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Databases run better with Percona



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End of Life is Coming for MongoDB v4.2:

How to Upgrade

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Kimberly Wilkins
MongoDB Tech Lead
Percona

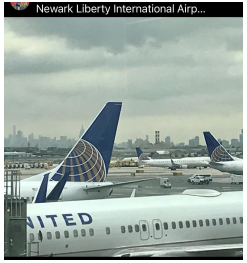


/wilkinskimberly

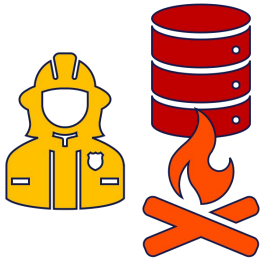
@dba_denizen

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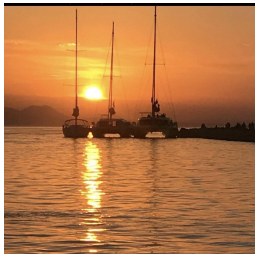
ORACLE

STAR WARS THE OLD REPUBLIC

mongoDB.

BioWARE

ObjectRocket



MANHEIM

EA

rackspace

COX AUTOMOTIVE

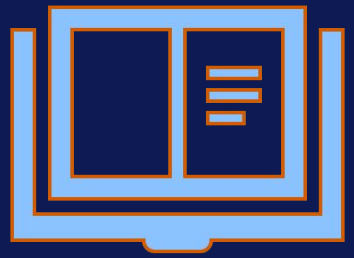
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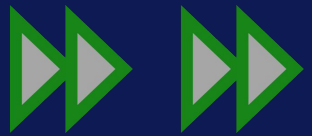
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Agenda

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- ❑ EOL – … what? when?
- ❑ Why upgrade? … many good reasons
- ❑ Types of environments and upgrades
- ❑ Upgrade steps for each
- ❑ Downgrades
- ❑ Gotchas and things to watch out for
- ❑ Best Practices
- ❑ Recommended upgrade path/s
- ❑ The new Beasts … Kubernetes clusters, Operators, etc.
- ❑ Migrations, sort of
- ❑ PSMDB, PDB, PMM … all of the P's





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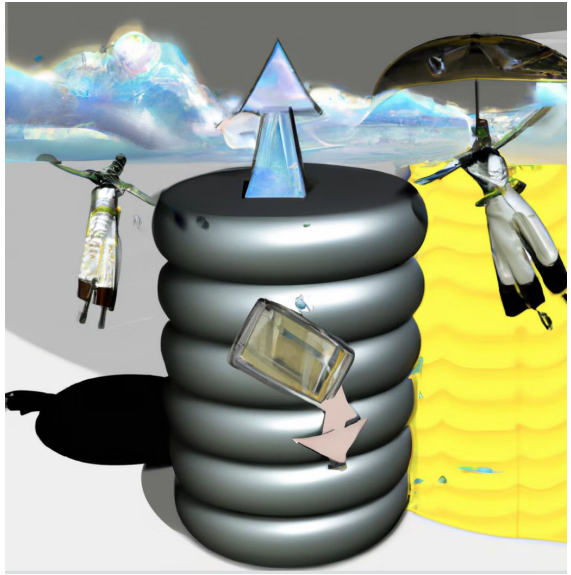
EOL? What does that even mean ?

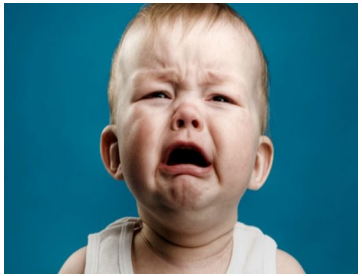
End of Life – going bye-bye, no new toys,

Crusty old software …

Might be broken ….

out of Support,





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End of Life Version … Don't get EOL'd

MongoDB 3.6		November 2017	April 2021
MongoDB 4.0		June 2018	April 2022
MongoDB 4.2		August 2019	April 2023
MongoDB 4.4		July 2020	February 2024
MongoDB 5.0	**Major New Features**	July 2021	October 2024
MongoDB 6.0	**New Features from v5.0 Fixed/Improved plus new v6 features**	**July 2022**	**July 2025**







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https://www.percona.com/services/policies/percona-software-support-lifecycle

https://www.mongodb.com/support-policy/lifecycles

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Everything's Fine - Why Upgrade?

Because ... many good reasons

- Security and/or Compliance
- Bug Fixes
- Performance
- Application or 3rd party req's
- Driver changes
- New Features
- Bleeding Edge



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Potential Blockers to Upgrading

Lack of Resources or Staff

Legacy Code

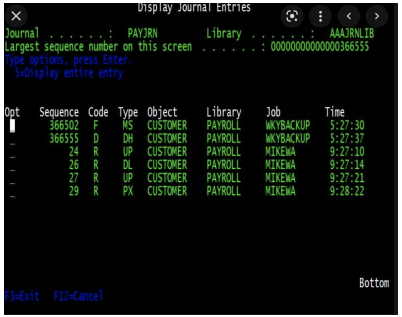
Outdated Drivers

Too Busy / Lack of Time

Caution …

Stack Incompatibility









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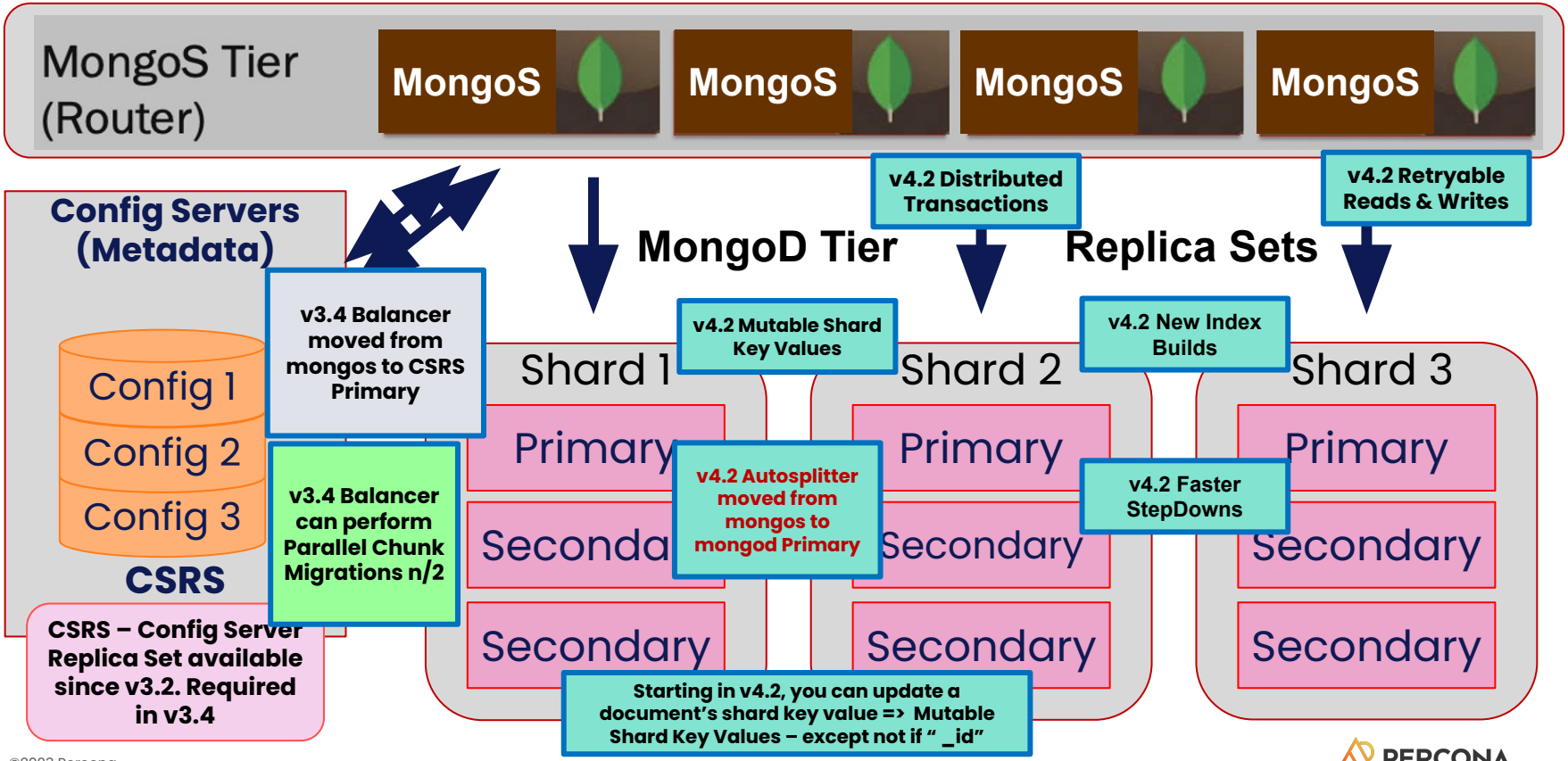
Quick Summary of Previous Changes and Features in MongoDB



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MongoDB Changes v4.2 and below

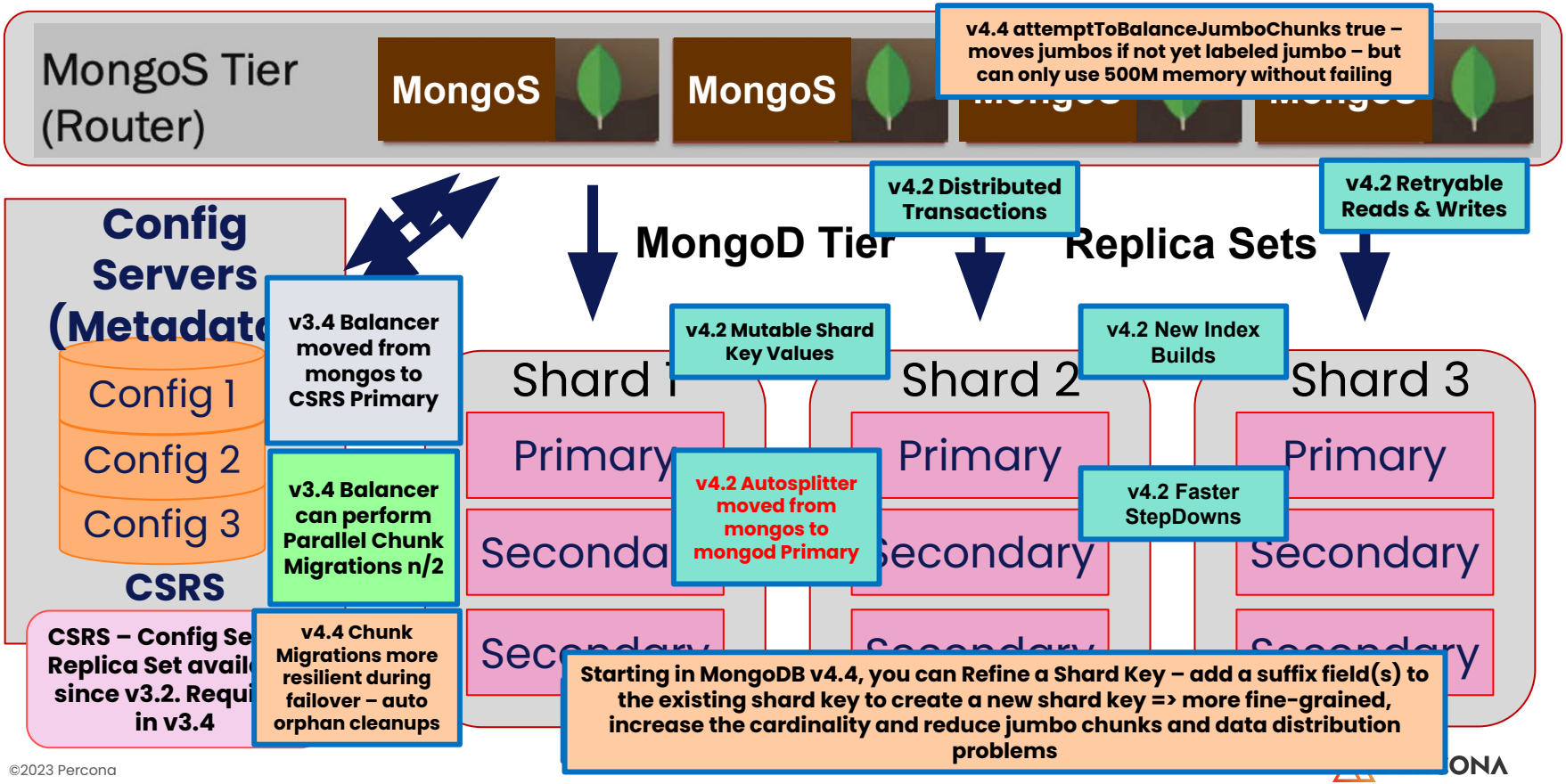
Who's on 3.6?



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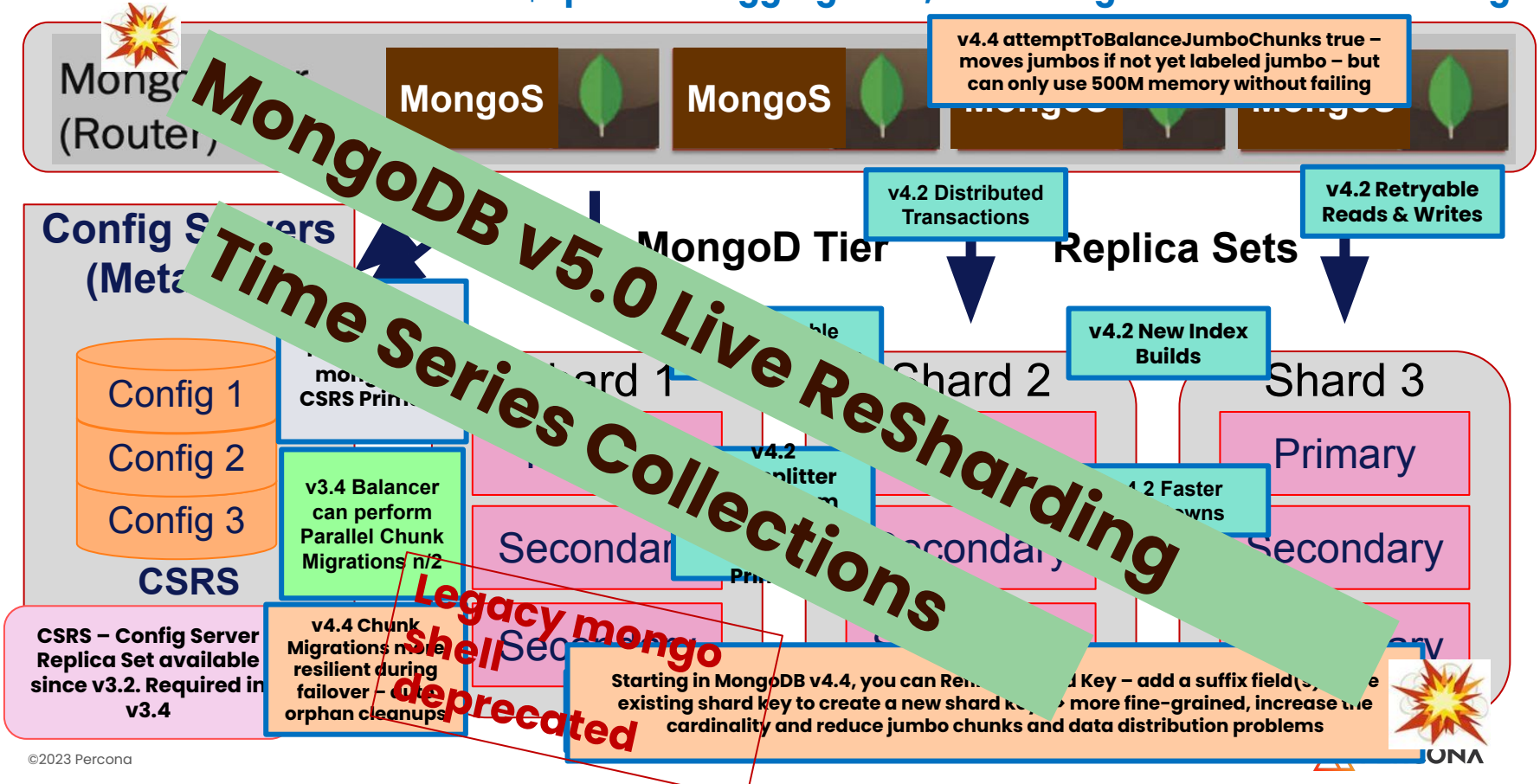
MongoDB Changes v4.4 and below



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MongoDB Changes v5.0 and below

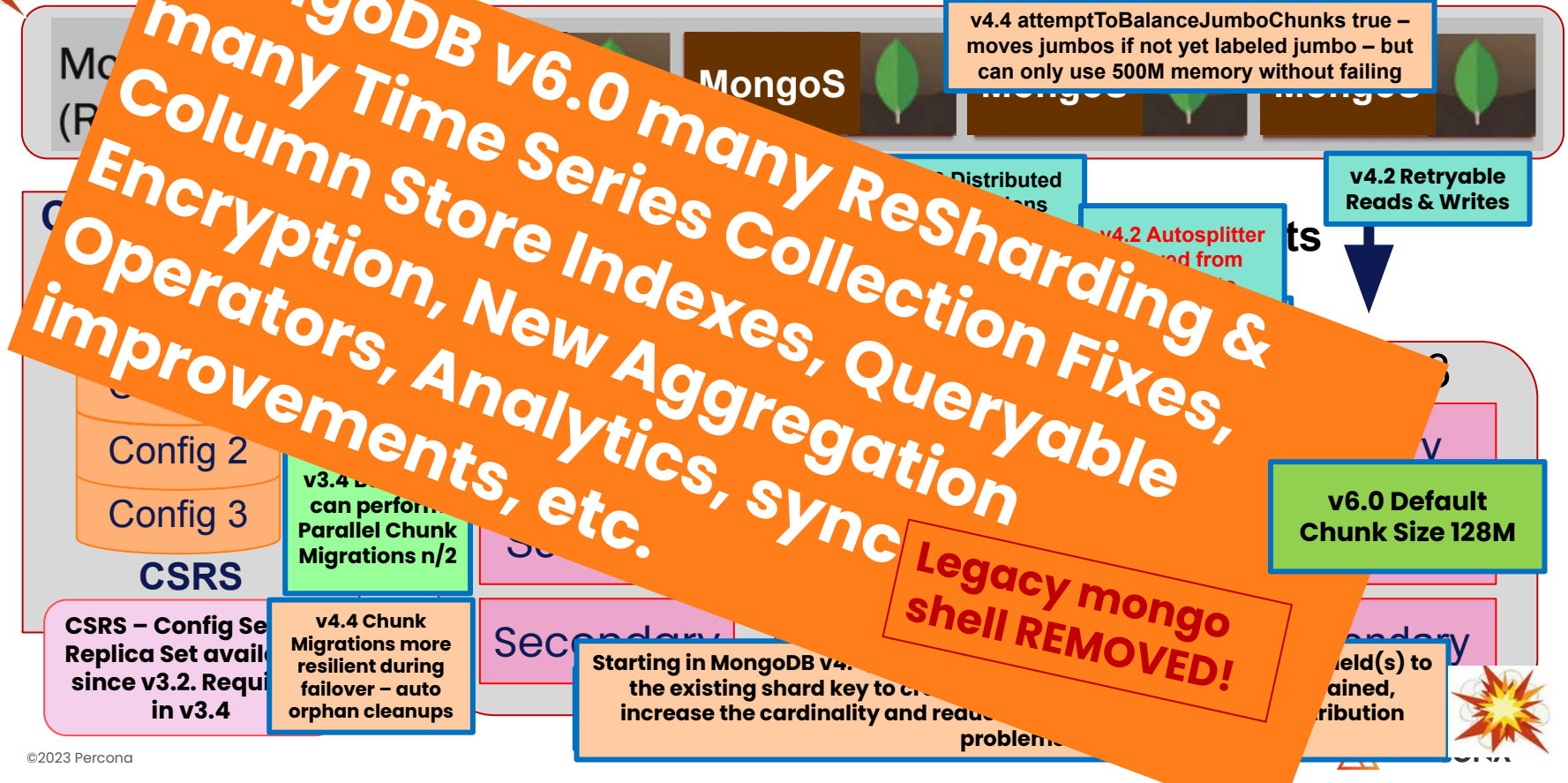
v5.0 Time Series Collections **v5.0 $operators Aggregation, etc. changes** **v5.0 API Versioning**



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Mong changes v6.0 and below

Many Bug Fixes



MongoDB v6.0 many ReSharding & many Time Series Collection Fixes, Column Store Indexes, Queryable Encryption, New Aggregation Operators, Analytics, sync improvements, etc.

Legacy mongo shell REMOVED!

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Other Notable Changes in MongoDB

Block change size increased from 64M to 128M. This should better address more frequent chunk splits after prior changes to aut0splitter and balancer process.

Many changes/improvements to resharding.
Fixes to issues around stalled reshard commands, inconsistent or corrupted data, etc.



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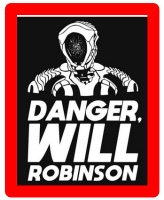
New mongosh shell



The l**egacy mongo shell was deprecated in MongoDB 5.0 and removed in MongoDB 6.0.**
The new MongoDB Shell, mongosh, offers numerous advantages over the legacy shell.
The new shell improved:

- compatibility with the MongoDB Node.js driver
- syntax highlighting
- command history
- logging

-Some legacy methods unavailable or replaced…
-mongosh uses the same syntax as old mongo shell
- check your code



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Types of Environments

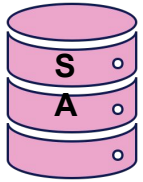
Architectures, Systems, Platforms

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Types of MongoDB Systems

Standalone

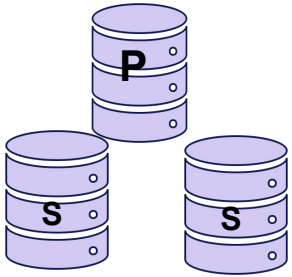
Single Node



NOT for PROD, no really!!

Replica Set

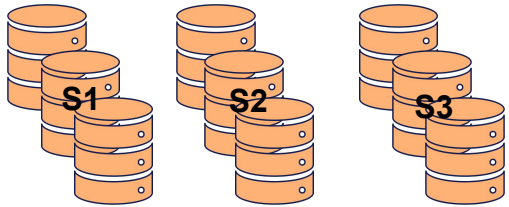
Replication



n number of nodes, up to 50, only 7 voting

Sharded Cluster

Each shard consists of a replica set

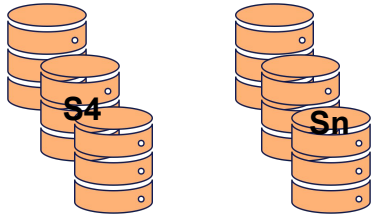




mongoS



CSRS, config srvs



many, many shards

Scale out =>

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MongoDB Architectural Components

Mongod nodes
data bearing nodes, basic building block

Replica set
cluster of mongodb hosts
50 max, 7 voting

Primary
replica set member, receives all write operations

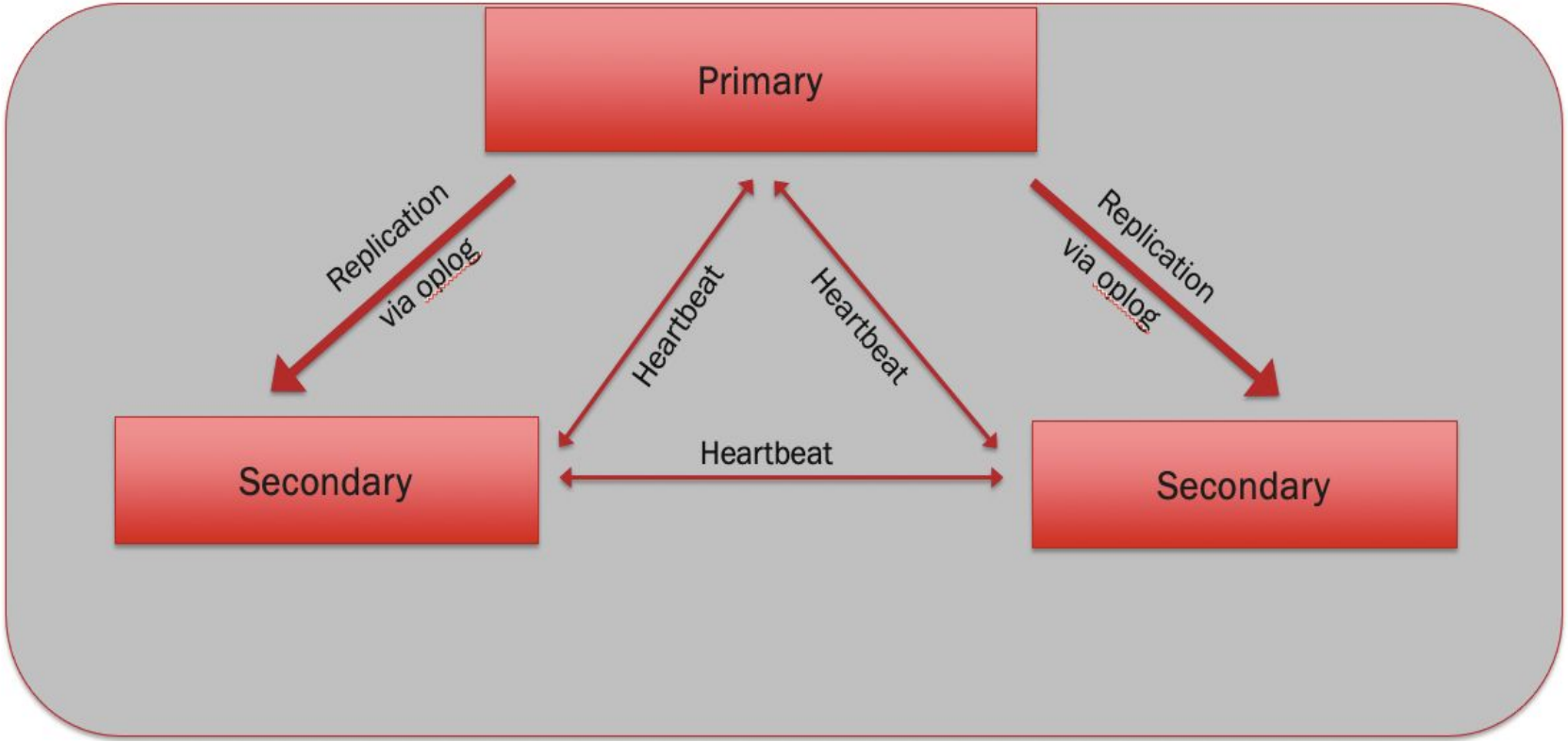
Secondaries
replica set members, data-bearing, copied from PRIMARY

Arbiter
non-data-bearing node, for quorum, etc.



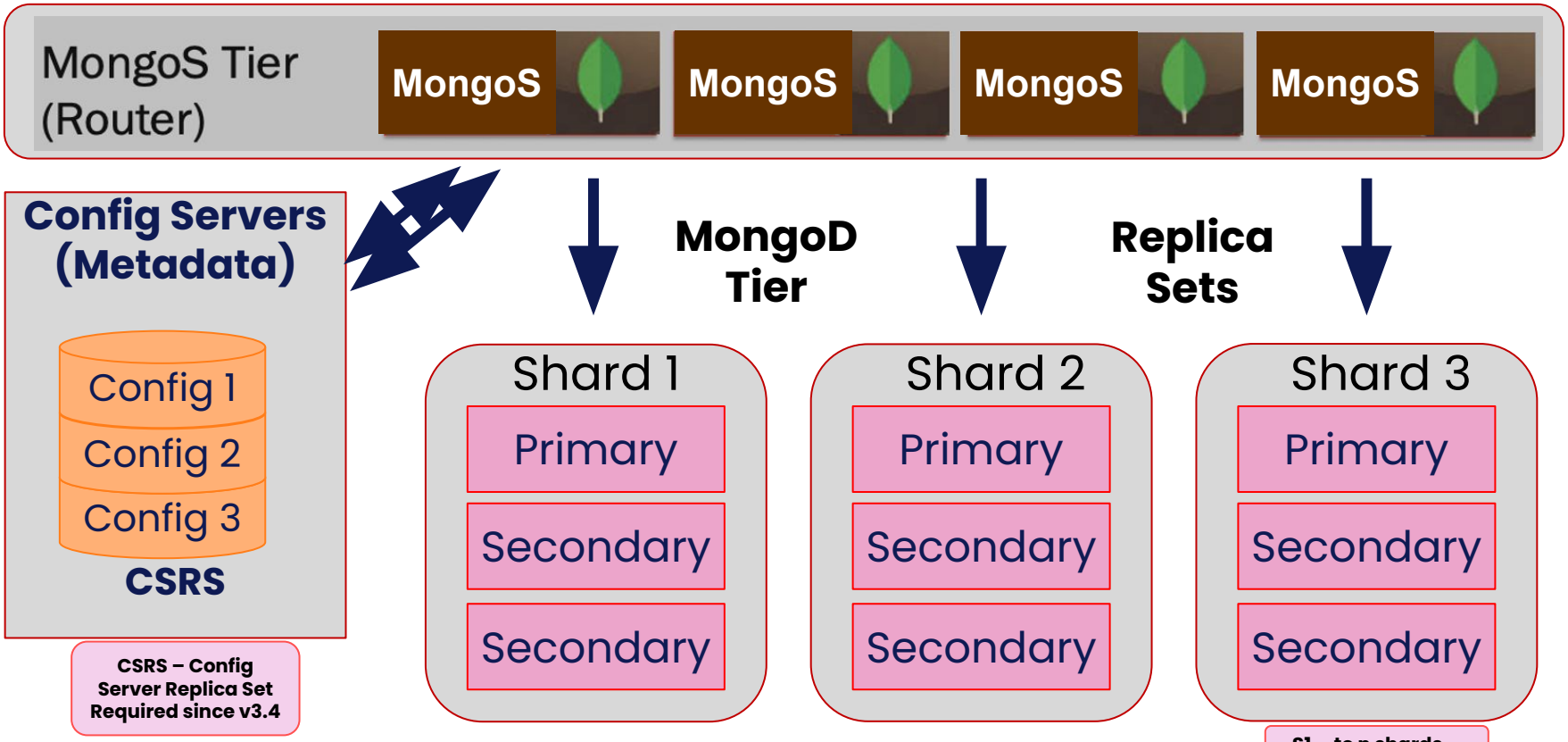
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Replication via Replica Sets



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MongoDB Architecture Sharded Cluster



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Let’s get to it!





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Basic upgrade and downgrade steps

Each Type environment -
except Standalone

Minor version vs Major version

Basic Upgrade Steps

Take a Backup Dag-nabbit!!

- **Check Prerequisites; Resolve as needed**
- **Add Resources if needed**
- **Download new desired Binaries**
- **Keep FCV set to Current/Previous version**
- **Shut down mongo processes in correct order; Rolling fashion as required by system type**
- **Replace current binaries with new binaries**
- **Start up mongo processes in correct order; Rolling fashion as required by system type**
- **Wait for amount of time to ensure no problems**
- **Set FCV to new desired version**



Let's ride!

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Replica Set

3+ nodes, PRIMARY Secondary Secondary

Pre-Requ's



- Test in lower envs
- Clean last shutdown
- Take Backup; old FCV
- Check driver compatibility
- Check for any MongoDB v3.0 metadata – look in *dbpath* – if *wiredTiger.basecfg* upgrade to MongoDB 4.4.1 or later- otherwise Painful Remediation *WT-6623

https://jira.mongodb.org/browse/WT-6623

Major Version

Upgrade in Rolling Manner, Secondary 1, Secondary 2, stepdown, old PRIMARY

Basic Replica Set Upgrade Steps:

Upgrade Secondaries in a Rolling Method

- **SECONDARY 1, SECONDARY 2,**
- **force election to new PRIMARY,**
- **upgrade old PRIMARY/new SECONDARY**

4.2 to 4.4

WARNING – potential non-fun ahead

Upgrade past base v4.4.0 to latest 4.4.x

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Replica Set Upgrade Steps – Major Version

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For Replica Set Upgrades – Upgrade binaries in a rolling manner then force the election of a new PRIMARY then upgrade the binary for the former PRIMARY.

Basic Replica Set Upgrade Steps:
Upgrade Secondaries in a Rolling Method - SECONDARY 1, SECONDARY 2, force election to new PRIMARY, upgrade old PRIMARY/new SECONDARY

Upgrade SECONDARY 1
- Shutdown Secondary 1
- Take Secondary 1 out of the replica set by restarting it with another port number (ex. port 3333)
- Change Binaries to new version
- Start Secondary 1 back up with its original replica set port number (ex. 27017)

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Replica Set Upgrade Steps – Major Version

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Upgrade SECONDARY 2 - Repeat that process with Secondary 2
Shutdown Secondary 2

- Take Secondary 2 out of the replica set by restarting it with another port number (ex. port 3333)

- Change Binaries to new version
- Start Secondary 2 back up with its original replica set port number (ex. 27017)

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Replica Set Upgrade Steps – Major Version

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Step Down the current Primary - force election of a new PRIMARY – make sure state is good
Upgrade old PRIMARY, now New Secondary

Shutdown old PRIMARY, now New Secondary 3

- Take new Secondary 3 out of the replica set by restarting it with another port number (ex. port 3333)

- Change Binaries to new version

- Start new Secondary 3 back up with its original replica set port number (ex. 27017)

Wait, check data and logs. If no problems, update FCV to new version

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Sharded Cluster

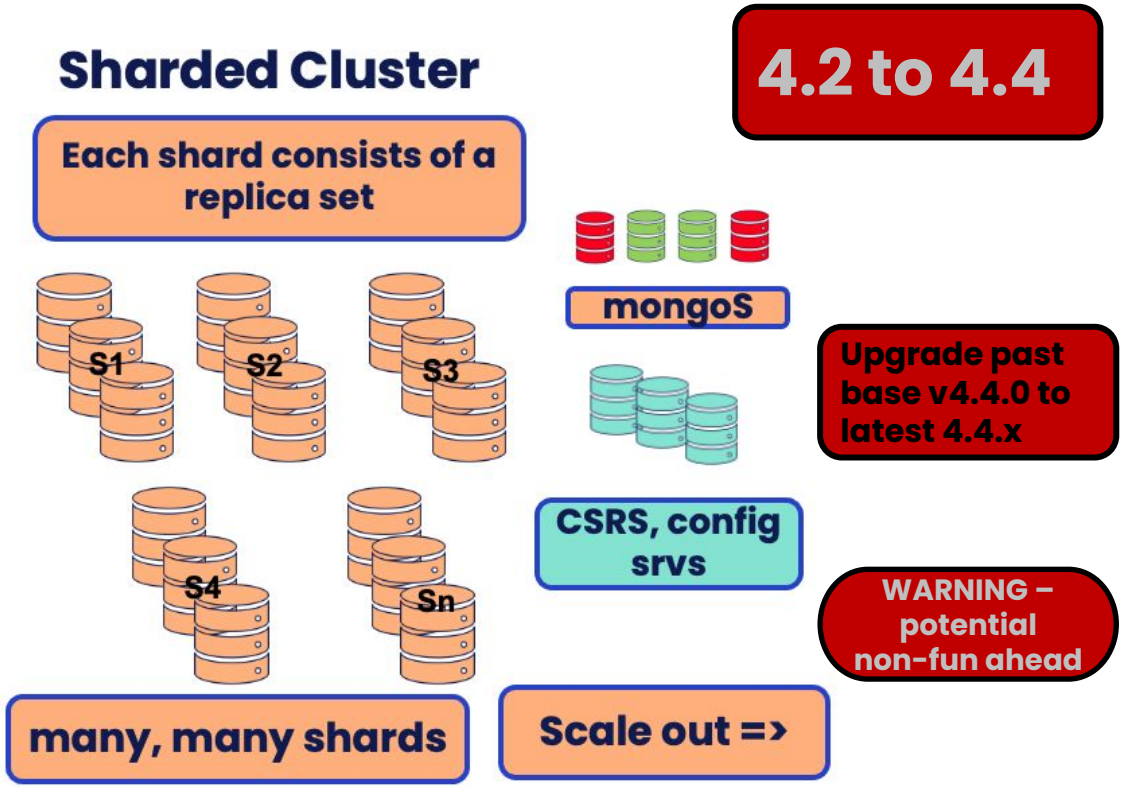
1 shard to … n Shards

Pre-Req's

- Test in lower envs
- Clean last shutdown
- Take Backup; old FCV
- Check driver compatibility
- Check for any MongoDB v3.0 metadata – look in *dbpath* – if *wiredTiger.basecfg* upgrade to MongoDB 4.4.1 or later- otherwise Painful Remediation *WT-6623

https://jira.mongodb.org/browse/WT-6623

Major Version



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Sharded Cluster Upgrade Steps – order matters

Stop Balancer



- **Upgrade Config Servers**



- **Upgrade Shard nodes – MongoD's**



- **Upgrade the MongoS's**

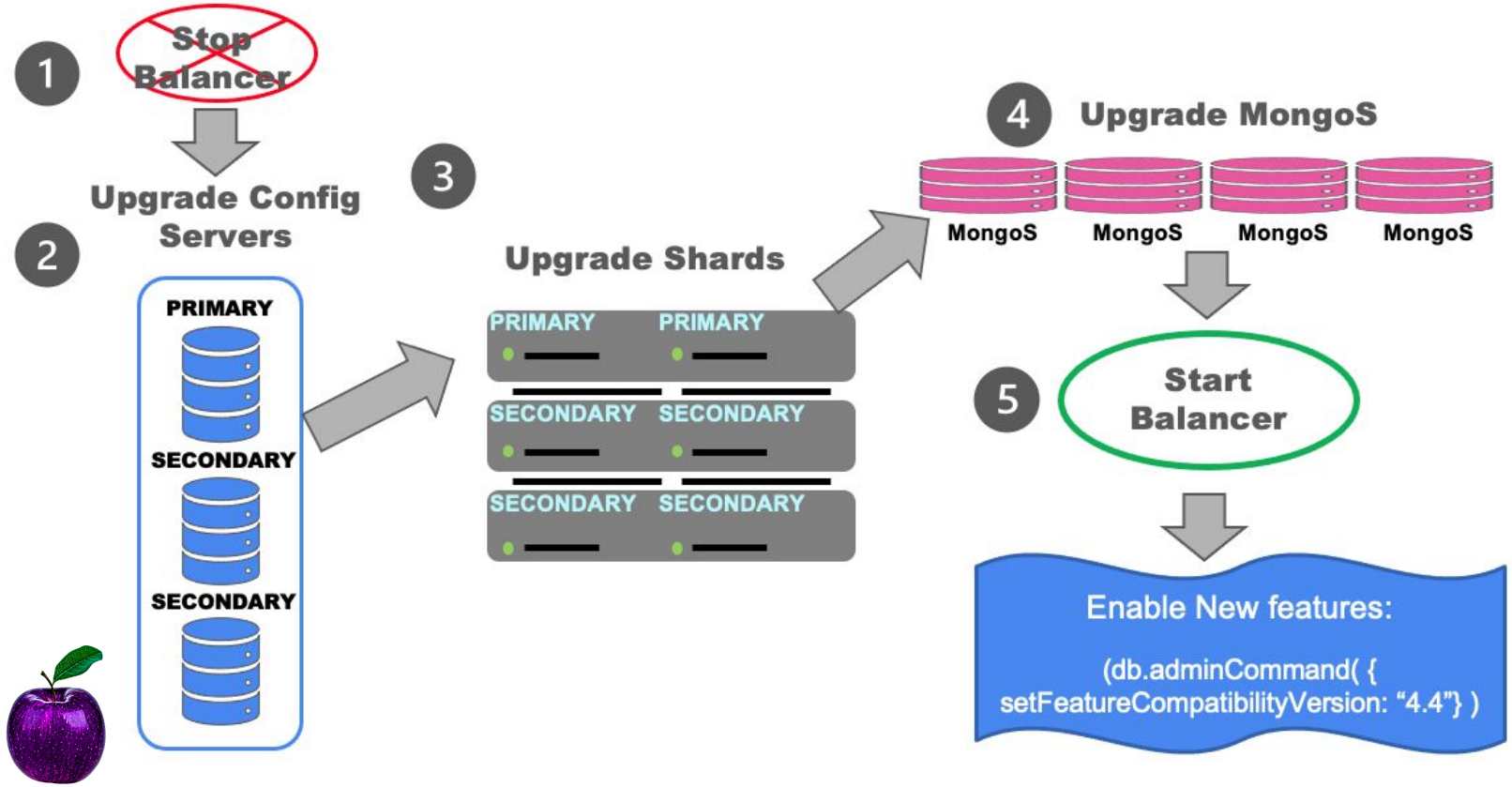


Start Balancer



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Sharded Cluster Upgrade – 4.2 to 4.4 example



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Downgrades

=> REVERSE



Sharded Cluster Downgrade Steps – order matters

Stop Balancer

- **Downgrade Mongos's**
- **Downgrade Shard Nodes – MongoD's**
- **Downgrade the Config Servers**

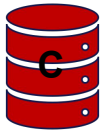
ReStart Balancer

*** All in a rolling manner at replset level again**





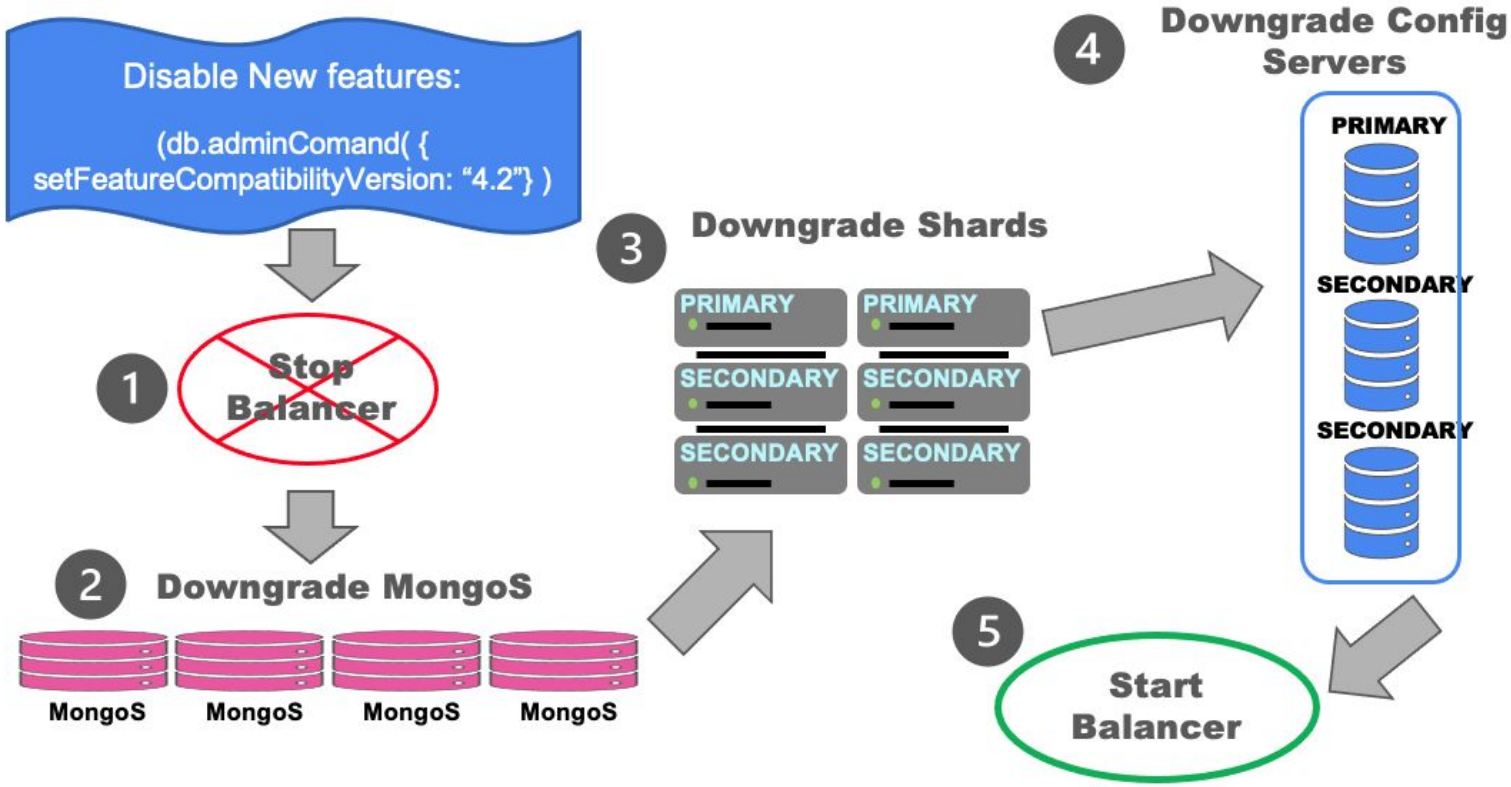






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Sharded Cluster Downgrade – 4.4.x to 4.2.x



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Things to watch out for and Gotchas!!

.... ror realz



Things to watch out for …. Compatibility and Deprecation issues

Deprecated - Simple Network Management Protocol (SNMP) v6.0
Starting in MongoDB 6.0, SNMP is deprecated and will be removed in the next release.

- If you have been on v6.0.x and above and have Time Series Collections and need to downgrade, those collections will need to be dropped
- Compatibility for Supported Life Cycle and OS Host Software – ex. MongoDB v5.0.x Community Edition drops support for RHEL/CentOS/Oracle 6 on x86_64 and other OS support changes
- Use the ReadPreference best suited for your application needs – ex. 'nearest' to reduce latency, secondaryReadPreferred for heavy read apps, etc.

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RHEL 9 x86_64 supported starting on v6.0.34

RHEL 6 NOT supported after v4.4

New *mongosh* mandatory in 6.0

older legacy *mongo* shell is deprecated in 5.0 and removed in v6.0.x

$operators, functions, etc. changes

MongoDB v5.1 removes or replaces several legacy query operators ex. $explain becomes cursor.explain()

TTL Behavior change between v4.4 and v6.0

=> can lead to unintended immediate document expiration

Driver changes and compatibility

MongoDB 6.0, upgrades the internal JavaScript engine – removes or deprecates multiple array and string functions

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Things to watch out for …. BUGS!!



Patch Releases

WARNING

Past Release Limitations

Some past releases have critical issues. These releases are not recommended for production use. Use the latest available patch release version instead.

Issue	Affected Versions
WT-7984	5.0.0 - 5.0.2
WT-7995	5.0.0 - 5.0.2
WT-10461	5.0.0 - 5.0.14 (ARM64 or POWER system architectures)
SERVER-58936	5.0.0 - 5.0.1
SERVER-68511	5.0.0 - 5.0.14

5.0.15 - Feb 27, 2023

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Don’t get Bug Bit …



MongoDB 3.6	November 2017	April 2021
MongoDB 4.0	June 2018	April 2022
MongoDB 4.2	August 2019	April 2023
MongoDB 4.4 Bug Warning: Data Corruption. Use v4.4.15 +	July 2020	February 2024
MongoDB 5.0 Bug Warning: All early v5.0 broken. Use v5.0.11 +	July 2021	October 2024
MongoDB 6.0 Warning: v6.0.0 broken. Many fixes coming in v6.0.2. WAIT …	**July 2022**	**July 2025**

OUTDATED

OUTDATED

Check for major Data Integrity and Security CVE Alerts here:
https://www.mongodb.com/alerts

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MongoDB v5.0 Backports completely Destroyed the 4.4 branch …

?*#@#?

These various bugs last pretty much ALL the way Through 4.4.8 – Serious bugs that cause checkpoint issues, possible data inconsistencies, missing documents/datal loss, duplicate unique key, problems restarting, omit page of data, unclean restarts, data loss.

4.4.2 - Nov 18, 2020

> **WARNING**
>
> MongoDB version 4.4.2 is not recommended for production use due to critical issue WT-7995, fixed in later versions. Use the latest available patch release version.

4.4.7 - Jul 16, 2021

> **WARNING**
>
> MongoDB version 4.4.7 is not recommended for production use due to critical issues SERVER-58936 and WT-7995, fixed in later versions. Use the latest available patch release version.

4.4.5 - Apr 8, 2021

> **WARNING**
>
> MongoDB version 4.4.5 is not recommended for production use due to critical issues WT-7426 and WT-7995, fixed in later versions. Use the latest available patch release version.

4.4.8 - Aug 4, 2021

> **WARNING**
>
> MongoDB version 4.4.8 is not recommended for production use due to critical issues WT-7984 and WT-7995, fixed in later versions. Use the latest available patch release version.

SERVER-61483. SERVER-61633 SERVER-61945 SERVER-61950 – problems restarting nodes WT-8104 WT-8204 – race conditions, memory leaks. WT-8395 – upgrade related –data in an "inconsistent state", missing documents WT-8534 WT-8551

Current 4.4 stable version is v4.4.16

https://www.percona.com/downloads/percona-server-mongodb-4.4/

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Then it was doing well but hit a stinker …



v5.0.0 x
v5.0.1 x
v5.0.2 x
v5.0.3 x
v5.0.4 x
v5.0.5 x
v5.0.6 x
v5.0.7 x
v5.0.8 x
v5.0.9 x
v5.0.10 x
v5.0.11 x
v5.0.12 x
v5.0.13 x
v5.0.14
v5.0.15 x
Feb 27, 2023

SERVER-68511 … quite ugly

Version 6.0 is better… with the Rapid Releases incorporated in along with other fixes

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Things to watch out for …. Performance ???

- Some reports of performance problems after upgrades from and to various versions, especially between v3.6 and v4.4. Lots of changes through there – major engine and core server changes, etc. but improvements as well.

- Support has seen some tickets, etc. And some other mentions along with seeing it in the past V3.6 => 4.0 but long ago. Benchmark – serpapi September 2022

- Recent reported Slowdown due to the new mongosh shell and a bug there – but seems to be with certain combinations and using a ruby driver …?? Below are links for that issue and bug:

- https://github.com/bitnami/charts/issues/10316#issuecomment-1131718880

- https://jira.mongodb.org/browse/MONGOSH-1240

With the most recent mongosh 1.7.0 we've made some performance improvements. We are not as fast as `mongo` and, realistically, I don't know if we'll be able to get there, but we made progress in the right direction:

```
❯ time mongo --eval 'db.adminCommand({ping: 1})' --quiet
{ "ok" : 1 }
mongo --eval 'db.adminCommand({ping: 1})' --quiet  0.12s user 0.03s system 58% cpu 0.249 total
❯ time mongosh.bin.1.5.1 --eval 'db.adminCommand({ping: 1})' --quiet
{ ok: 1 }
mongosh.bin.1.5.1 --eval 'db.adminCommand({ping: 1})' --quiet  1.17s user 0.14s system 112% cpu 1.168 total
❯ time mongosh.bin.1.7.0 --eval 'db.adminCommand({ping: 1})' --quiet
{ ok: 1 }
mongosh.bin.1.7.0 --eval 'db.adminCommand({ping: 1})' --quiet  0.72s user 0.26s system 72% cpu 1.355 total
```

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Versions and Recommendations

Percona Server for MongoDB – aka PSMDB

Versions, versions, and more or minor versions

Percona Server for MongoDB Current Versions

PSMDB v4.4.19-19

PSMDB v5.0.15-13

PSMDB v6.0.4-3

Use the latest minor version available!!

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Percona Recommended Upgrade Path

Slow, Steady, and Sure – especially when upgrading from v4.2.x to 4.4.x



To upgrade from a version earlier than the 4.4-series, you must successively upgrade major releases until you have upgraded to 4.4-series.

3.6 => 4.0 => 4.2 => 4.4.1+ =>5.0 =>6.0

Go to LATEST minor version available – lot of changes. Lot of releases for all of these major versions. Lot of bugs. Lot of bug fixes and improvements.



So go to latest **PSMDB v4.4.19-19, v5.0.15-13, v6.0.4-3**

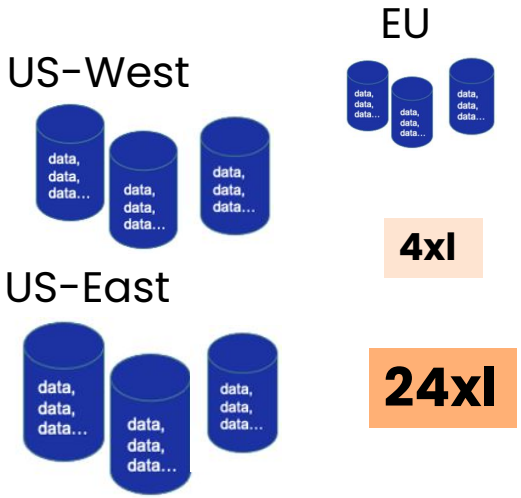
https://www.percona.com/software/mongodb/percona-server-for-mongodb

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General MongoDB Architectural and High Availability Best Practices

- Use different Data Centers, Availability Zones, Regions, etc. for your replica sets members – eliminate single points of failure
- Use the right level of server for your expected application needs – CPU, RAM, disk, IOPS, etc.
- Use the ReadPreference best suited for your application needs – ex. 'nearest' to reduce latency, secondaryReadPreferred for heavy read apps, etc.



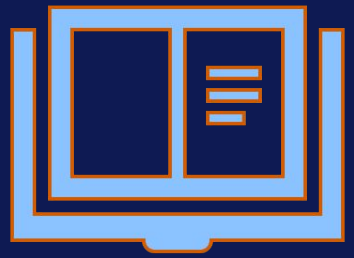
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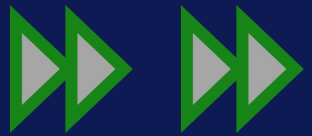
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Agenda

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- ❑ EOL – … what? when?
- ❑ Why upgrade? … many good reasons
- ❑ Types of environments and upgrades
- ❑ Upgrade steps for each
- ❑ Downgrades
- ❑ Gotchas and things to watch out for
- ❑ Best Practices
- ❑ Recommended upgrade path/s
- ❑ The new Beasts … Kubernetes clusters, Operators, etc.
- ❑ Migrations, sort of
- ❑ PSMDB, PDB, PMM … all of the P's





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The new Beasts ...

Kubernetes, Operators, kubectl, etc.



Upgrading Percona Operator for MongoDB and Kubernetes Clusters

When considering an upgrade for your MongoDB environment running on Kubernetes, there are multiple components to account for. Those are the Percona Operator for MongoDB, your Custom Resource Definition (CRD), and your Database software itself - Percona Server for MongoDB.

Generally speaking, there are 2 upgrade scenarios:

- Upgrade the Operator, CRD, and Database software
- Complete a minor database software version upgrade (PSMDB) without upgrading the Operator

Things to note:

The Operator supports the last 3 versions of the CRD so you can skip upgrading the CRD and just upgrade the Operator if that condition is met.

The Operator should be updated to the next nearest version - ex. go from 1.12.0 to 1.13.0, not skip from 1.12.0 to 1.14.0

The Percona Operator uses FQDN (fully-qualified domain names) starting in version 1.14.0 instead of IP Addresses. This follows best practices for running production MongoDB environments.

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Upgrading the Operator and CRD and the Database

Upgrading the Operator and CRD can be done either manually using **kubectl** commands or via Helm if the Operator was installed using Helm

Remember to account for any customized parameters that your environment may be using by including those in your **helm upgrade** command.

See specific steps and commands here:
https://docs.percona.com/percona-operator-for-mongodb/update.html#manual-upgrade

https://docs.percona.com/percona-operator-for-mongodb/update.html#upgrade-via-helm

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Upgrading Percona Server for MongoDB within a Kubernetes Cluster with the Operator

Recommended way to upgrade the Percona Server for MongoDB version is with using the Smart Update Strategy – allows Operator to control how the objects are updated.

This is true for both Manual and Automated upgrades.

Smart Update strategy (even when set to not automatically upgrade) provides proper restarting of Pods when triggered by other changes such as resource values, password rotation and more.

Manual Upgrade Process:

1. Update CRD file to reflect SmartUpdate, spec.upgradeOptions.apply to Never or Disabled

```
...
spec:
  updateStrategy: SmartUpdate
  upgradeOptions:
    apply: Disabled
    ...
```

1. Use **kubectl patch psmdb** command to apply the desired patch to your CRD file to update version and image names with the newer version tag

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Upgrading Percona Server for MongoDB within a Kubernetes Cluster with the Operator – cont'd

For example, updating kw-cluster-upgradetest1 cluster to the Operator 1.14.0 version and the PSMDB 5.0.15-13 version should look as follows:

```
kubectl patch psmdb kw-cluster-upgradetest1 --type=merge --patch '{
"spec": {
"crVersion":"1.14.0",
"image": "percona/percona-server-mongodb:5.0.15-13”,
"backup": { "image": "percona/percona-backup-mongodb:2.0.4" },
"pmm": { "image": "percona/pmm-client:2.35.0" }
}}'
```

1. Monitor the patch triggered deployment rollout process using the kubectl rollout status command.

```
kubectl rollout status sts kw-cluster-upgradetest1-rs0
```

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Automated Upgrade Process

Automated upgrades using the Smart Update strategy, set all desired parameters and version selection options in deploy_cr.yaml file including the *upgradeOptions.apply* values to dictate which versions you would like to select from and whether you want a minor or a major version upgrade to occur.

Details for setting those options here:
https://docs.percona.com/percona-operator-for-mongodb/update.html#automated-upgrade

Apply changes using the kubectl apply command
ex. kubectl apply -f deploy/cr.yaml

For minor or major version upgrades – moving only within 1 major version at a time

Operator does not set the FCV (FeatureCompatibilityVersion) to new version automatically.

Allows for rollback if necessary. Recommended to make sure that this setting is not updated for a while until you are sure that backwards-incompatible features are not enabled that could cause a more difficult downgrade process.

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Low Level Manual Upgrades of PSMDB in K8's env's

Still some cases where manual database version upgrades are required.
Ex. when using PSMDB with older versions of the **Percona Operator - version 1.5.0 and earlier**.

For those cases you can perform manual upgrades using one the the following strategies:

- Rolling Update - initiated manually and controlled by Kubernetes
- Manual Update on Delete - done by Kubernetes on a per-Pod basis with manual deletion of the Pods

In the interest of time, see those specific instructions here:
https://docs.percona.com/percona-operator-for-mongodb/update_manually.html#manual-upgrade-the-on-delete-strategy

Beware: https://jira.mongodb.org/browse/MONGOSH-1240

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With all of this greatness, migrate on over to PSMDB today

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It’s really just a lift and shift. Normally a binary change between PSMDB and MGDB CE

Migrations

You want to move it move it



Migrations

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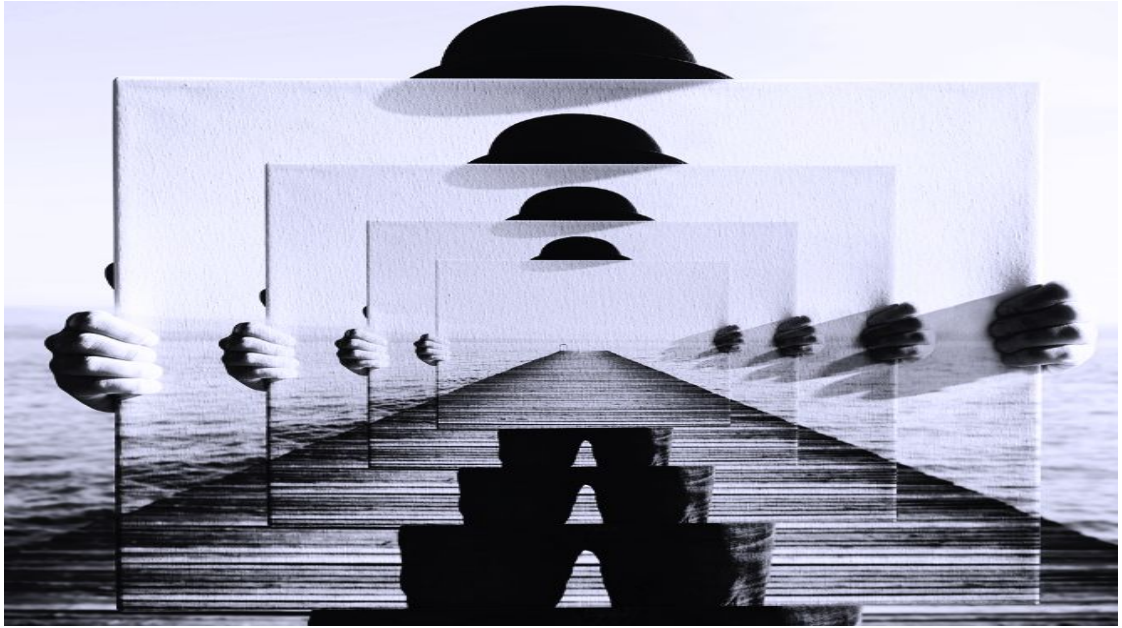
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Percona Server for MongoDB

https://www.percona.com/software/mongodb/percona-server-for-mongodb



Questions?
Let's talk.

/wilkinskimberly
@dba_denizen

Percona Operator for MongoDB

https://docs.percona.com/percona-operator-for-mongodb/index.html



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Thank You!