Midas

On-the-fly-Schema-Migration Tool

For

EQUAL EXPERTS

Schema Migration Problems

- Applications have to hand-roll their own schema migration infrastructure or use some third-party tool

- Difficult to migrate TBs of data without downtime
  - unacceptable from SLA stand-point!

- How about: on-the-fly schema migration - *a Midas Touch*?

Zero-downtime Deployment

- Expansion Scripts
  - Apply changes to the documents safely that do not break backwards compatibility with existing version of the application.
    - e.g Adding, copying, merging, splitting fields in a document.
- Contraction Scripts
  - Clean up any database schema that is not needed after the upgrade.
  - e.g. removing fields from a document.

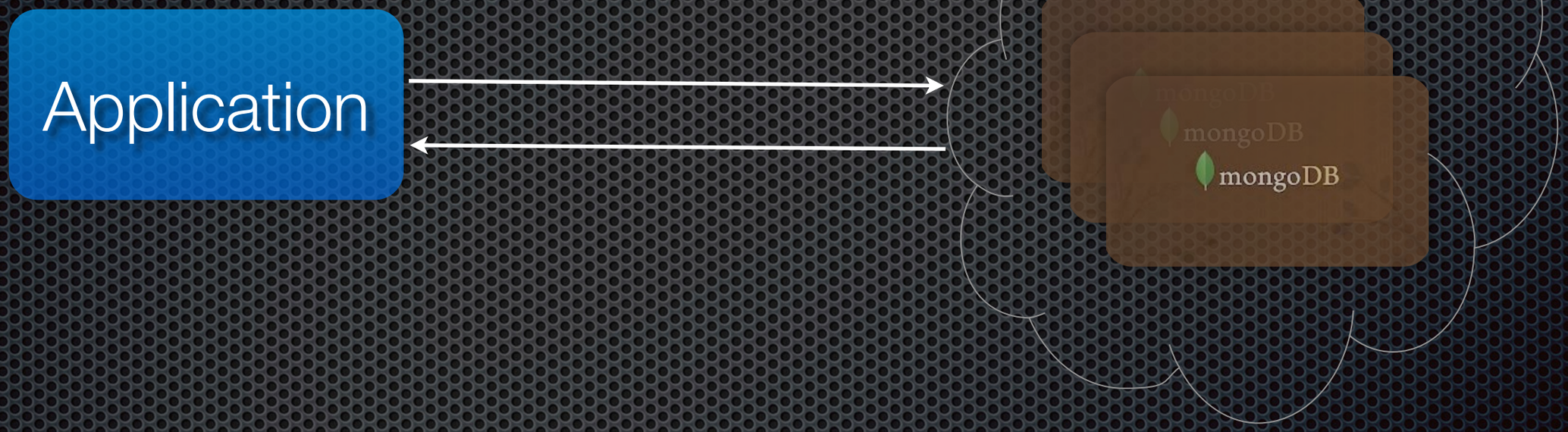
The Mechanics

- Run Expansion scripts before upgrading the application
- Upgrade the cluster, a node at a time
- Run Contraction Scripts
  - Once the system has been completely upgraded and deemed stable.
  - Typically, contractions can be run, say days/weeks after complete validation.

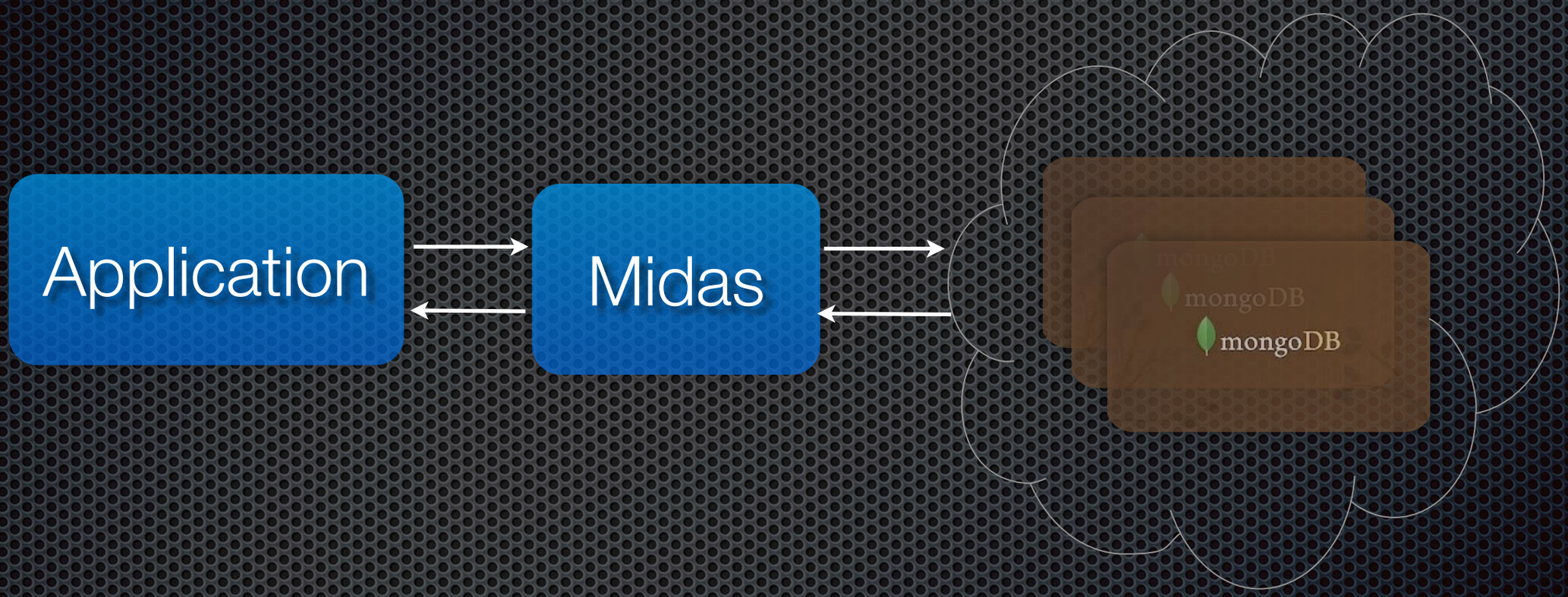
Do we need DB rollback?

- Short Answer
  - No
- Long Answer
  - Reversing DB changes can lead to potential loss of data or leave it in an inconsistent state.
  - Its safer to rollback application without needing to rollback DB changes as expansions are backward compatible.

How it works?
An Architectural Overview



How it works?
An Architectural Overview

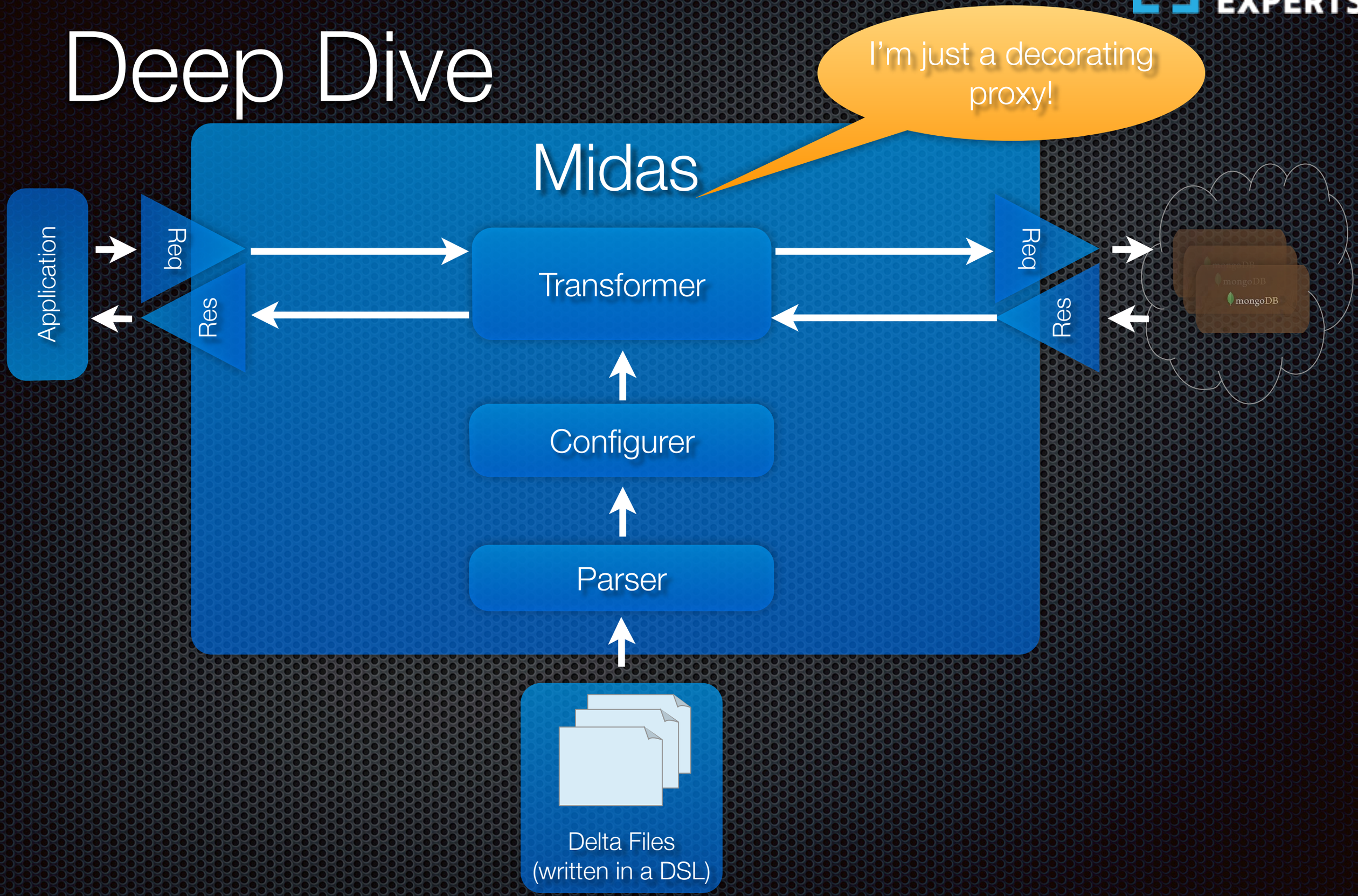


- Intercepts Responses at Protocol Level
- Upgrades/Downgrades Document schema in-transit

Protocol Level brings Transparency

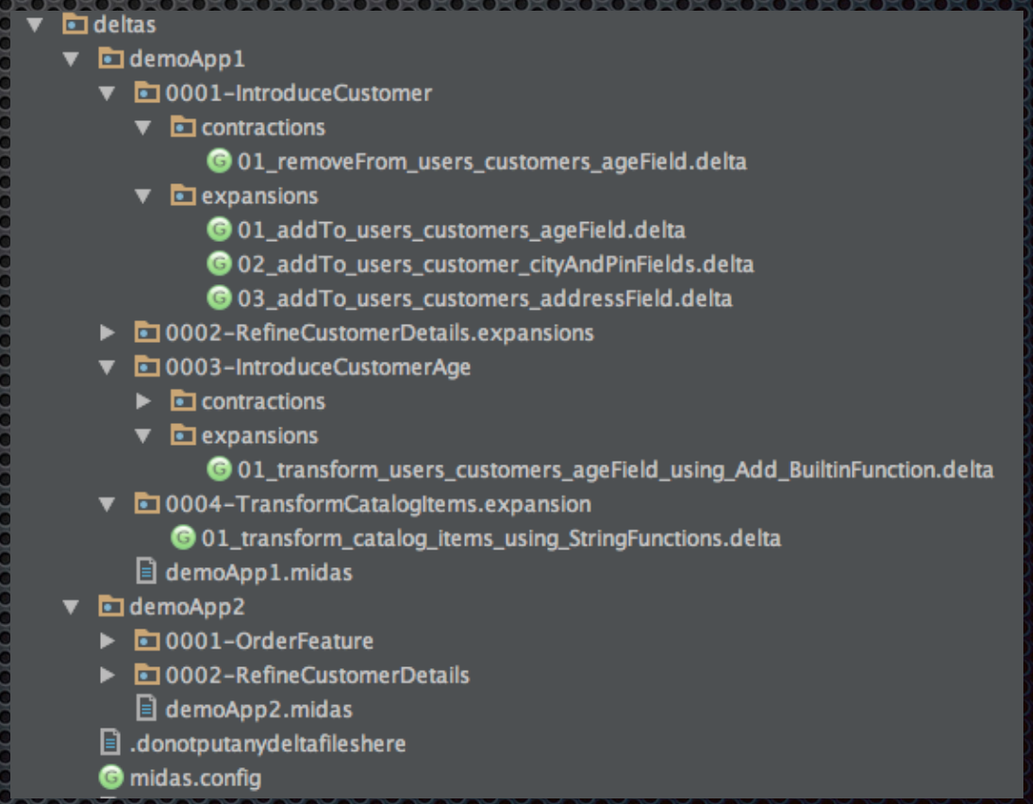
- From the App perspective
  - Midas is Agnostic of Language specific drivers and versions within those languages
    - Works with versions of Ruby, Python, C# and Java drivers.
- From MongoDB perspective
  - Midas is Agnostic of the MongoDB configurations
  - Works with Standalone, Replica Sets, Sharded environments.

Deep Dive


I'm just a decorating proxy!
Midas
Application
Req
Res
Transformer
Req
Res
mongoDB
mongoDB
Configurer
Parser
Delta Files
(written in a DSL)

Delta scripts

- Group ChangeSet as Directories
- Group deltas as Expansion and/or Contraction deltas as Directories within ChangeSet
- Write delta scripts using the `.delta` extension
- Midas relies on the order specified by you
  - Ordering info is embedded by you within the change set directory name and delta files



Delta Scripts - Convention

- Must begin change set directories with a number and subsequent change set directories are numbered in ascending order.
  - Example: use `<changesetNumber>-<featureName>` as convention for naming change set directory.
- Within a change set, expansion and contraction scripts are grouped by folders - **`expansions`** and **`contractions`**.
- Always begin delta scripts with a number and subsequent delta scripts are numbered in ascending order.
  - Example: use `<changeNumber>_<WhatTheChangeIs>.delta` as convention for naming delta files

Sample Delta Script

- Each Delta script is written using a DSL
- Very close to MongoDB lingo, virtually no learning curve.

```
use users
db.customers.remove('["address.line1"]')
db.customers.merge([“lname”, “fname”], “ “, “name”)


use transactions
db.orders.add('dispatch : { status: 'NOT DELIVERED'}')
```

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Agile App Delivery & DevOps

- Inject Midas into Architecture
  - Start or Middle of project
- Supports Development of Application in small-steps
  - Add Application ChangeSets/Deltas on-the-fly
- Copes with Load
  - Add/Remove Application Nodes on-the-fly
- Supports Multiple Applications
  - Add/Remove Application(s) on-the-fly

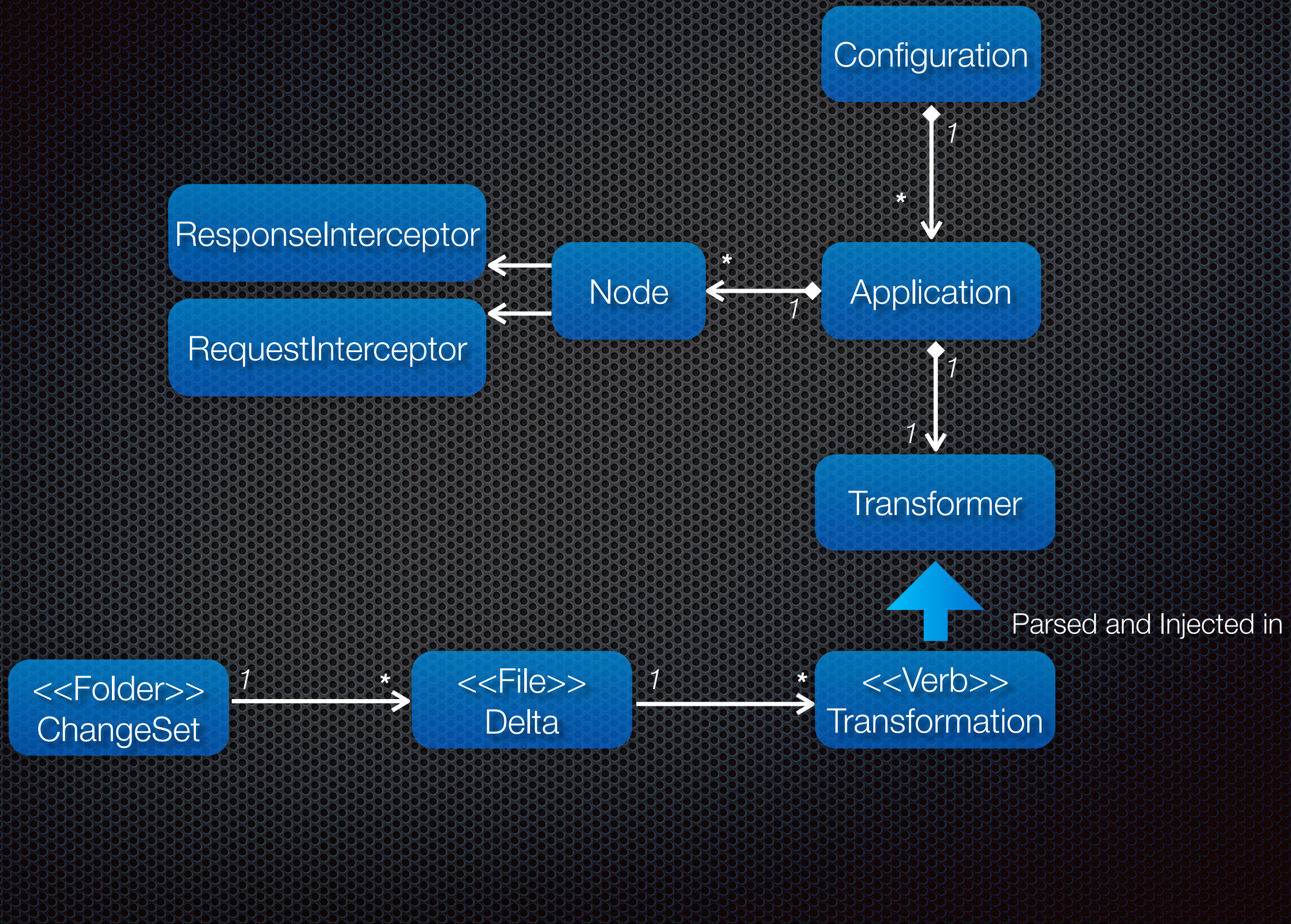
No Leaky Abstractions

- Does not expect the Domain Model to be aware of versioning.
  - Allows developers to focus on the domain while freeing them from versioning concerns.
    - If you wish to take charge, Midas will not come in your way.
- Midas maintains versioning information within the document itself.
  - _expansionVersion and _contractionVersion fields are part of the documents “touched” by Midas.
  - Updates them during request and response.

Caveats

- Never ever change a delta that has been applied to production.
  - Always move forward in time.
  - Reverse a change by a counter-change.
- Force-update migration on documents that are not
  - expanded by App demand, and then proceed to contraction.
  - contracted by App demand, and then proceed to next App-upgrade cycle.
- Currently Midas supports Zero Downtime Configuration - 1 (see later slides), others will be supported in subsequent releases.

Midas Domain Model



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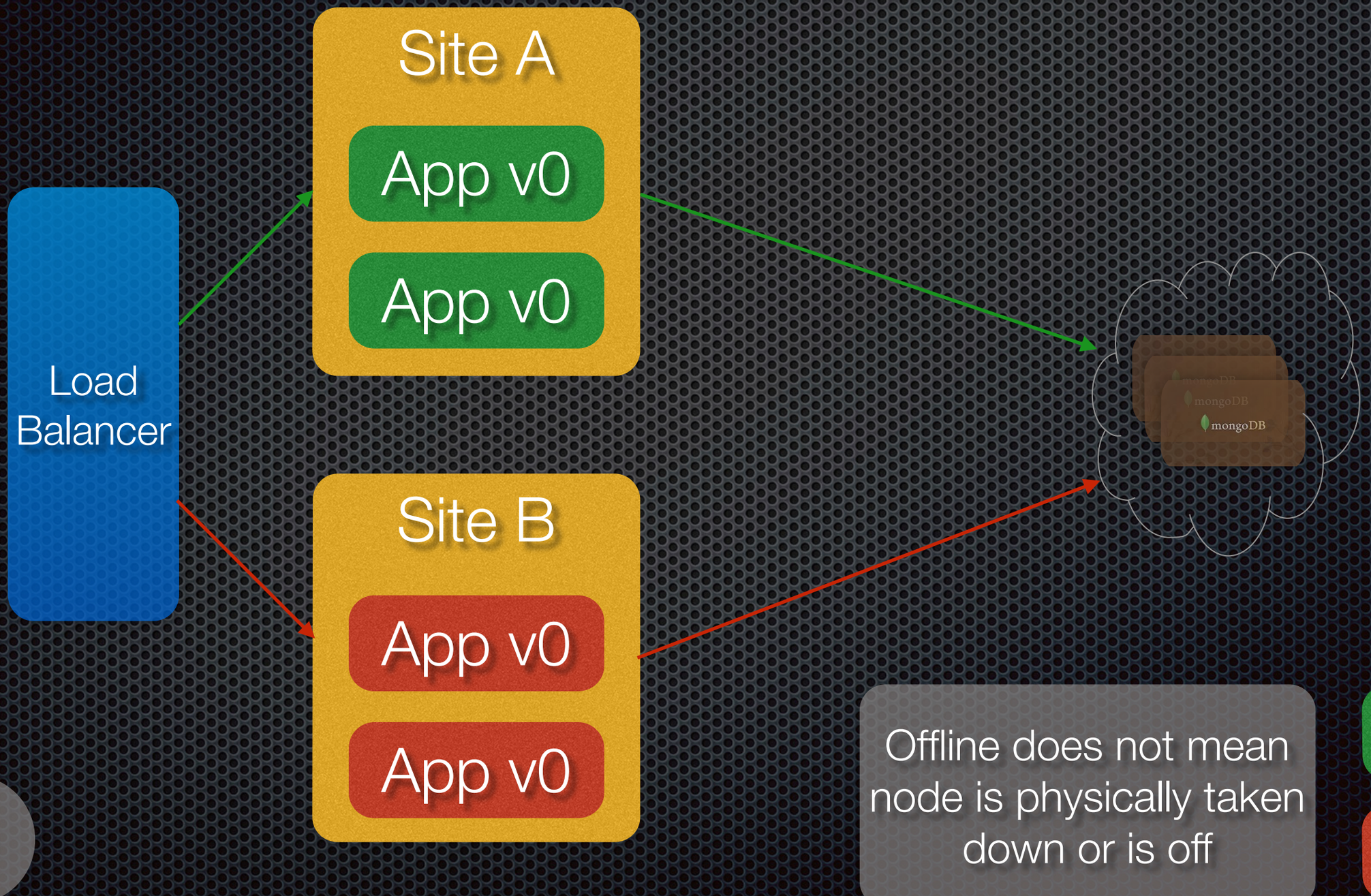
Zero-Downtime Deployment

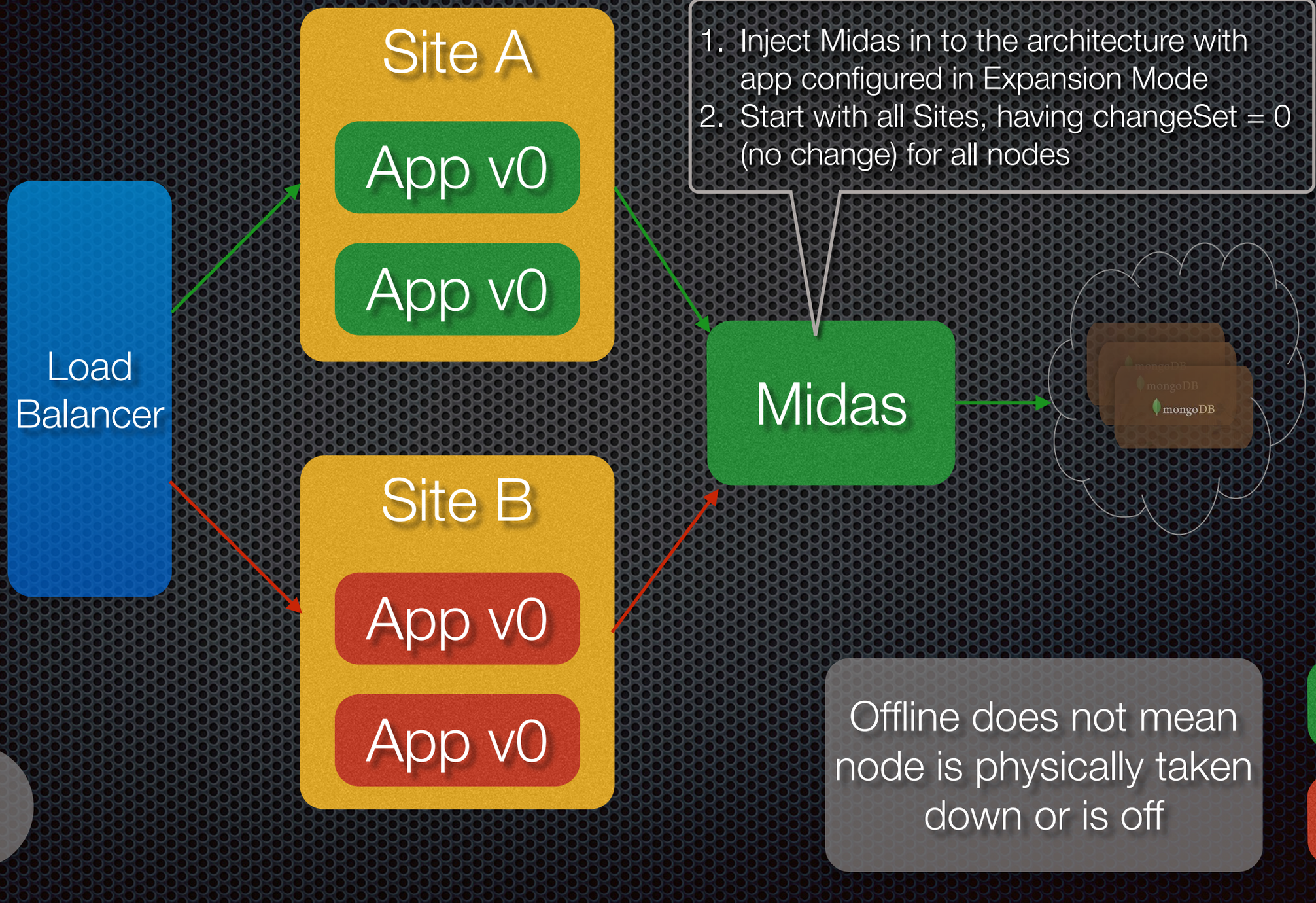
Configuration - 1

Injecting and Using Midas

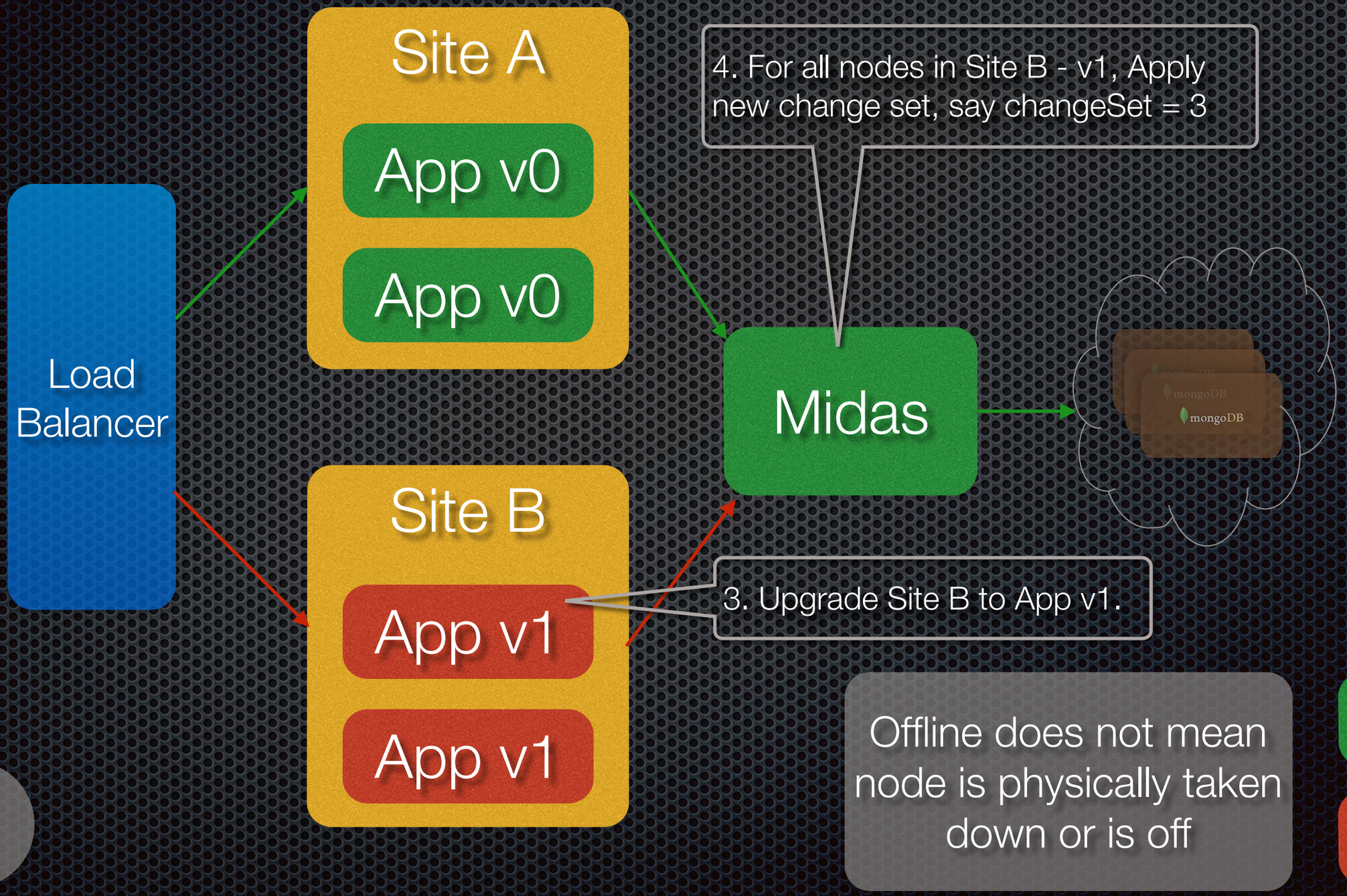
Deployment config - 1



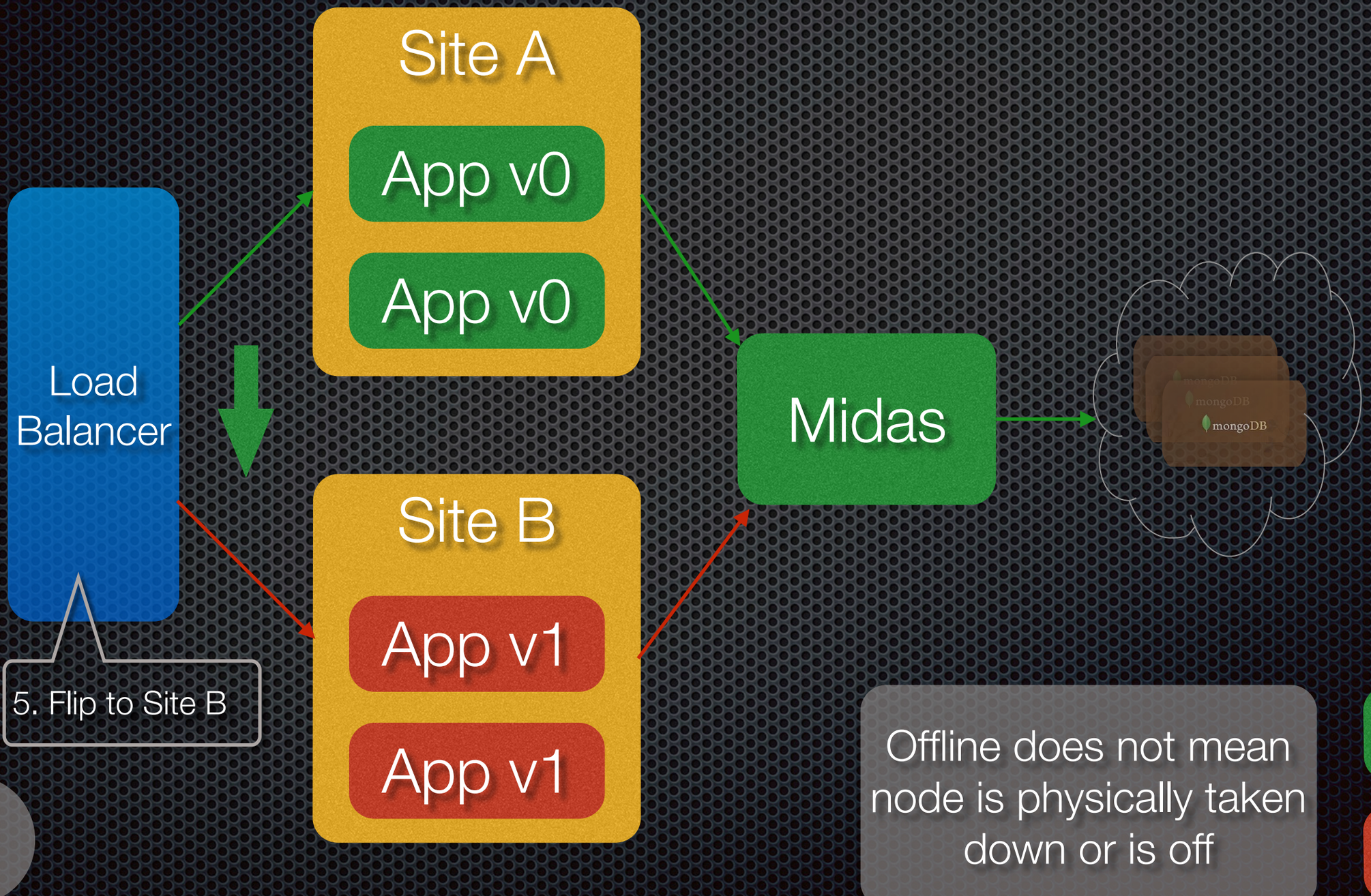
Deployment config - 1



Deployment config - 1



Deployment config - 1

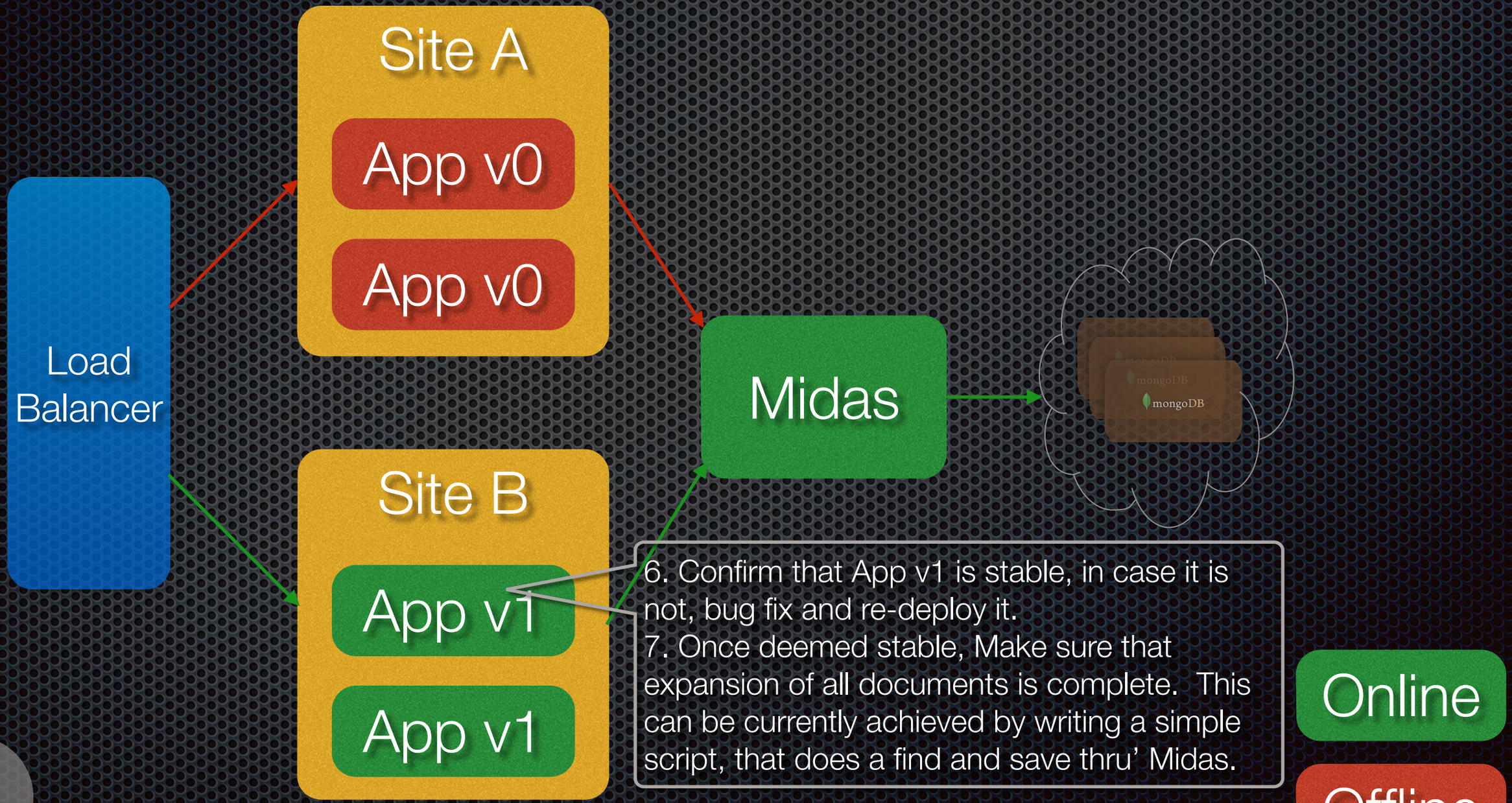


Offline does not mean node is physically taken down or is off

Online

Offline

Deployment config - 1



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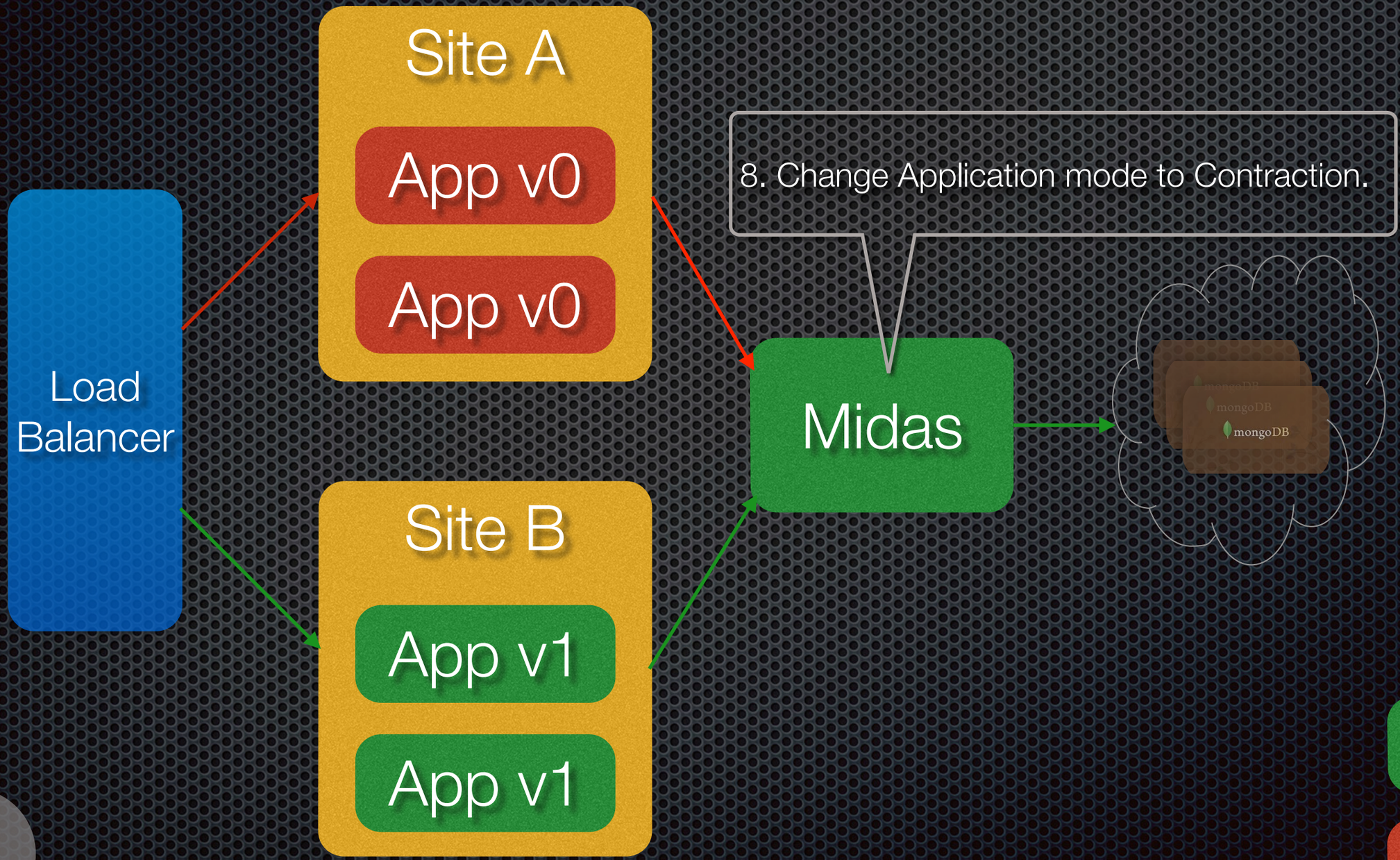

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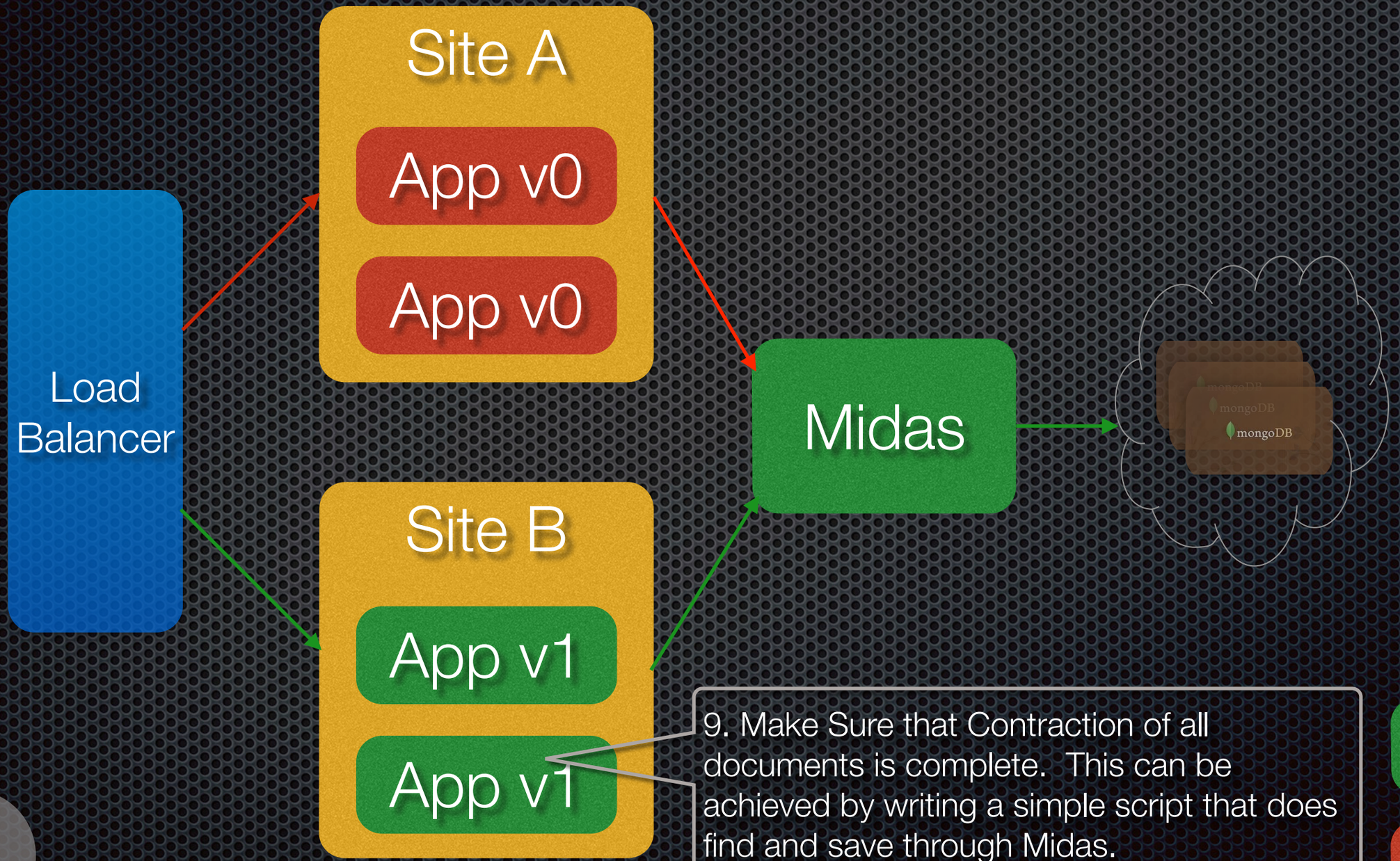
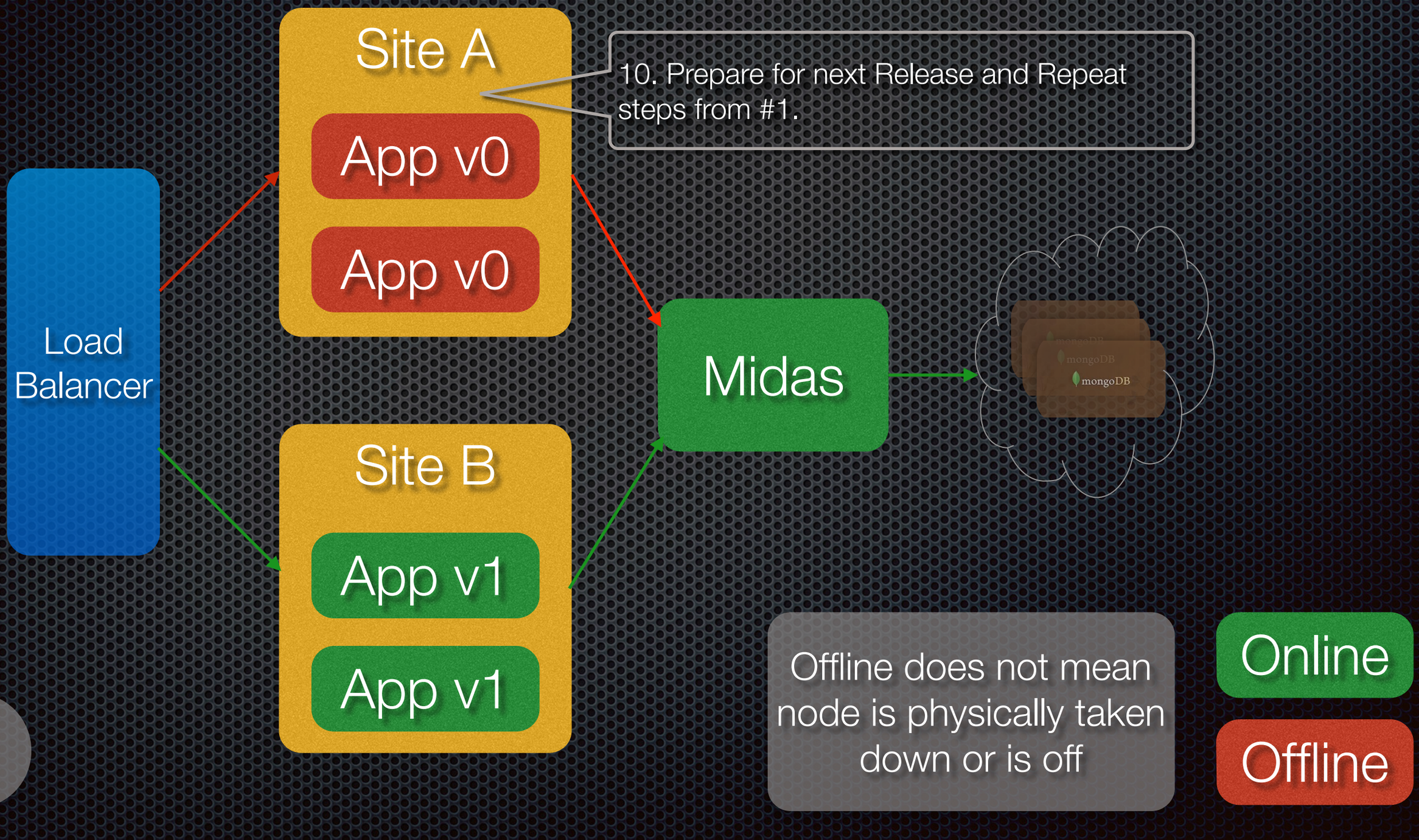


Deployment config - 1



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Zero-Downtime Deployment

Configuration - 1

Node Removal at Runtime

EQUAL EXPERTS

Say, due to some problems, you want to remove Node0 from service:

1. Remove Node0 from LB.

2. Remove Node0 from **app.midas**

```
demoAppV1 {
  mode = contraction
//  siteANode0 {
//    ip = x.x.x.x
//    changeSet = 3
//  }
  siteANode1 {
    ip = y.y.y.y
    changeSet = 3
  }
}
```

Load Balancer

Site A

Node0

Node1

Midas

mongoDB

mongoDB

Online

Offline

2. Midas will sever all connections with Node0

Load Balancer

Site A

Node0

Node1

Midas

Offline does not mean node is physically taken down or is off

Online

Offline

EQUAL EXPERTS

Zero-Downtime Deployment

Configuration - 1

Node Injection at Runtime

You want to inject new node for App in service

1. Add Node2 to **app.midas**.

```
demoAppV1 {
  mode = expansion
  siteANode0 {
    ip = x.x.x.x
    changeSet = 3
  }
  siteANode1 {
    ip = y.y.y.y
    changeSet = 3
  }
  siteANode2 {
    ip = z.z.z.z
    changeSet = 3
  }
}
```

Load Balancer

Site A

Node0

Node1

Node2

Midas

mongoDB

mongoDB

2. Midas is ready to receive connections from Node2

Offline does not mean node is physically taken down or is off

Online

Offline

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3. Add Node2 to LB.

Load Balancer

Site A

Node0

Node1

Node2

Midas

mongoDB

mongoDB

Online

Offline

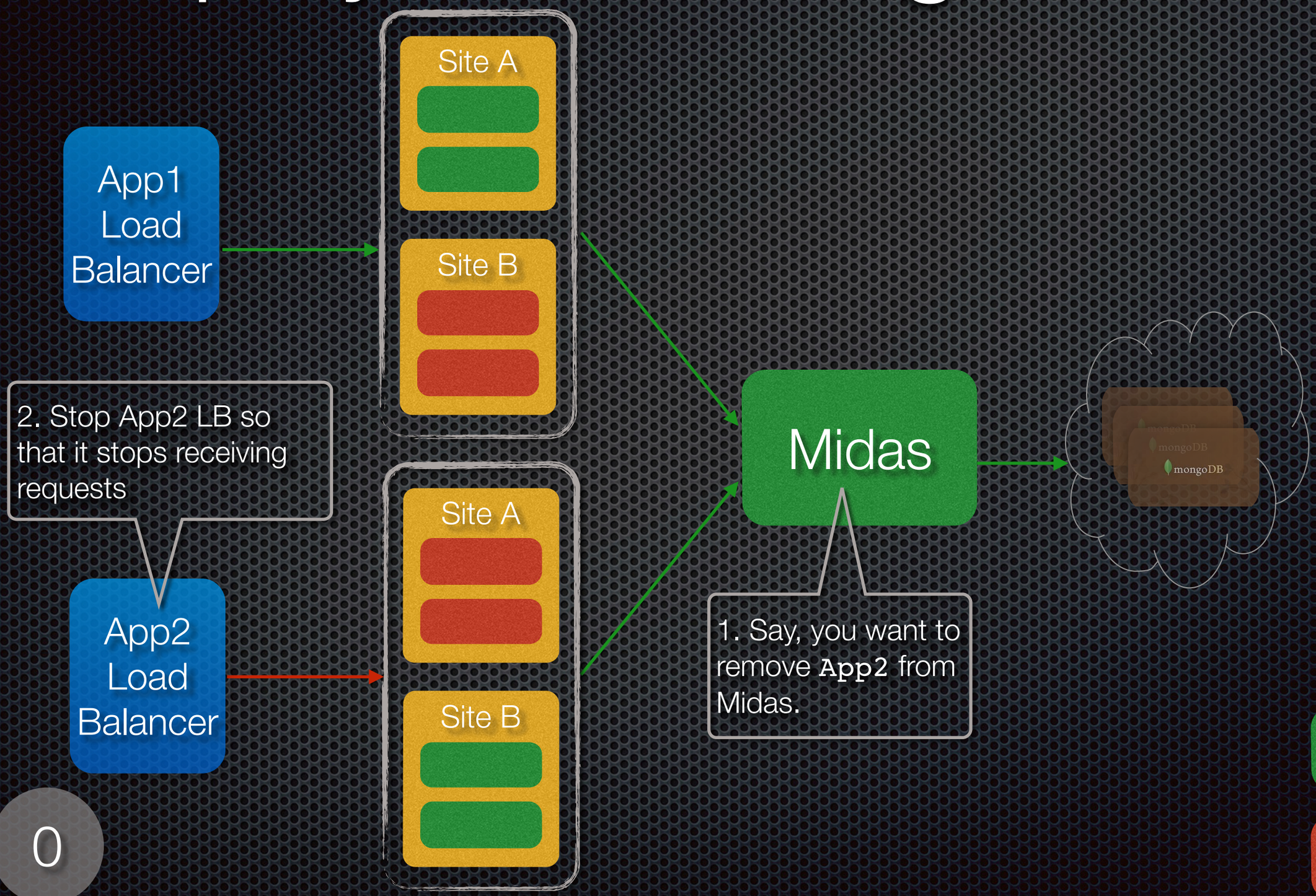
EQUAL EXPERTS

Zero-Downtime Deployment Configuration - 1

App Removal at Runtime

EQUAL EXPERTS

Deployment config - 1



EQUAL EXPERTS

1. Remove App2 from **`midas.config`**

```
apps {
  demoApp1
//  demoApp2
}
```

Note: *You don't have to remove* ***`demoApp2`*** *dir or* ***`demoApp2.midas`*** *to remove the application from Midas (this allows you to re-inject App2 should the need be)*

App1 Load Balancer

Site A

Site B

Midas

mongoDB

mongoDB

2. Midas will sever all connections from **`App2`**

App2 Load Balancer

Site A

Site B

3. You can now take down **`App2`**

Online

Offline

EQUAL EXPERTS

Zero-Downtime Deployment Configuration - 1

App Injection at Runtime

EQUAL EXPERTS

App1 Load Balancer

Site A

Site B

1. Say, you want to add `App2` to Midas.

Midas

App2 Load Balancer

Site A

Site B

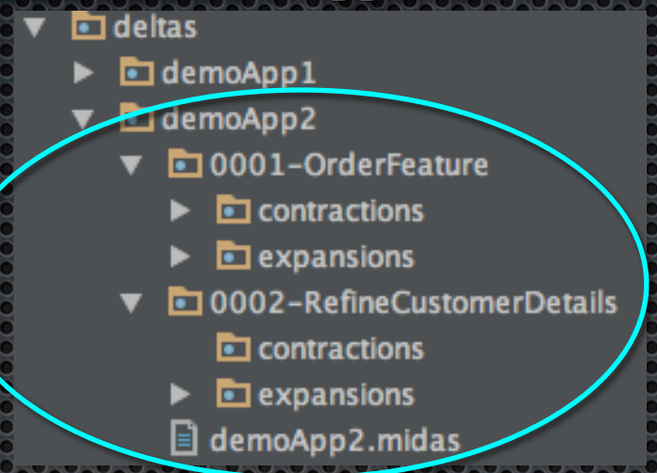
2. Setup the infrastructure for `App2` (Sites and Nodes).

Online

Offline

EQUAL EXPERTS

3. Create `App2` dir within deltas dir
4. Set-up change sets with expansions and contractions in `App2` dir.



App1 Load Balancer

Site A

Site B

Midas

mongoDB

mongoDB

App2 Load Balancer

Site A

Site B

Online

Offline

5. Add **`demoApp2.midas`** (with mode and nodes configured)

```
demoApp2Ver1_0 {
  mode = expansion
  siteANode1 {
    ip = a.a.a.a
    changeSet = 2
  }
  …
  …
  siteBNode1 {
    ip = p.p.p.p
    changeSet = 2
  }
}
```

App1 Load Balancer

Site A

Site B

App2 Load Balancer

Site A

Site B

Midas

mongoDB

mongoDB

Online

Offline

EQUAL EXPERTS

App1 Load Balancer

Site A

Site B

6. Add App2 to **midas.config**

```
apps {
  demoApp1
  demoApp2
}
```

7. Midas is ready to receive connections from App2

Midas

9. Start the LB so that App2 is live

App2 Load Balancer

Site A

Site B

8. Start any Site that can go-live, say Site A here

Online

Offline

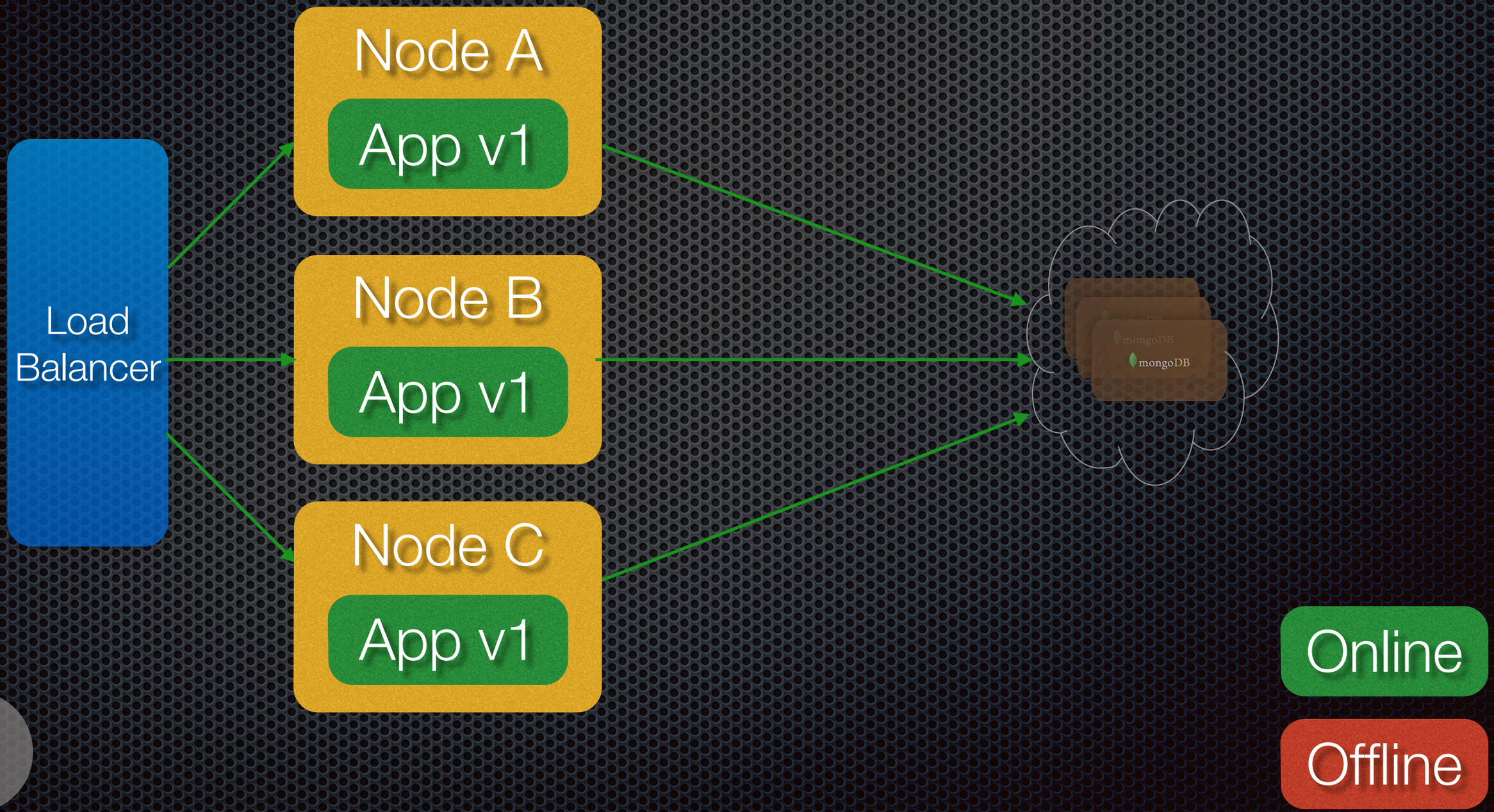
EQUAL EXPERTS

Zero-Downtime Deployment

Configuration - 2

Not Supported in this Release

Deployment config - 2



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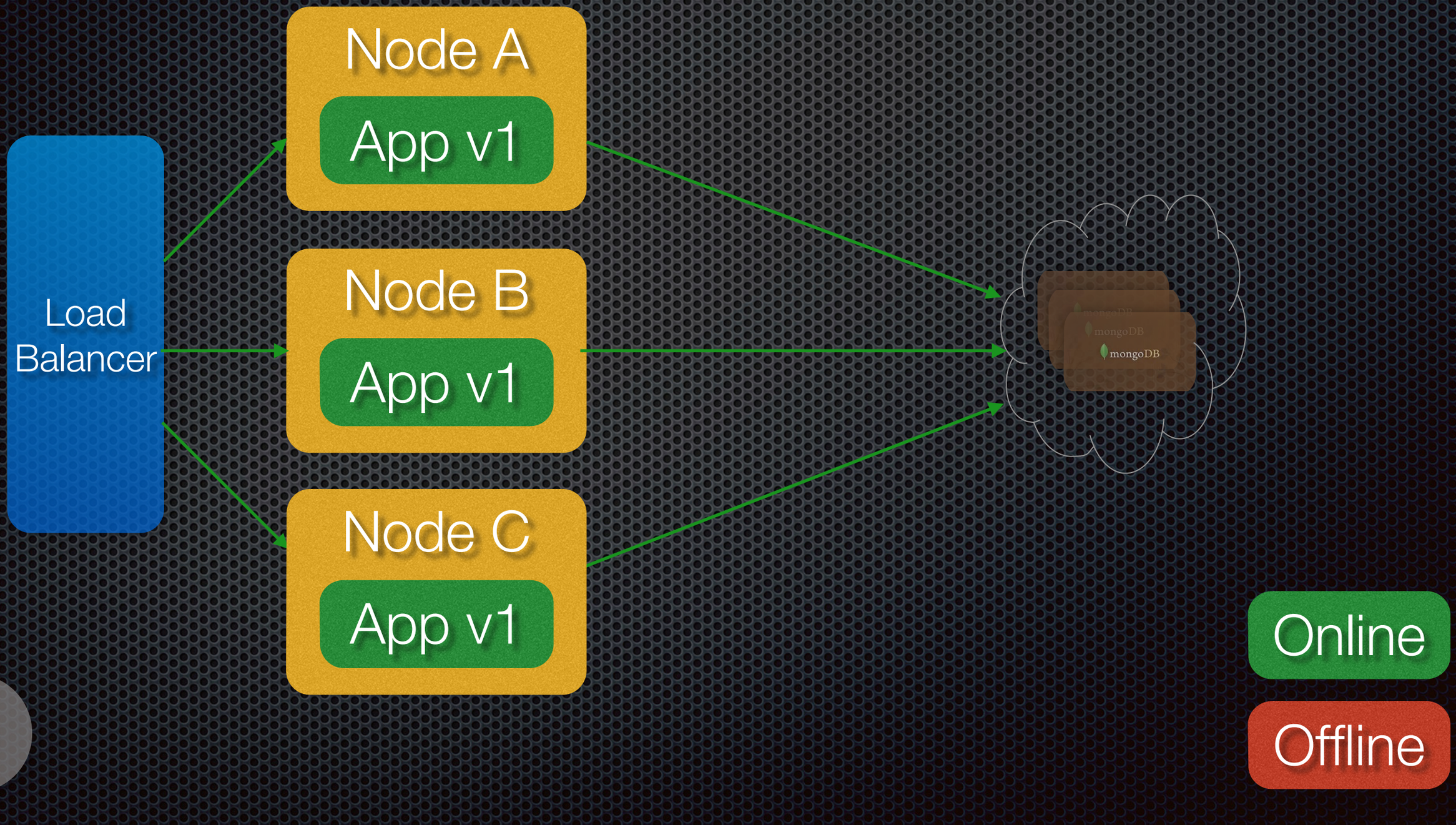
Zero-Downtime Deployment Configuration - 3 AWS

Not Supported in this Release

Deployment config - 3



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References

- Owen Rogers
- http://exortech.com/blog/2009/02/01/weekly-release-blog-11-zero-downtime-database-deployment/

EQUAL EXPERTS

Thank-You