Need industry-standard SQL & ACID guarantees?

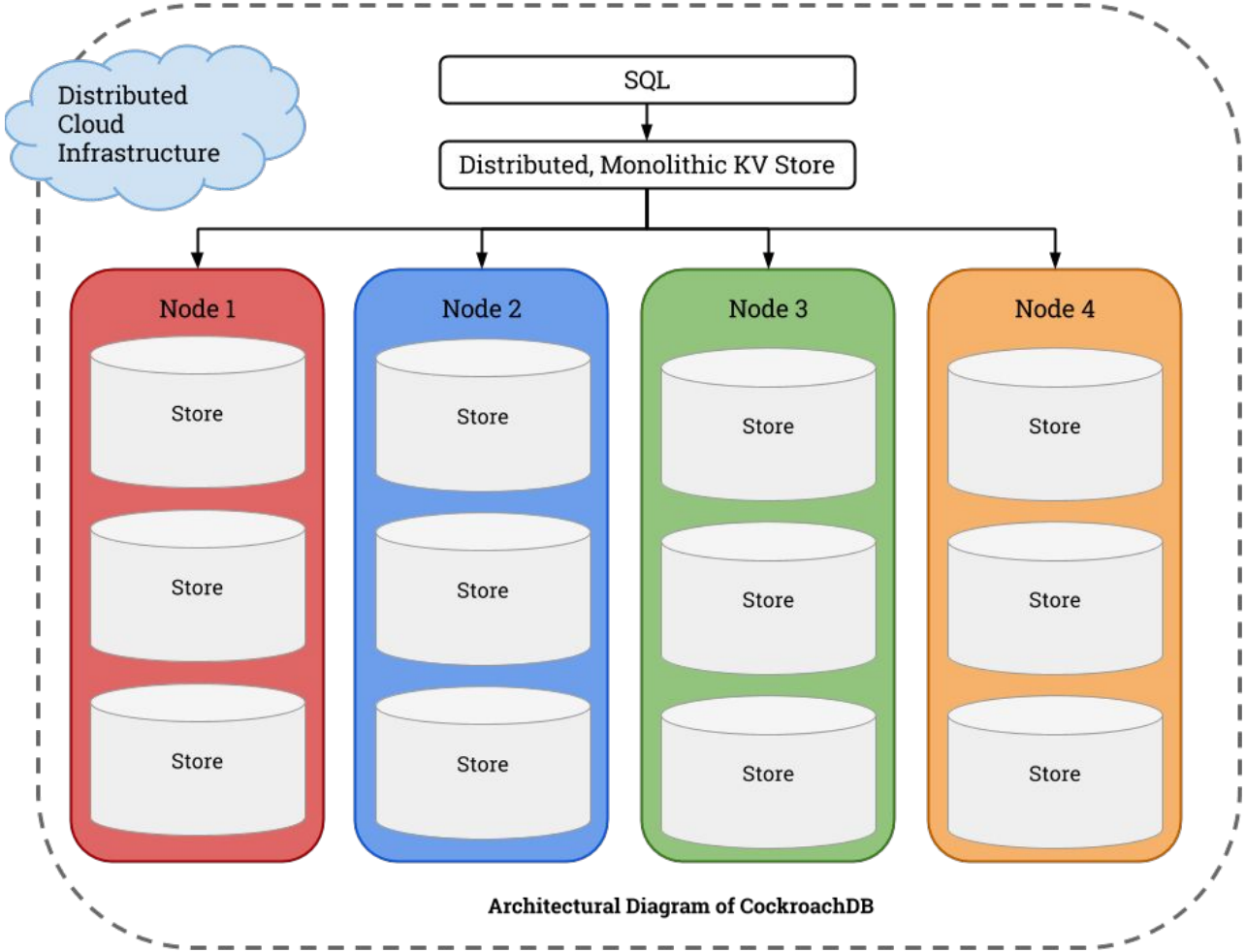
Need a distributed database?

Don’t want to depend on one cloud provider?

CockroachDB

Emanuel Kranjec & Felix Tröbinger

Globally Distributed SQL



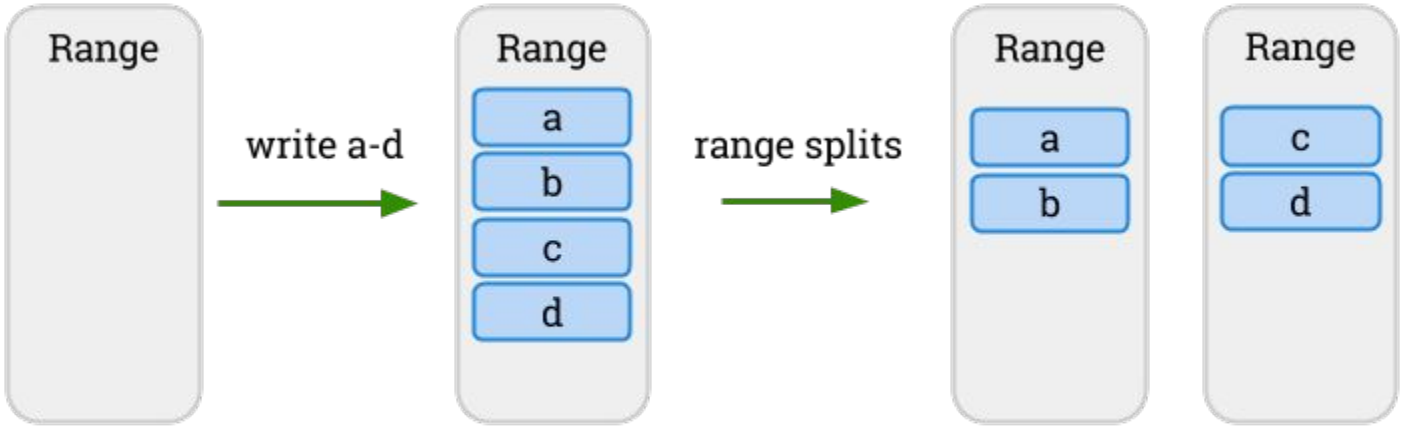
Architectural Diagram of CockroachDB

Key:Value store

id	name	weight
34	carl	10.1
7A	dagne	13.4
94	figment	65.8
BC	jack	49.7

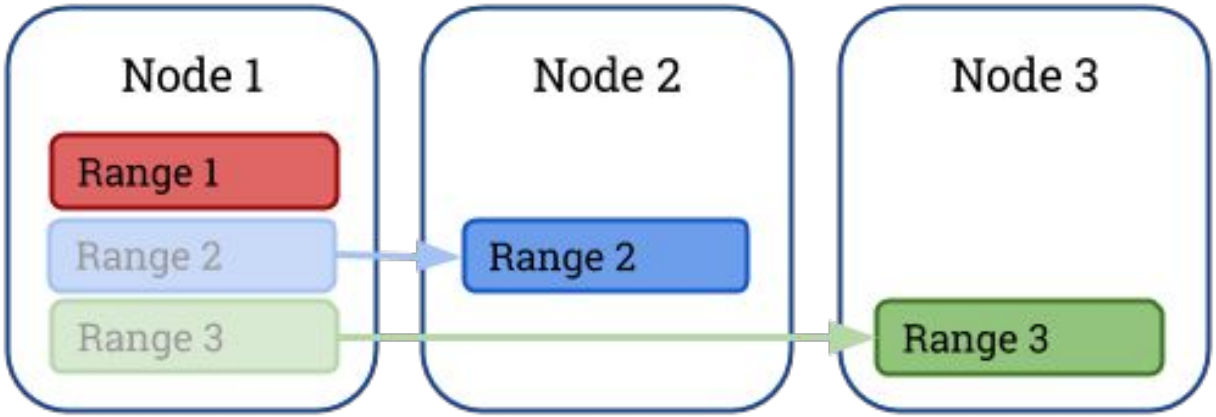
key	value
dog/34/name	carl
dog/34/weight	10.1
dog/7A/name	dagne
dog/7A/weight	13.4
dog/94/name	figment
dog/94/weight	65.8
dog/BC/name	jack
dog/BC/weight	49.7

Horizontal Scaling



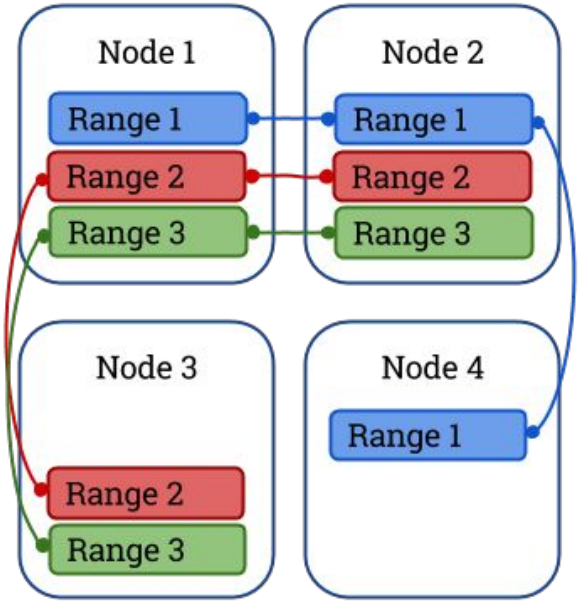
Range Distribution & Rebalancing in CockroachDB

Horizontal Scaling



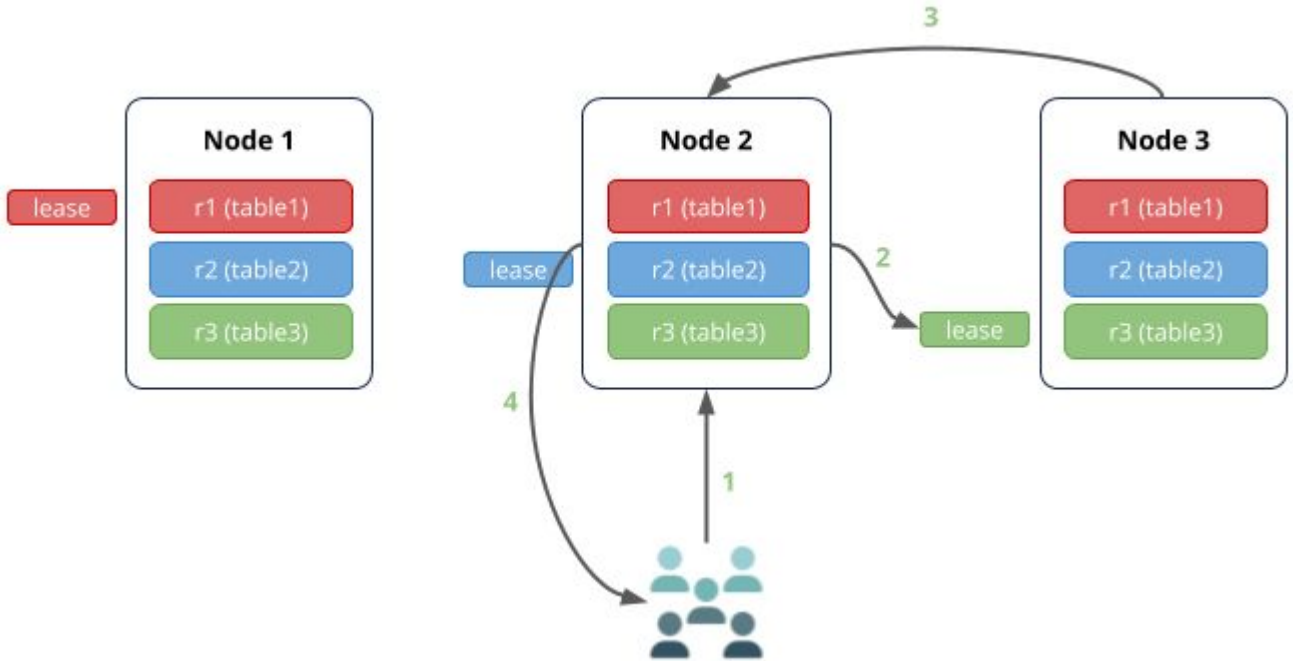
Range Distribution Across Nodes in CockroachDB

Replication (Raft)

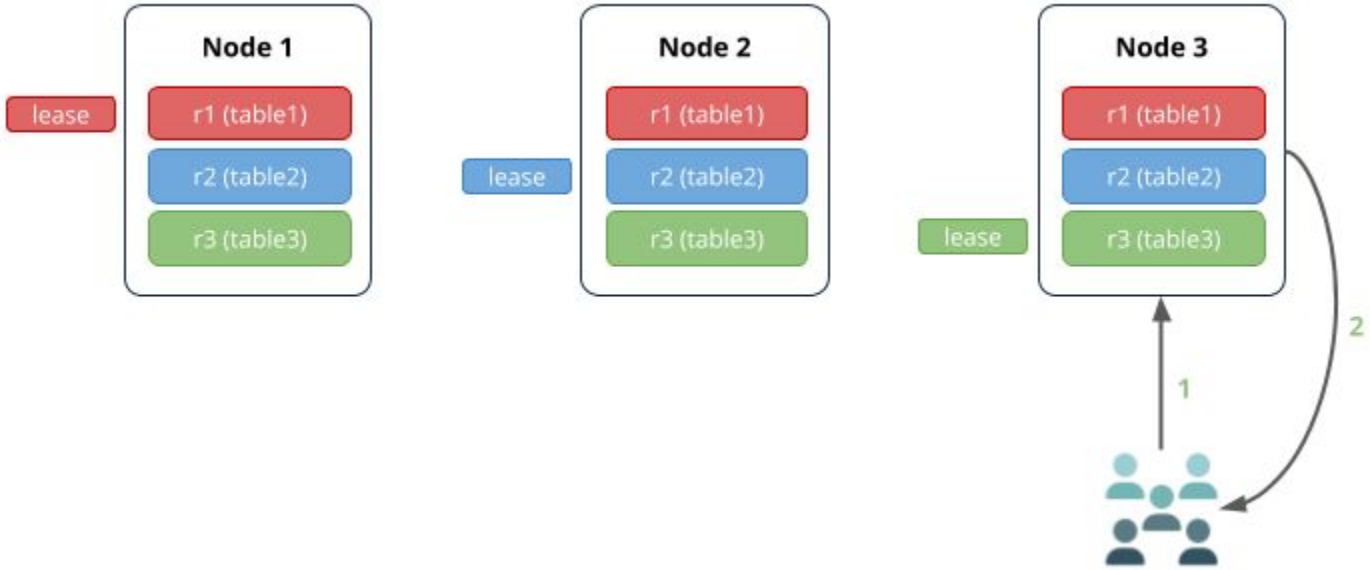


Range Replication in CockroachDB

Read Scenario



Read Scenario



Pricing

- *CockroachCloud*
  - “simple distributed SQL database”
  - available on AWS and Google Cloud
  - pricing per node and hour
- *Cockroach Enterprise*
  - “enterprise features and support”
  - self hosted
- *CockroachDB Core*
  - free

Licensing (new model since 2020)

	2020 Release	2021 Release	2022 Release	2023 Release
BSL Features (Free)	Optimizer v20 Bug Fixes v20	Optimizer v21 Bug Fixes v21	Optimizer v22 Bug Fixes v22	Optimizer v23 Bug Fixes v23
Apache 2.0 Features (Free and OSS)	Optimizer v19	Optimizer v19	Optimizer v19	Optimizer v20 Bug Fixes v20

Companies using CockroachDB

- **Bose**: cloud-connected audio products and platforms
- US **financial software company** for log in
- international **financial data firm**
- **eCommerce** checkout platform

Using CockroachDB with Docker

- official Docker images provided
- starting a multi-node cluster on local machine is relatively easy
- nice looking web interface

Creating a Node Cluster with Docker

Start a node: (x3)	Initialize the cluster:

`docker run -d \`
`--name=roach1 \`
`--hostname=roach1 \`
`--net=roachnet \`
`-p 26257:26257 -p 8080:8080  \`
`-v "${PWD}/roach1:/cockroach/cockroach-data"  \`
`cockroachdb/cockroach:latest start \`
`--insecure \`
`--join=roach1,roach2,roach3`
	`docker exec -it roach1 ./cockroach init`
	`--insecure`

Built in SQL Client

from node 1:	from a different node:

`docker exec -it roach1 ./cockroach sql --insecure`
 	
`CREATE DATABASE empdept;`
`[ ... more standard SQL statements ... ]`
	`docker exec -it roach2 ./cockroach sql --insecure`
	
	`SELECT * FROM empdept.emp;`
	
	outputs the data we gave node 1

CLUSTER OVERVIEW

Capacity Usage

0.0%

0 GiB 200 GiB 400 GiB

USED CAPACITY 51.3 MiB

USABLE CAPACITY 429.2 GiB

Node Status

LIVE NODES	SUSPECT NODES	DEAD NODES
3	0	0

Replication Status

TOTAL RANGES	UNDER-REPLICATED RANGES	UNAVAILABLE RANGES
25	0	0

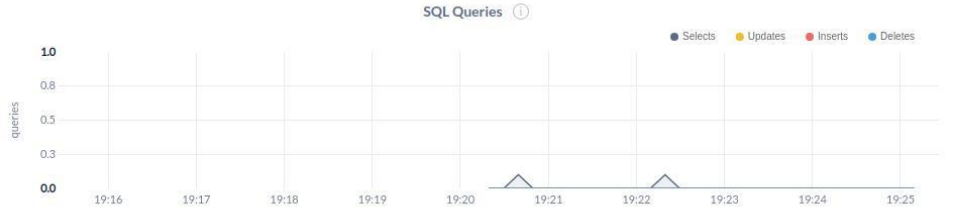
VIEW: NODE LIST

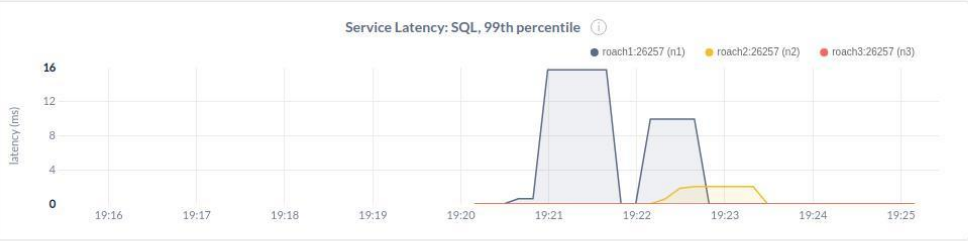
Live Nodes

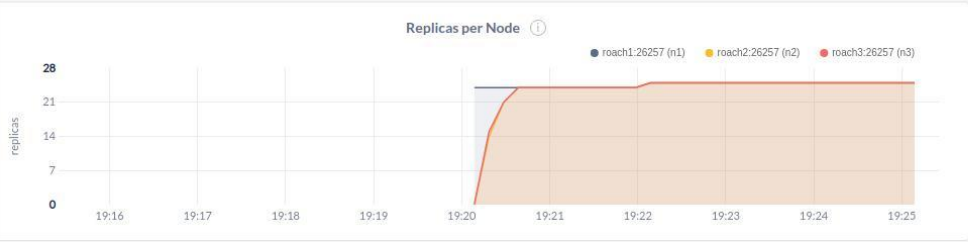
ID	ADDRESS	UPTIME	REPLICAS	CPUS	CAPACITY USAGE	MEM USAGE	VERSION	LOGS
n1	roach1:26257	5 minutes	25	8	0% 18.3 MiB 143.1 GiB	1% 263.2 MiB 15.2 GiB	v19.2.6	Logs
n2	roach2:26257	5 minutes	25	8	0% 16.4 MiB 143.1 GiB	1% 253.2 MiB 15.2 GiB	v19.2.6	Logs
n3	roach3:26257	5 minutes	25	8	0% 16.6 MiB 143.1 GiB	1% 244.5 MiB 15.2 GiB	v19.2.6	Logs

OVERVIEW DASHBOARD

GRAPH: CLUSTER | DASHBOARD: OVERVIEW | LAST 10 MIN







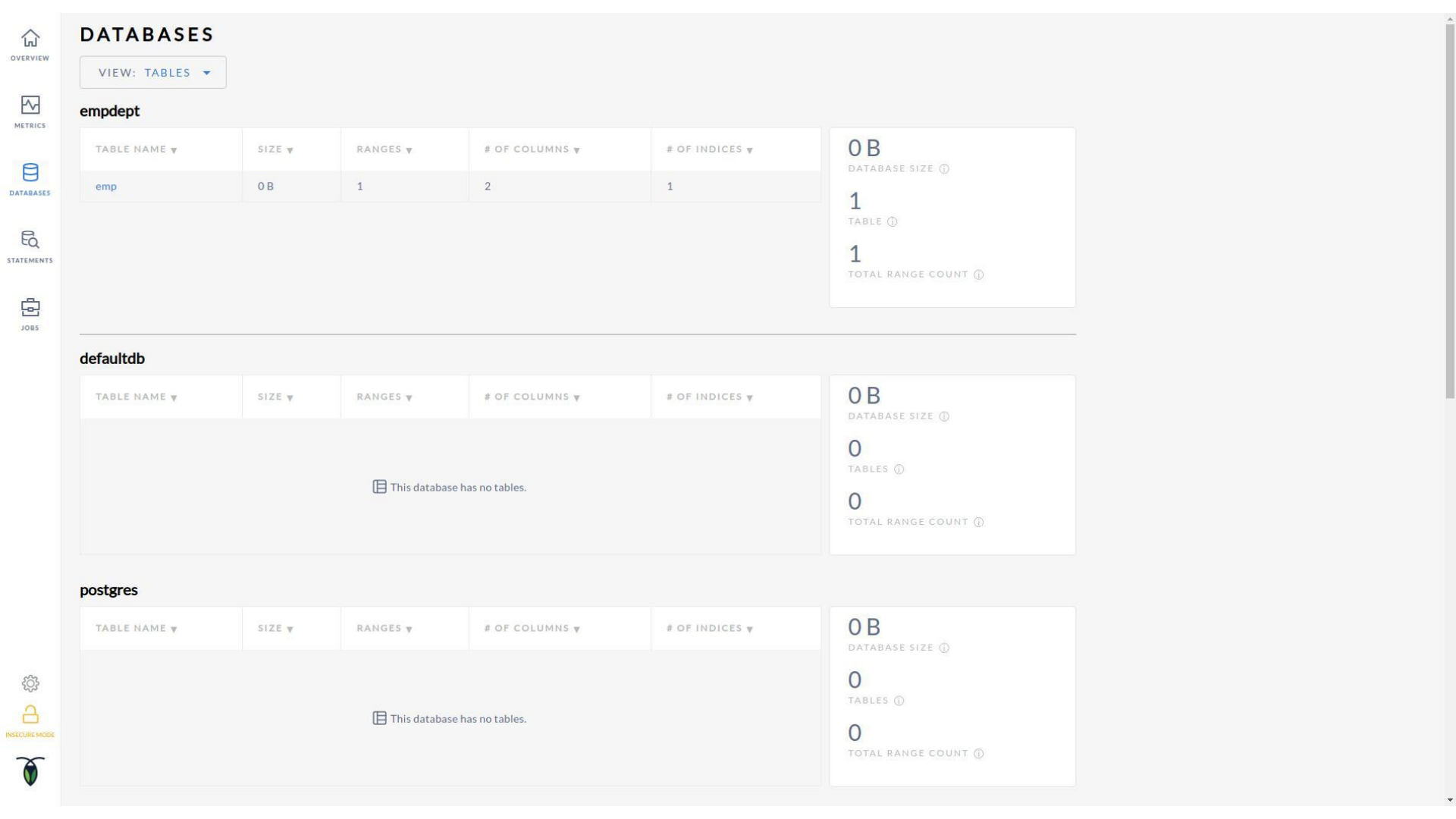
Summary

Total Nodes View nodes list	3
Capacity Used You are using 55.0 MiB of 429.2 GiB usable storage capacity across all nodes.	0.01%
Unavailable ranges	0
Queries per second Sum of Selects, Updates, Inserts, and Deletes across your entire cluster.	0.0
P99 latency	0.0 ms

Events

Table Created: User root cr...	3 mins ago
Database Created: User ro...	4 mins ago
Node Joined: Node 3 joined...	5 mins ago
Node Joined: Node 2 joined...	5 mins ago
Schema Change: User node ...	5 mins ago
Schema Change: User node ...	5 mins ago
Zone Config Changed: User...	5 mins ago
Zone Config Changed: User...	5 mins ago
Node Joined: Node 1 joined...	5 mins ago
Database Created: User ro...	5 mins ago

VIEW ALL EVENTS


OVERVIEW
METRICS
DATABASES
STATEMENTS
JOBS
INSECURE MODE
DATABASES
VIEW: TABLES
empdept
TABLE NAME
SIZE
RANGES
OF COLUMNS
OF INDICES
emp
0 B
1
2
1
0 B
DATABASE SIZE
1
TABLE
1
TOTAL RANGE COUNT
defaultdb
TABLE NAME
SIZE
RANGES
OF COLUMNS
OF INDICES
This database has no tables.
0 B
DATABASE SIZE
0
TABLES
0
TOTAL RANGE COUNT
postgres
TABLE NAME
SIZE
RANGES
OF COLUMNS
OF INDICES
This database has no tables.
0 B
DATABASE SIZE
0
TABLES
0
TOTAL RANGE COUNT

STATEMENTS

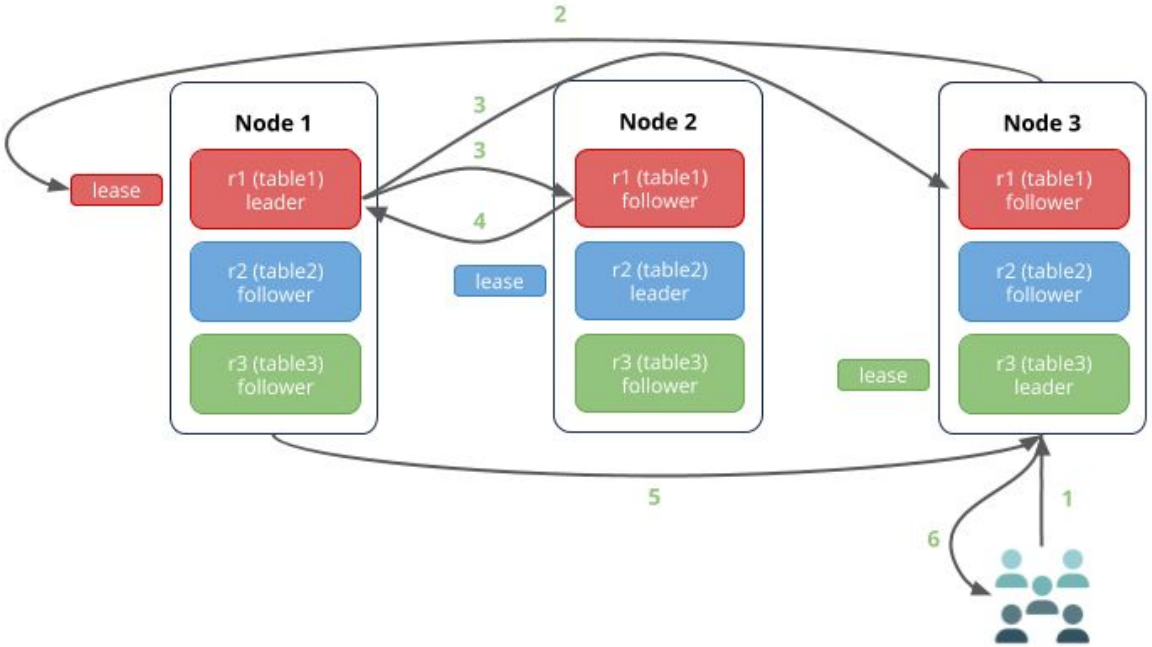
APP: ALL

20 statement fingerprints.

Last cleared 2020-04-22 19:20:17.

STATEMENT	TXN TYPE	TIME	EXECUTION COUNT	RETRIES	ROWS AFFECTED	LATENCY
CREATE DATABASE empdept	Implicit	15.4 ms	1	0	0	15.4 ms
DELETE FROM system.public.lease	Implicit	13.2 ms	1	0	1	13.2 ms
CREATE TABLE emp	Implicit	9.6 ms	1	0	0	9.6 ms
SELECT FROM system.jobs	Implicit	67.1 ms	15	0	0	4.5 ms
SELECT FROM system.eventlog	Implicit	3.2 ms	1	0	0	3.2 ms
SELECT FROM system.replication_critical_localities	Explicit	4.3 ms	2	0	0	2.1 ms
SELECT FROM system.reports_meta	Explicit	5.3 ms	3	0	0	1.8 ms
SELECT FROM system.ui	Implicit	1.6 ms	1	0	0	1.6 ms
SHOW TABLES	Implicit	4.5 ms	3	0	1	1.5 ms
UPSERT INTO system.reports_meta(id, generated) VALUES ($1, $2)	Explicit	8.5 ms	6	0	1	1.4 ms
INSERT INTO system.rangelog	Explicit	76.3 ms	58	0	1	1.3 ms
SELECT FROM system.replication_stats	Explicit	1.7 ms	2	0	0	864.3 µs
INSERT INTO system.eventlog	Explicit	1.6 ms	2	0	1	815.9 µs
INSERT INTO system.public.lease	Explicit	779.7 µs	1	0	1	779.7 µs
UPSERT INTO system.replication_stats(report_id, zone_id, subzone_id, total_ranges, unavailable_ranges, under_replicated_ranges, over_replicated_ranges) VALUES ($1, $2, __more5__)	Explicit	5.2 ms	7	0	1	749.7 µs
SELECT FROM crdb_internal.node_build_info	Implicit	1.2 ms	2	0	6	585.4 µs
SELECT FROM	Explicit	1.0 ms	2	0	0	503.5 µs

Write Scenario



Write Scenario