > Settings
- Left Sidebar:** Dashboard, Servers, Buckets, Backup, XDCR, Security, Settings (selected).
- Sample Buckets Section:** Describes sample buckets for experimentation. It lists three buckets: beer-sample, gamesim-sample, and travel-sample. The travel-sample checkbox is checked. A "Load Sample Data" button is present.
- Add New User Dialog:** A modal window titled "Add New User".
 - Fields:** Username (couchbase), Full Name (optional) (Workshop User), Password (*****), Verify Password (*****).
 - Roles and Groups:** A list of roles:
 - Read-Only Admin (unchecked)
 - Local User Security Admin (unchecked)
 - External User Security Admin (unchecked)
 - Cluster Admin (checked)** (highlighted with a green checkmark)
 - Eventing Full Admin (unchecked)
 - Backup Full Admin (unchecked)
 - Views Admin (unchecked)
 - External Stats Reader (unchecked)
 - Bucket:** A dropdown menu under "Bucket Admin" with "travel-sample" selected and a green checkmark.
- Buttons:** "Cancel" and "Add User" at the bottom right of the dialog.

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Testing Installation

Testing the Installation



REST API

- Cluster Status:

```
http://localhost:8091/nodeStatuses  
curl -u Administrator:couchbase  
http://localhost:8091/nodeStatuses | jq
```

- System Statistics

```
http://localhost:8091/pools
```

- Cluster Details:

```
http://localhost:8091/pools/default
```

- Bucket Monitoring

```
http://localhost:8091/pools/default/buckets/travel-  
sample
```

- Tasks running:

```
http://localhost:8091/pools/default/tasks
```

- Performance on Queries:

```
http://localhost:8093/admin/vitals
```

- Statistics on indexes (check storage mode):

```
http://localhost:9102/stats
```

- *Install a plug-in in Browser to format JSON*

Ex: Beautiful JSON {J}

- *Install a CLI plug-in to format JSON*

Ex: yum install jq



Testing the Installation

CLI

- Login to docker containers

```
docker exec -it couchbase-1 bash
```

- List the nodes & buckets of your current cluster

```
couchbase-cli server-list --cluster=localhost:8091 -u Administrator -p couchbase  
couchbase-cli server-list --cluster=localhost:8091 -u Administrator -p couchbase
```

- Investigate data and index directory

```
# You should see approximately 1030 files in this directory.  
# So one file per vBucket + some extra files.  
  
ls -al /opt/couchbase/var/lib/couchbase/data/travel-sample  
# list index files  
  
ls -al /opt/couchbase/var/lib/couchbase/index/@2i/...
```



Testing the Installation

cbc-pillowfight

- Create a bucket

```
couchbase-cli bucket-create -c <IP>:8091 --username Administrator \
--password couchbase --bucket test --bucket-type couchbase --bucket-ramsize 128
```

- Generate a workload on the bucket "test »

- 50% write & 50% read (r = % of write workload => 100 means 100% writes, 0 means 100% reads)
- Size = 100 bytes
- Number of items = 250 000
- Number of threads = 2
- Json documents

```
cbc-pillowfight -U couchbase://localhost/test -u Administrator -P couchbase -I 250000 \
-r 50 -m 100 -t 2 -J
```

- Observe the Metrics on the UI

https://docs.couchbase.com/sdk-api/couchbase-c-client-3.2.4/md_doc_cbc_pillowfight.html

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Buckets Operations

Edit a Bucket



Perform the following steps in order to edit a bucket

- Open the Web Admin UI and go to the ‘Buckets’ tab

<http://localhost:8091>

- Edit the bucket ‘test’ and configure the following:
 - Update the Memory quota to 256 MB RAM
 - Enable one Replica (Why do you get a Warning?)
 - Enable Flush
- Insert a new document in the bucket & search for it from the UI

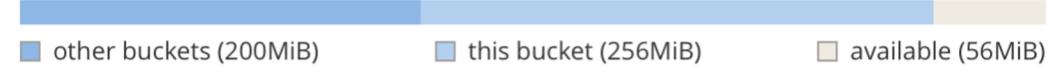
Edit Bucket Settings

Name authorized users
test

Bucket Type
 Couchbase Memcached Ephemeral

Storage Backend
 CouchStore Magma

Memory Quota in megabytes per server node
256 MiB


other buckets (200MiB) this bucket (256MiB) available (56MiB)

► Advanced bucket settings

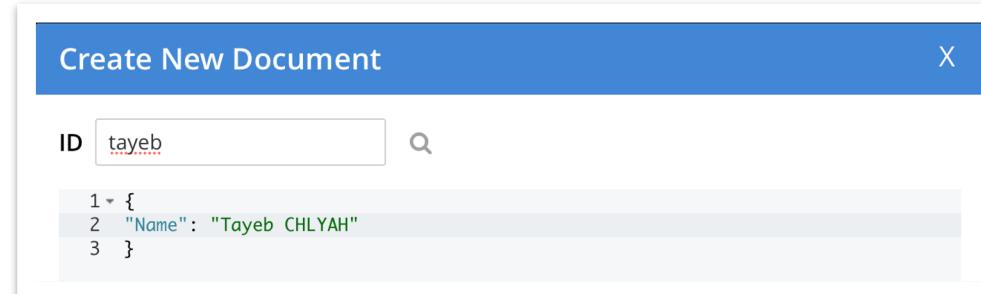
Cancel Save Changes

Create a document in the Bucket



Perform the following steps in order to add a document

- Open the Web Admin UI and go to the Buckets.
- Insert a new document in the bucket (check the Metadata)



- Search for it with the name of the key.

Keyspace bucket.scope.collection
test _default _default
Limit 100 Offset 0 Document ID tayeb
show range N1QL WHERE
no indexes available...
Retrieve Docs

1 Results for test._default._default, document id: tayeb
enable field editing
< prev batch | next batch >

id
tayeb

{"Name": "Tayeb CHLYAH"}

id
tayeb
{"Name": "Tayeb CHLYAH"}

4 Cluster Operations

Start a Cluster with Docker



Perform the following steps

- Start 2 new Docker containers with Couchbase already installed, without port mapping

```
docker run -d --name couchbase-2 couchbase  
docker run -d --name couchbase-3 couchbase
```

- Get the IP of each node with Docker

```
docker inspect couchbase-$i | grep IPAddress
```

- Test if all nodes are reachable

```
docker exec -it couchbase-1 bash  
bash-4.2# curl http://<IP couchbase-$i>:8091/pools
```



Couchbase Docker Repository:
https://hub.docker.com/_/couchbase/

Add the 2nd node via UI



Perform the following steps

- Add the 2nd node via the UI with IP of couchbase-2

- IP from docker inspect on couchbase-2
- Username = Administrator
- Password = couchbase
- Load only Data Service (disable all remaining services)

- Add Server

Add Server Node X

Warning: Adding a server to this cluster means any previous Couchbase Server data on that server will be removed.

Hostname/IP Address .../...

Username a user with admin access to this server .../...

Password

Services ⓘ

Data

Index

Query

Search

Analytics

Eventing

Backup

Customize disk storage paths (this node)

Cancel Add Server

filter servers... 🔍

name	group	services	CPU	RAM	swap	disk used	items	
172.17.0.2	Group 1	data query index search	4.9%	32.9%	0.0%	187MiB	313K/0	Statistics
172.17.0.3	Group 1	data	4.8%	32.7%	0.0%	---	0/0	Statistics

New node | Not available for traffic | REBALANCE to finish adding node Cancel Add

Rebalance



Add the 3rd node via CLI

Perform the following steps

- On the 3rd node execute the following command
(you can log-in by using docker exec -it couchbase-3 /bin/bash)

```
# docker exec -it couchbase-3 bash
bash-4.2# couchbase-cli server-add --server-add=<IP couchbase-3> \
--server-add-username=Administrator --server-add-password=couchbase \
-c <IP couchbase-1> -u Administrator -p couchbase
```

- Don't forget to rebalance in the UI!

The screenshot shows the Couchbase UI interface. On the left, there is a table titled 'Servers' with columns: name, group, services, and CPU. The table lists three nodes: 172.17.0.2, 172.17.0.3, and 172.17.0.4, all grouped under 'Group 1'. The 'services' column shows 'data query index search' for 172.17.0.2 and 172.17.0.4, while 172.17.0.3 only has 'data'. The 'CPU' column shows values of 4.4%, 5.1%, and 4.4% respectively. On the right, a modal dialog is open for a rebalance operation. The dialog title is 'Rebalance' with a start time of 'start 29 Mar 18:24:55 status in progress'. It shows progress metrics: 'elapsed 00:10' and 'vBuckets moved: 726 of 1024 71%'. Below these are sections for 'Data' (with a 'test' entry), 'Search', 'Index', and 'Query'. There are 'Stop' and 'Stop Rebalance' buttons at the bottom right of the dialog.

Auto-failover



Perform the following steps

- Enable Auto-Failover in the Cluster to 15s

General Auto-Compaction Alerts Sample Buckets

Node Availability ⓘ

Auto-failover after seconds for up to node

Auto-failover for sustained data disk read/write failures after seconds

- Stop couchbase service on Node 3 to simulate a failure.

```
# docker stop couchbase-3
```

- Monitor the console on the tab Servers. (Is the bucket 100% available?)

name ▾	group	services	CPU	RAM	swap	disk used	items	
172.17.0.2	Group 1	data query index search	4.2%	41.7%	0.0%	111MiB	104K/83.4K	Statistics
172.17.0.3	Group 1	data	4.8%	41.9%	0.0%	119MiB	104K/83.2K	Statistics
172.17.0.4	Group 1	data	4.2%	41.6%	0.0%	119MiB	104K/83.2K	
Node unresponsive Not available for traffic FAILOVER to activate any available replicas								Failover

Recover from a Failure



Perform the following steps

- Restart the failing node

```
# docker start couchbase-3
```

- Monitor the UI “Servers” tab.
- Couchbase should be back as reachable.
- You have 2 options:
 - **Full Recovery:** Erase RAM and restore from replicas)
 - **Delta Recovery:** Compare and recover mutations which happened after failures.
- Rebalance

name	group	services	CPU	RAM	swap	disk used	items	Actions
172.17.0.2	Group 1	data query index search	5.9%	39.6%	0.0%	112MiB	146K/41.7K	Statistics
172.17.0.3	Group 1	data	7.1%	39.8%	0.0%	119MiB	145K/41.7K	Statistics
172.17.0.4	Group 1	data	7.1%	39.6%	0.0%	119MiB	104K/83.2K	

Node failed-over | Not available for traffic | REBALANCE to finish removing node

This server is now reachable. Do you want to add it back to the cluster on the next rebalance?

Add Back: Full Recovery Add Back: Delta Recovery

5 Security

Create a User with limited permissions



Perform the following steps

- Create a User with “Bucket Admin” role on travel-sample.
- Logout and Login with the new user.
 - Can you change the settings of test bucket?
- Log back as Administrator.
- Grant more permissions to your user.

GRANT Cluster_Admin TO `admin`
SELECT * FROM system:user_info

The screenshot shows the 'Add New User' dialog box. On the left, there are input fields for 'Username' (set to 'admin'), 'Full Name (optional)', 'Password' (containing several dots), and 'Verify Password' (also containing several dots). On the right, under the 'Roles' tab, a tree view shows 'Administrative' expanded, with 'Bucket' expanded further to show 'Bucket Admin' assigned to 'travel-sample'. Other options like 'Manage Scopes' and 'Application Access' are also listed. The 'Groups' tab is visible but empty.

- Test again with the new user

<https://docs.couchbase.com/server/current/learn/security/roles.html>

Enable Auditing - Admin



Perform the following steps

- Enable Auditing in the Security tab
- Perform some Administration tasks
 - Change Auto-Compaction to 20%.
- Check the audit.log file.

The screenshot shows the Couchbase Server UI with the 'Audit' tab selected. At the top, there's a toggle switch labeled 'Audit events & write them to a log'. Below it, a note states: 'Auditing will log a minimum set of events by default. Expand the events modules below to see these defaults and/or select your own set of events.' A note also mentions: 'NOTE: The number of events selected for logging may impact your cluster's performance. Audit logs may also use significant disk space.' Underneath, there's a section for 'Audit Log Directory' with a text input field containing '/opt/couchbase/var/lib/couchbase/logs'.

```
{"database_fragmentation_threshold": {"percentage": 20}, "description": "Compaction settings were modified", "id": 8225, "index_circular_compaction_abort": false, "index_circular_compaction_interval": {"from_hour": 0, "from_minute": 0, "to_hour": 0, "to_minute": 0}, "index_compaction_mode": "circular", "local": {"ip": "172.17.0.2", "port": 8091}, "magma_fragmentation_percentage": 50, "name": "modify compaction settings", "parallel_db_and_view_compaction": false, "purge_interval": 3, "real_userid": {"domain": "builtin", "user": "Administrator"}, "remote": {"ip": "172.17.0.1", "port": 62322}, "session_id": "323bb7b9a258ff86c3aa73388574a9415d2428cc", "timestamp": "2022-03-29T18:50:33.783Z", "view_fragmentation_threshold": {"percentage": 30}}
```

<https://docs.couchbase.com/server/current/learn/security/auditing.html>

6

Backup & Restore

Backup Couchbase



Perform the following steps in order to backup some data

- Create a target folder

```
cd /tmp  
mkdir cb-backup
```

- Prepare the backup archive

```
cbbackupmgr config --archive /tmp/cb-backup --repo workshop
```

- Backup the data twice and then use the info command to list the increments!

```
cbbackupmgr backup -a /tmp/cb-backup -r workshop -c http://localhost:8091  
-u Administrator -p couchbase  
cbbackupmgr info -archive /tmp/cb-backup --repo workshop
```

Restore Couchbase



Perform the following steps in order to restore some data

- Delete a document in the bucket travel-sample via the UI
- Get the count of document – 31590 (after delete)
- Restore the database.

```
cbbackupmgr list --archive /tmp/cb-backup --repo workshop  
cbbackupmgr restore --archive /tmp/cb-backup --repo workshop -c http://localhost:8091 -u  
Administrator -p couchbase --start 2022-03-30T18_07_25.462463124+01_00 --end 2022-03-  
30T18_07_25.462463124+01_00
```

- Does the document come back? => Try again with --force-updates

```
cbbackupmgr restore --archive /tmp/cb-backup --repo workshop -c http://localhost:8091 -u  
Administrator -p couchbase --start 2022-03-30T18_07_25.462463124+01_00 --end 2022-03-  
30T18_07_25.462463124+01_00 --force-updates
```

7

XDCR

Replicate a Bucket



Let's XDCR the travel-sample bucket to a new bucket “travel-destination”

- Create a new bucket “travel-destination”
 - RAM Quota = 100MB
 - No Replica
 - Conflict Resolution: Sequence Number
 - Flush: Enable
- Add a remote cluster (the local one)
 - Name of the Cluster: WorkshopCouchbase
 - IP of the local cluster
- Add replication
 - from “travel-sample” to “travel-destination”
 - Default Settings

Remote Clusters			
name ▾	IP/hostname		
WorkshopCouchbase	172.17.0.2:8091		
Outgoing Replications			
source bucket	destination bucket	remote cluster	status
travel-sample	travel-destination	WorkshopCouchbase	replicating .. 2

Replicate a Bucket – Update Source



Let's update a document in the source cluster

- Update 1 document in travel-sample
 - Select 1 document “airline_10”
 - Check the metadata this document.
 - Save the revision (CAS) id.
 - Create a new document in travel-sample
 - ID = airline_XX
 - Check the “airline_10” document in the “travel-destination” bucket.
 - Check the document count on both buckets.
 - Bonus: Play with bi-directional replication.

```
1 {
2   "id": "airline_10",
3   "rev": "1-14f33c01fd1f00000000000000002000000",
4   "expiration": 0,
5   "flags": 33554432
6 }
```

```
1 {  
2   "id": "airline_10",  
3   "rev": "2-14f671d35bd200000000000002000000",  
4   "expiration": 0,  
5   "flags": 33554432  
6 }
```

Replicate a Bucket – Filtering on Airlines



Let's XDCR all document with type “airlines” from the travel-sample bucket to a new bucket “airline-destination”

- Create a new bucket “airline-destination”
 - RAM Quota = 100MB
 - No Replica
 - Conflict Resolution: Sequence Number
 - Flush: Enable
- Add replication from “travel-sample” to “airline-destination”
 - Enable **Advance Filtering**.
 - Enter a filter expression
REGEXP_CONTAINS(META().id, "airline")
 - **Start Replication**
 - Run the **following query** & compare the results

```
SELECT COUNT(*) FROM `travel-sample` WHERE meta().id LIKE "airline%"
```

Outgoing Replications 56.5K mutations remaining			
source bucket	destination bucket	remote cluster	status
travel-sample <small>filter</small>	airline-destination	WorkshopCouchbase	replicating ... ②
travel-sample	travel-destination	WorkshopCouchbase	replicating ... ②

THANK YOU



Couchbase