k8s : h4p

RATIS

RATIS

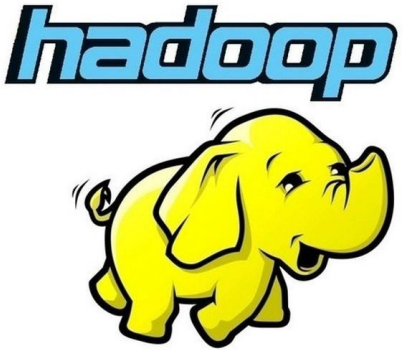
RAFT library for Java

RATIS

RAFT library for Java

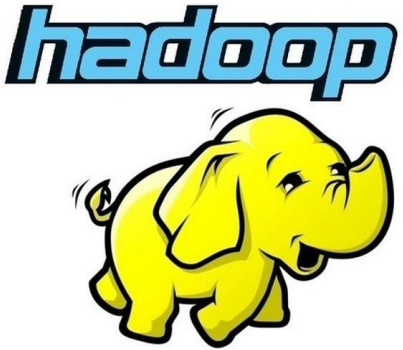
RATIS

RAFT library for Java

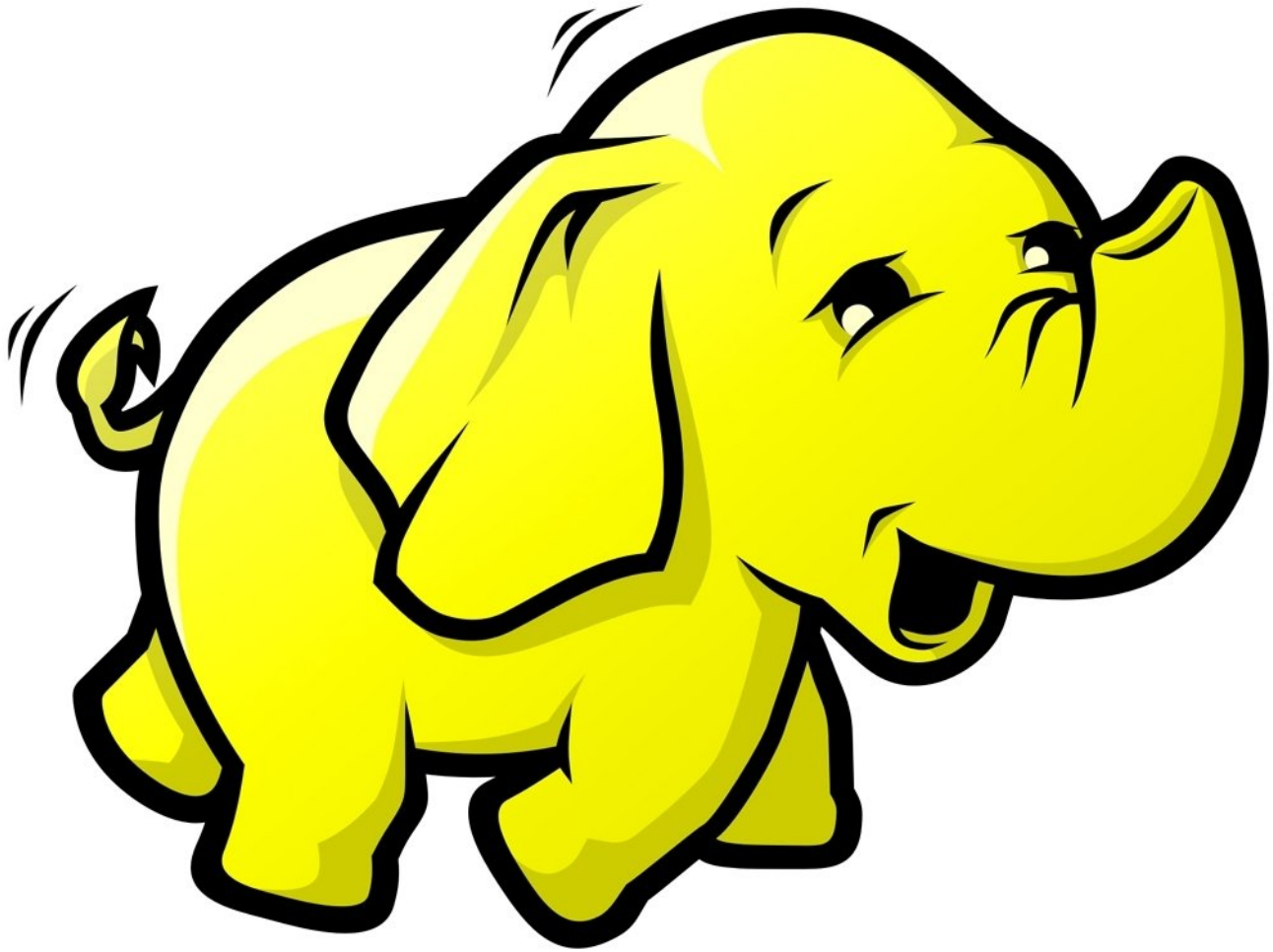


RATIS

RAFT library for Java



https://flokkr.github.io




©2007 Cizauskas

Energy

Manufacturer
Model

Fridge-Freezer

More efficient

A
B
C
D
E
F
G

Less efficient

A

Energy consumption kWh/year
(Based on standard test results for 24h)

Actual consumption will depend on how the appliance is used and where it is located

325

Fresh food volume l	190
Frozen food volume l	126
	✱✱✱✱

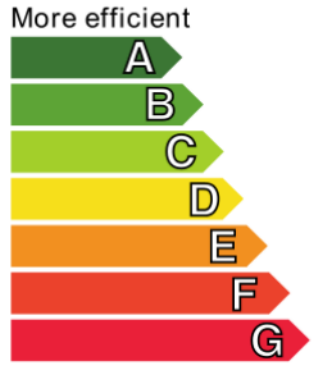
Noise
(dB(A) re 1 pW)

Further information is contained in product brochures

Norm EN 153 May 1990
Refrigerator Label Directive 94/2/EC

Docker

Local compose file



Configuration management	
Source	
Preprocessing	
On change	
Provisioning, Scheduling	
Multihost support	
Scheduling	
Cluster definition	
Scaling	
Multi tenancy	
Failover	
Network	
Intraservice network	
DNS	
Service discovery	
Data locality	
Availability of the ports	

G Less efficient	docker
Configuration management	
Source	
Preprocessing	
On change	
Provisioning, Scheduling	
Multihost support	
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Cluster definition	
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Intraservice network	
DNS	
Service discovery	
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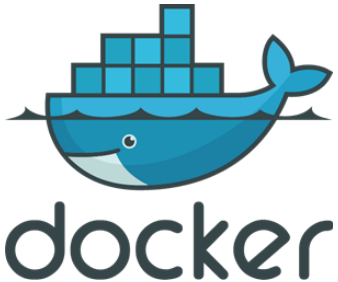
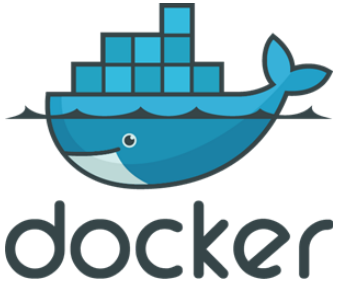
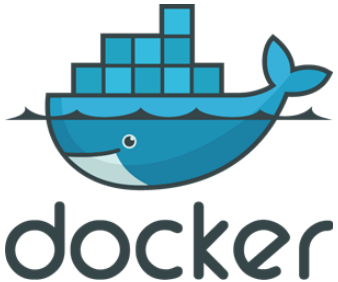
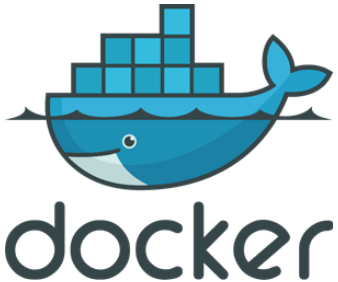
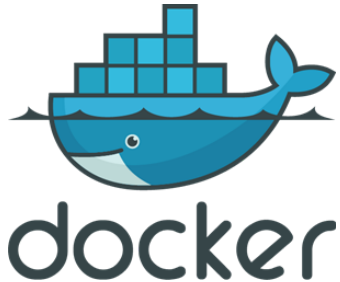
docker

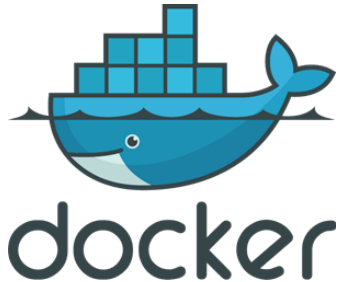

docker


docker


docker


docker


docker

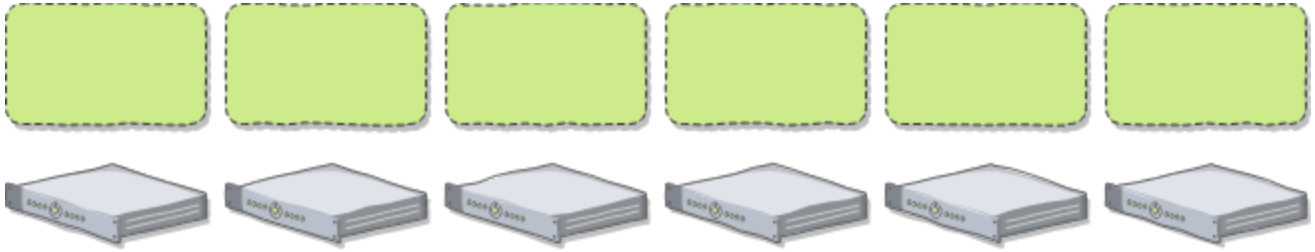

docker

What is Apache Hadoop

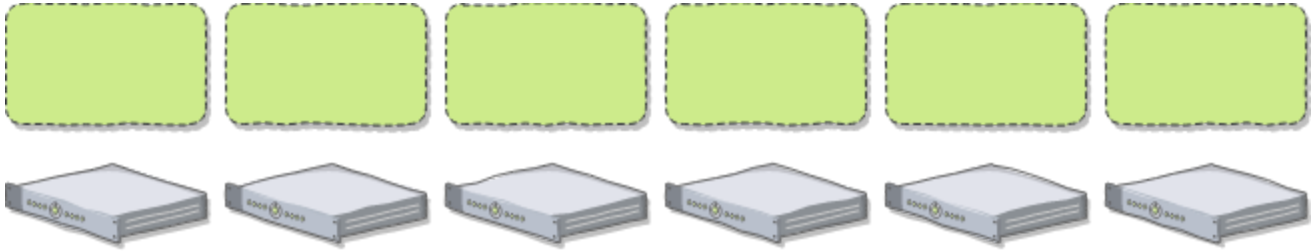
What is Apache Hadoop

in 60 seconds

Data

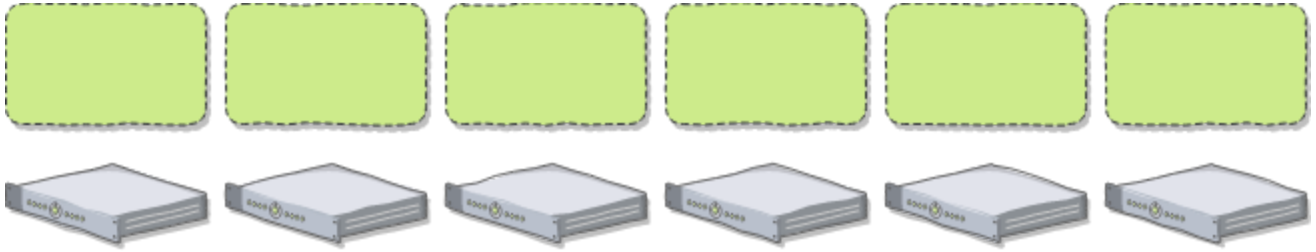


HDFS



HDFS

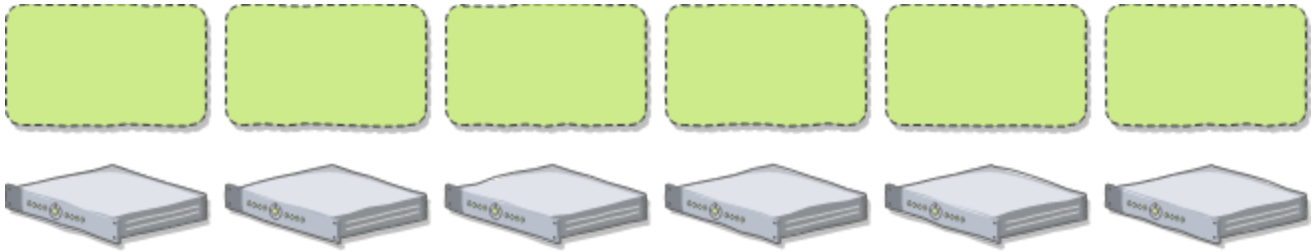
YARN



HDFS

YARN

Mapreduce

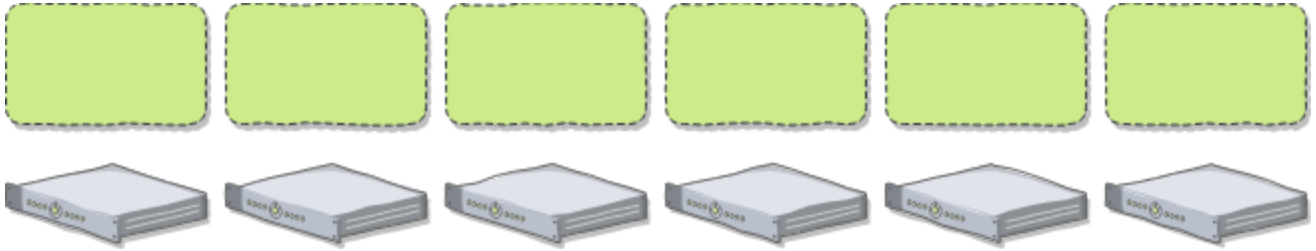


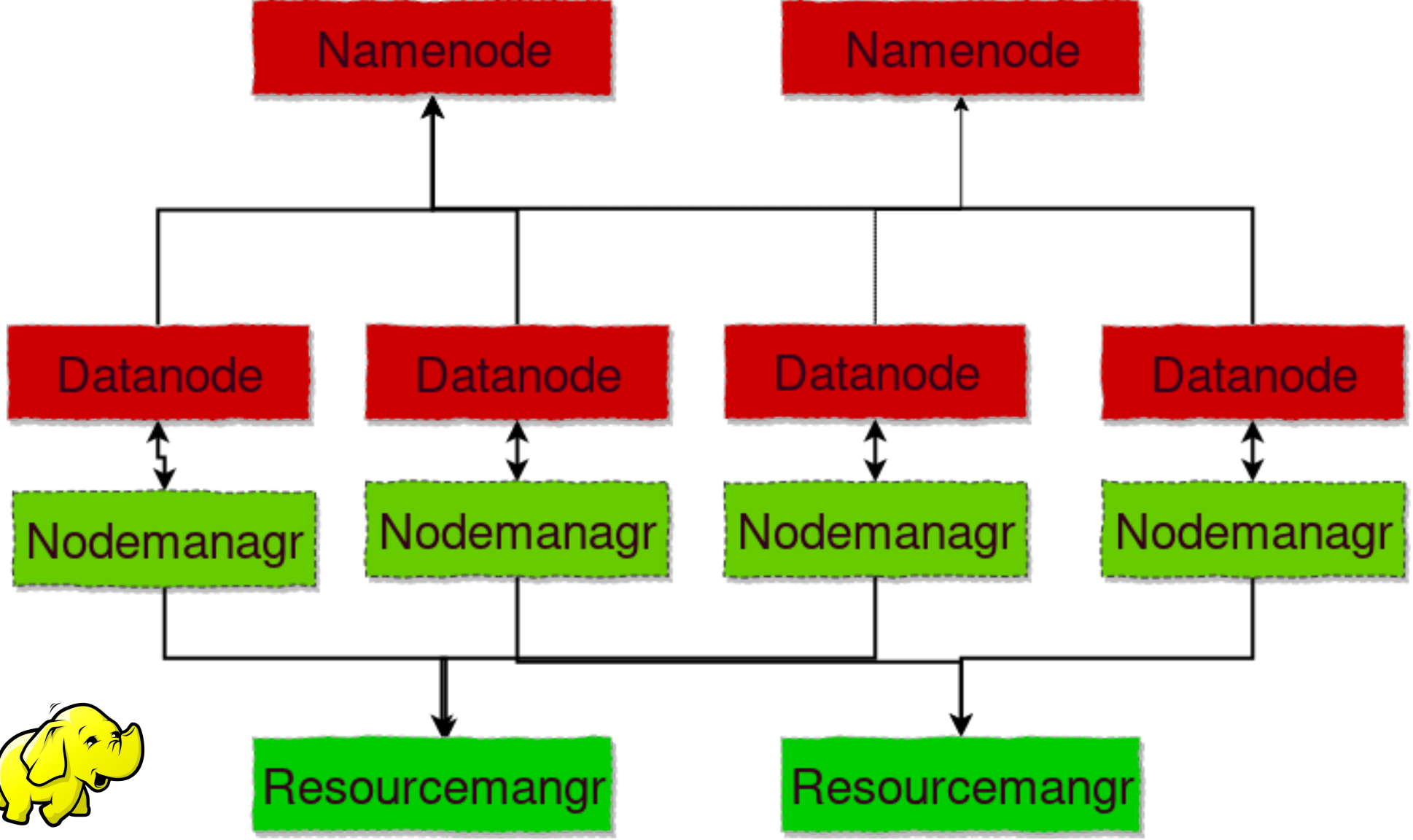
HDFS

YARN

Mapreduce

Ozone + HDDS




Namenode
Namenode
Datanode
Datanode
Datanode
Datanode
Nodemanagr
Nodemanagr
Nodemanagr
Nodemanagr
Resourcemangr
Resourcemangr

Dockerfile

```
FROM frolvlad/alpine-oraclejdk8
ADD hadoop-3.2.0.tar.gz /opt
WORKDIR /opt/hadoop
```

G Less efficient	docker
Configuration management	
Source	
Preprocessing	
On change	
Provisioning, Scheduling	
Multihost support	
Scheduling	
Cluster definition	
Scaling	
Multi tenancy	
Failover	
Network	

```xml
<configuration>
   <property>
      <name>dfs.namenode.rpc-address</name>
      <value>namenode:9000</value>
   </property>
   <property>
      <name>dfs.datanode.plugins</name>
      <value>org.apache.hadoop.ozone.HddsDatanodeService</value>
   </property>
   <property>
      <name>rpc.metrics.percentiles.intervals</name>
      <value>60,300</value>
   </property>
   <property>
      <name>dfs.namenode.name.dir</name>
      <value>/data/namenode</value>
   </property>
   <property>
      <name>rpc.metrics.quantile.enable</name>
      <value>true</value>
   </property>
</configuration>
```

```yaml
version: "3"
services:
   service1:
      image: apache/imagename
      hostname: namenode
      ports:
         - 9870:9870
      environment:
          CONFIGURATION1: value
          DFS_DIR: /dfs
          THREAD_NUMBER: 1
```

How to handle configuration?

Create a simple **launcher** script to

- Create config file from environment variables
- Start the application

```yaml
version: "3"
services:
   namenode:
      image: flokkr/hadoop
      hostname: namenode
      command: ["hdfs","namenode"]
      ports:
         - 9870:9870
      environment:
         ENSURE_NAMENODE_DIR: "/tmp/hadoop-root/dfs/name"
         CORE-SITE.XML_fs.defaultFS: "hdfs://namenode:9000"
         HDFS-SITE.XML_dfs.namenode.rpc-address: "namenode:9000"
         HDFS-SITE.XML_dfs.replication: "1"
   datanode:
      image: flokkr/hadoop
      command: ["hdfs", "datanode"]
      environment:
         CORE-SITE.XML_fs.defaultFS: "hdfs://namenode:9000"
         HDFS-SITE.XML_dfs.namenode.rpc-address: "namenode:9000"
         HDFS-SITE.XML_dfs.replication: "1"
         LOG4J.PROPERTIES_log4j.rootLogger: "INFO, stdout"
         LOG4J.PROPERTIES_log4j.appender.stdout: "org.apache.log4j.ConsoleAppender"
         LOG4J.PROPERTIES_log4j.appender.stdout.layout: "org.apache.log4j.PatternLayout"
         LOG4J.PROPERTIES_log4j.appender.stdout.layout.ConversionPattern: "%d{yyyy-MM-dd HH:mm:ss} %-5p
```

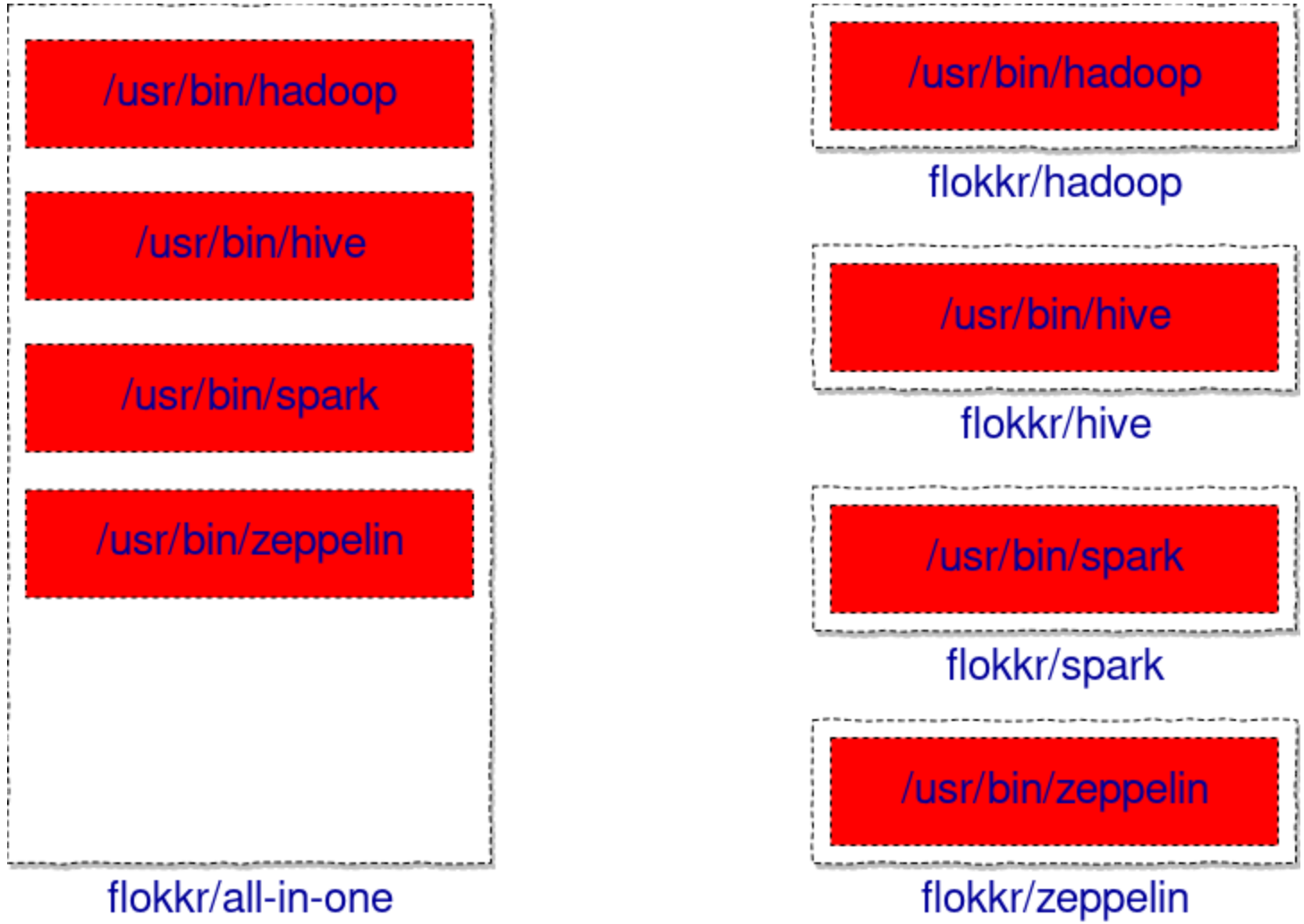
Configuration management is managing the configuration **values**

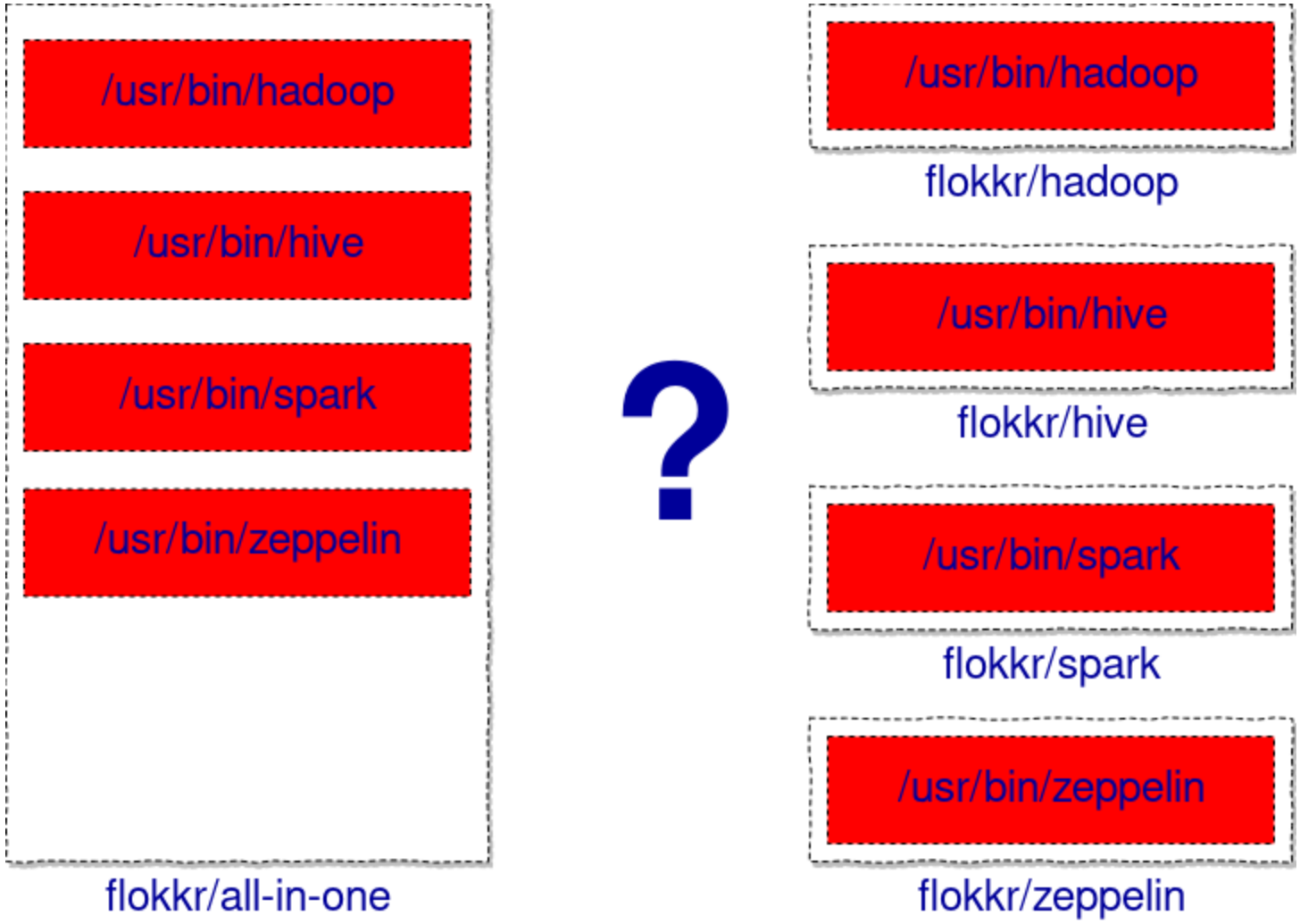
Less efficient

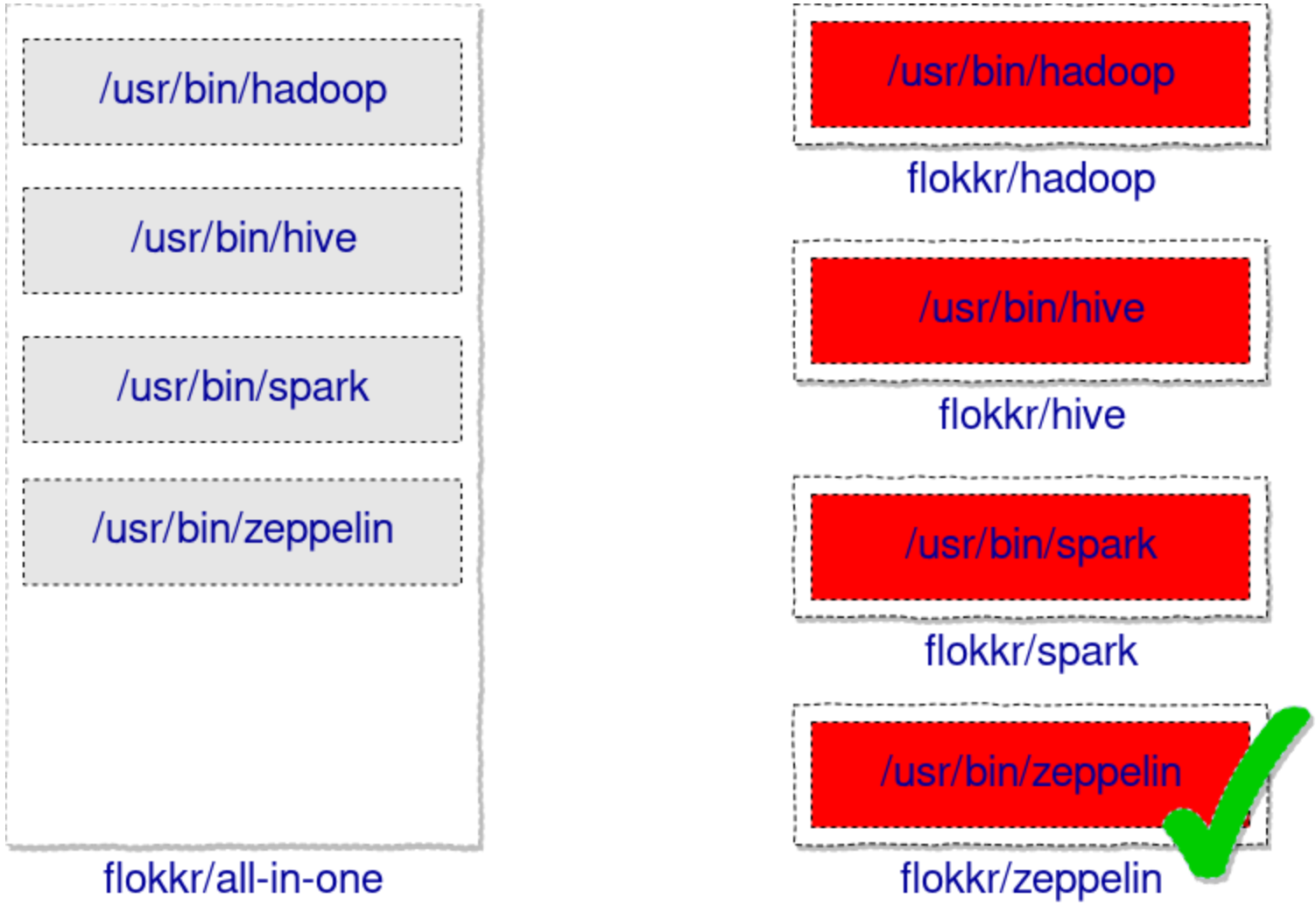
docker

Configuration management	
Source	ENV (script)
Preprocessing	n/a
On change	n/a
Provisioning, Scheduling	
Multihost support	
Scheduling	
Cluster definition	
Scaling	
Multi tenancy	
Failover	
Network	
Intraservice network	
DNS	
Service discovery	
Data locality	

flokkr/all-in-one


/usr/bin/hadoop
/usr/bin/hive
/usr/bin/spark
/usr/bin/zeppelin
flokkr/all-in-one
/usr/bin/hadoop
flokkr/hadoop
/usr/bin/hive
flokkr/hive
/usr/bin/spark
flokkr/spark
/usr/bin/zeppelin
flokkr/zeppelin


/usr/bin/hadoop
/usr/bin/hive
/usr/bin/spark
/usr/bin/zeppelin
flokkr/all-in-one
?
/usr/bin/hadoop
flokkr/hadoop
/usr/bin/hive
flokkr/hive
/usr/bin/spark
flokkr/spark
/usr/bin/zeppelin
flokkr/zeppelin


/usr/bin/hadoop
/usr/bin/hive
/usr/bin/spark
/usr/bin/zeppelin
flokkr/all-in-one
/usr/bin/hadoop
flokkr/hadoop
/usr/bin/hive
flokkr/hive
/usr/bin/spark
flokkr/spark
/usr/bin/zeppelin
flokkr/zeppelin

Container is the **unit** of packaging.

Launcher script has the power

Launcher script

Launcher script

- Create config files from ENV

Launcher script

- Create config files from ENV
- Wait for the dependency (TCP check)

Launcher script

- Create config files from ENV
- Wait for the dependency (TCP check)
- Download additional optional component

Launcher script

- Create config files from ENV
- Wait for the dependency (TCP check)
- Download additional optional component
- Prepare HDFS (format namenode, ...)

Launcher script

- Create config files from ENV
- Wait for the dependency (TCP check)
- Download additional optional component
- Prepare HDFS (format namenode, ...)
- Retrieve kerberos/SSL secrets

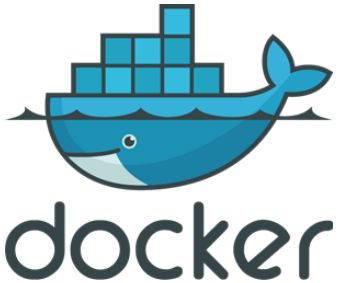
Launcher script

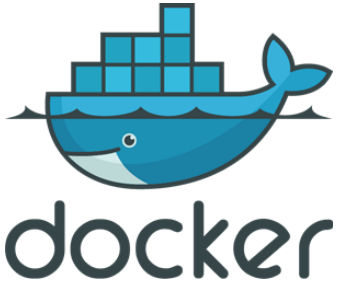
- Create config files from ENV
- Wait for the dependency (TCP check)
- Download additional optional component
- Prepare HDFS (format namenode, ...)
- Retrieve kerberos/SSL secrets
- Enable prometheus monitoring (Java agent)

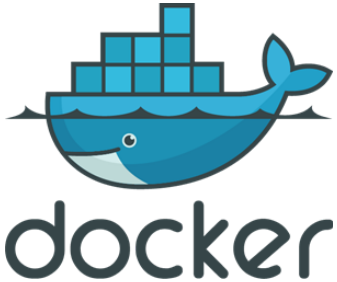
Launcher script

- Create config files from ENV
- Wait for the dependency (TCP check)
- Download additional optional component
- Prepare HDFS (format namenode, ...)
- Retrieve kerberos/SSL secrets
- Enable prometheus monitoring (Java agent)
- Show network traffic (Instrumentation with Java agent)

```
datanode_1   | ========================================
datanode_1   | *** Launching "hdfs datanode"
namenode_1   | Formatting using clusterid: CID-51b1d36b-356a-4c2a-9570-57b6300ccd5d
namenode_1   | ===== Plugin is activated BYTEMAN =====
namenode_1   | Connecting to kv.anzix.net (176.9.127.13:443)
namenode_1   | byteman.jar           14% |****                            |   112k  0:00:06 ETA
namenode_1   | byteman.jar          100% |*******************************|   791k  0:00:00 ETA
namenode_1   |
namenode_1   | Connecting to gist.githubusercontent.com (151.101.36.133:443)
namenode_1   | byteman.btm          100% |*******************************|   710   0:00:00 ETA
namenode_1   |
namenode_1   | Process is instrumented with setting JAVA_OPTS to -javaagent:/opt/byteman/byteman.jar=script:/tmp/byteman.btm
namenode_1   | Standard output is replaced with btrace output
namenode_1   | ========================================
namenode_1   | *** Launching "hdfs namenode"
namenode_1   | --> RPC message request: VersionRequestProto from 172.23.0.3:52480
namenode_1   |
namenode_1   | --> RPC message response: VersionRequestProto to 172.23.0.3:52480
namenode_1   | info {
namenode_1   |   buildVersion: "16b70619a24cdcf5d3b0fcf4b58ca77238ccbe6d"
namenode_1   |   unused: 0
namenode_1   |   blockPoolID: "BP-1294221783-172.23.0.2-1528791611084"
namenode_1   |   storageInfo {
namenode_1   |     layoutVersion: 4294967232
namenode_1   |     namespceID: 2129242657
namenode_1   |     clusterID: "CID-51b1d36b-356a-4c2a-9570-57b6300ccd5d"
namenode_1   |     cTime: 1528791611084
namenode_1   |   }
namenode_1   |   softwareVersion: "3.1.0"
namenode_1   |   capabilities: 1
namenode_1   |   state: ACTIVE
namenode_1   | }
namenode_1   |
namenode_1   | --> RPC message request: RegisterDatanodeRequestProto from 172.23.0.3:52480
namenode_1   | registration {
namenode_1   |   datanodeID {
namenode_1   |     ipAddr: "0.0.0.0"
namenode_1   |     hostName: "8d6011399538"
namenode_1   |     datanodeUuid: "92926bb4-04b5-4e9c-8f85-694a2d7c61ec"
namenode_1   |     xferPort: 9866
namenode_1   |     infoPort: 9864
namenode_1   |     ipcPort: 9867
namenode_1   |     infoSecurePort: 0
```


docker


docker


docker

Hashicorp stack

"do it yourself"

Service Discovery and Configuration Made Easy

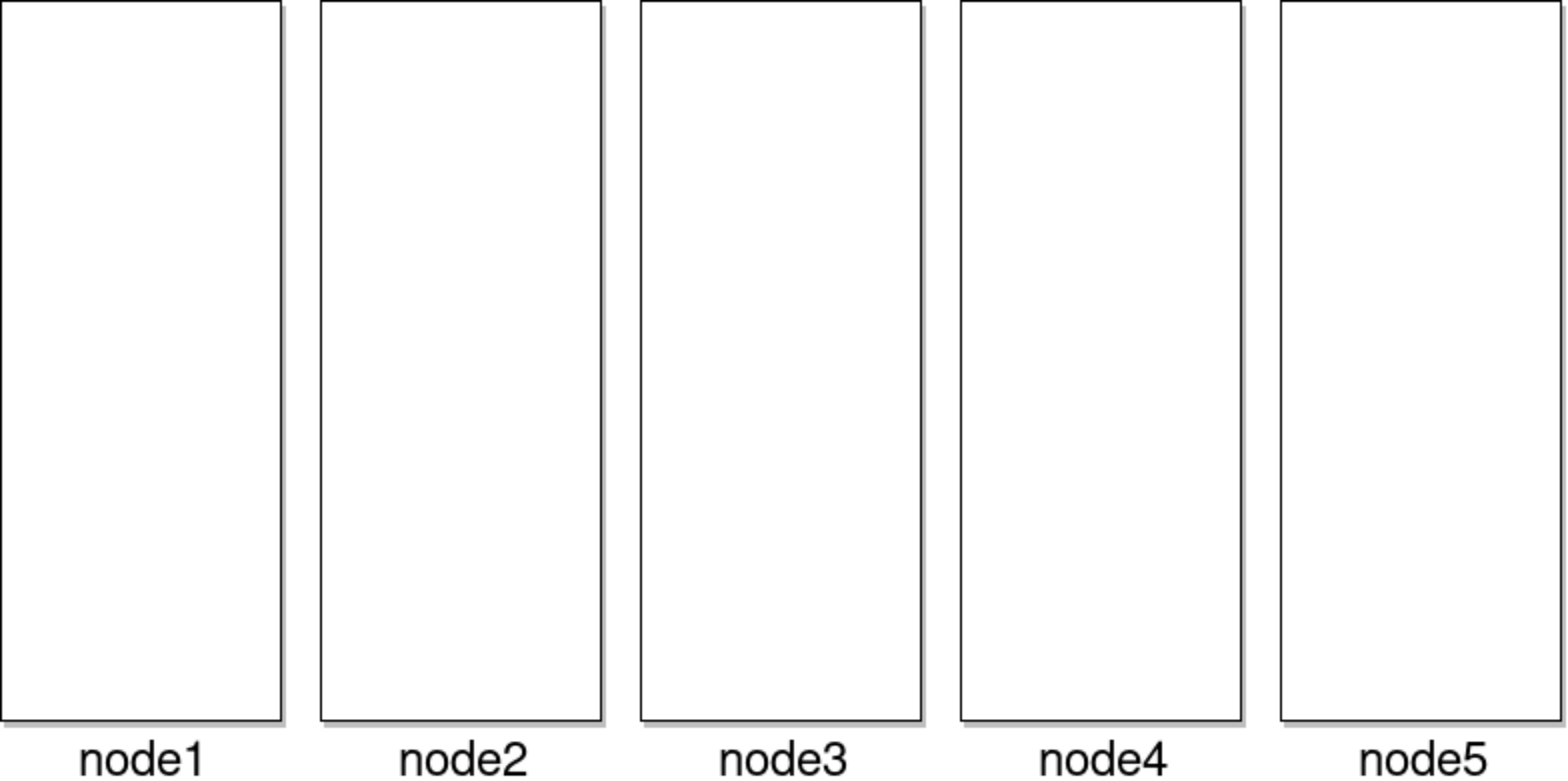
Service Discovery and Configuration Made Easy

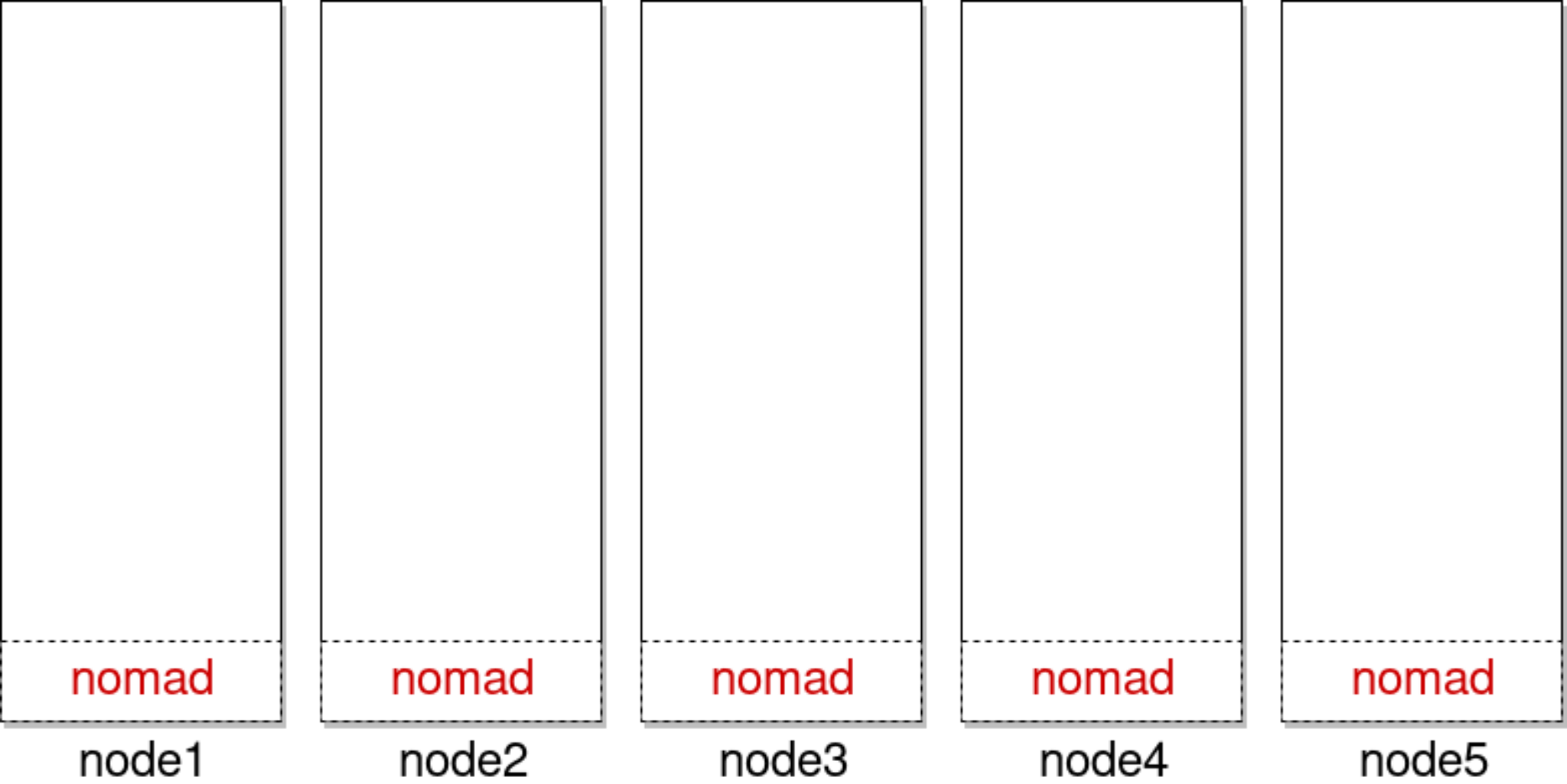
A Tool for Managing Secrets

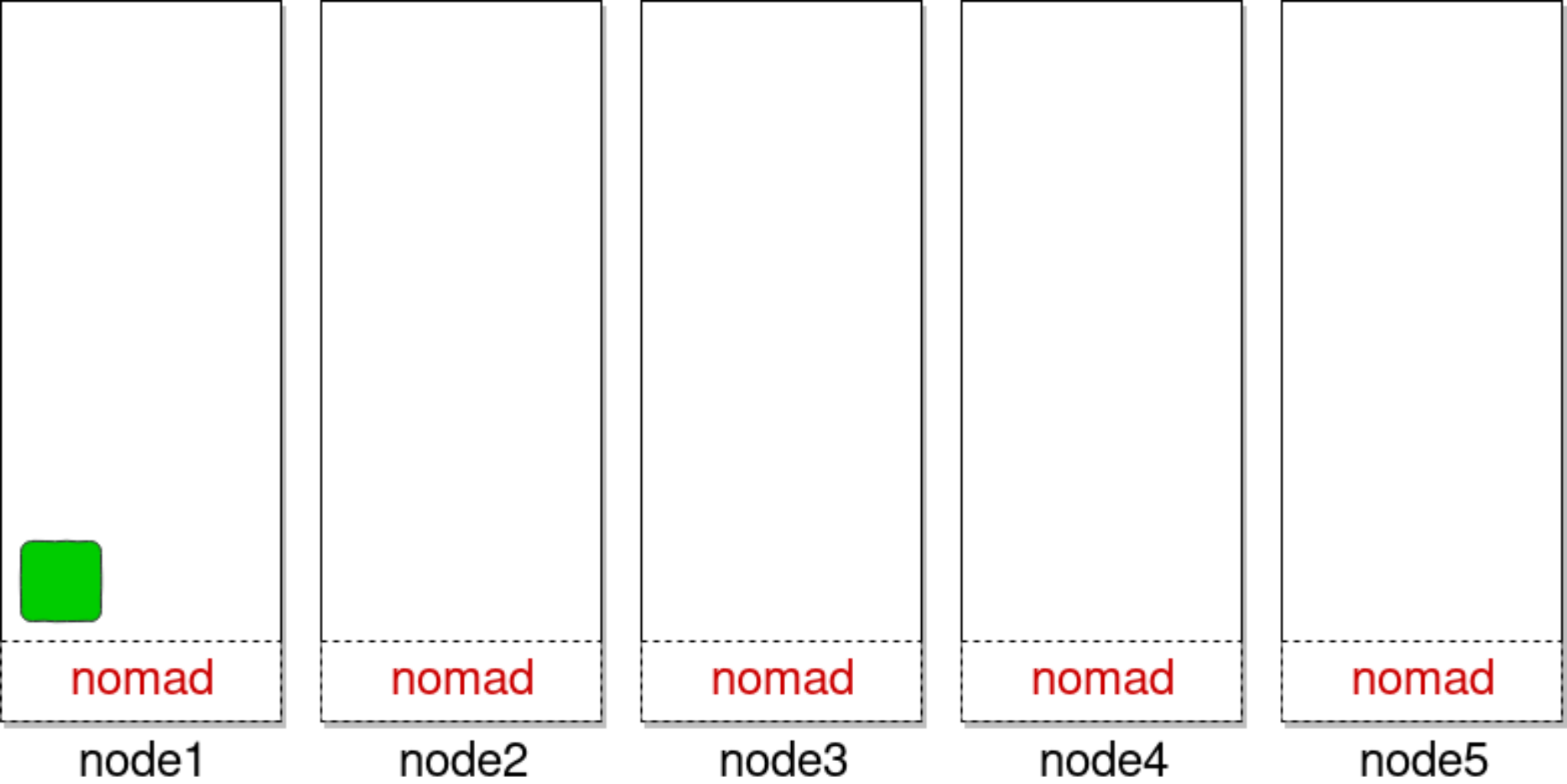
Service Discovery and Configuration Made Easy

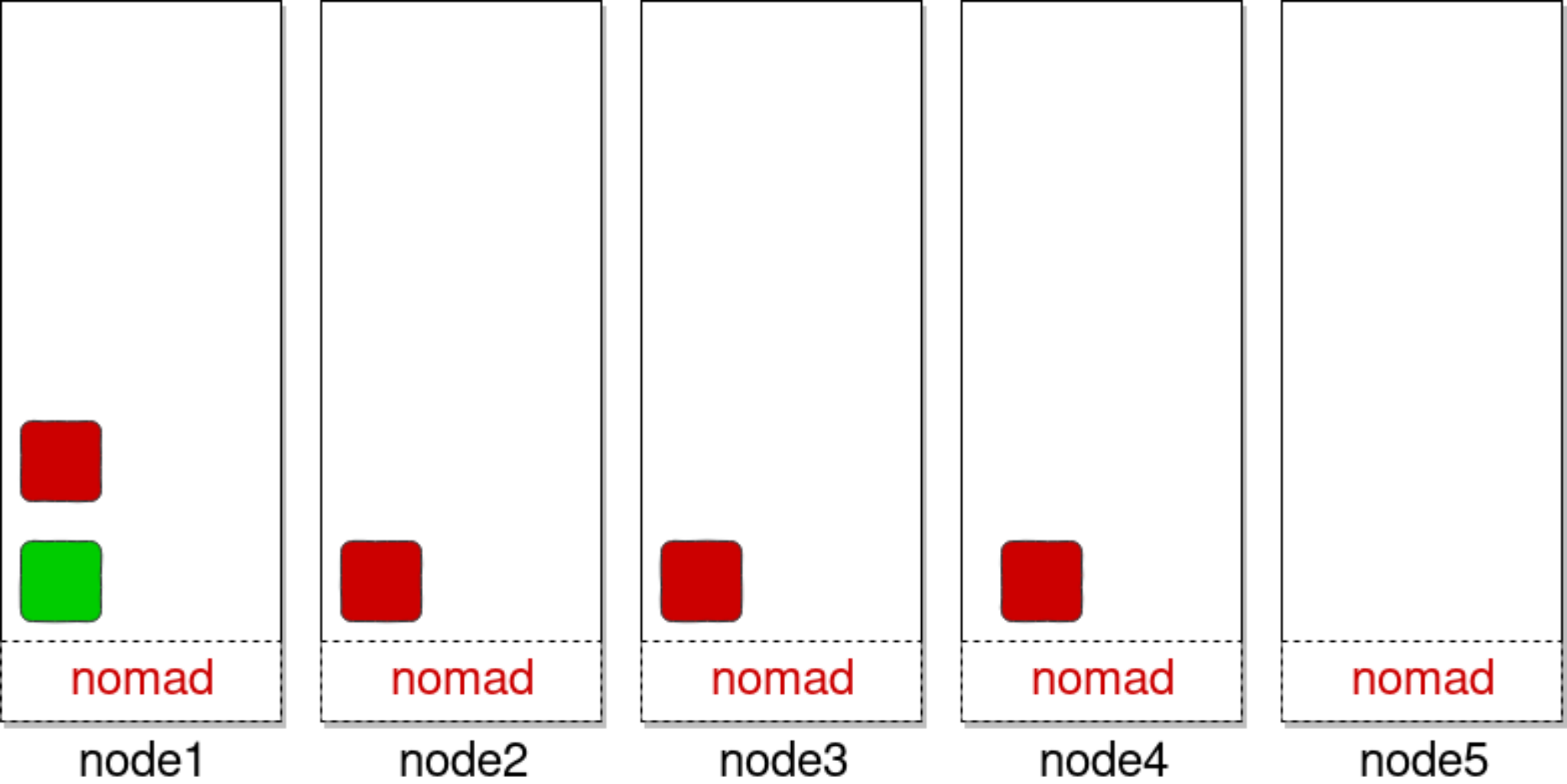
A Tool for Managing Secrets

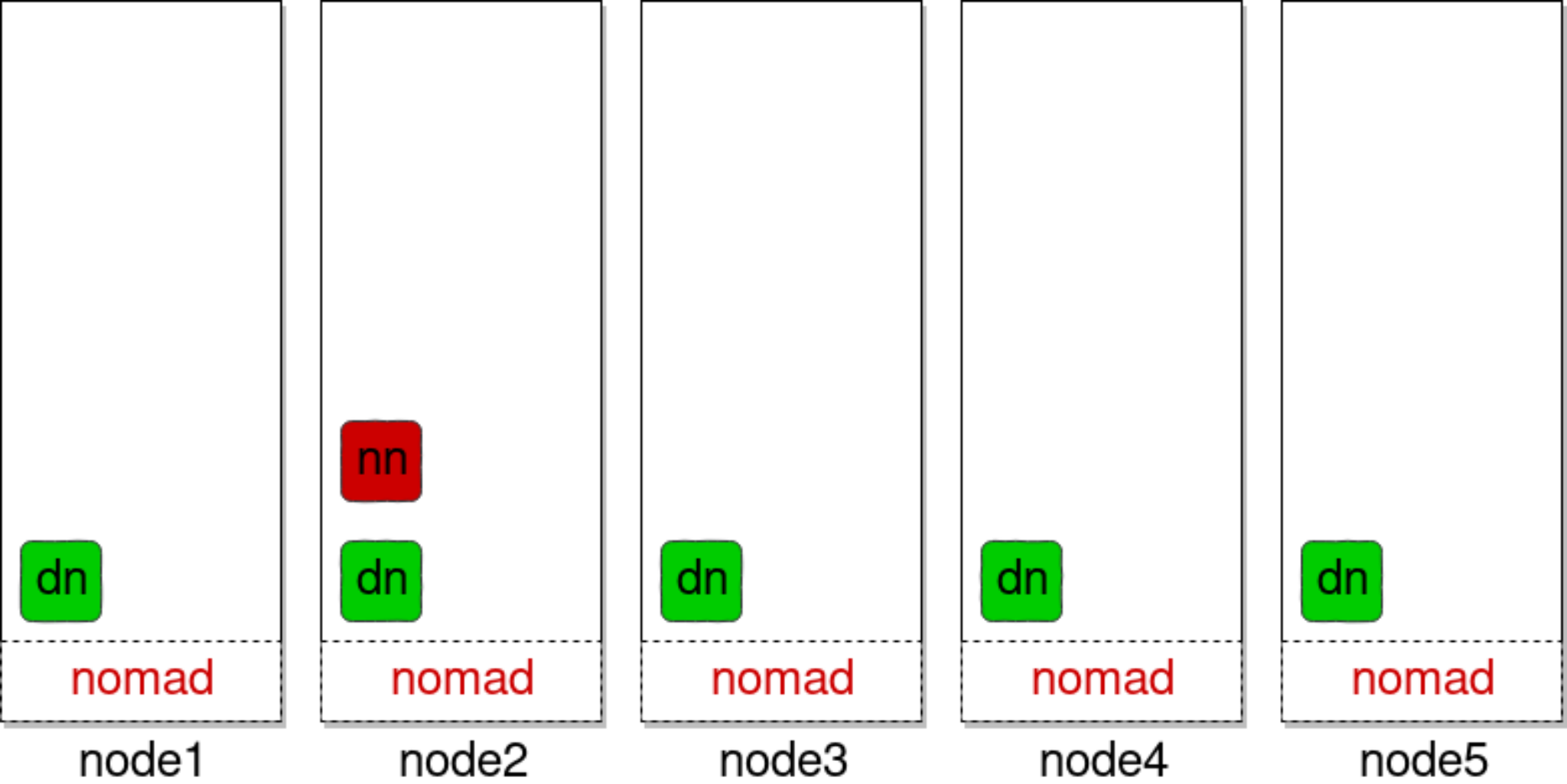
Easily Deploy Applications at Any Scale

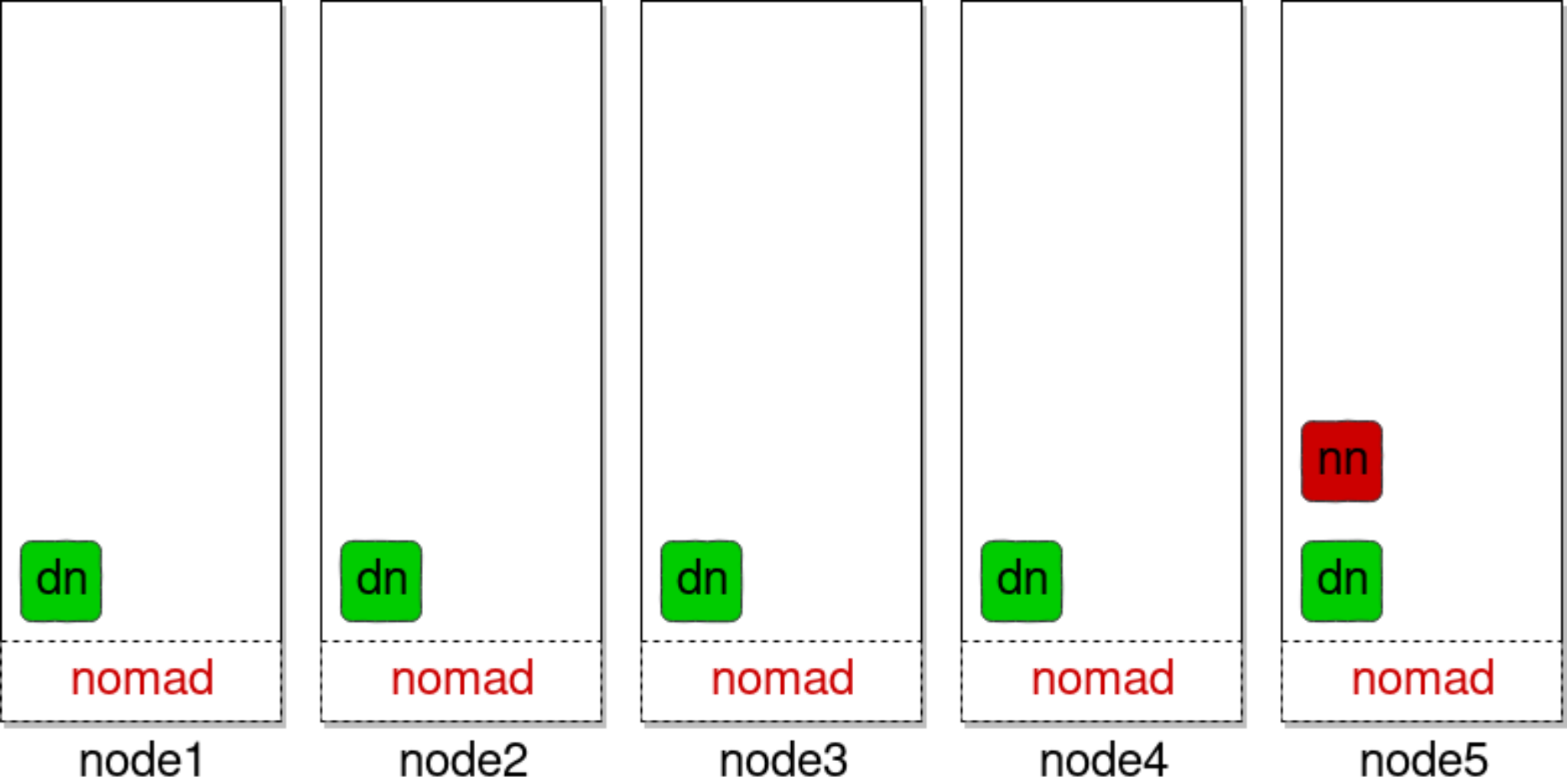

node1
node2
node3
node4
node5

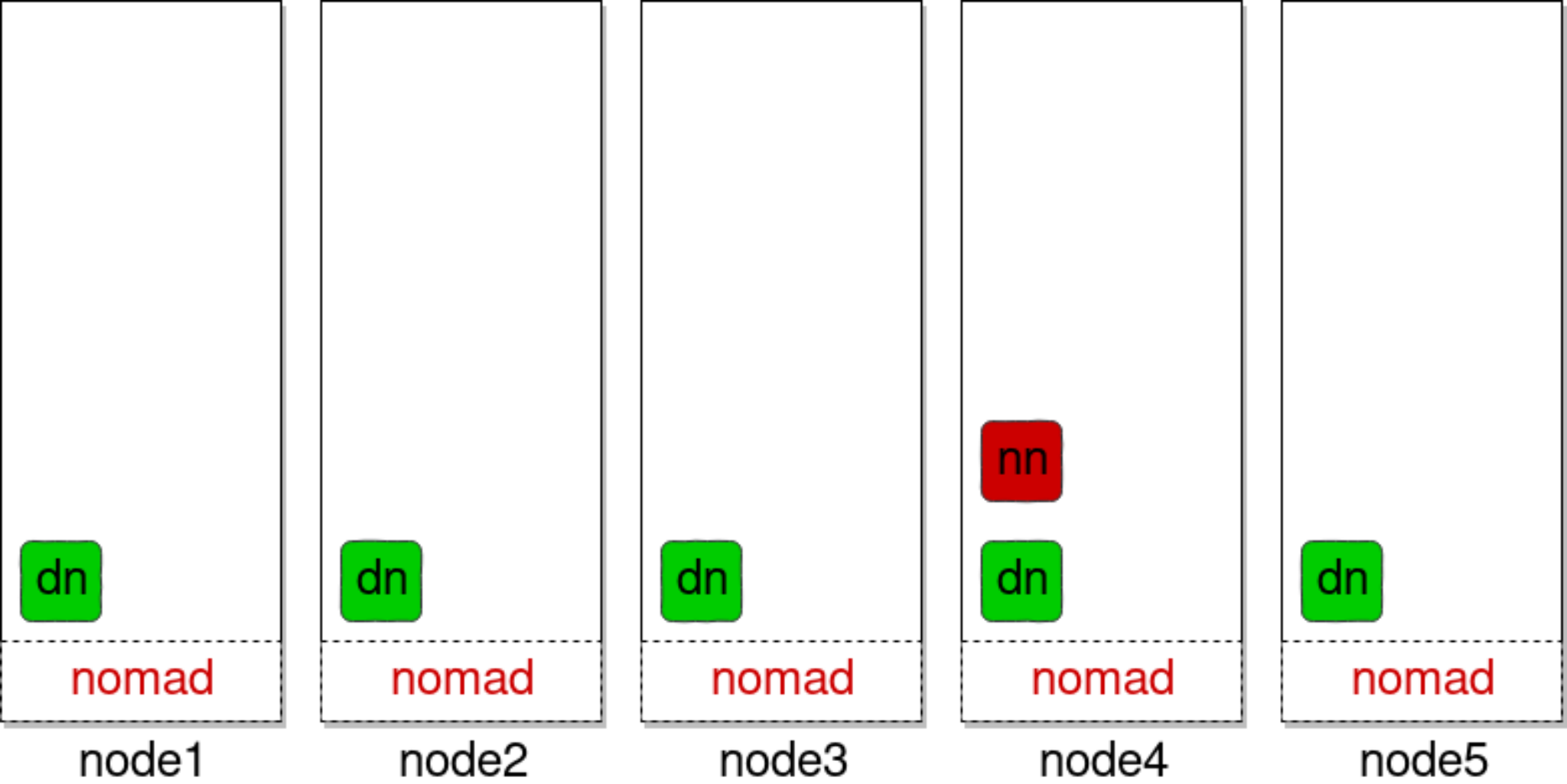

nomad
nomad
nomad
nomad
nomad
node1
node2
node3
node4
node5


nomad
nomad
nomad
nomad
nomad
node1
node2
node3
node4
node5

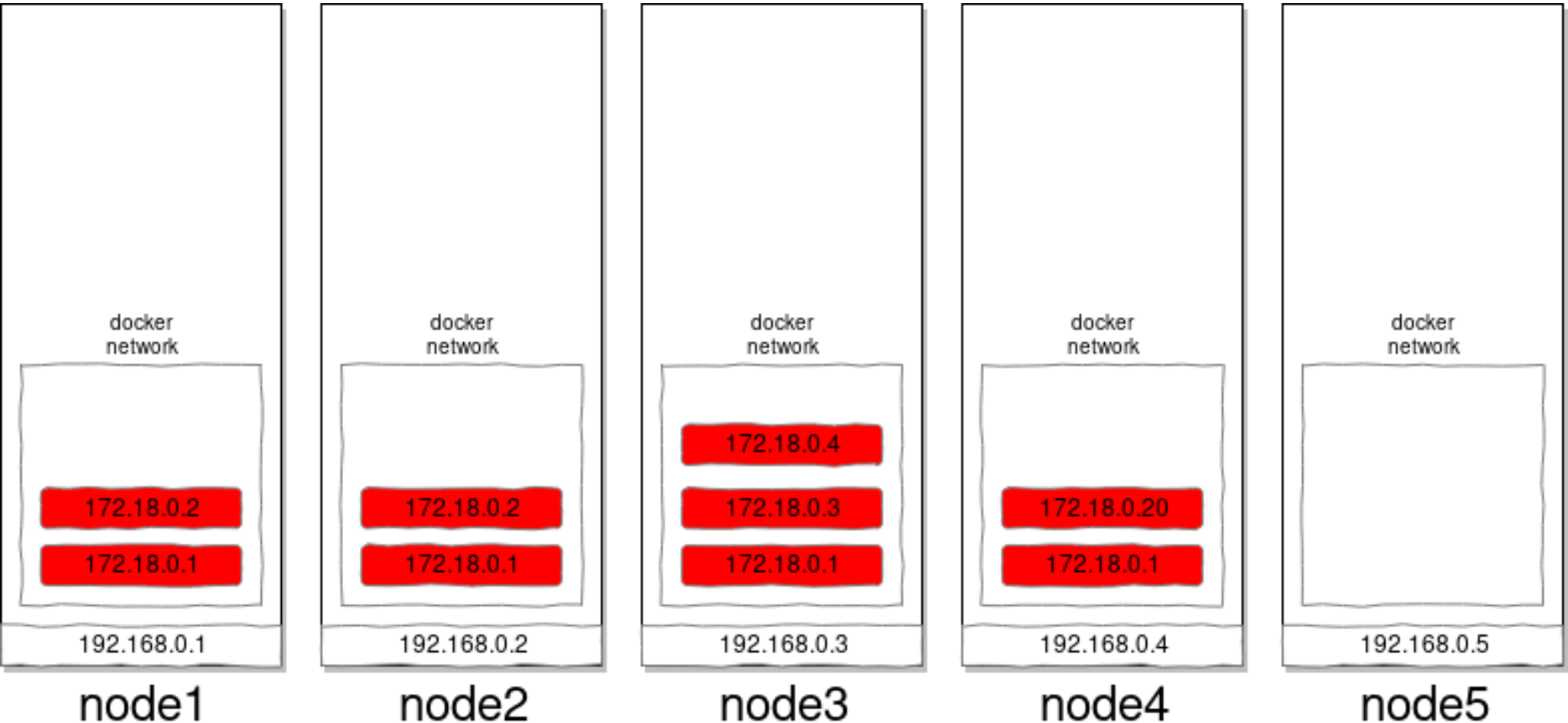

nomad
nomad
nomad
nomad
nomad
node1
node2
node3
node4
node5


nn
dn
dn
dn
dn
dn
nomad
nomad
nomad
nomad
nomad
node1
node2
node3
node4
node5

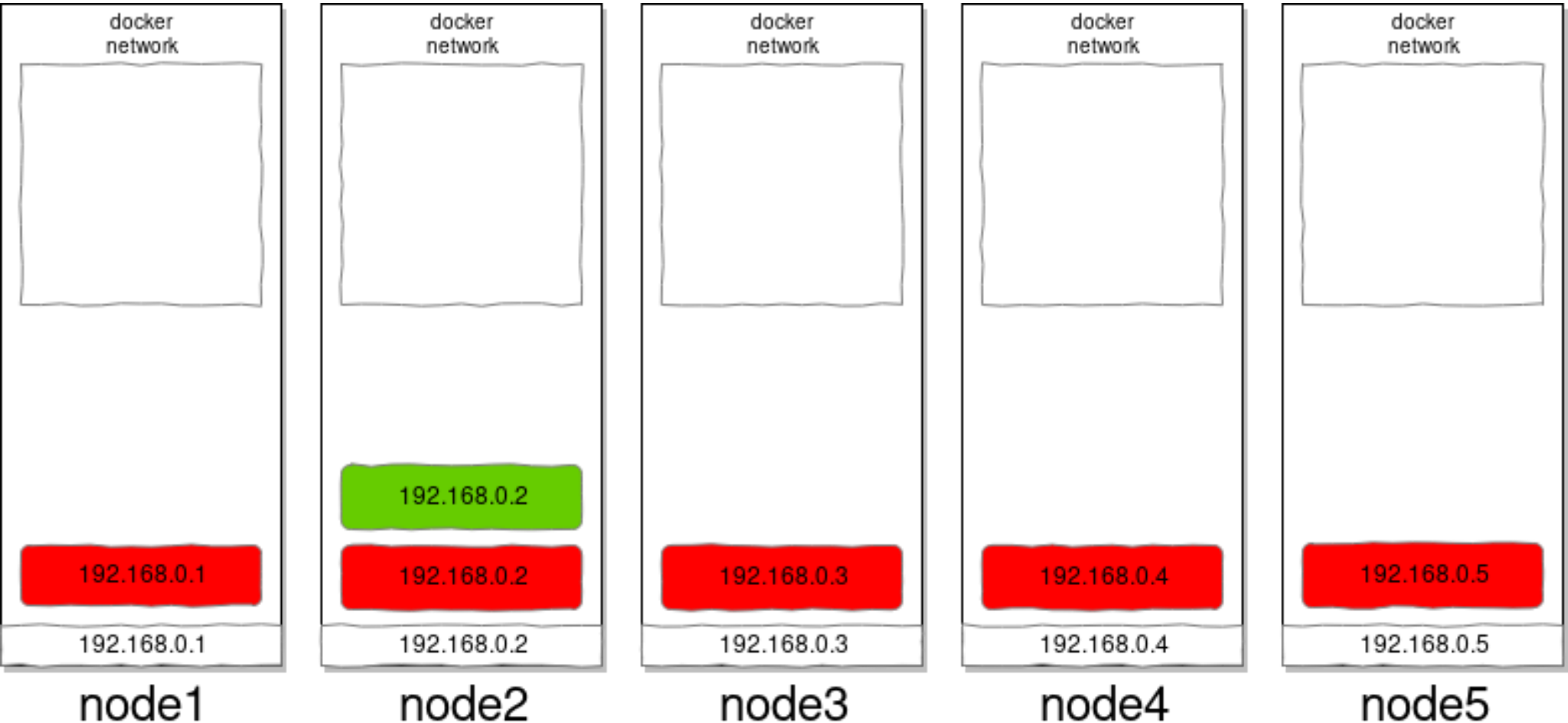

dn
nomad
node1
dn
nomad
node2
dn
nomad
node3
dn
nomad
node4
nn
dn
nomad
node5


dn
nomad
node1
dn
nomad
node2
dn
nomad
node3
nn
dn
nomad
node4
dn
nomad
node5

Docker network

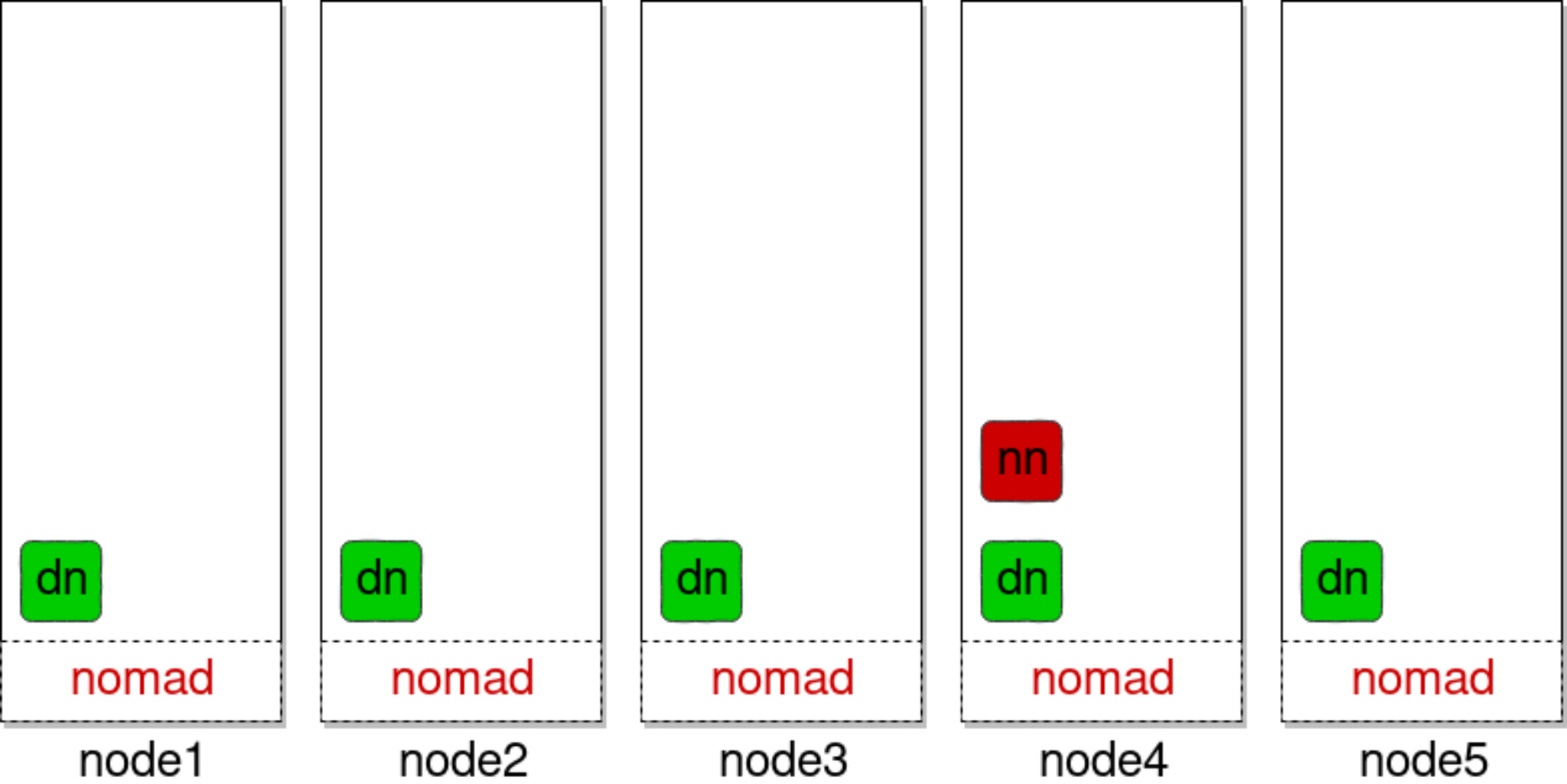


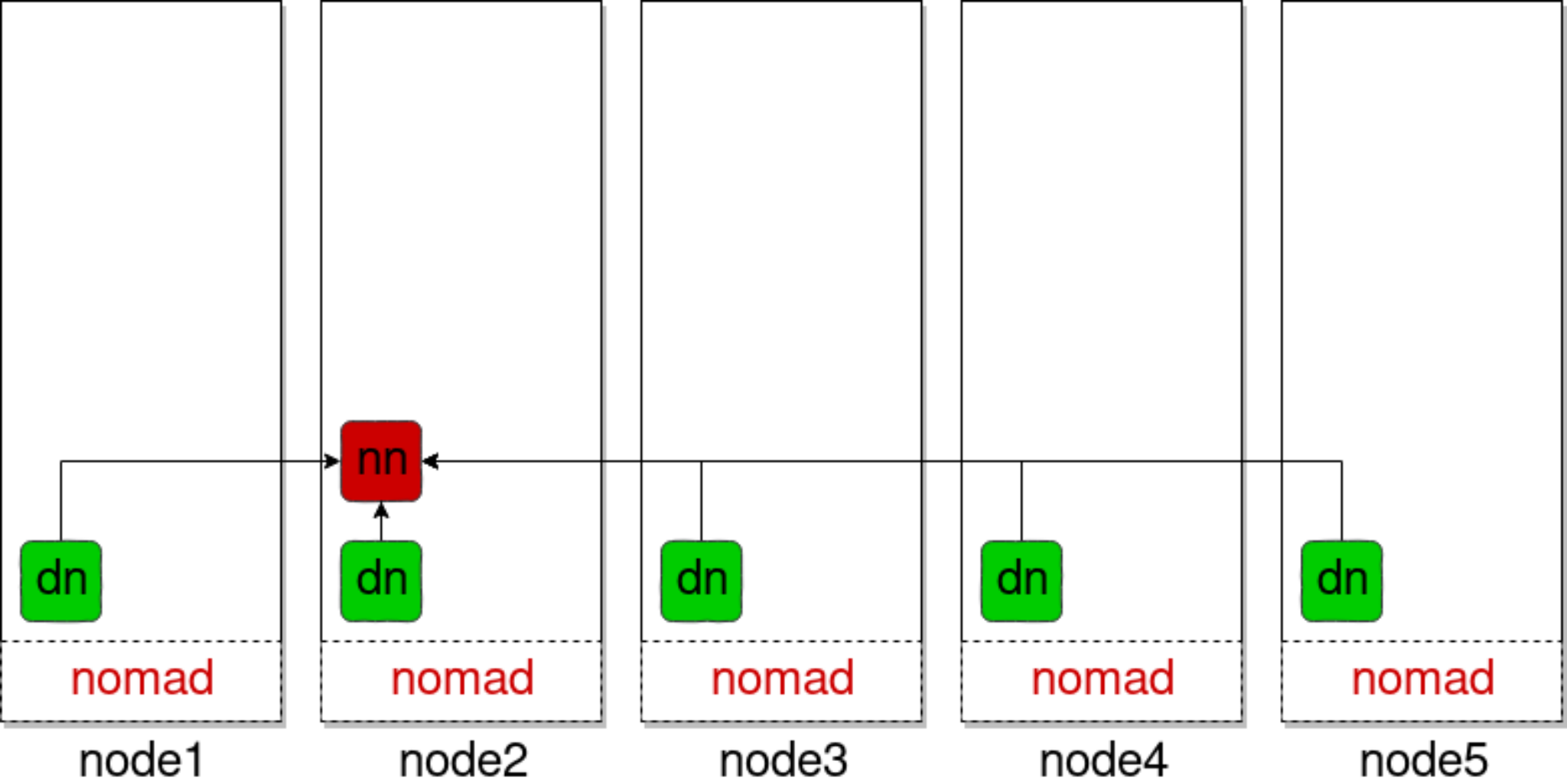
Host network

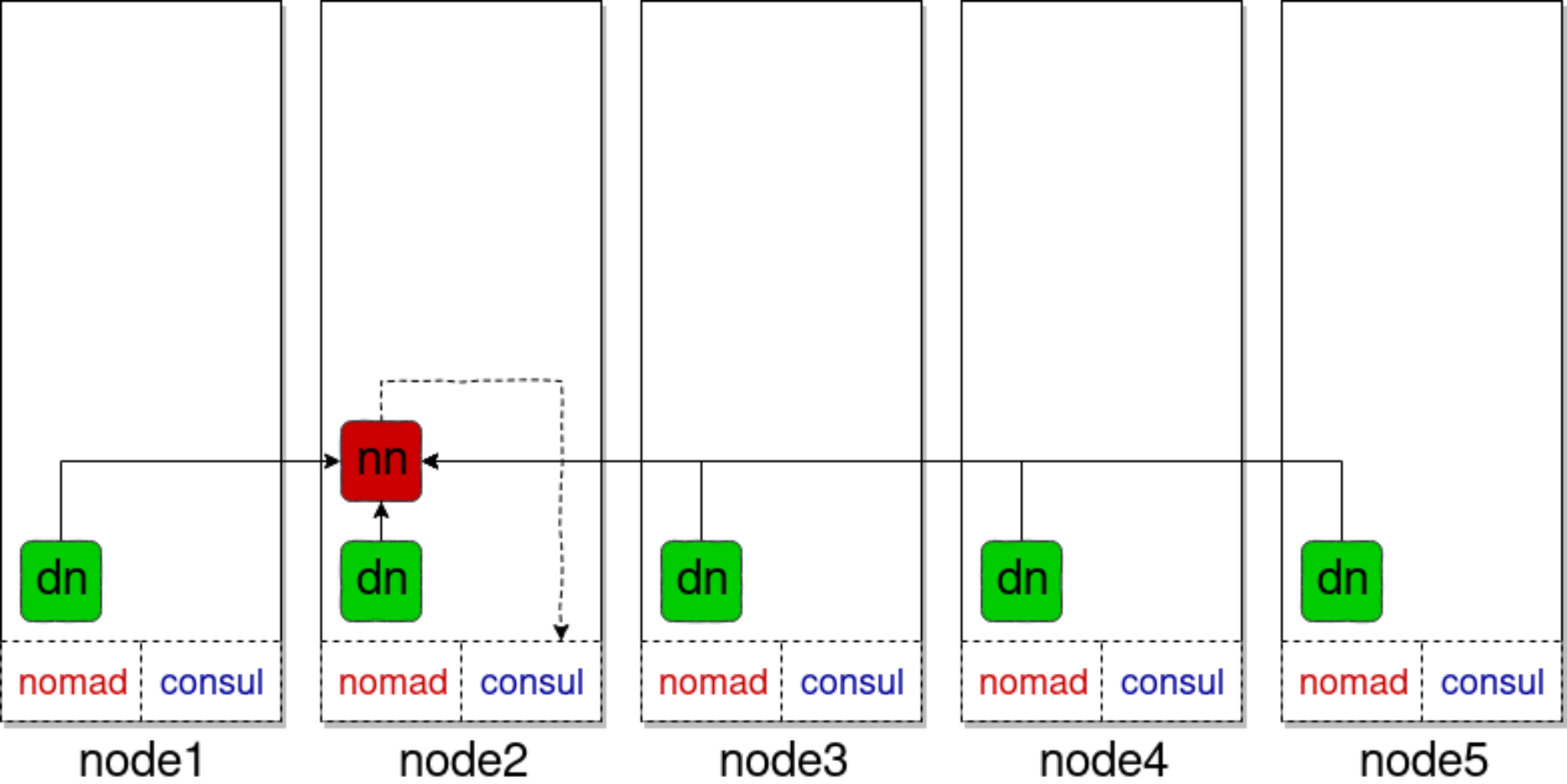


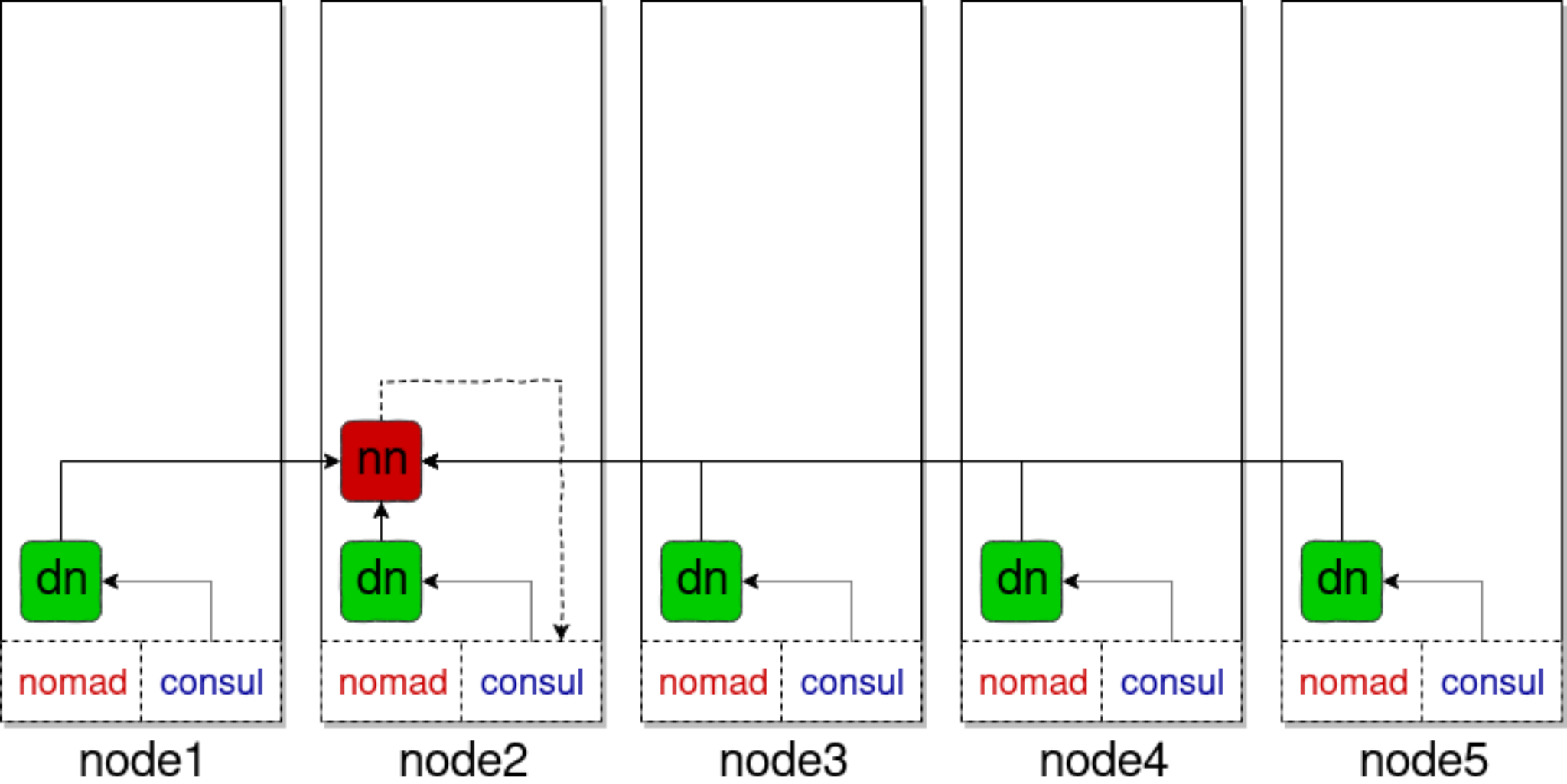
Preprocessing	
On change	
Provisioning, Scheduling	
Multihost support	
Scheduling	
Cluster definition	
Scaling	
Multi tenancy	
Failover	
Network	
Intraservice network	docker host
DNS	host dns
Service discovery	
Data locality	
Availability of the ports	

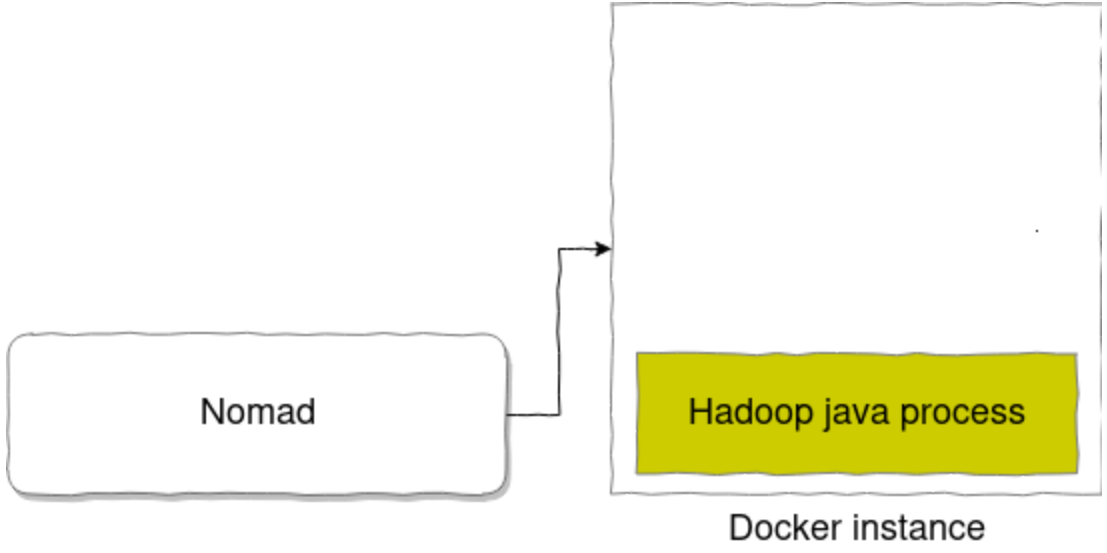
```
<configuration>
   <property>
      <name>dfs.namenode.rpc-address</name>
      <value>namenode:9000</value>
   </property>
   <property>
      <name>dfs.datanode.plugins</name>
      <value>org.apache.hadoop.ozone.HddsDatanodeService</value>
   </property>
   <property>
      <name>rpc.metrics.percentiles.intervals</name>
      <value>60,300</value>
   </property>
   <property>
      <name>dfs.namenode.name.dir</name>
      <value>/data/namenode</value>
   </property>
   <property>
      <name>rpc.metrics.quantile.enable</name>
      <value>true</value>
   </property>
</configuration>
```

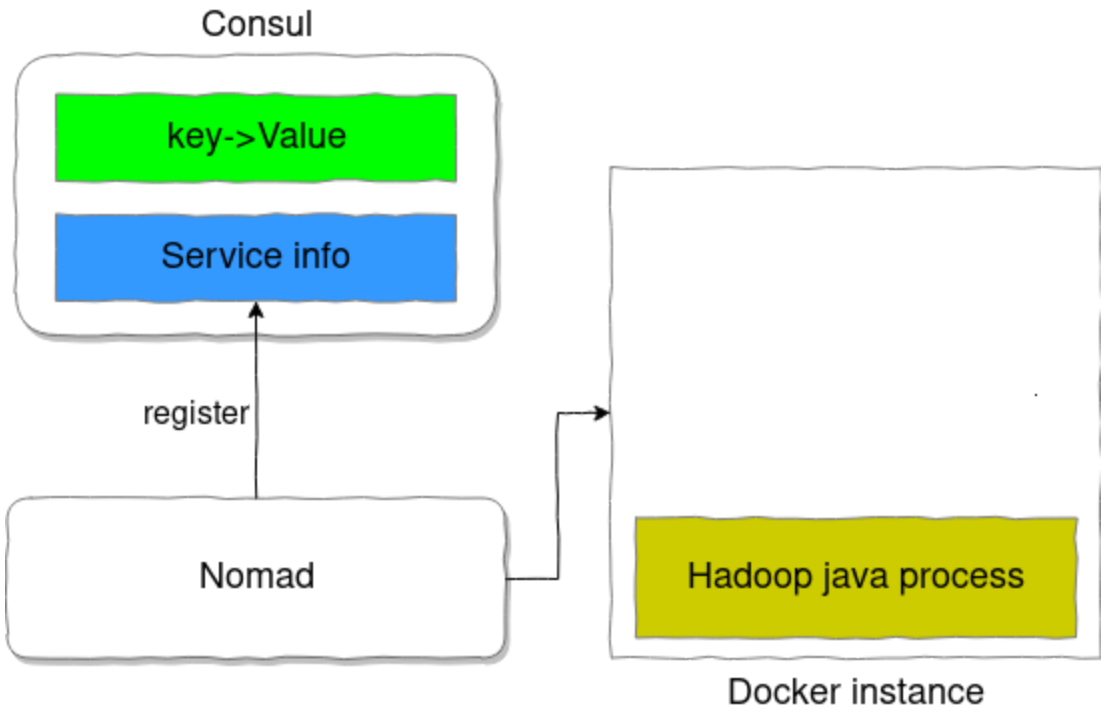

dn
nomad
node1
dn
nomad
node2
dn
nomad
node3
nn
dn
nomad
node4
dn
nomad
node5

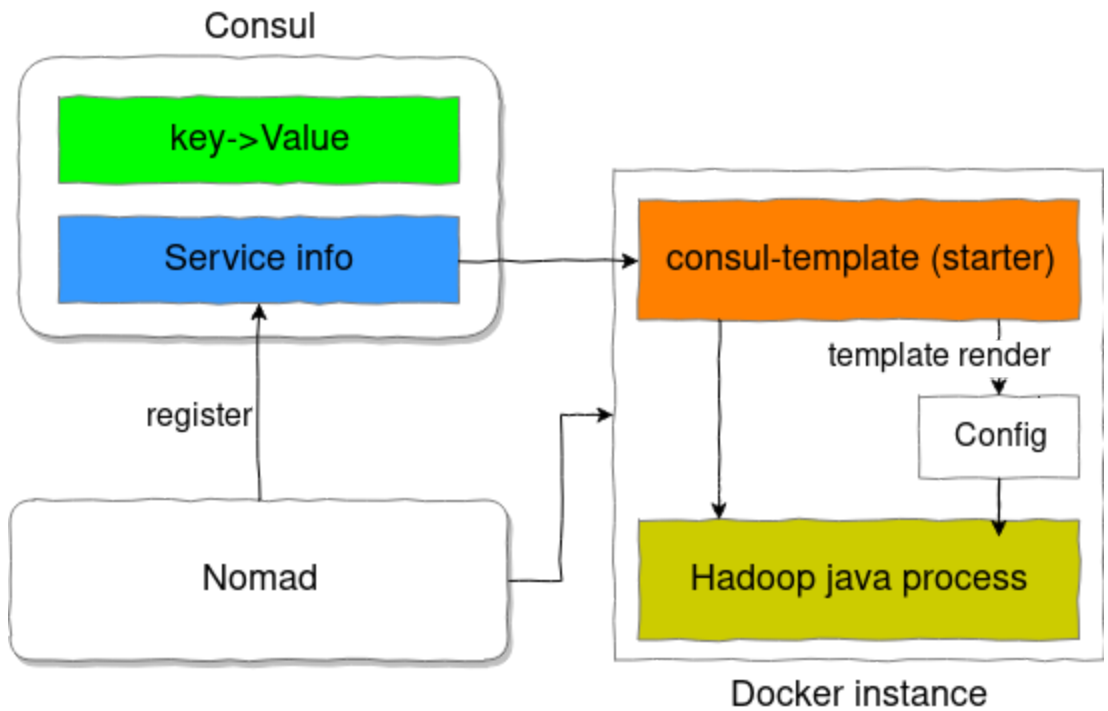

nn
dn
dn
dn
dn
dn
nomad
nomad
nomad
nomad
nomad
node1
node2
node3
node4
node5

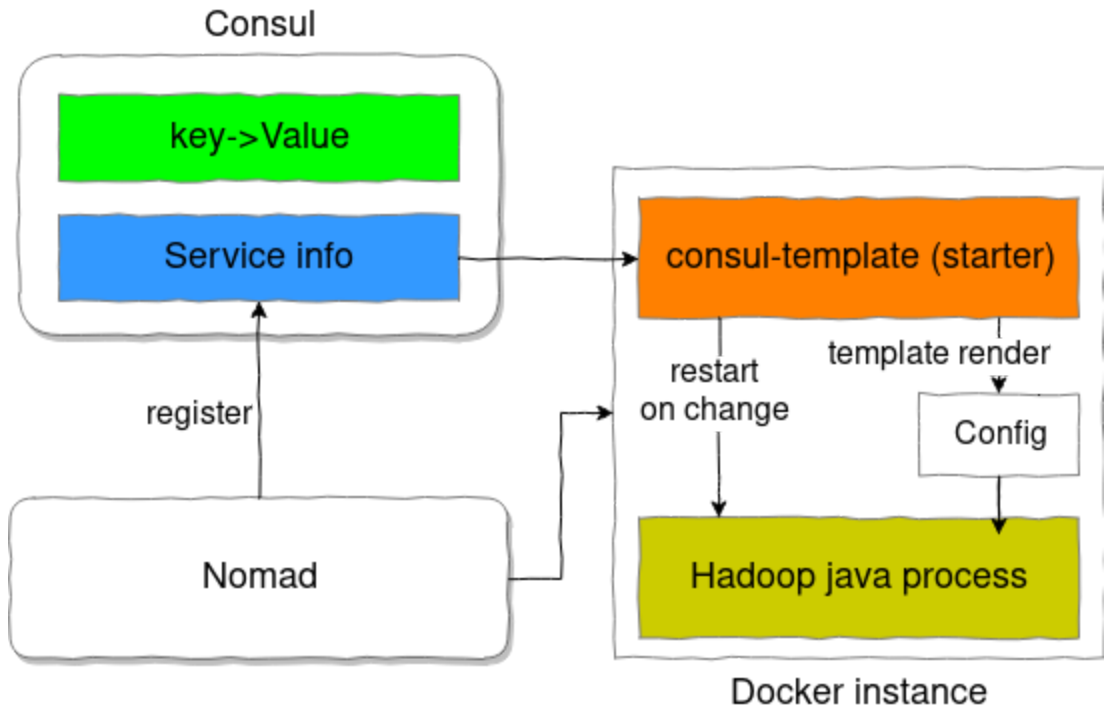

nn
dn
dn
dn
dn
dn
nomad
consul
nomad
consul
nomad
consul
nomad
consul
nomad
consul
node1
node2
node3
node4
node5

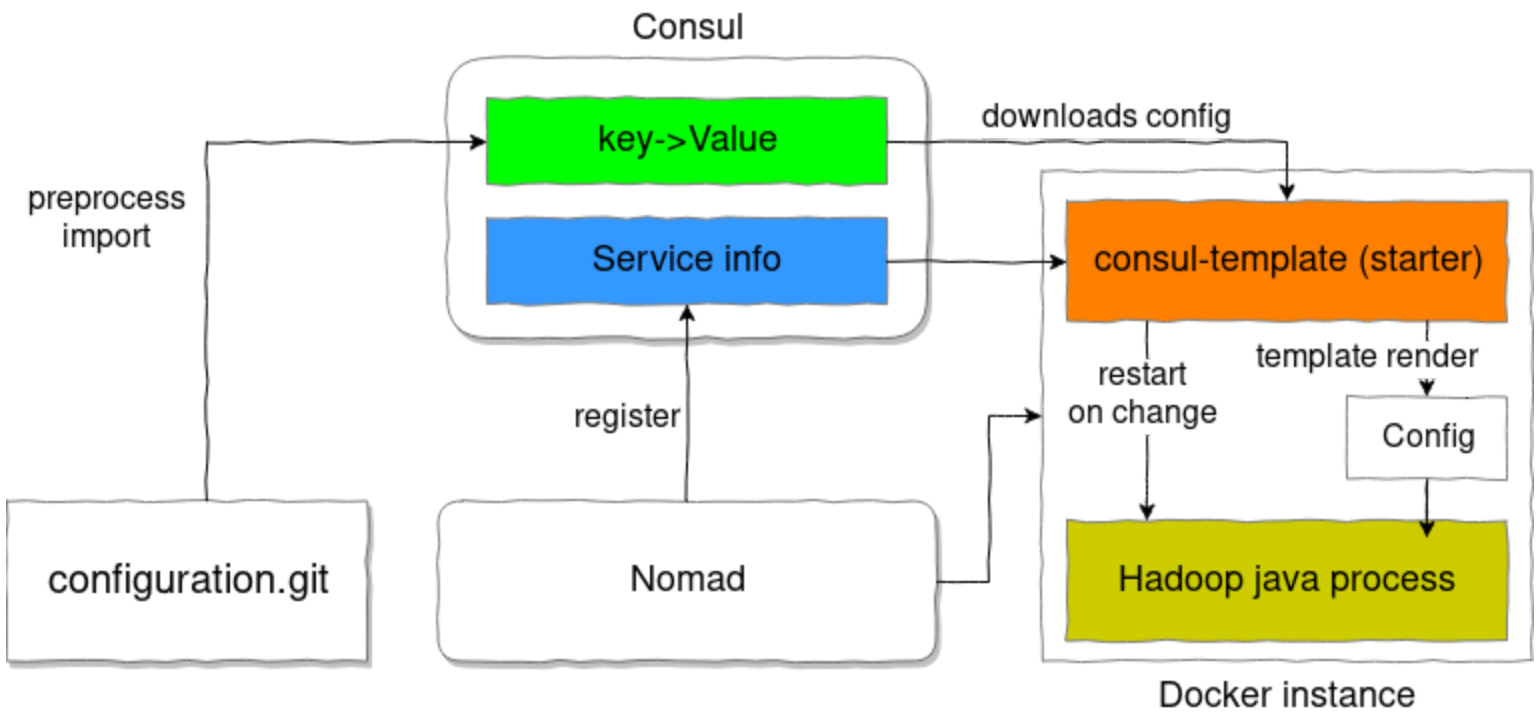

nn
dn
dn
dn
dn
dn
nomad
consul
nomad
consul
nomad
consul
nomad
consul
nomad
consul
node1
node2
node3
node4
node5


Nomad
Hadoop java process
Docker instance

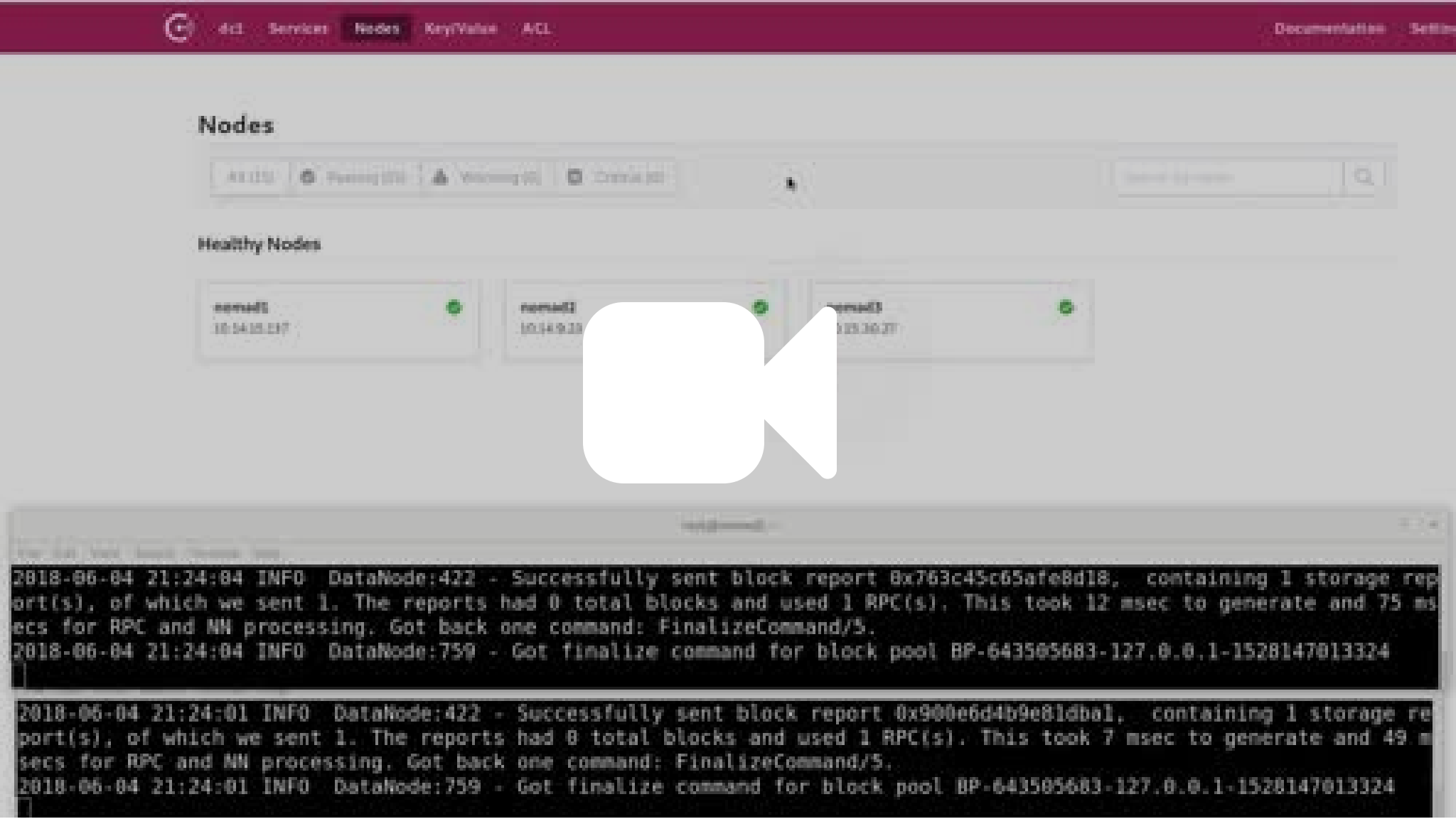

Consul
key->Value
Service info
register
Nomad
Hadoop java process
Docker instance


Consul
key->Value
Service info
consul-template (starter)
template render
Config
register
Nomad
Hadoop java process
Docker instance

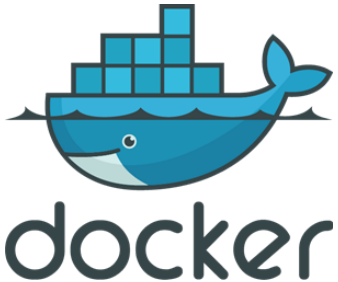

Consul
key->Value
Service info
register
Nomad
consul-template (starter)
restart
on change
template render
Config
Hadoop java process
Docker instance


Consul
key->Value
Service info
downloads config
preprocess
import
consul-template (starter)
restart
on change
template render
Config
register
configuration.git
Nomad
Hadoop java process
Docker instance

DIY

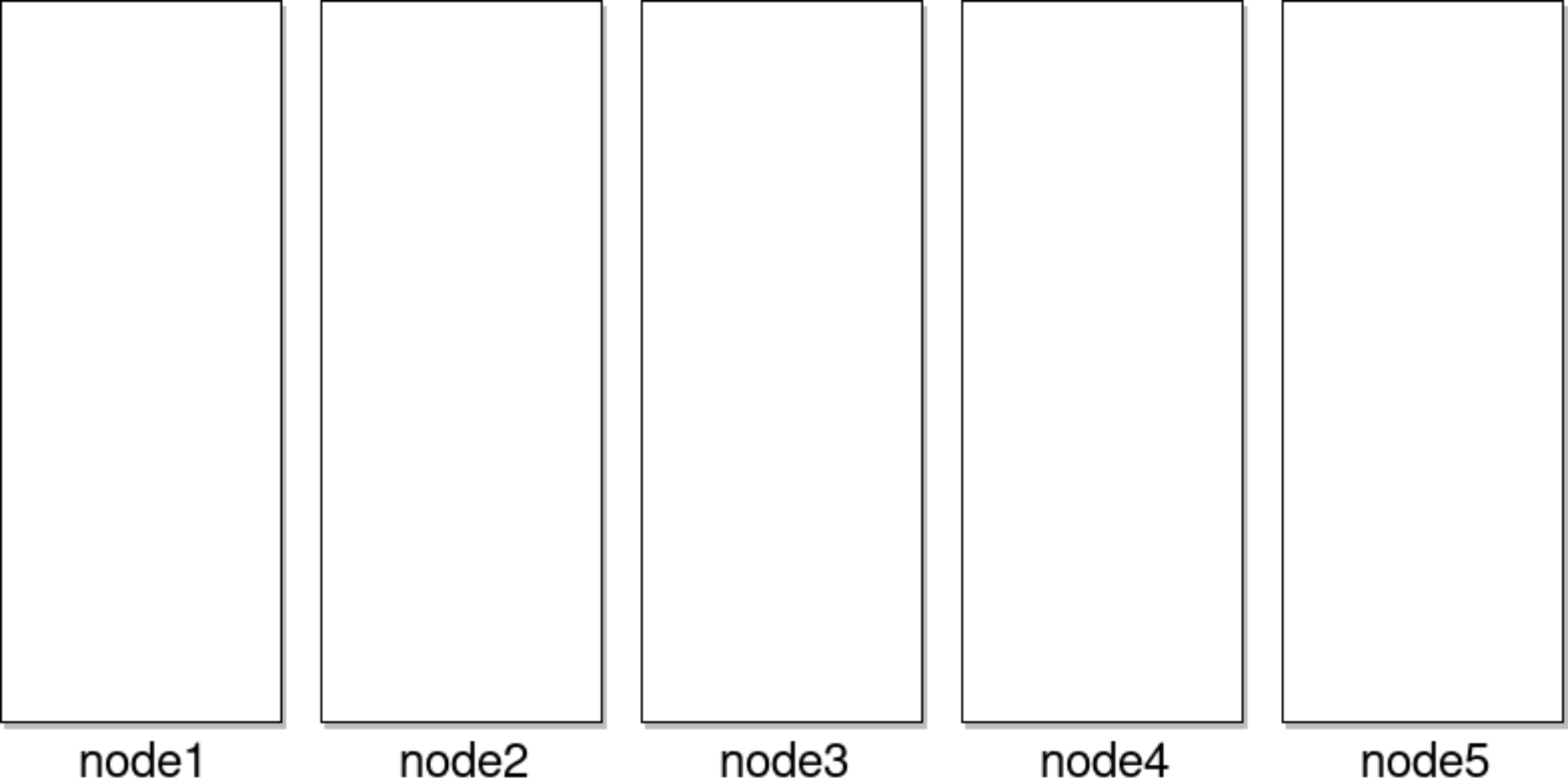

dc1
Services
Nodes
Key/Value
ACL
Documentation
Nodes
Healthy Nodes
nomad1
nomad2
nomad3
2018-06-04 21:24:04 INFO DataNode:422 - Successfully sent block report 0x763c45c65afe8d18, containing 1 storage report(s), of which we sent 1. The reports had 0 total blocks and used 1 RPC(s). This took 12 msec to generate and 75 msecs for RPC and NN processing. Got back one command: FinalizeCommand/5.
2018-06-04 21:24:04 INFO DataNode:759 - Got finalize command for block pool BP-643505683-127.0.0.1-1528147013324
2018-06-04 21:24:01 INFO DataNode:422 - Successfully sent block report 0x900e6d4b9e81dba1, containing 1 storage report(s), of which we sent 1. The reports had 0 total blocks and used 1 RPC(s). This took 7 msec to generate and 49 msecs for RPC and NN processing. Got back one command: FinalizeCommand/5.
2018-06-04 21:24:01 INFO DataNode:759 - Got finalize command for block pool BP-643505683-127.0.0.1-1528147013324

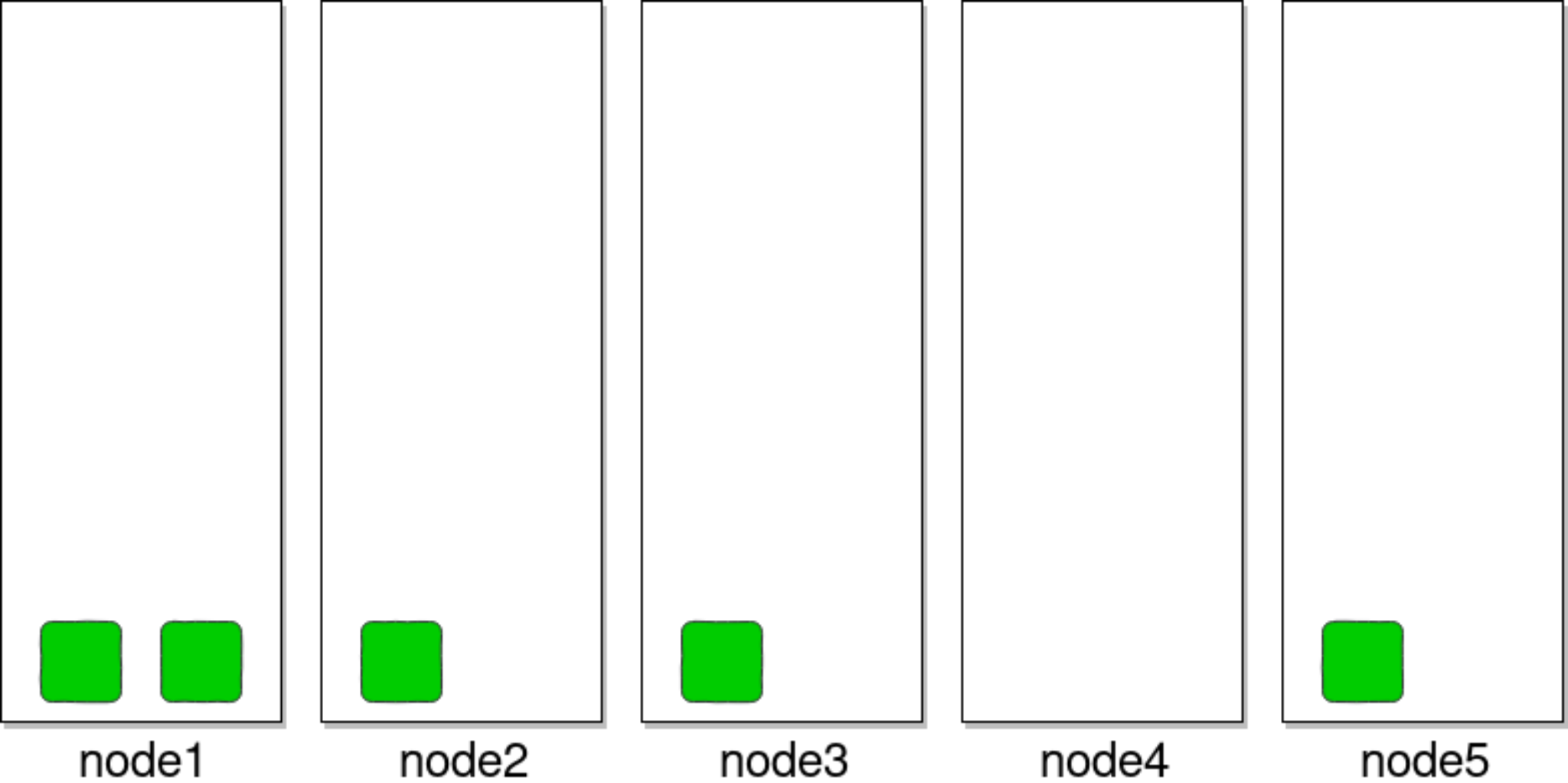
Less efficient	
Configuration management	
Source	Consul
Preprocessing	Yes (script)
On change	Restart
Provisioning, Scheduling	
Multihost support	host netw
Scheduling	Nomad
Cluster definition	.nomad
Scaling	redeploy
Multi tenancy	no
Failover	yes
Network	
Intraservice network	host netw
DNS	yes
Service discovery	consul
Data locality	yes
Availability of the ports	host

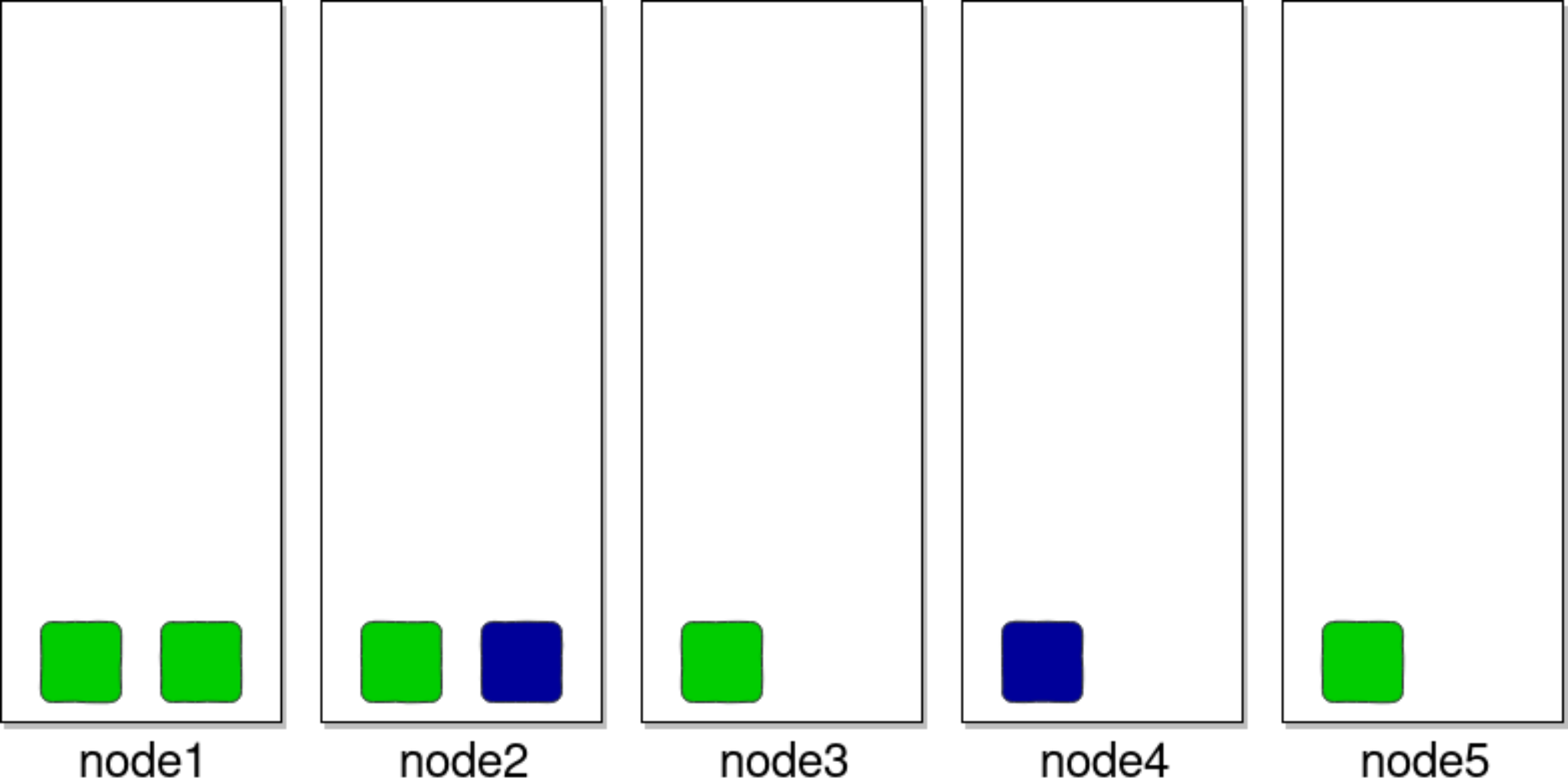

docker

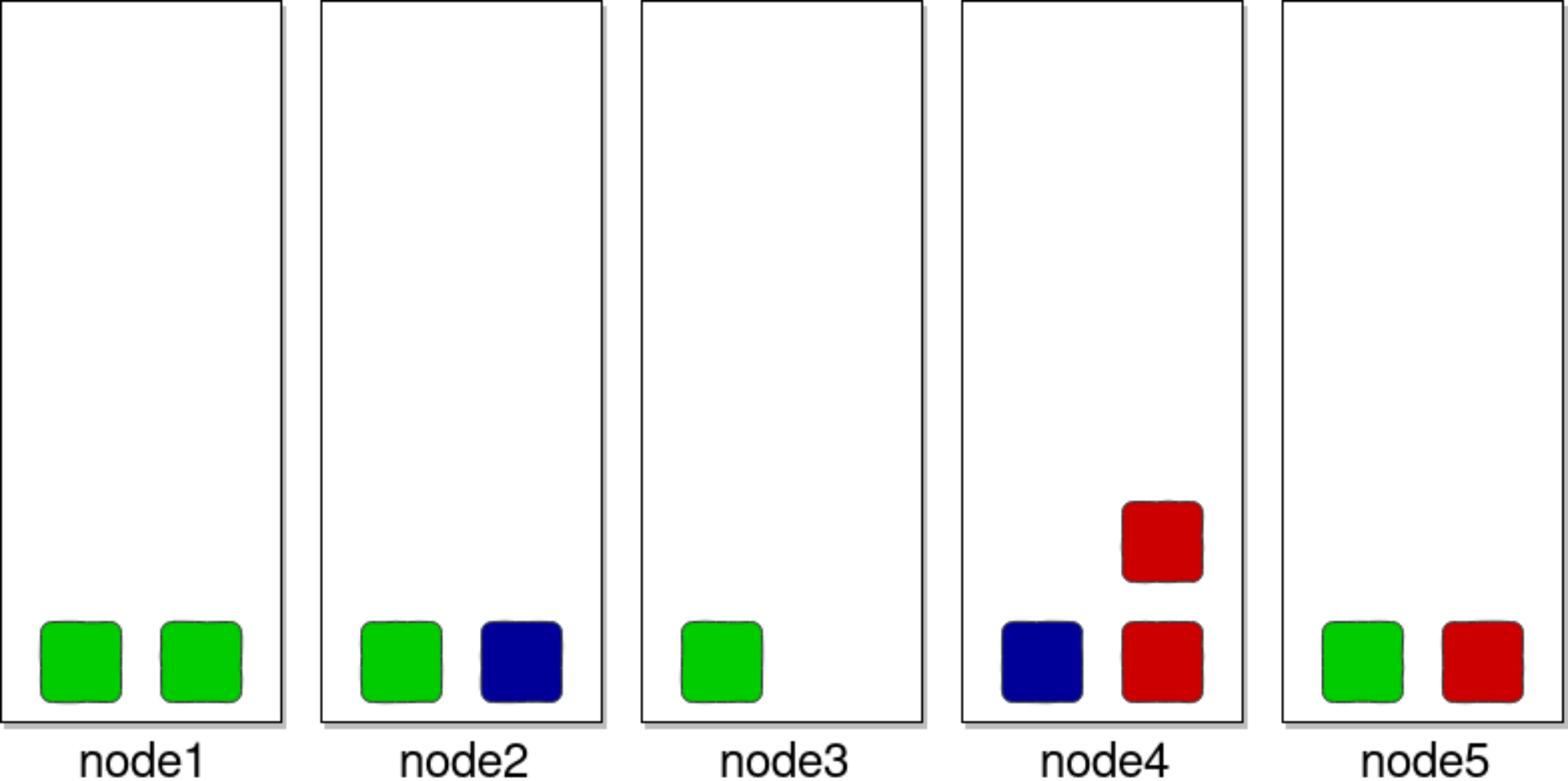
Kubernetes

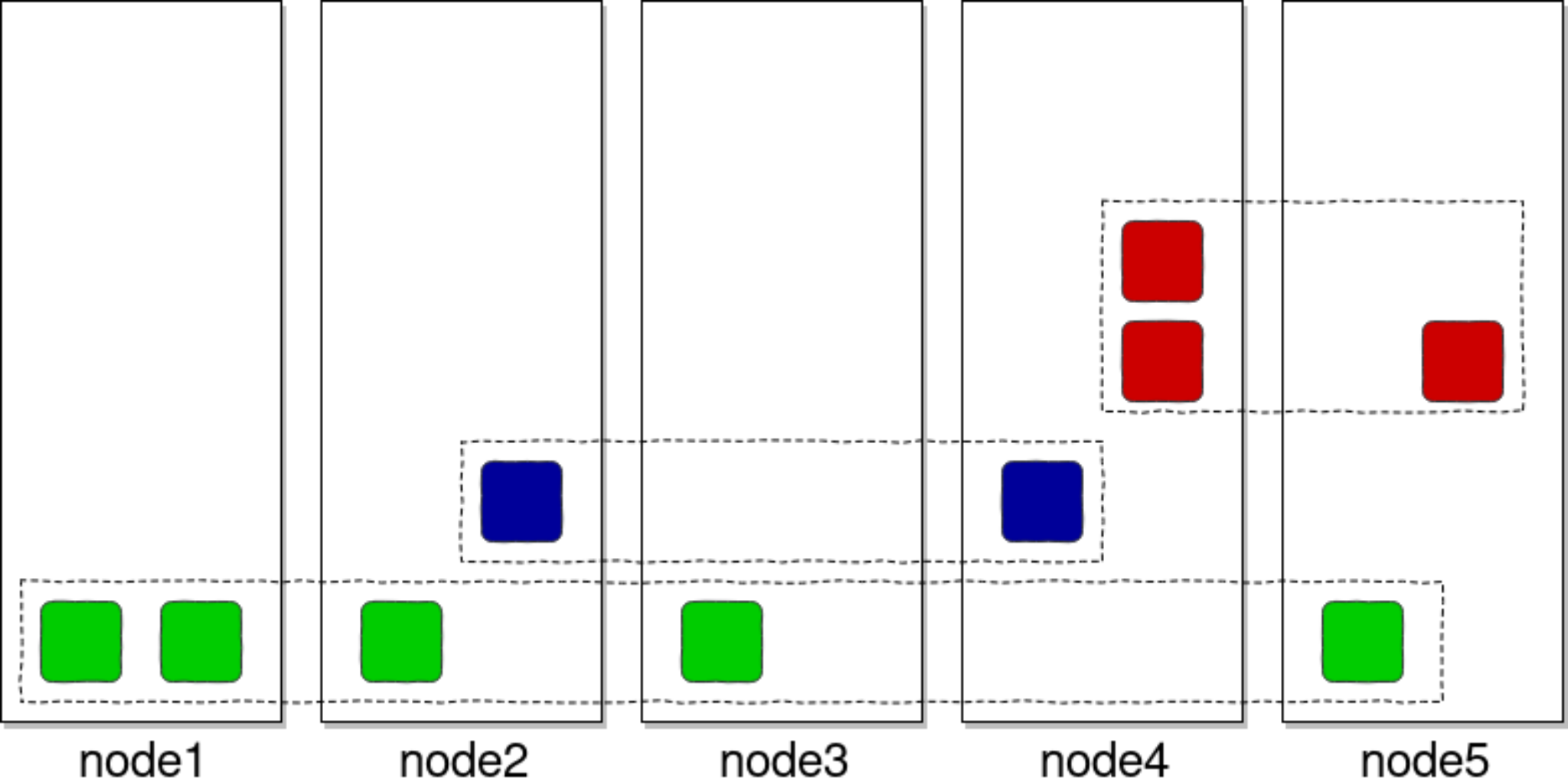
"out of the box"


node1
node2
node3
node4
node5


node1
node2
node3
node4
node5

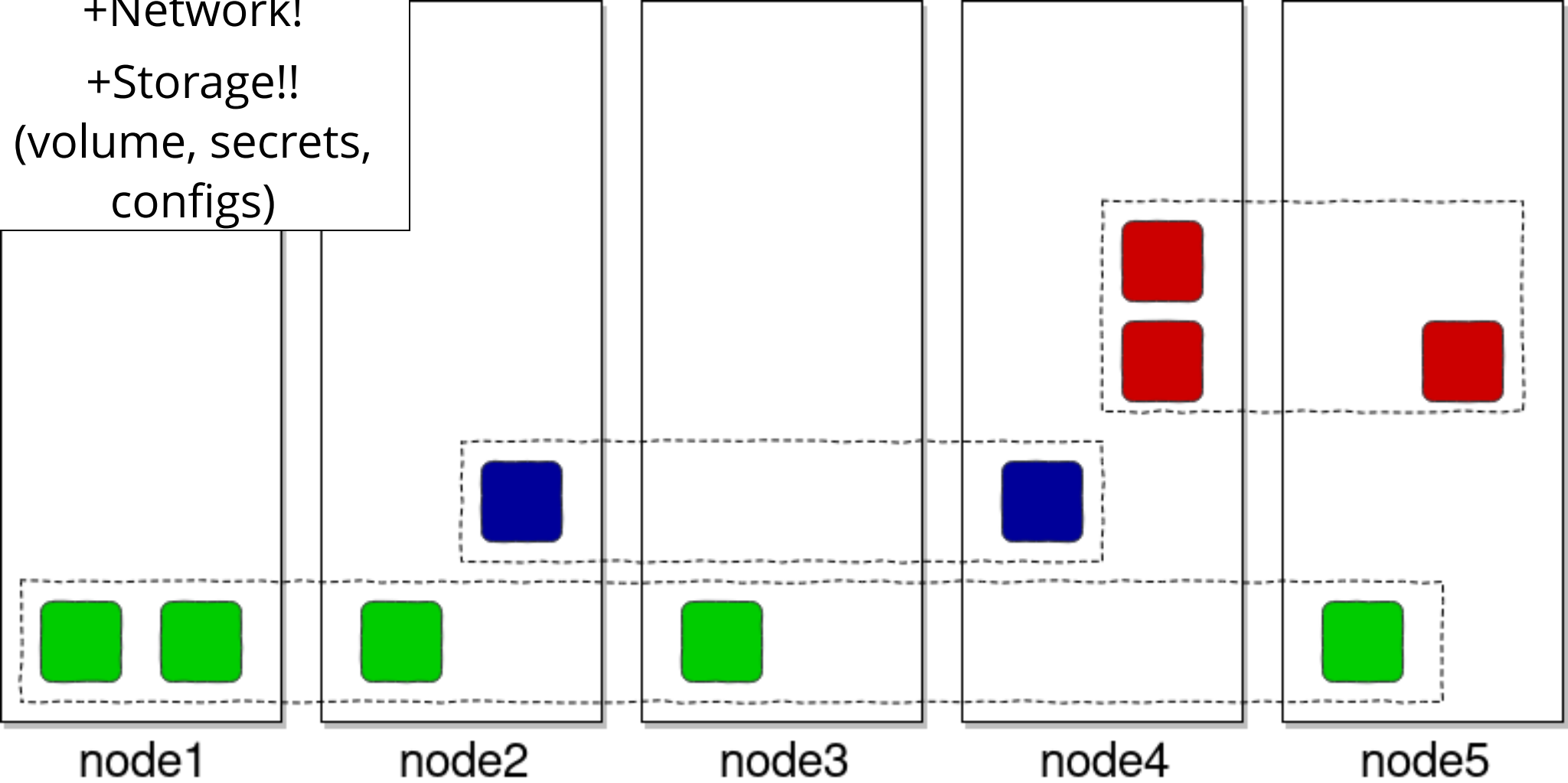

node1
node2
node3
node4
node5

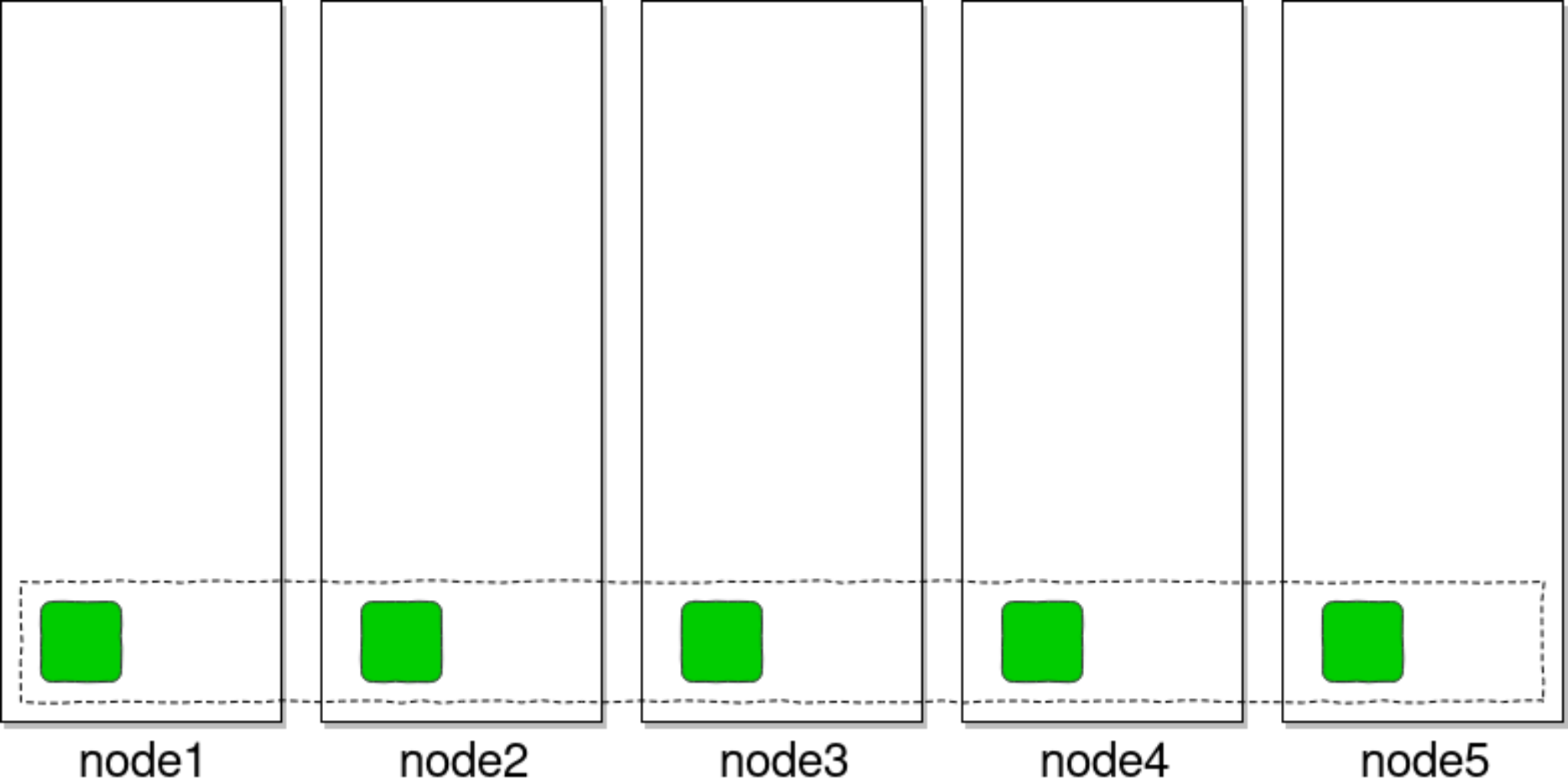

node1
node2
node3
node4
node5


node1
node2
node3
node4
node5

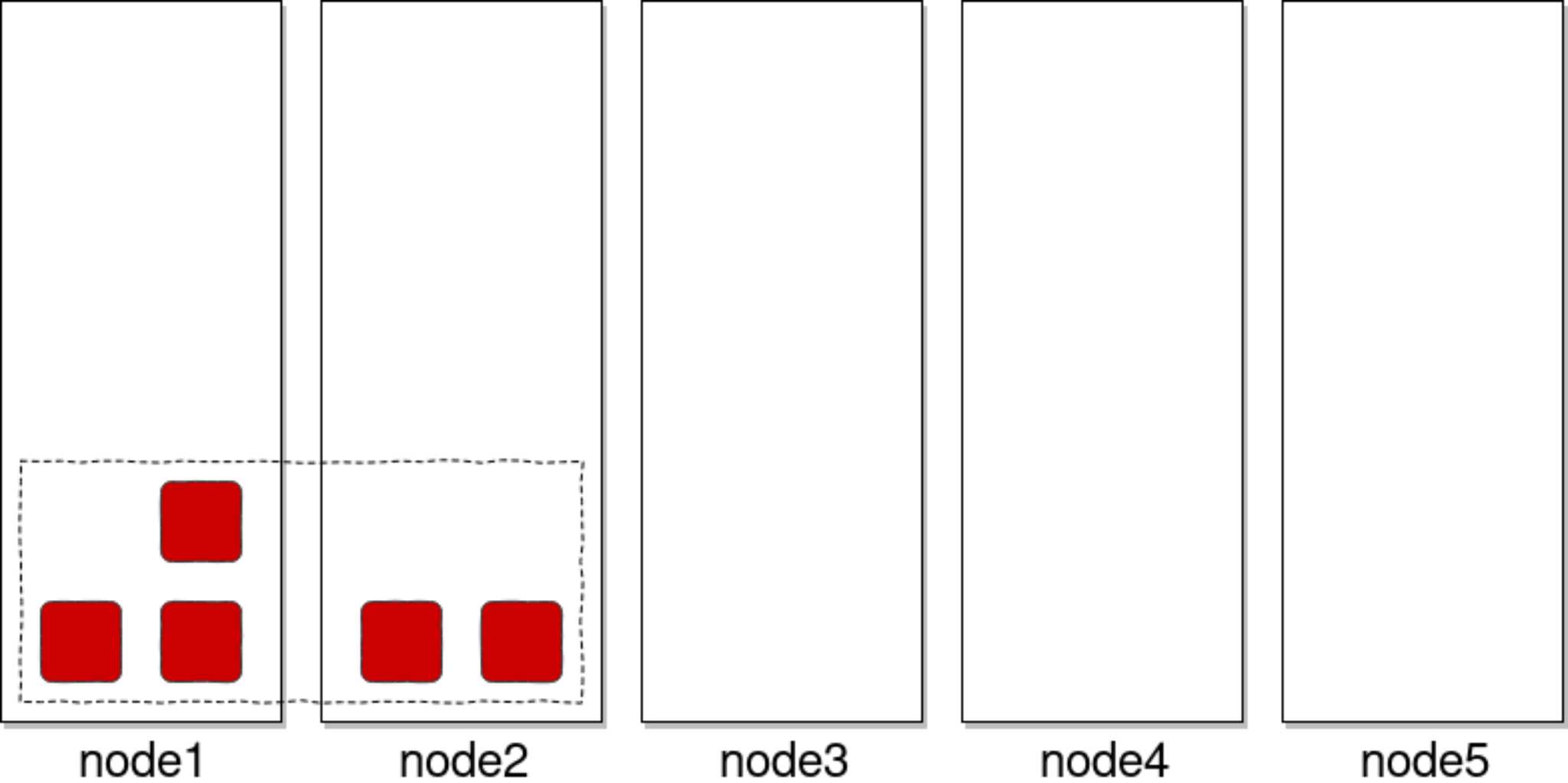
+Network!

+Storage!!
(volume, secrets, configs)





DaemonSet

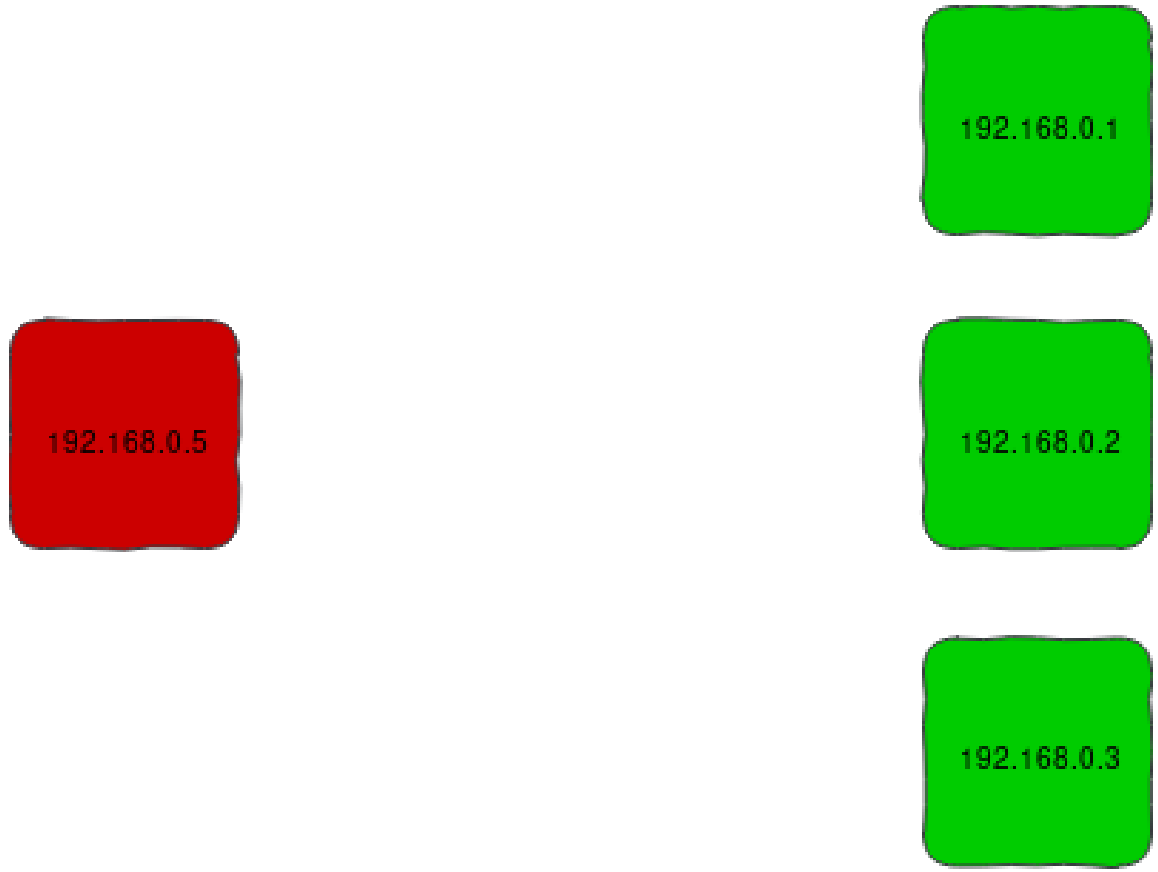


ReplicaSet

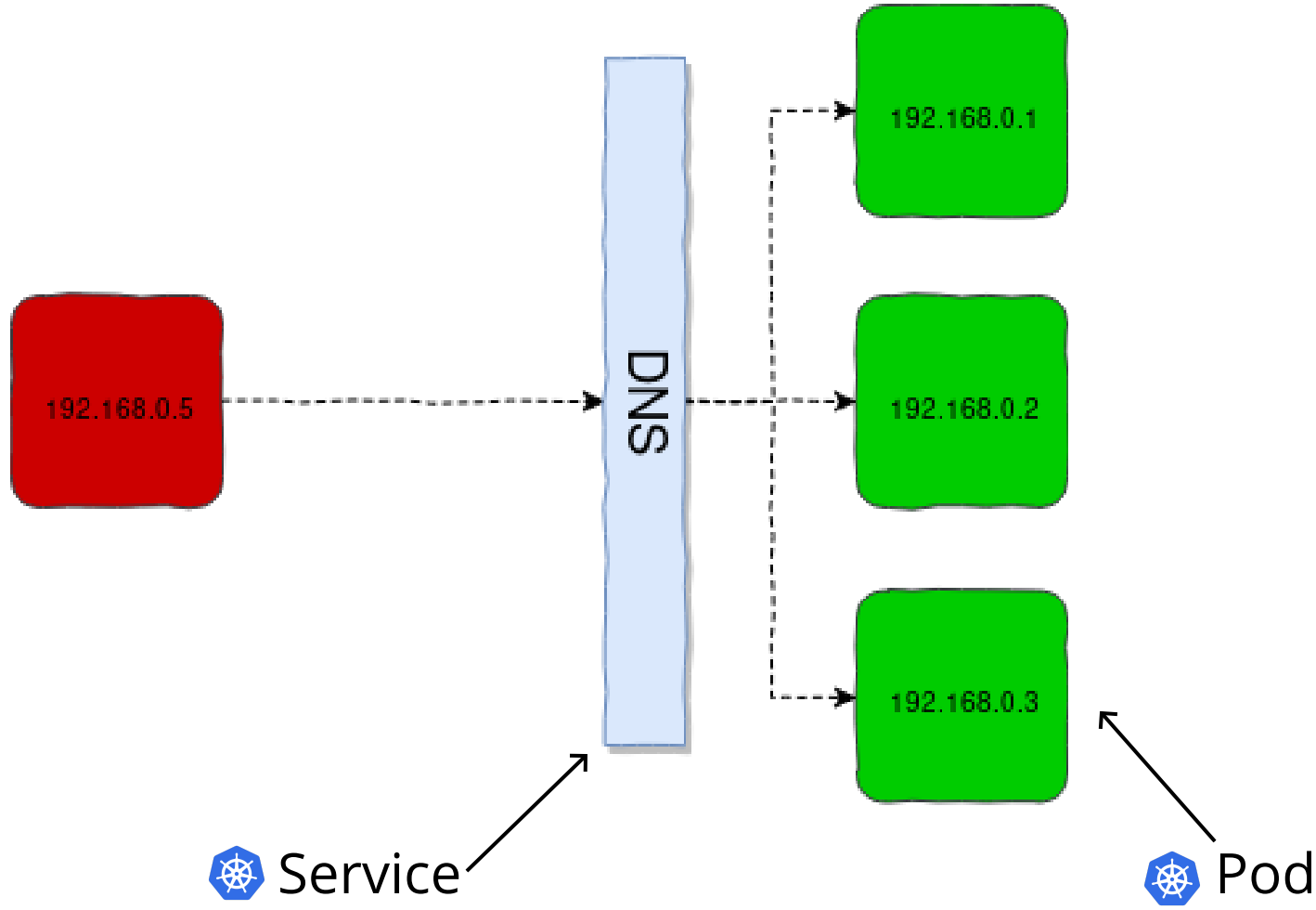
192.168.0.1

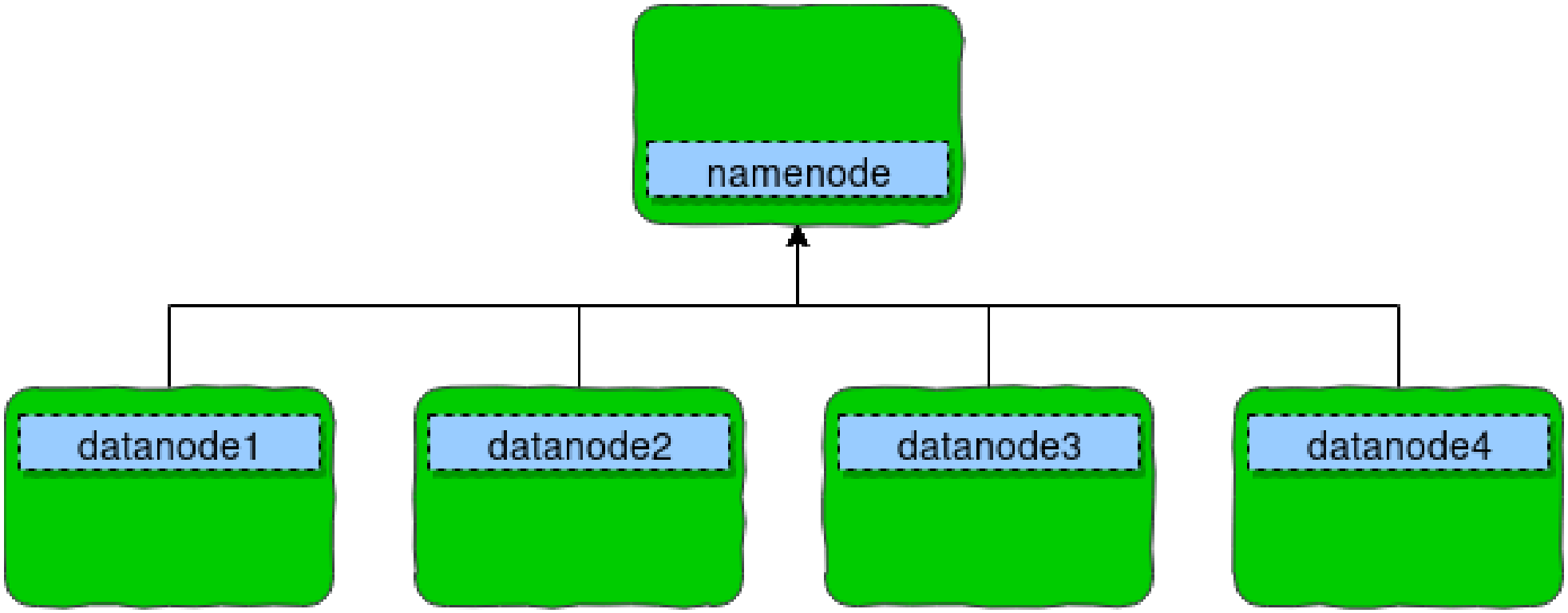
192.168.0.2

192.168.0.3

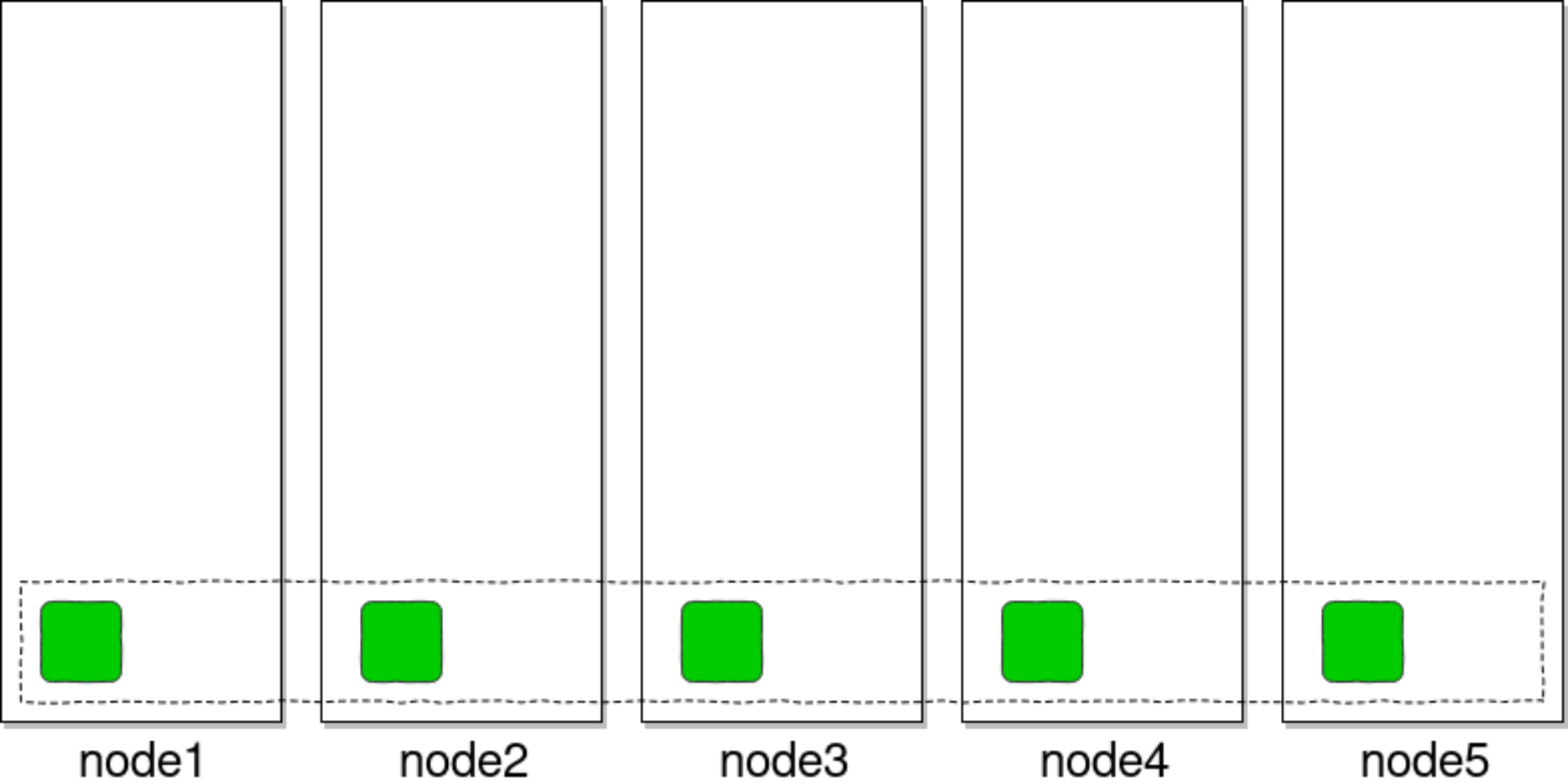

192.168.0.1
192.168.0.5
192.168.0.2
192.168.0.3

192.168.0.5
DNS
192.168.0.1
192.168.0.2
192.168.0.3

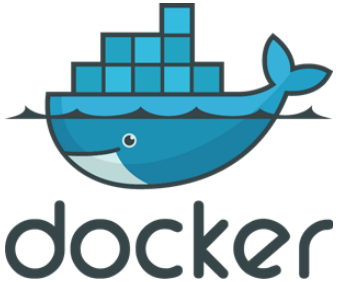

192.168.0.5
DNS
192.168.0.1
192.168.0.2
192.168.0.3
Service
Pod



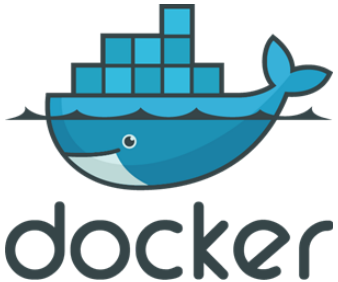
StatefulSet



DaemonSet


docker

192.168.0.5
DNS
192.168.0.1
192.168.0.2
192.168.0.3


docker

Benefits of Hadoop + k8s?

Benefits of Hadoop + k8s?

Ecosystem

Flexibility

Example:

Monitor Hadoop with Prometheus

Prometheus Alerts Graph Status Help

Enable query history

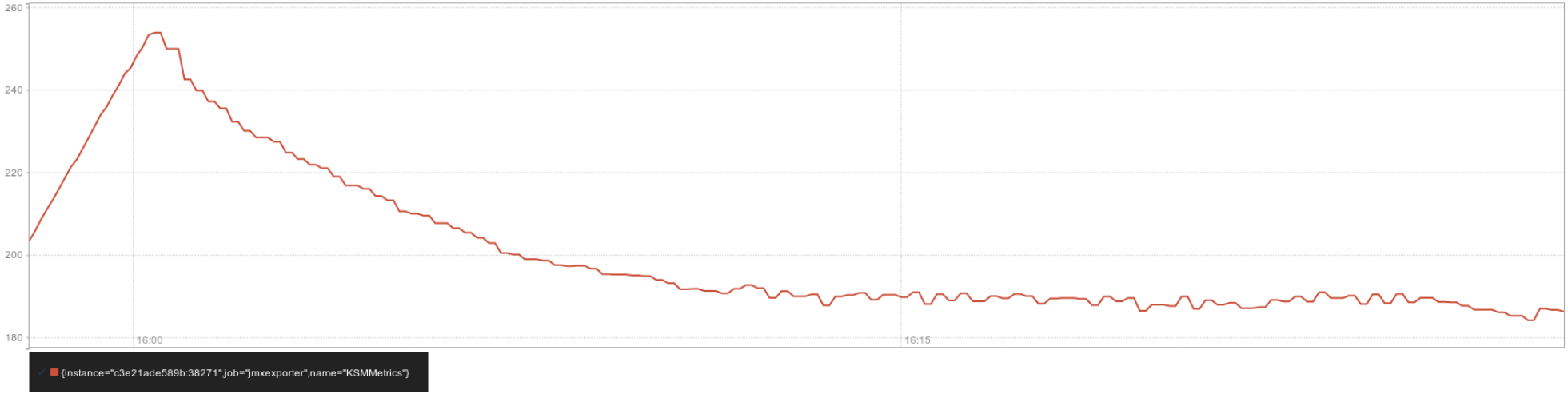
rate(Hadoop_KeySpaceManager_NumKeyCommits[10m])

Load time: 187ms
Resolution: 7s
Total time series:

Execute java_lang_OperatingSyste

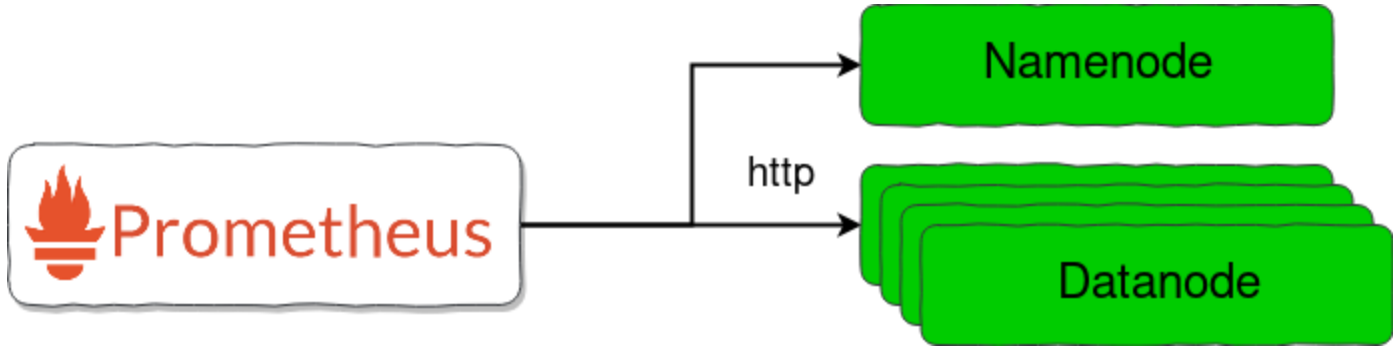
Graph Console

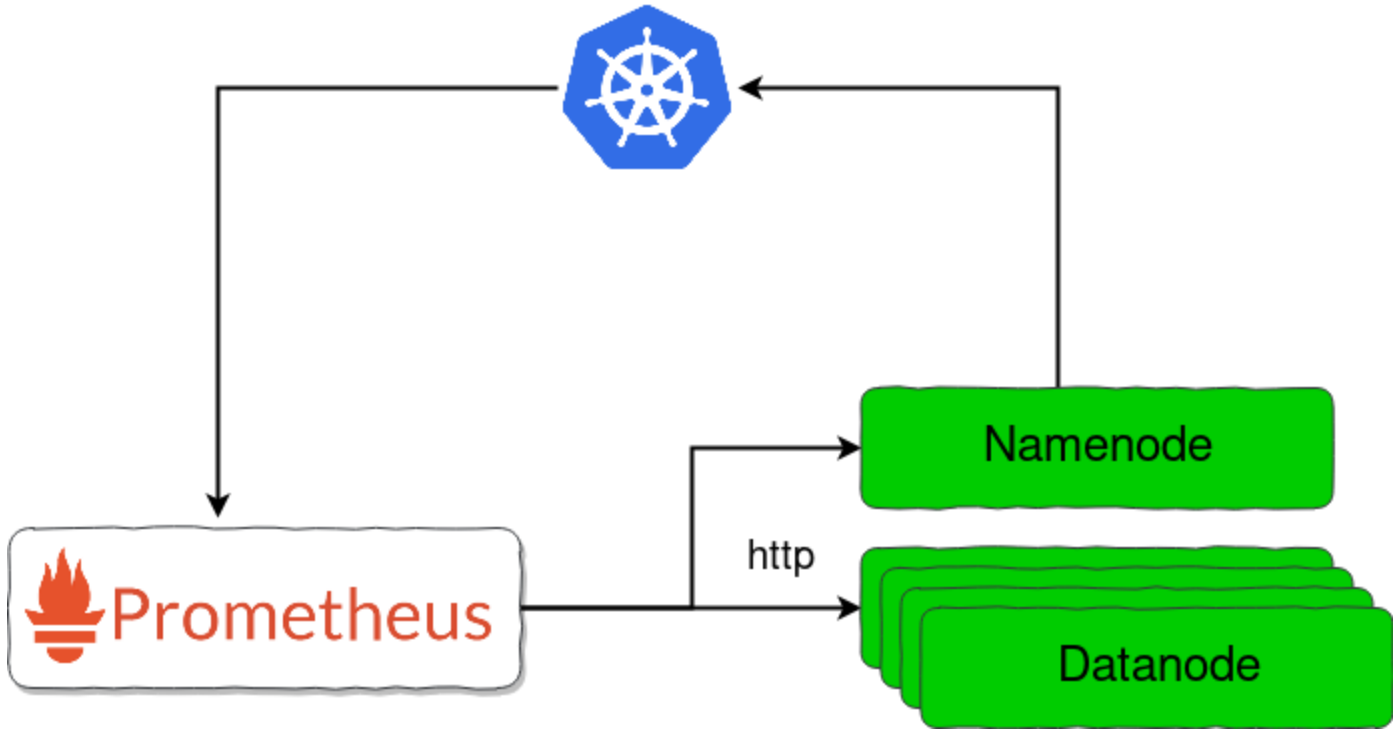
30m Until Res. (s) stacked



Remove Grap

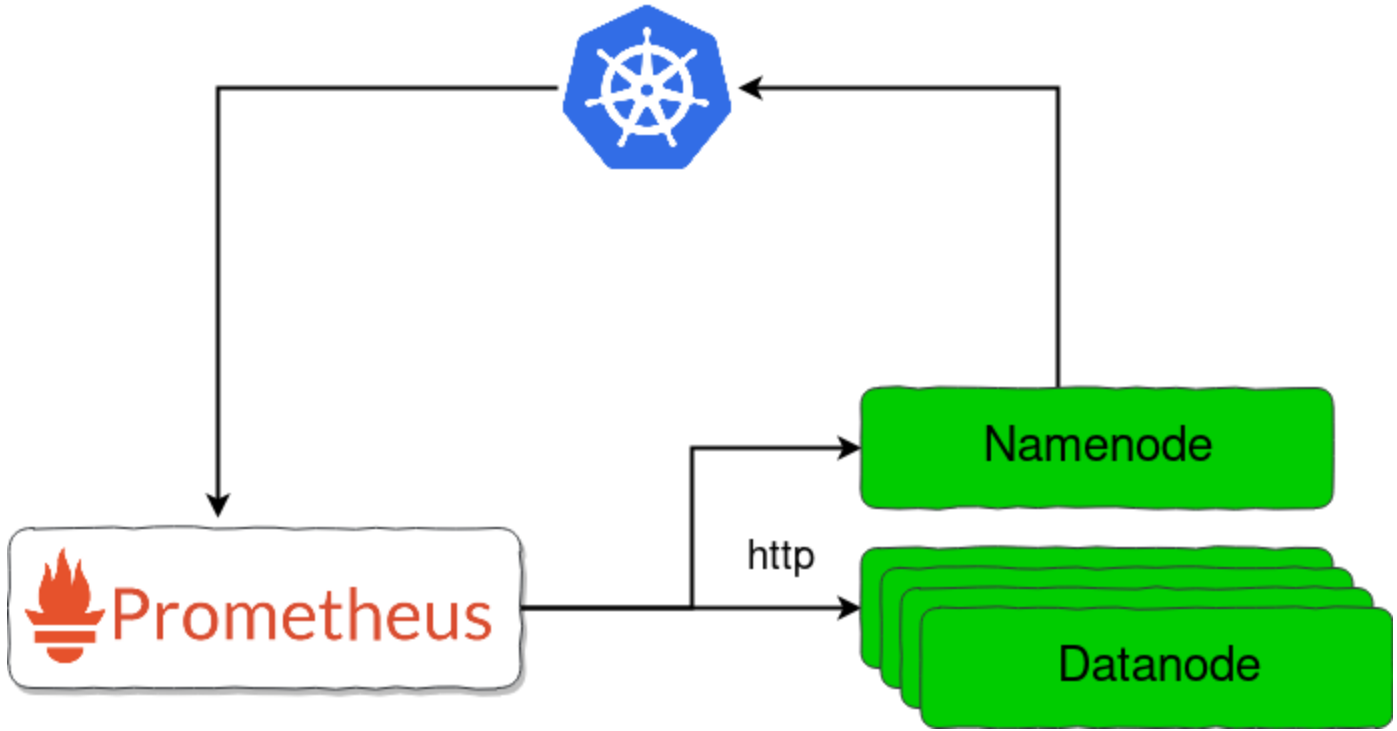
Add Graph

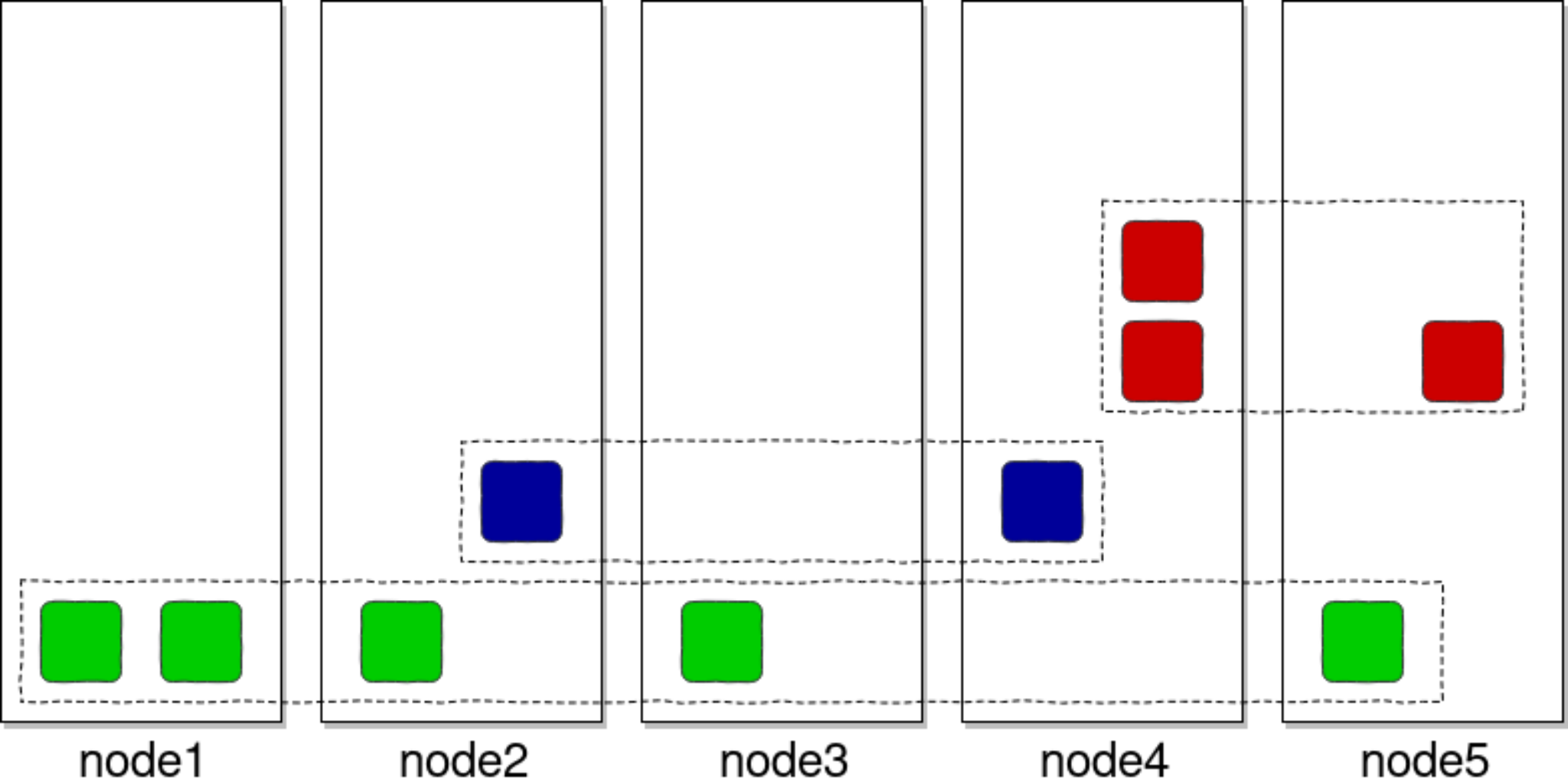

Prometheus
http
Namenode
Datanode

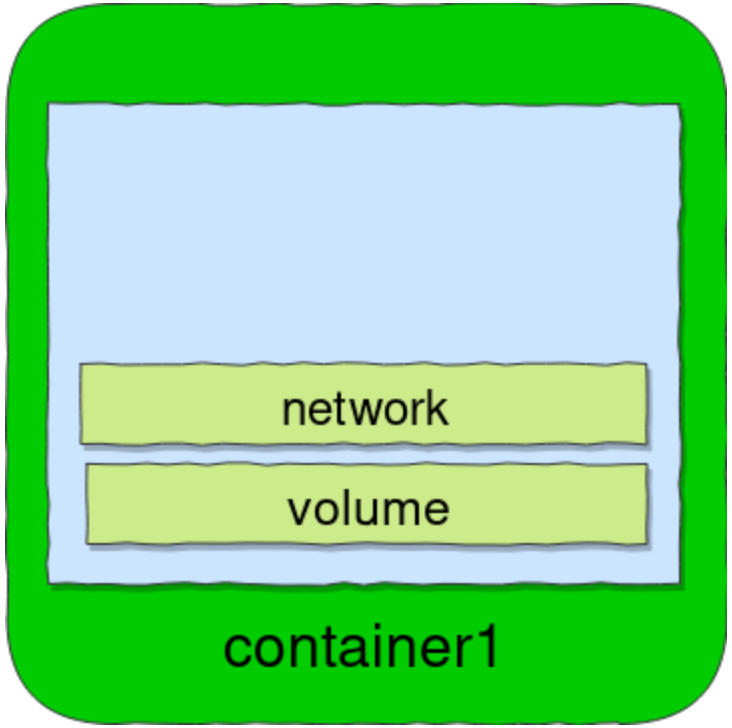

Namenode
http
Prometheus
Datanode

```yaml
apiVersion: apps/v1beta1
kind: StatefulSet
metadata:
  name: ozone-hdfs-namenode
spec:
  serviceName: ozone2-hdfs-namenode
  replicas: 1
  template:
    metadata:
      labels:
        app: ozone
    spec:
      containers:
        - name: hdfs-namenode
          image: flokkr/ozone:2.1.0
          args: ["hdfs","namenode"]
```

```yaml
apiVersion: apps/v1beta1
kind: StatefulSet
metadata:
  name: ozone-hdfs-namenode
spec:
  serviceName: ozone2-hdfs-namenode
  replicas: 1
  template:
    metadata:
      labels:
        app: ozone
      annotations:
        prometheus.io/scrape: "true"
        prometheus.io/port: "28942"
    spec:
      containers:
        - name: hdfs-namenode
          image: flokkr/ozone:2.1.0
          args: ["hdfs","namenode"]
```

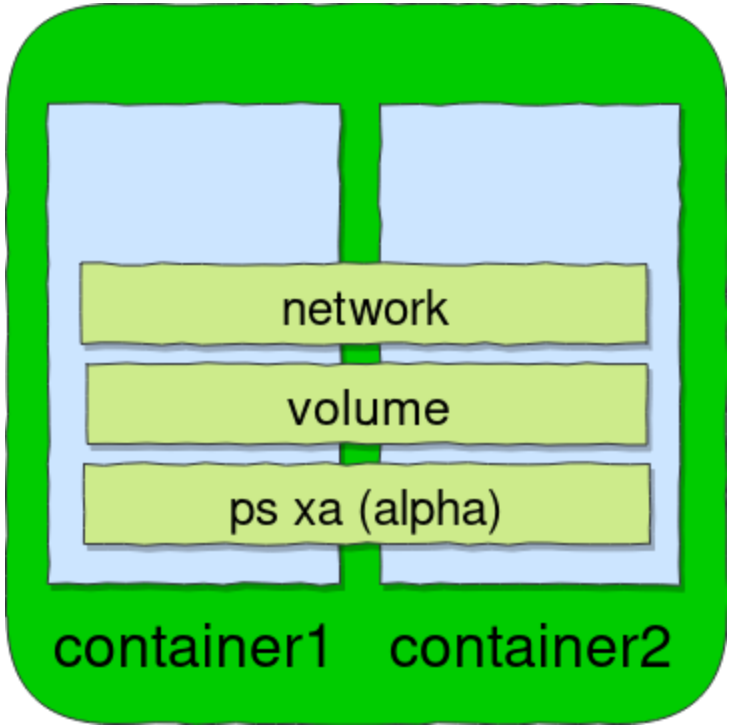

Namenode
http
Prometheus
Datanode


node1
node2
node3
node4
node5



Pod

Sidecar pattern

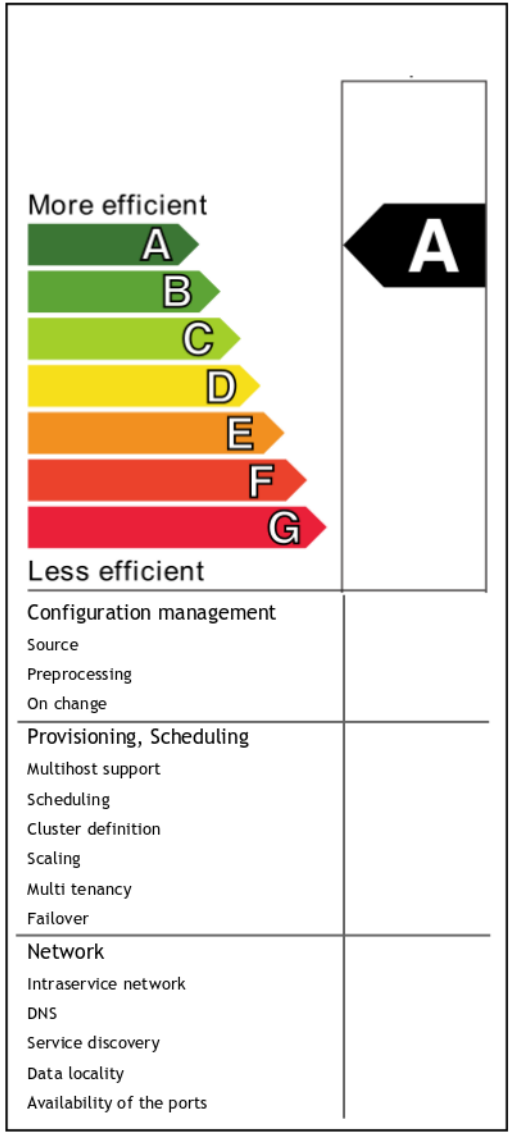


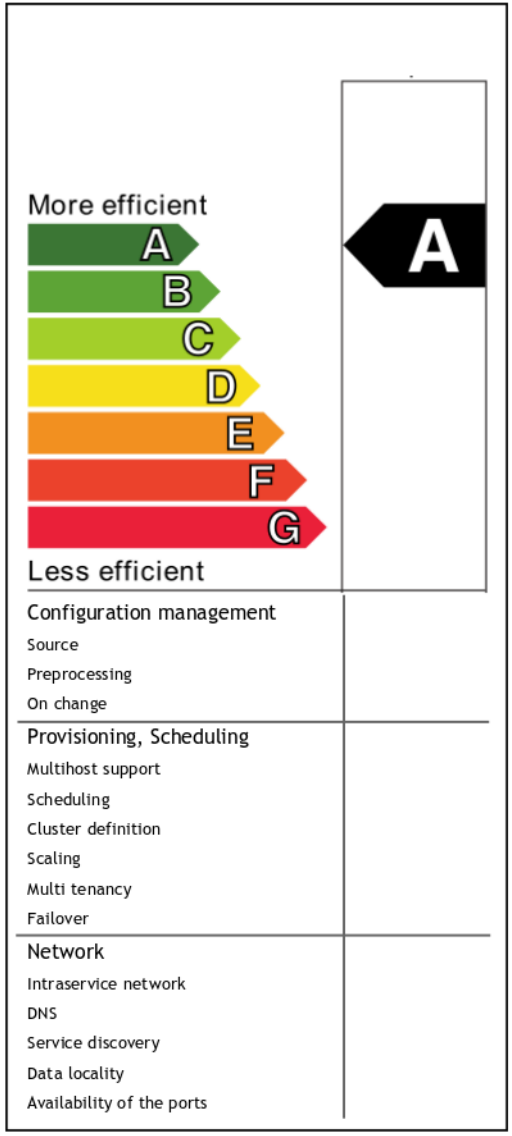
Pod

```yaml
apiVersion: apps/v1beta1
kind: StatefulSet
metadata:
  name: ozone-hdfs-namenode
spec:
  serviceName: ozone2-hdfs-namenode
  replicas: 1
  template:
    metadata:
      labels:
        app: ozone
      annotations:
        prometheus.io/scrape: "true"
        prometheus.io/port: "28942"
    spec:
      shareProcessNamespace: true
      containers:
        - name: hdfs-namenode
          image: flokkr/ozone:2.1.0
          args: ["hdfs","namenode"]
        - name: jmxpromo
          image: flokkr/jmxpromo-sidecar
```

Less efficient	
Configuration management	
Source	configmap
Preprocessing	helm
On change	n/a
Provisioning, Scheduling	
Multihost support	CNI
Scheduling	kubectl
Cluster definition	helm, yaml
Scaling	yes
Multi tenancy	namespaces
Failover	yes
Network	
Intraservice network	CNI
DNS	statefuset
Service discovery	DNS
Data locality	no
Availability of the ports	service/ingress

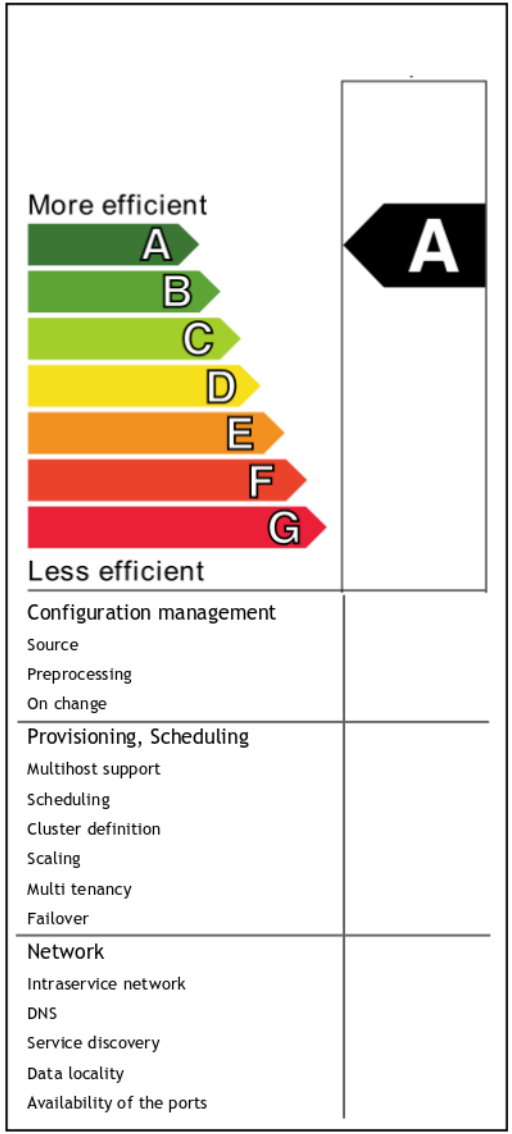
Summary


More efficient
A
B
C
D
E
F
G
Less efficient
A
Configuration management
Source
Preprocessing
On change
Provisioning, Scheduling
Multihost support
Scheduling
Cluster definition
Scaling
Multi tenancy
Failover
Network
Intraservice network
DNS
Service discovery
Data locality
Availability of the ports



Summary

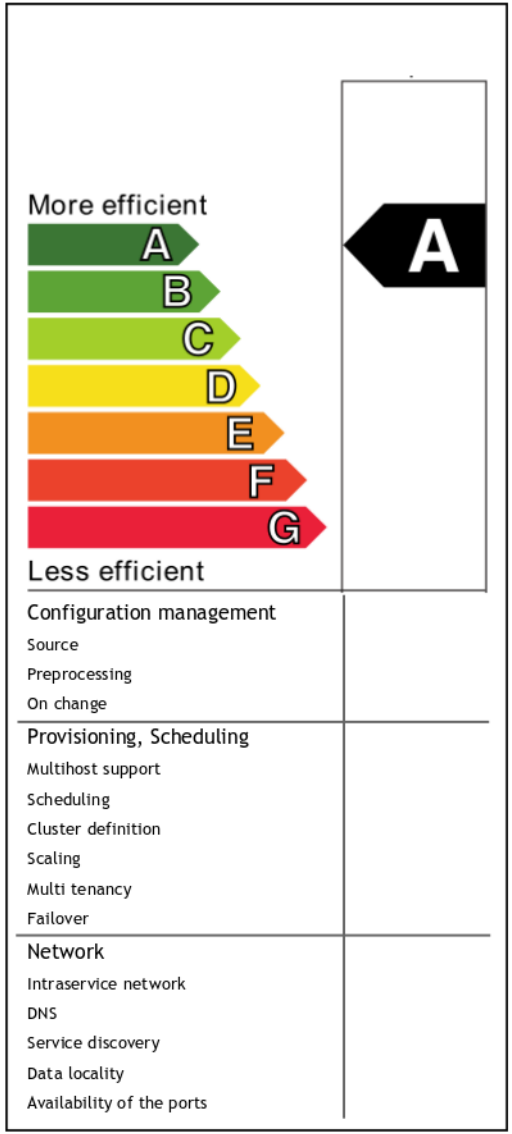
Don't buy without checking the label



Summary

Don't buy without checking the label

Hadoop is first class citizen of cloud-native/containerized environments*



Summary

Don't buy without checking the label

Containerization can help a lot to manage our *Bigdata* clusters

Hadoop is first class citizen of cloud-native/containerized environments*

Q&A

Apache Roadshow EU:
Kubernetes + Hadoop + Ozone
13th June, 14:20

Márton Elek @anzix
https://flokkr.github.io (bigdata + containers project)
https://github.com/flokkr (source)
elek@apache.org

Image credits

Yan Pritzker (CC)

Carrie Cizauskas (CC)