riak KV

Advanced Databases (CIS 6930) Fall 2016

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Group 17

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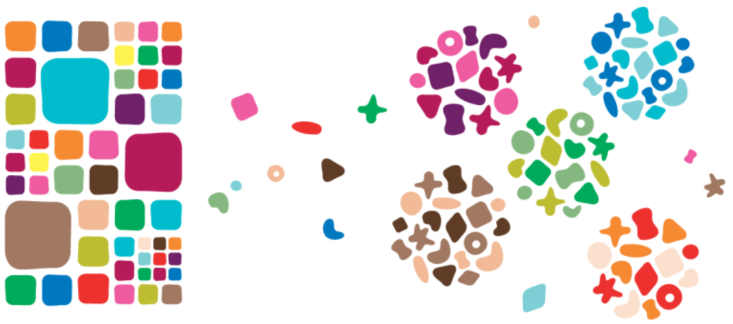
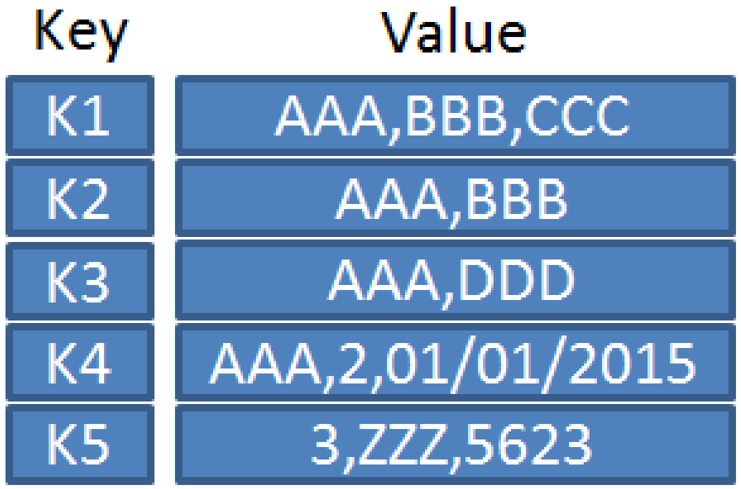
BEFORE WE BEGIN…

- NOSQL : It is mechanism for storage & retrieval of data using means other than tabular relations.

- KEY – VALUE : A data storage paradigm that uses (key, value) pairs to store, retrieve and manage data.



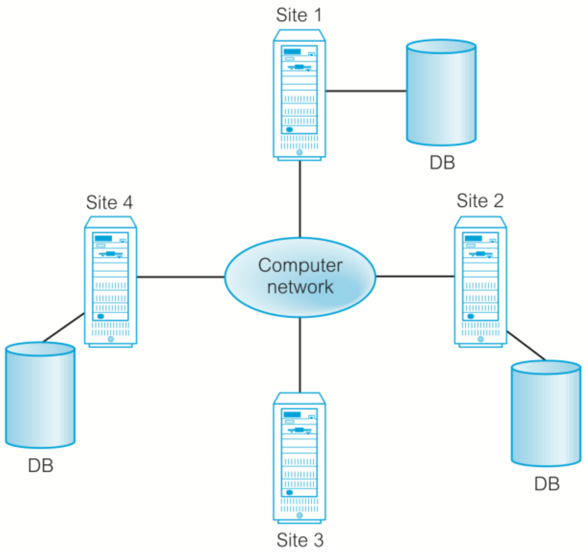


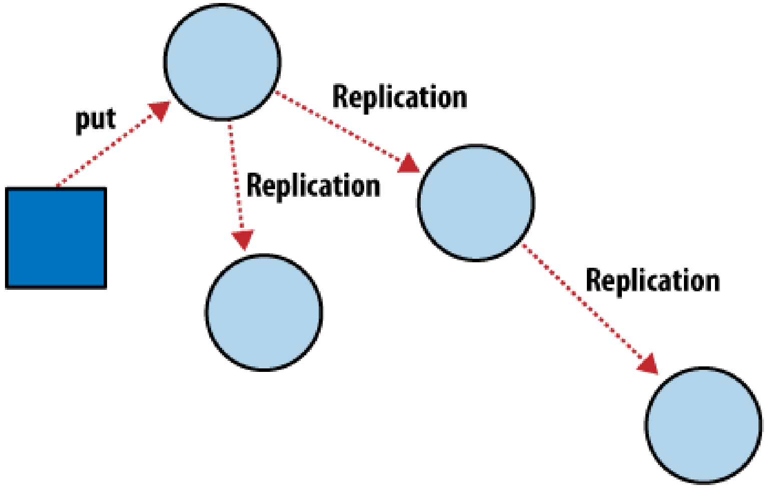
Key	Value
K1	AAA,BBB,CCC
K2	AAA,BBB
K3	AAA,DDD
K4	AAA,2,01/01/2015
K5	3,ZZZ,5623

BEFORE WE BEGIN…

- DISTRIBUTED DATABASES : A setup in which databases are hosted at different locations and are interconnected through a computer network.

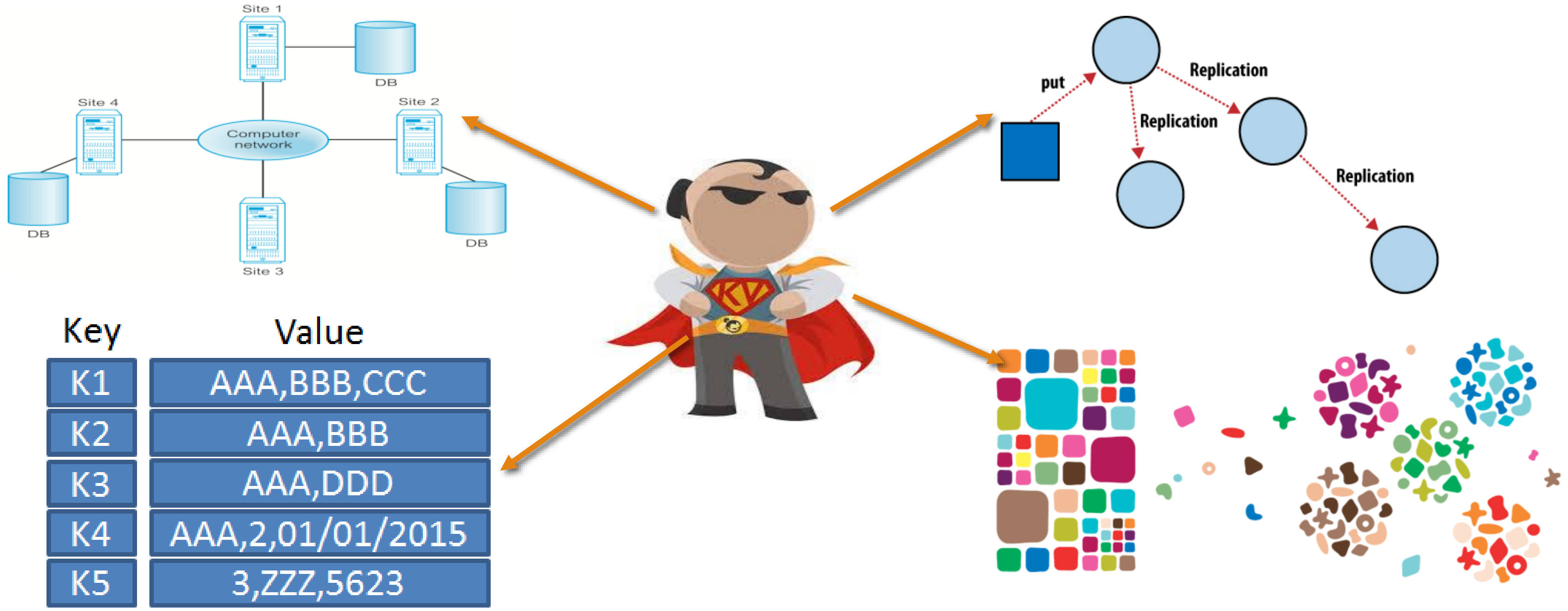
- EVENTUAL CONSISTENCY : A consistency model which informally guarantees that, if no new updates are made to a given data item, eventually all accesses to that item will return the last updated value.





DEFINING RIAK KV

Riak KV is a distributed, NoSQL, key-value database with advanced local and multi-cluster replication.

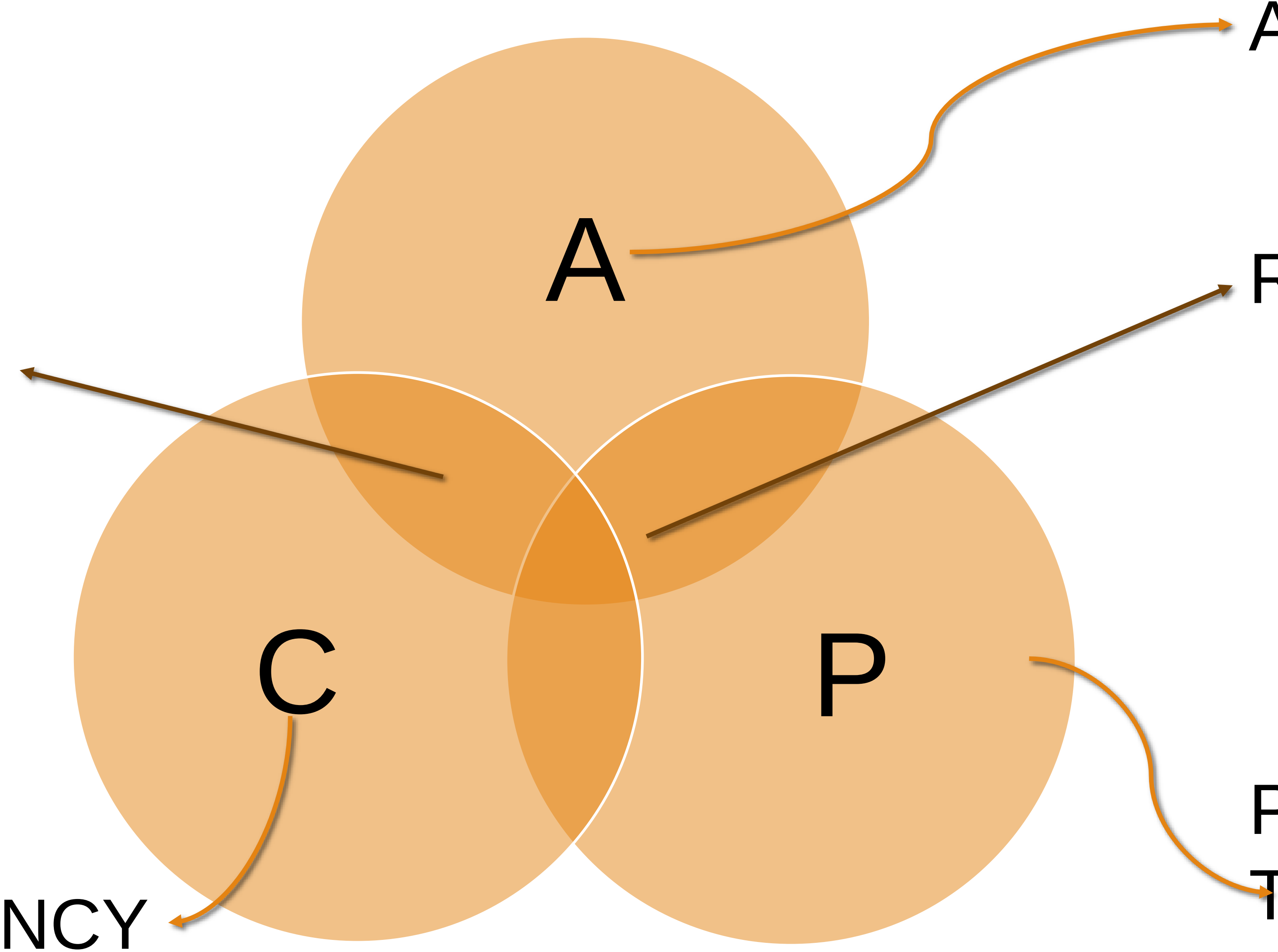


Key	Value
K1	AAA,BBB,CCC
K2	AAA,BBB
K3	AAA,DDD
K4	AAA,2,01/01/2015
K5	3,ZZZ,5623

SHORT BIO OF RIAK

- Developed by Basho Technologies
- Open source
- Written in Erlang – a functional programming language
- Latest version – Riak v2.1

CAP THEOREM



AVAILABILITY

RIAK

RDBMS

PARTITION TOLERANCE

CONSISTENCY

BASHO’S GOALS FOR RIAK

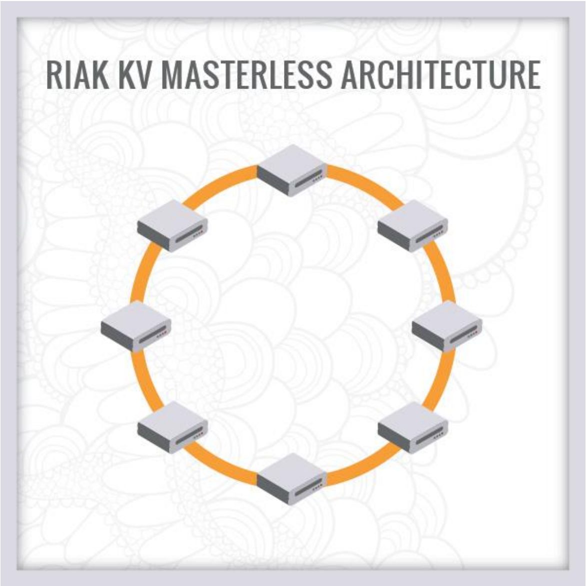
- Availability
- Operational Simplicity
- Scalability
- Masterless

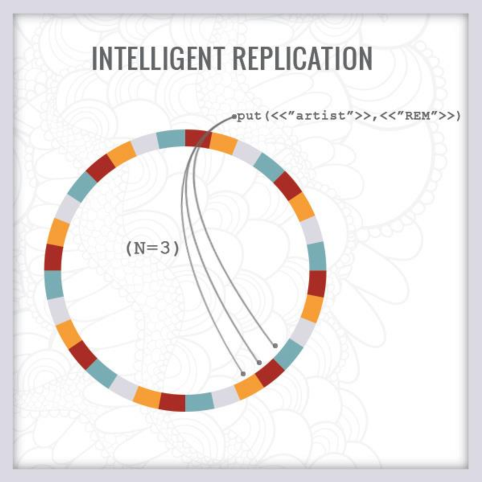
FEATURES OF RIAK KV

- Resiliency

- Massive Scalability

- Operational Simplicity



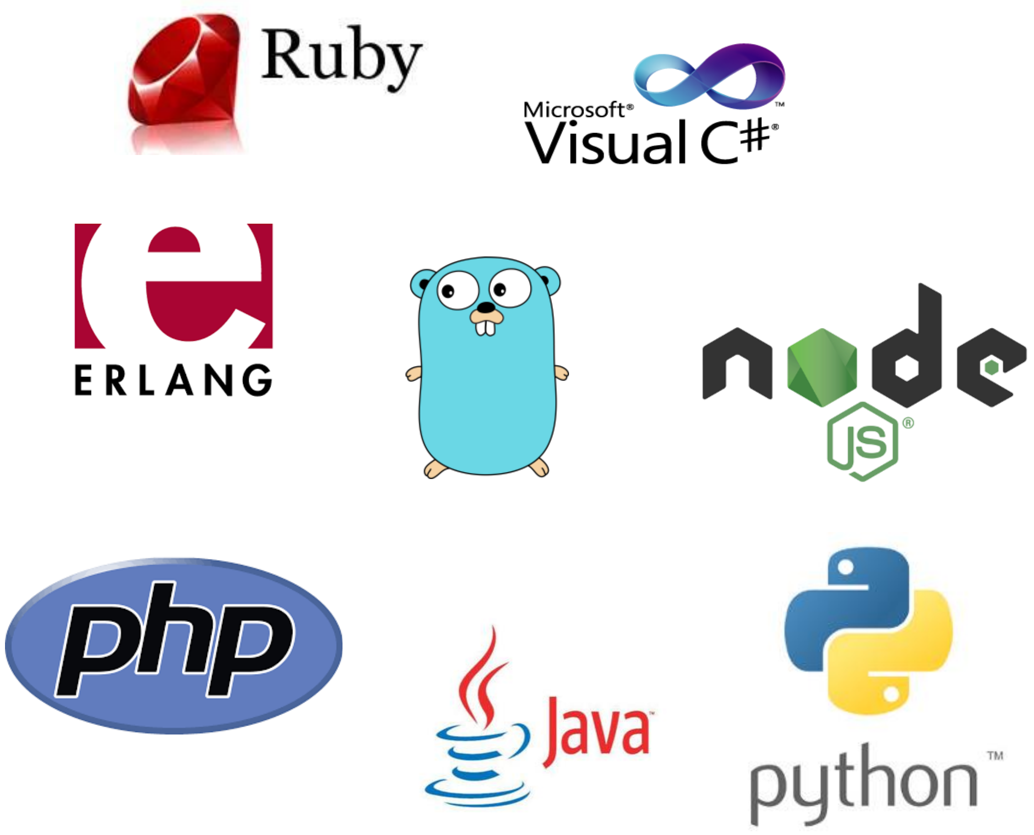


FEATURES OF RIAK KV

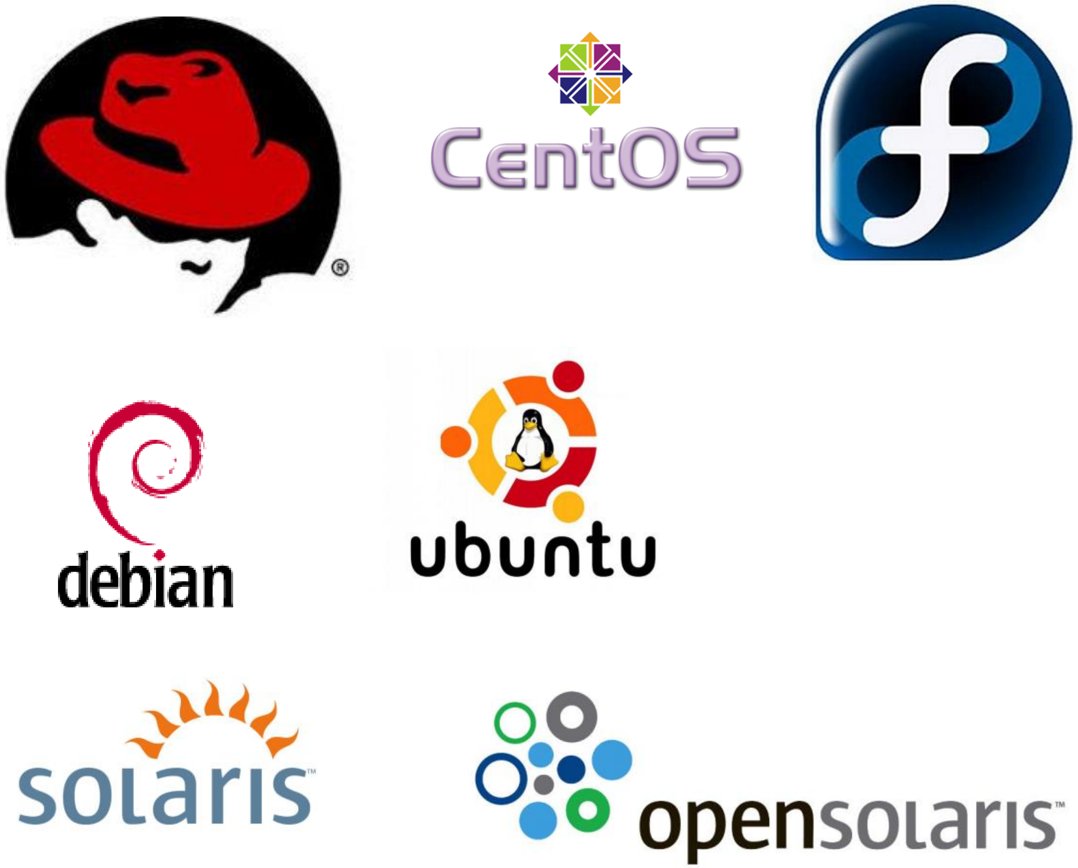
- Intelligent Replication
- Complex Query Support

SUPPORTED LANGUAGES AND PLATFORMS

Languages



Operating Systems



GOOD FITS FOR RIAK

- Immutable data
- Small objects
- Independent Objects
- Objects with Natural Keys
- Data Compatible with Riak Datatypes

NOT - SO GOOD FITS FOR RIAK

- Objects that exceed the size 1-2 MB

- Objects with complex interdependencies

WHY MOVE FROM RELATIONAL TO RIAK

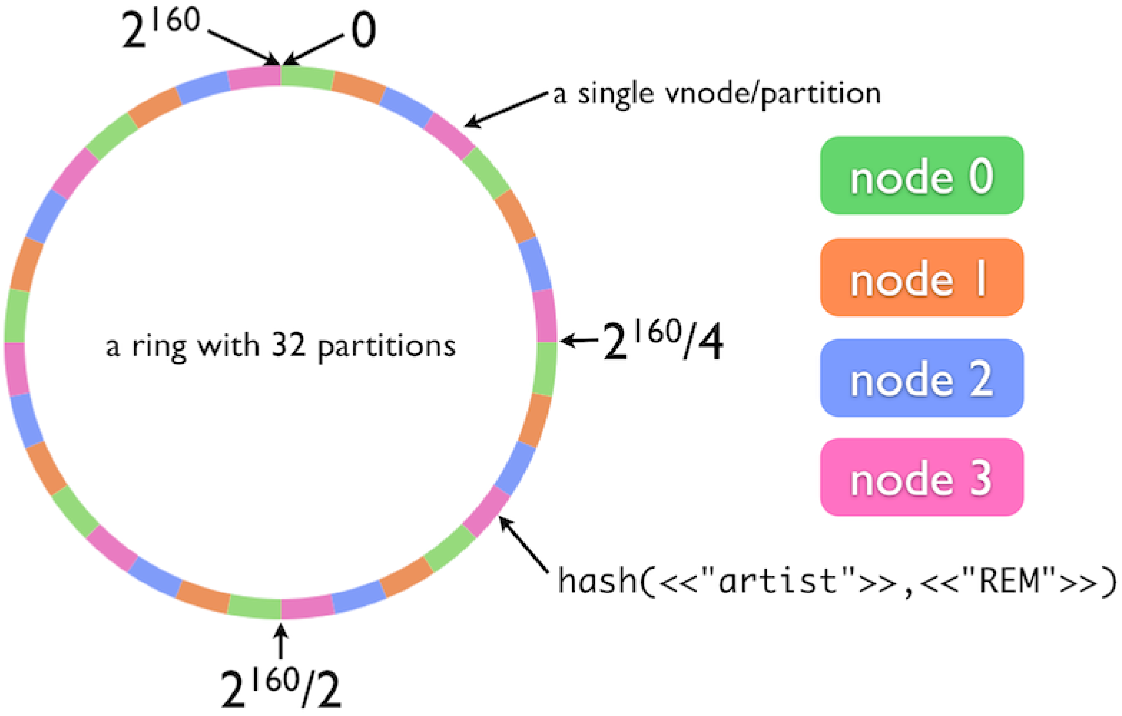
- High Availability

- Minimizing the cost of scale

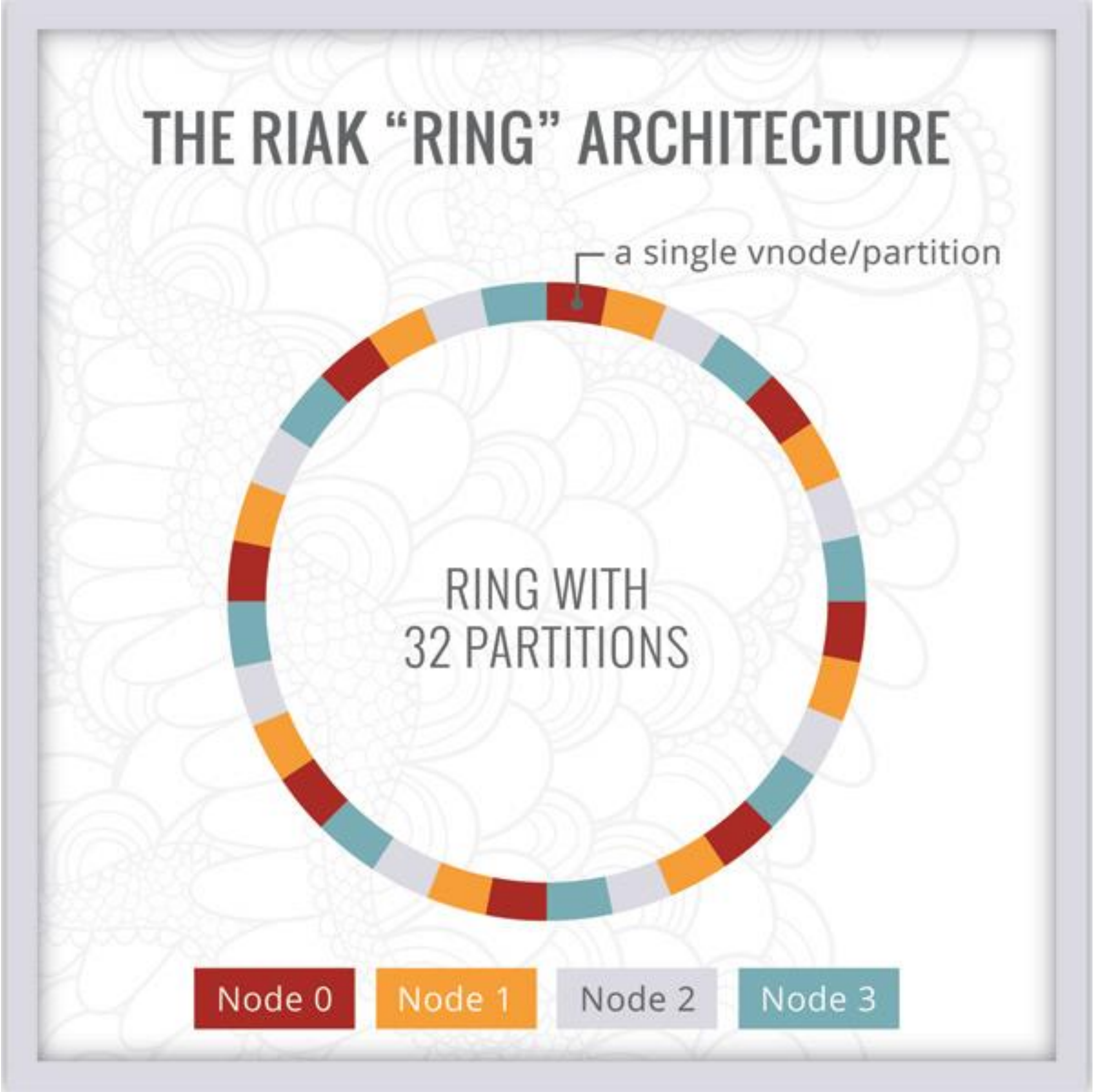
- Simple Data Models

- Multi Data center Operations

RIAK RING ARCHITECTURE



- Keys and Objects - basic elements of Riak.
- Interaction with Objects - using the Bucket and the Key.
- Internally the structure is a ring as shown.



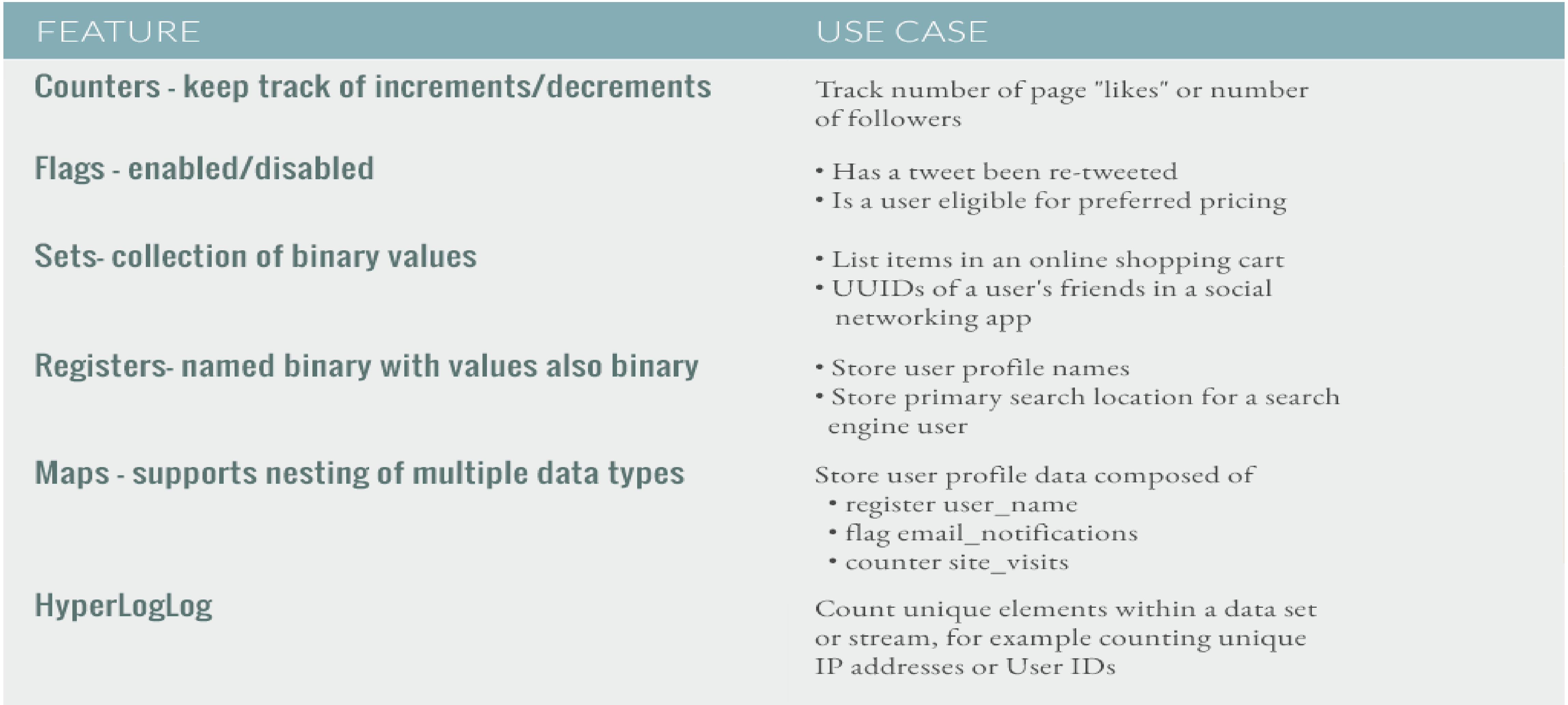
KEY TERMS IN THE RIAK RING

- Node
- Vnode
- Partition

FORMATION OF THE RING

- The method used is Consistent Hashing

technique used to limit the reshuffling of keys when a hash-table data structure is rebalanced.



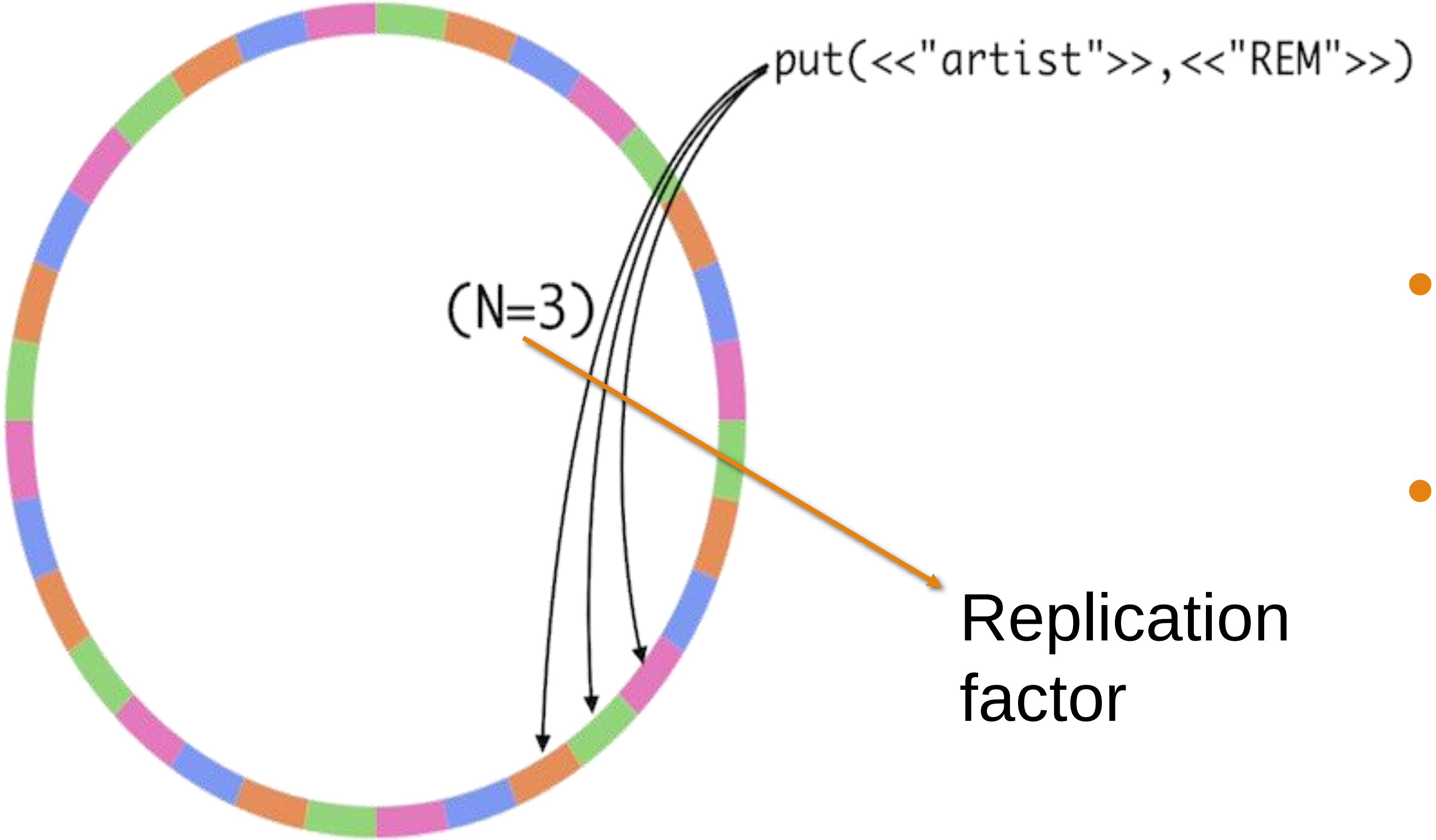
FEATURE	USE CASE
Counters - keep track of increments/decrements	Track number of page "likes" or number of followers
Flags - enabled/disabled	• Has a tweet been re-tweeted • Is a user eligible for preferred pricing
Sets- collection of binary values	• List items in an online shopping cart • UUIDs of a user's friends in a social networking app
Registers- named binary with values also binary	• Store user profile names • Store primary search location for a search engine user
Maps - supports nesting of multiple data types	Store user profile data composed of • register user_name • flag email_notifications • counter site_visits
HyperLogLog	Count unique elements within a data set or stream, for example counting unique IP addresses or User IDs

SPECIAL DATA TYPES IN RIAK

SPECIAL DATA TYPES IN RIAK

- These data types are eventually convergent replicated data types (CRDTs)

- The advantage is Automatic Conflict Resolution



Replication factor

ACHIEVING AVAILABILTIY

- **Intelligent Replication** is used
- Another protocol that is used is the **Gossiping Protocol** – used to pass the ring state around the cluster.

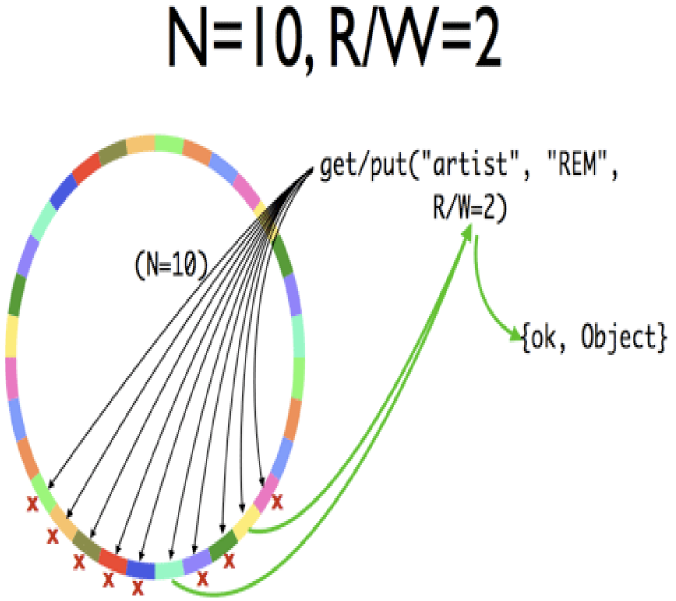
ACHIEVING EVENTUAL CONSISTENCY

- What is quorum?

- minimum number of parties that need to be successfully involved to consider an operation as whole.

- Default value of the quorum is 3

- Default quorum can be changed to user specified value



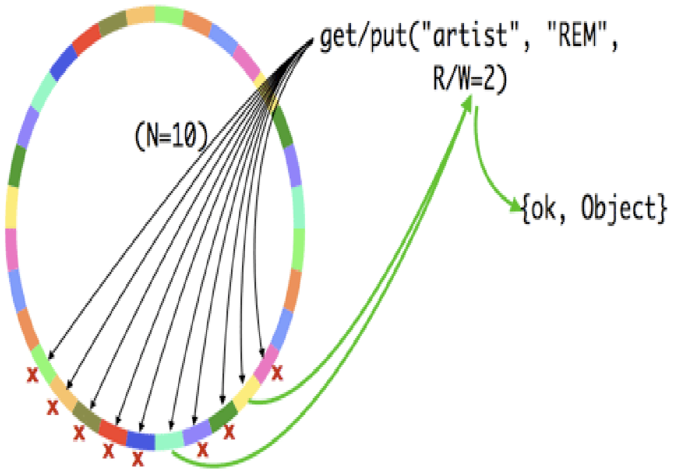
ACHIEVING EVENTUAL CONSISTENCY

- Writing with non - default value of quorum
  - change the parameter w

- Reading with non - default value of quorum
  - change the parameter r

- N > (r + w) = always consistent data

N=10, R/W=2



TALKING WITH RIAK

- HTTP API

  - Uses curl to interact

  - Operations specific to different elements

- PROTOCOL BUFFERS API

  - Riak listens to TCP port 8087 by default

  - On establishing connection – communication starts

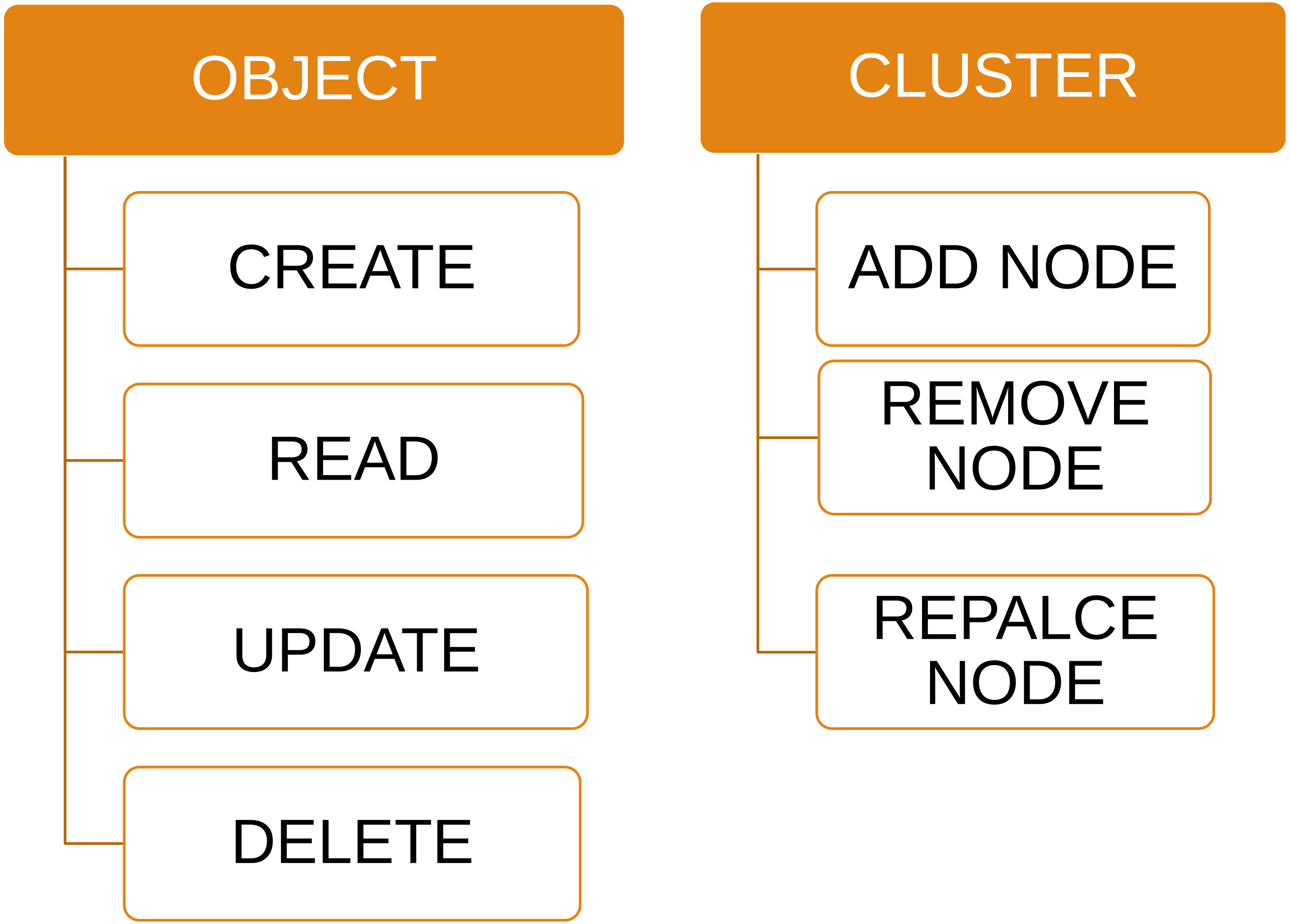
  - Operations specific to different elements

TALKING WITH RIAK

COMPARING HTTP AND PROTOCOL BUFFERS

HTTP	PROTOCOL BUFFERS
Higher data load	Lesser data load
Slower	Faster
Feature rich	Feature deficient

OPERATIONS IN RIAK KV



OBJECT

CREATE

READ

UPDATE

DELETE

CLUSTER

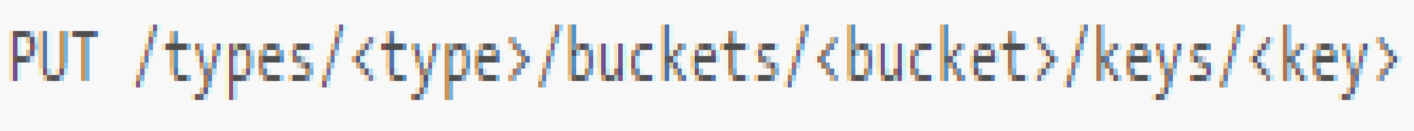
ADD NODE

REMOVE NODE

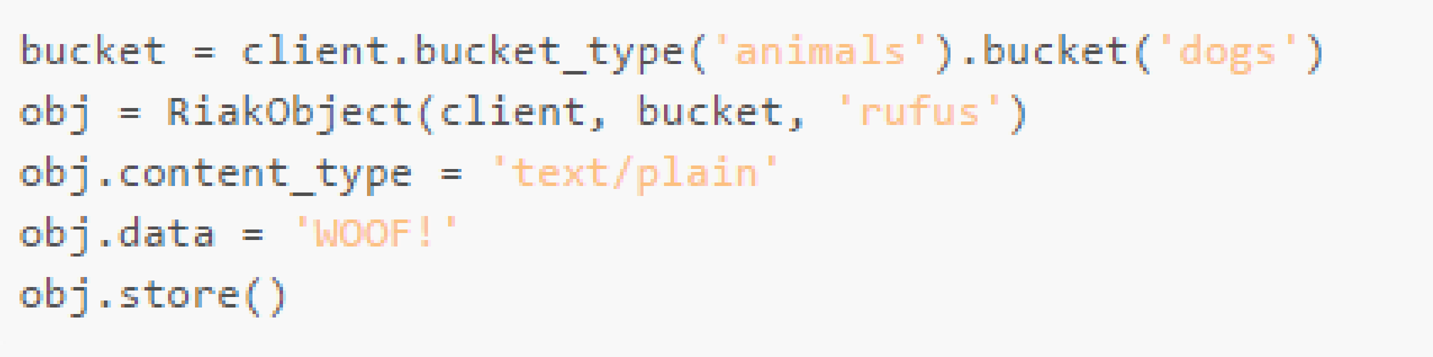
REPALCE NODE

OPERATIONS IN RIAK

- CREATE OBJECT



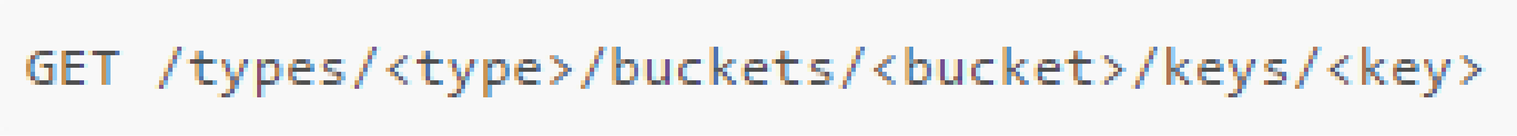
```
PUT /types/<type>/buckets/<bucket>/keys/<key>
```



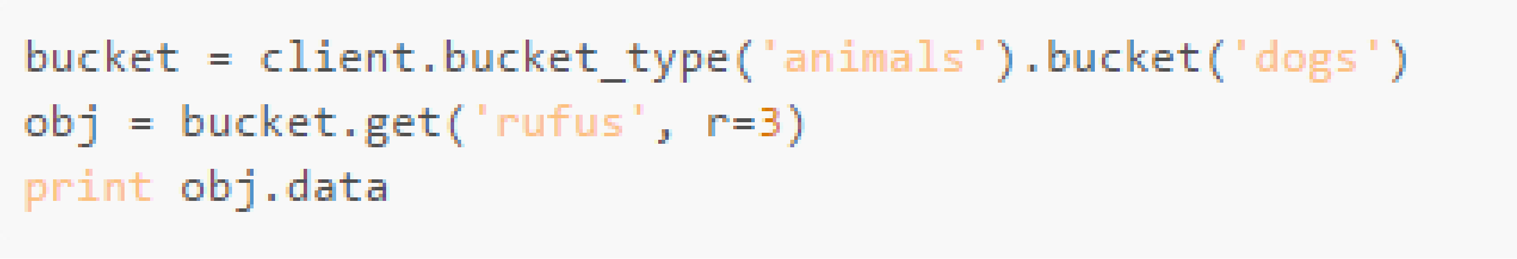
```
bucket = client.bucket_type('animals').bucket('dogs')
obj = RiakObject(client, bucket, 'rufus')
obj.content_type = 'text/plain'
obj.data = 'WOOF!'
obj.store()
```

OPERATIONS IN RIAK

- READ OBJECT



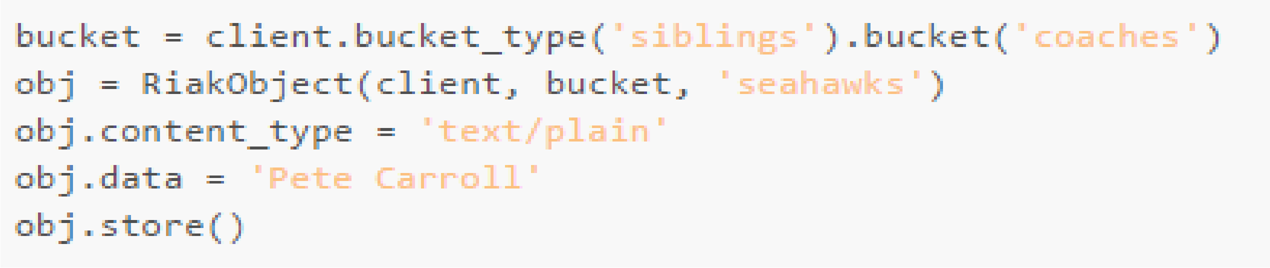
```
GET /types/<type>/buckets/<bucket>/keys/<key>
```



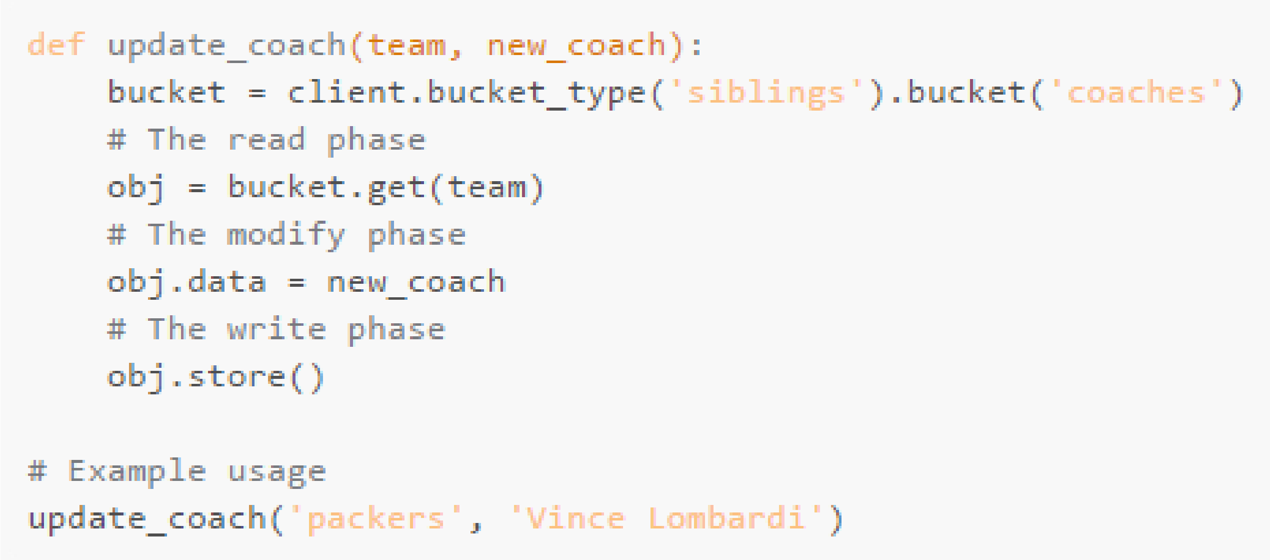
```
bucket = client.bucket_type('animals').bucket('dogs')
obj = bucket.get('rufus', r=3)
print obj.data
```

OPERATIONS IN RIAK

- UPDATE OBJECT



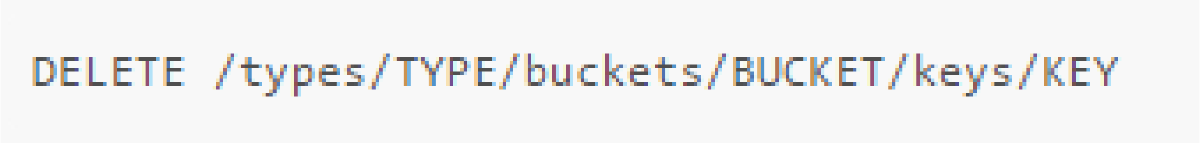
```
bucket = client.bucket_type('siblings').bucket('coaches')
obj = RiakObject(client, bucket, 'seahawks')
obj.content_type = 'text/plain'
obj.data = 'Pete Carroll'
obj.store()
```



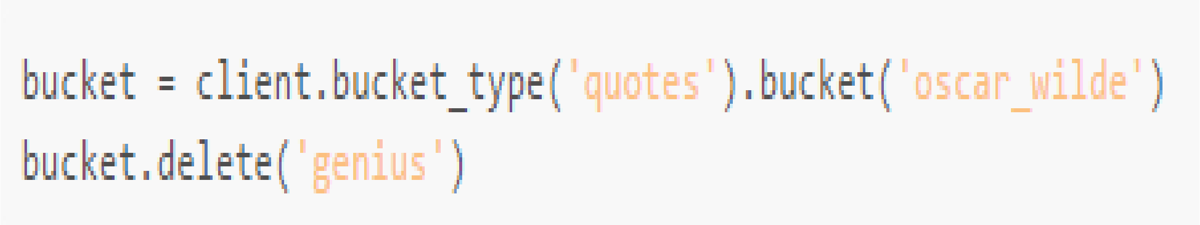
```
def update_coach(team, new_coach):
    bucket = client.bucket_type('siblings').bucket('coaches')
    # The read phase
    obj = bucket.get(team)
    # The modify phase
    obj.data = new_coach
    # The write phase
    obj.store()

# Example usage
update_coach('packers', 'Vince Lombardi')
```

OPERATIONS IN RIAK

- DELETE OBJECT



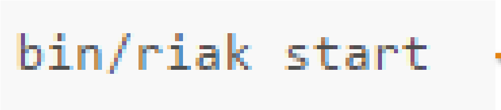
```
DELETE /types/TYPE/buckets/BUCKET/keys/KEY
```



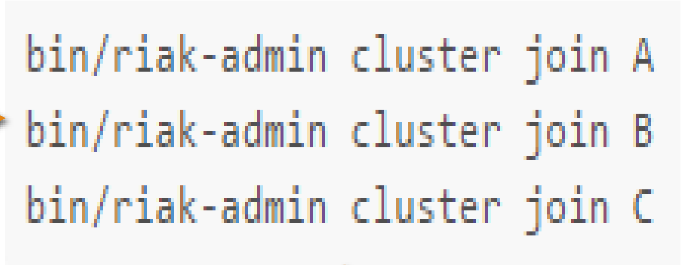
```
bucket = client.bucket_type('quotes').bucket('oscar_wilde')
bucket.delete('genius')
```

OPERATIONS IN RIAK

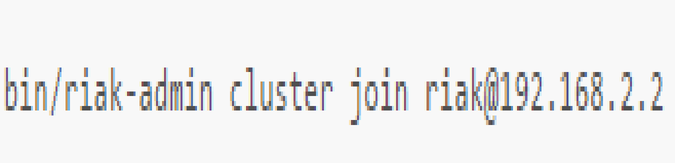
- ADDING A NODE



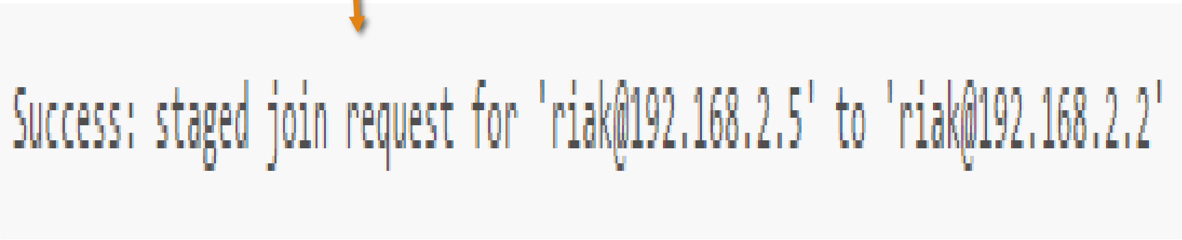
```
bin/riak start
```



```
bin/riak-admin cluster join A
bin/riak-admin cluster join B
bin/riak-admin cluster join C
```



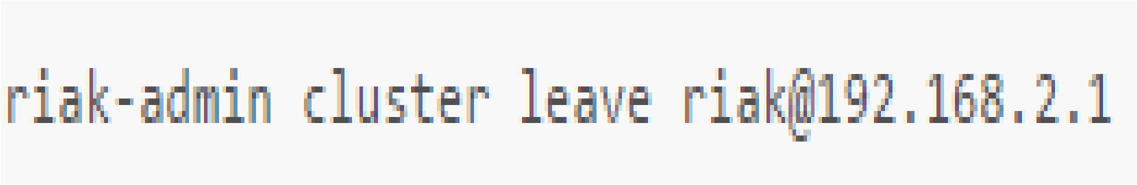
```
bin/riak-admin cluster join riak@192.168.2.2
```



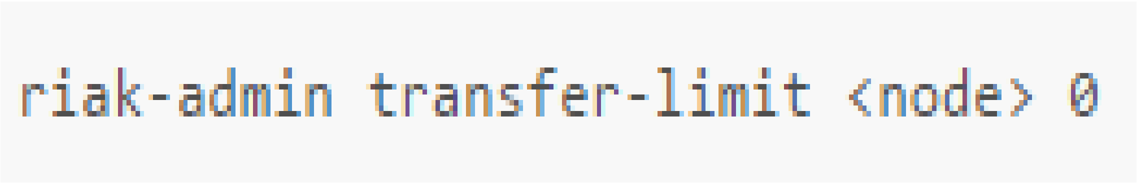
```
Success: staged join request for 'riak@192.168.2.5' to 'riak@192.168.2.2'
```

OPERATIONS IN RIAK

- REMOVING A NODE



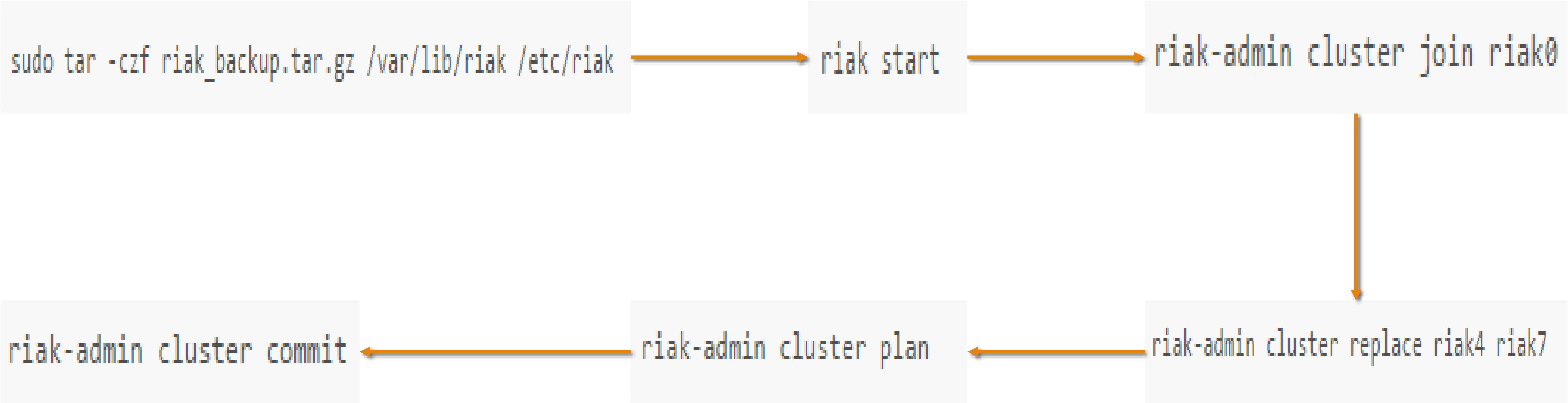
```
riak-admin cluster leave riak@192.168.2.1
```



```
riak-admin transfer-limit <node> 0
```

OPERATIONS IN RIAK

- REPLACING A NODE



```
sudo tar -czf riak_backup.tar.gz /var/lib/riak /etc/riak
```

```
riak start
```

```
riak-admin cluster join riak0
```

```
riak-admin cluster replace riak4 riak7
```

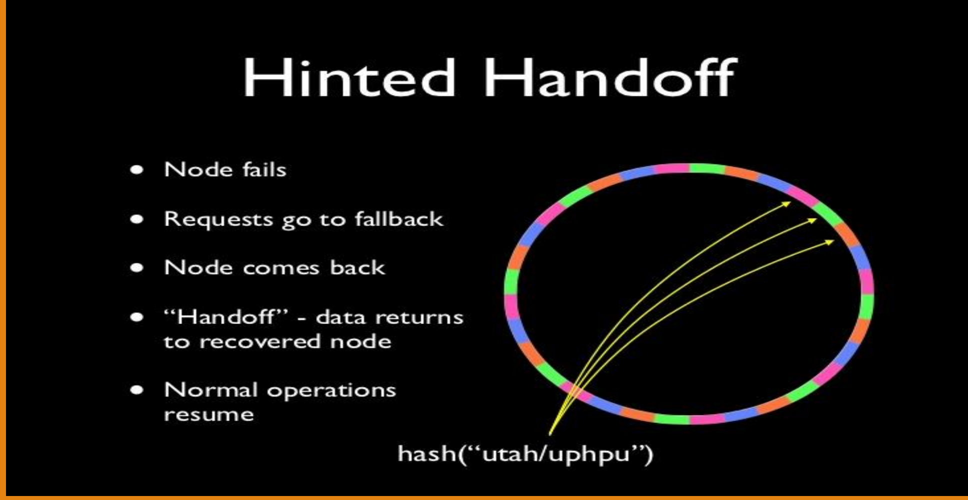
```
riak-admin cluster plan
```

```
riak-admin cluster commit
```

RECOVERY MECHANISMS

- Node Failure
  - Hinted Handoff

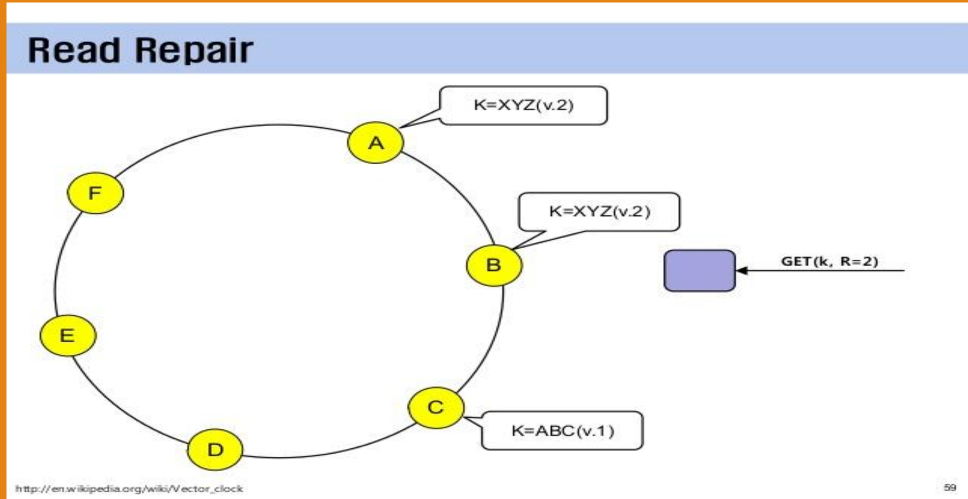
- Data Integrity Failure
  - Read repair
  - Active Anti-Entropy



Hinted Handoff

- Node fails
- Requests go to fallback
- Node comes back
- "Handoff" - data returns to recovered node
- Normal operations resume

DOTTED VERSION VECTORS (DVVS)



Read Repair

http://en.wikipedia.org/wiki/Vector_clock

CONFLICT RESOLUTION STRATEGIES

- The type of strategy depends on the context of the conflict

- 2 contexts – casual and concurrent

- Casual Context - the difference of two versions of the same variable can be identified easily.

- Concurrent Context – the difference of the two versions of the same variable cannot be identified easily.

CONFLICT RESOLUTION STRATEGIES

- In case of casual context, the strategy is the **Dotted Version Vectors (DVV)** or the **Vector Clocks**
- DVV is also used for ordering the events in the distributed systems
- A vector clock is an algorithm for generating a partial ordering of events in a distributed system
- Main difference is that DVV can identify the value for each update, VC cannot do the same.

CONFLICT RESOLUTION STRATEGIES

- In case of concurrent context, the strategy is to create **Siblings** or resolve using the **Timestamps**

- In timestamp strategy, the value with the latest timestamp is used to resolve the conflict.

- In sibling strategy, siblings are created for each concurrent update, which need to be handled by the client logic.

USE CASES & REAL TIME APPLICATIONS

SESSION DATA

ROVIO

Stores session data for gamers and players

comcast®

Manage customer data records, and store subscriber session information for mobile and web applications.

Virgin america

store passenger information and session data

USE CASES & REAL TIME APPLICATIONS

CONTENT & DOCUMENTS

bet 365

Stores betting information for all the customers.

NHS National Health Service

Used to help in delivering demographic and clinical information.

BEST BUY

Used as the core content store for the product catalog.

USE CASES AND REAL TIME APPLICATIONS

MESSAGING & CHAT

LEAGUE of LEGENDS

Used to provide worldwide in game chat for millions of people

Internal messaging for employees and customers.

yammer

The Enterprise Social Network

Notification and alert systems.

PRESENT SCOPE OF RIAK KV

TO RIAK, OR NOT TO RIAK… THIS IS THE QUESTION

- What type of the data you have?
  - Requires distributed database?
  - Can it be managed as key and values?

- Is downtime unacceptable?

- Can the data be modelled as one of the data types or can be stored using these datatypes?

SOURCES

- http://basho.com/products/riak-kv/
- https://images.google.com/
- http://wikipedia.org
- https://github.com
- Riak Handbook : A Hands-on guide by Mathias Meyer

thank you
gracias
merci
danke
obrigado
bedankt
dziękuję
teşekkür ederim
go raibh maith agat
mochchakkeram
sukriya
kop khun krap
terima kasih
ngiyabonga
謝謝
tapadh leat
dank je
arigatô
dakujem
takk
grazie
taiku
sagolun
spasibo
спасибо
рахмат
Баярлалаа
faafetai lava
vinaka
спасибі
blagodaram
mersi
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welalin
tack
spas
misaotra
matondo
paldies
grazzi
mahalo
хвала
asante
manana
obrigada
tenki
murakoze
chokrane
mamnun
дякую
tau
djiere dieuf
sulpáy
akun dankon
aĉiū
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mauruuru
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감사합니다
তোমাকে ধন্যবাদ