INTRODUCTION TO BIGCOUCH

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INTRODUCTIONS

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BIGCOUCH

PUTTING THE "C" BACK IN COUCHDB

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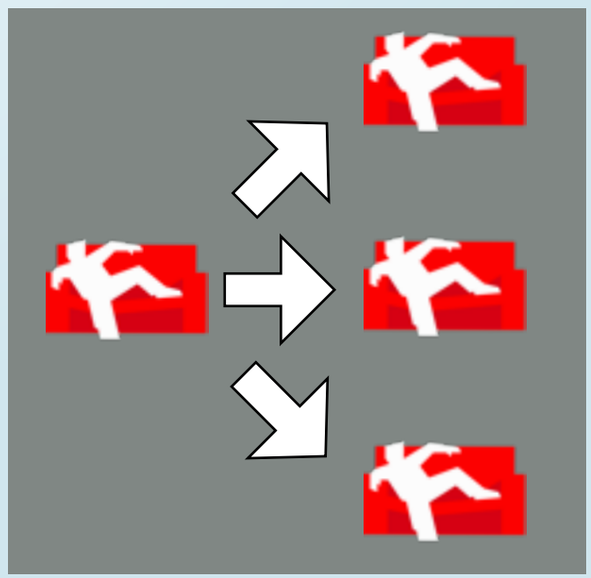
WHAT WE TALK ABOUT WHEN WE TALK ABOUT SCALING

- **Horizontal scaling: more servers creates more capacity**
- **Transparent to the application: adding more capacity should not affect the business logic of the application.**
- **No single point of failure.**

Pseudo Scalars



http://adam.heroku.com/past/2009/7/6/sql_databases_dont_scale/

BIGCOUCH = COUCH+SCALING

- **Horizontal Scalability**

  Easily add storage capacity by adding more servers

  Computing power (views, compaction, etc.) scales with more servers

- **No single point of failure (SPOF)**

  Any node can handle any request

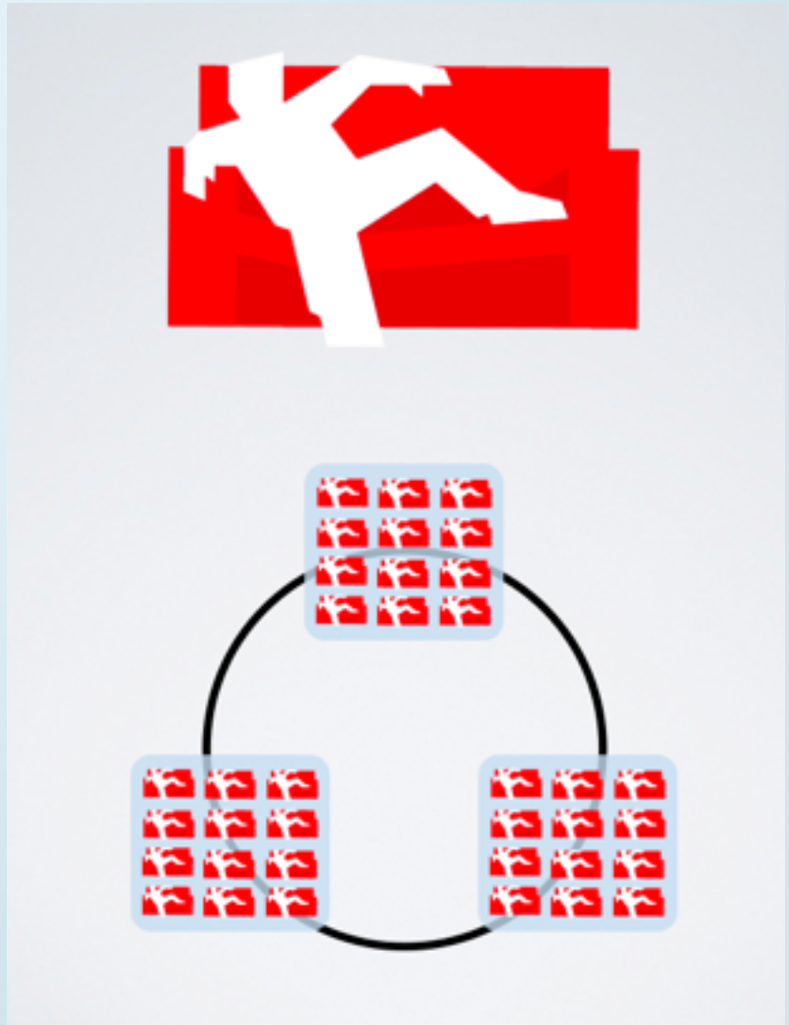
  With quorum, individual nodes can come and go

- **Transparent to the Application**

  All clustering operations take place “behind the curtain”

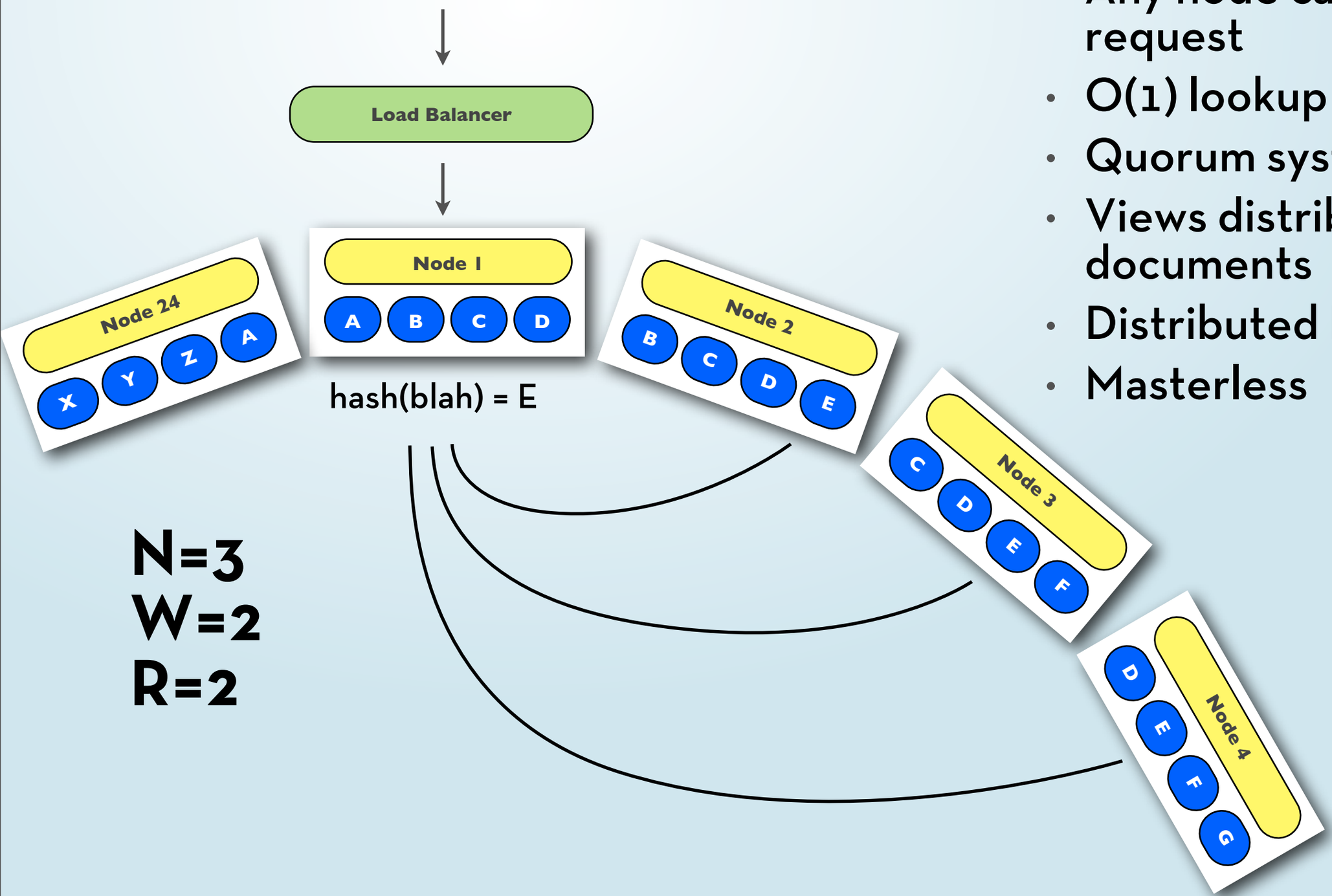
  ‘looks’ like a single server instance of Couch, just with more awesome

  asterisks and caveats discussed later



GRAPHICAL REPRESENTATION

PUT http://rnewson.cloudant.com/dbname/blah?w=2



N=3
W=2
R=2

- Clustering in a ring (a la Dynamo)
- Any node can handle a request
- O(1) lookup
- Quorum system (N, R, W)
- Views distributed like documents
- Distributed Erlang
- Masterless

BUILDING YOUR FIRST CLUSTER

- **Shopping List**

  Dependencies

  - Erlang (R13B03+)
  - ICU
  - Spidermonkey
  - LibCurl
  - OpenSSL
  - make
  - Python

```
brew install erlang icu4c spidermonkey
brew ln icu4c
```

```
git clone https://github.com/cloudant/bigcouch.git
cd bigcouch
./configure
make dev
```

BUILDING YOUR FIRST CLUSTER

`rel/dev1/bin/bigcouch`

`rel/dev2/bin/bigcouch`

`rel/dev3/bin/bigcouch`

dev1

dev2

dev3

Join the cluster

```
curl localhost:15986/nodes/dev2@127.0.0.1 -X PUT -d '{}'
curl localhost:15986/nodes/dev3@127.0.0.1 -X PUT -d '{}'
```

... and verify

```
curl http://localhost:15984/_membership
```

QUORUM: IT'S YOUR FRIEND

- **BigCouch Clusters are governed by 4 parameters**

  Q: Number of shards per DB

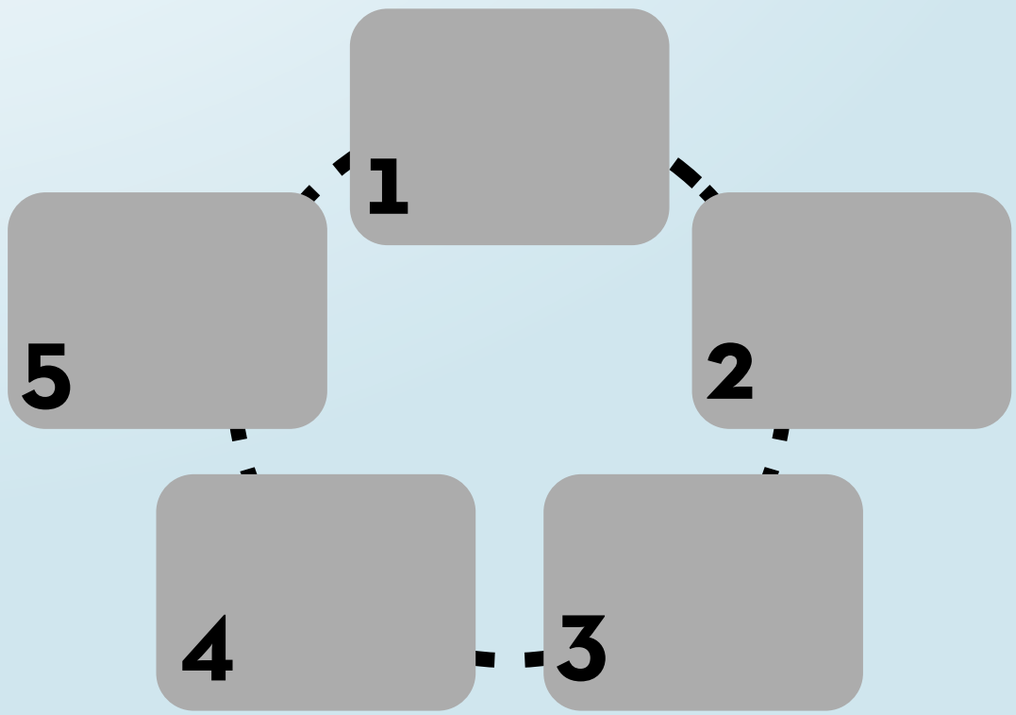
  N: Number of redundant copies of each document

  R: Read quorum constant

  W: Write quorum constant

  (NB: Also consider the number of nodes in a cluster)

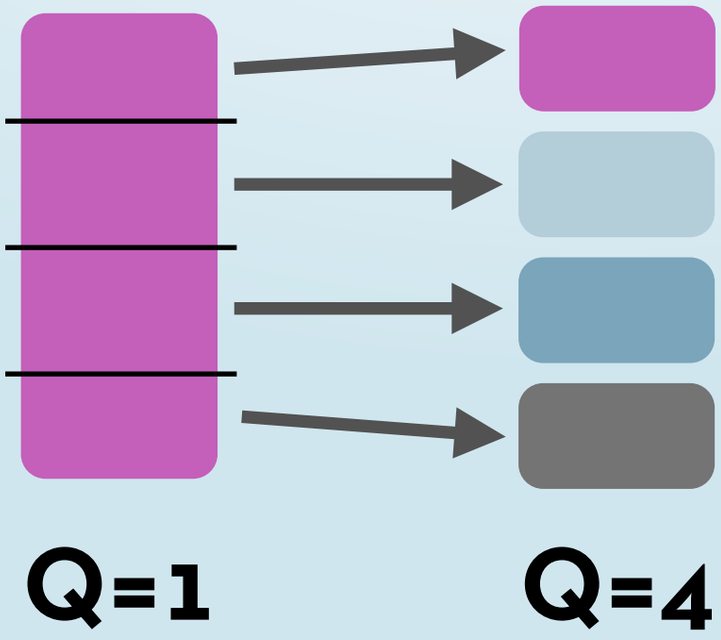
For the next few examples, consider a 5 node cluster

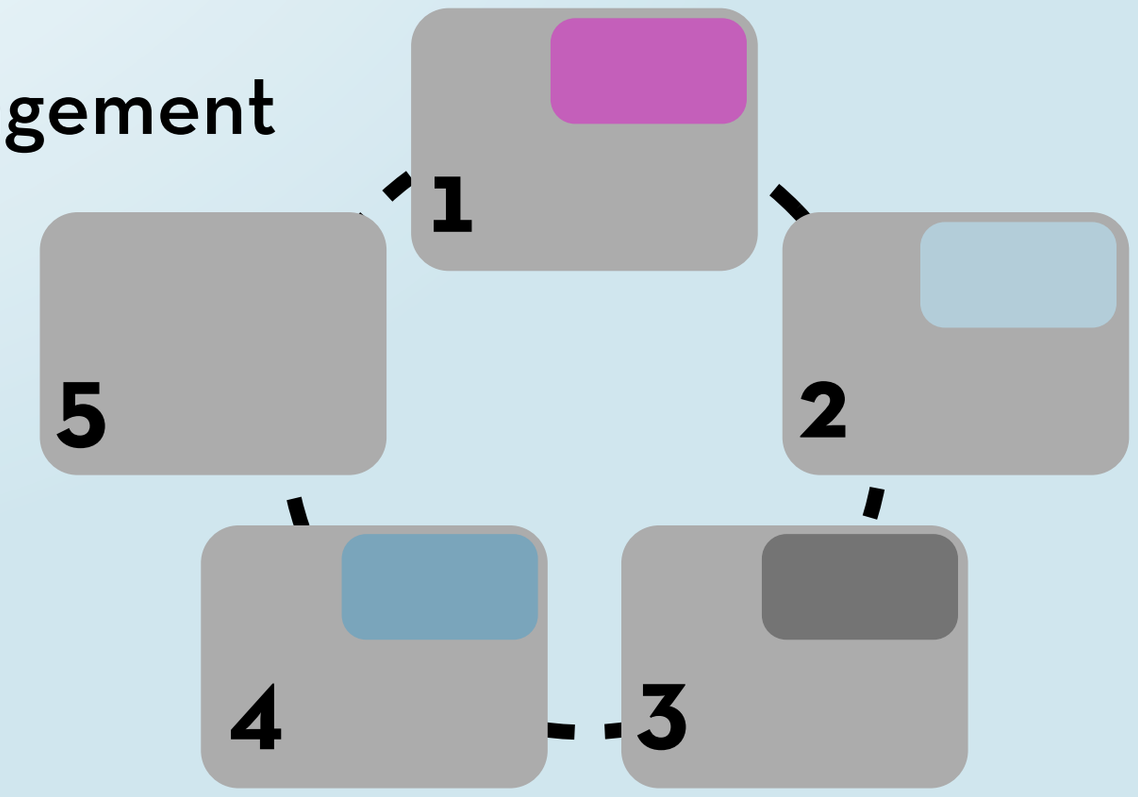


Q

- **Q: The number of shards over which a DB will be spread**

  consistent hashing space divided into Q pieces
  Specified at DB creation time
  possible for more than one shard to live on a node
  Documents deterministically mapped to a shard
  More shards = faster view builds
  Less shards = better memory management





N

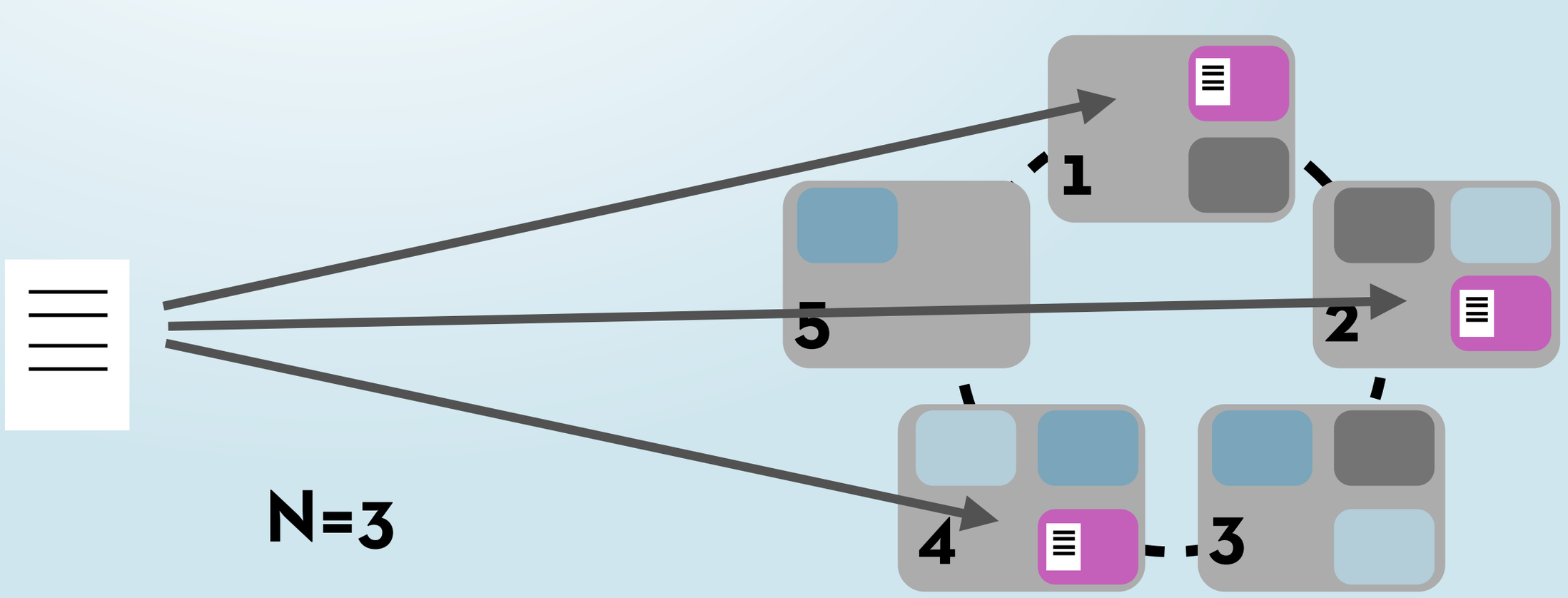
- **N: The number of redundant copies of each document**

  Choose N>1 for fault-tolerant cluster

  Default specified at DB creation

  Each shard is copied N times

  Recommend N>2



W

- **W: The number of document copies that must be saved before a document is “written”**

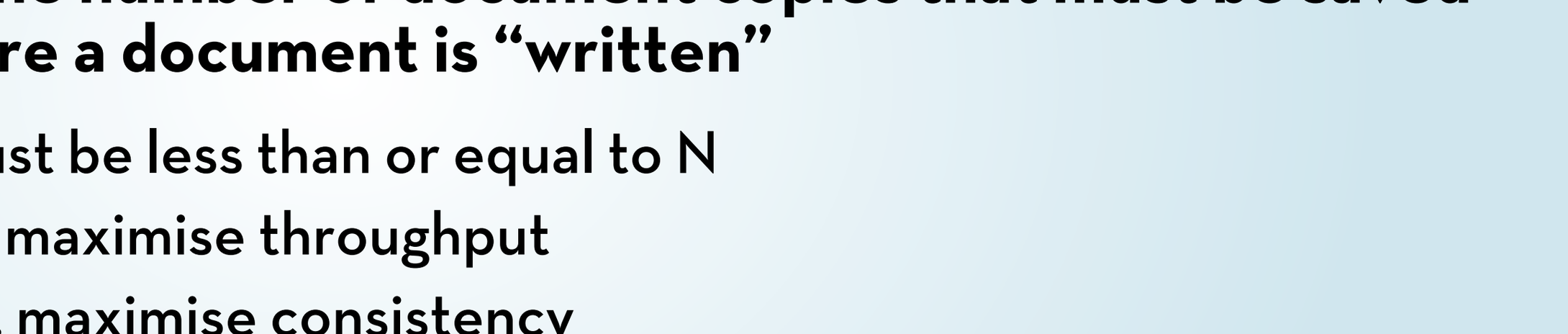
  W must be less than or equal to N

  W=1, maximise throughput

  W=N, maximise consistency

  Allow for “202” created response

  Can be specified at write time



R

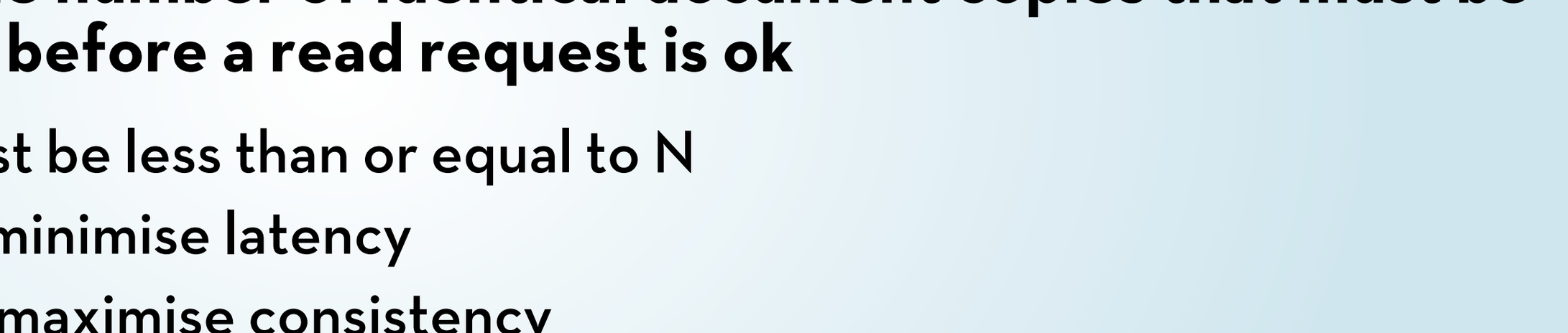
- **R: The number of identical document copies that must be read before a read request is ok**

  R must be less than or equal to N

  R=1, minimise latency

  R=N, maximise consistency

  Can be specified at query time



Views

- **So far, so good, but what about secondary indexes?**

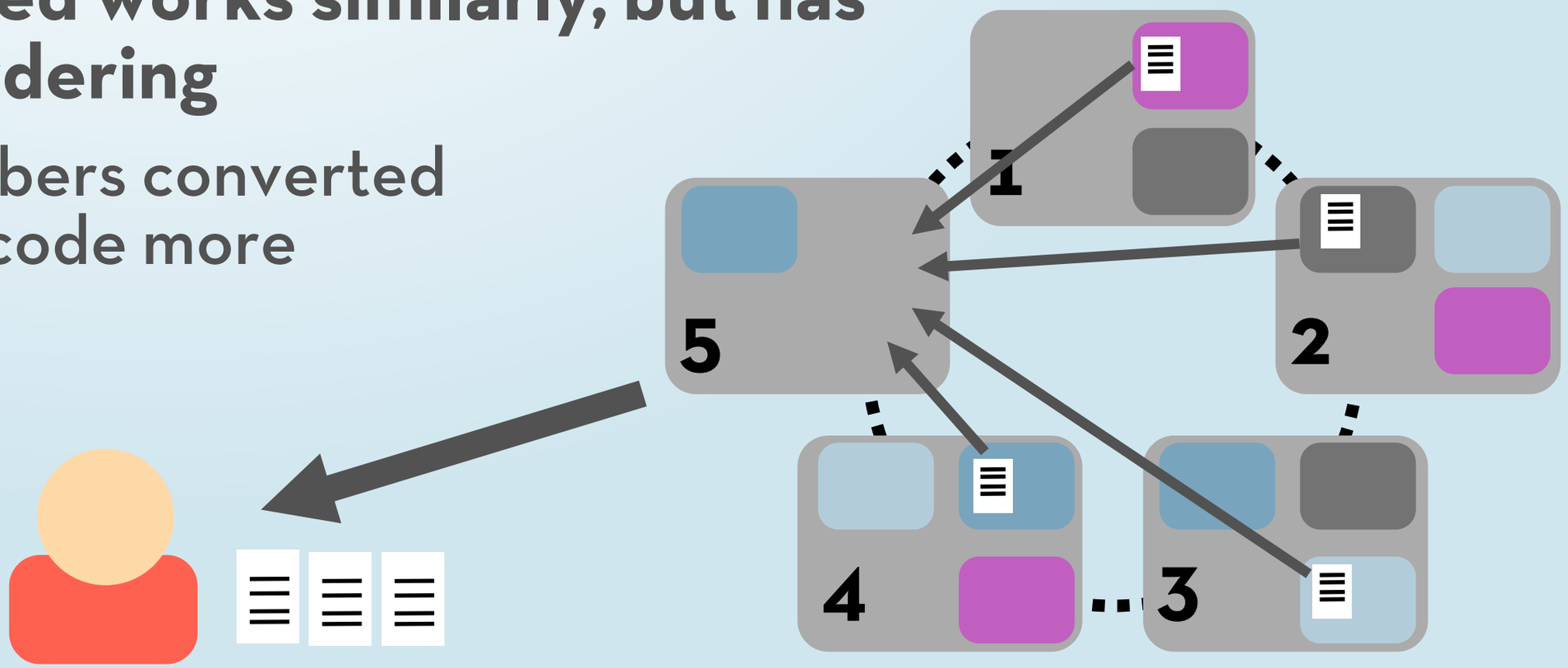
Views are built locally on each node, for each DB shard

Merge sort at query time using exactly one copy of each shard

Run a final re-reduce on each row if the view has a reduce

- **_changes feed works similarly, but has no global ordering**

Sequence numbers converted to JSON to encode more information



API AND CAVEATS

- **Clustered API**

  By default listens on port 5984

  All single-doc operations and most view operations

- **What's Different?**

  update_seq value is now opaque JSON

  rereduce=true always called on reduce views

  no temporary views

  no all_or_nothing: true

- **'Backdoor' Access**

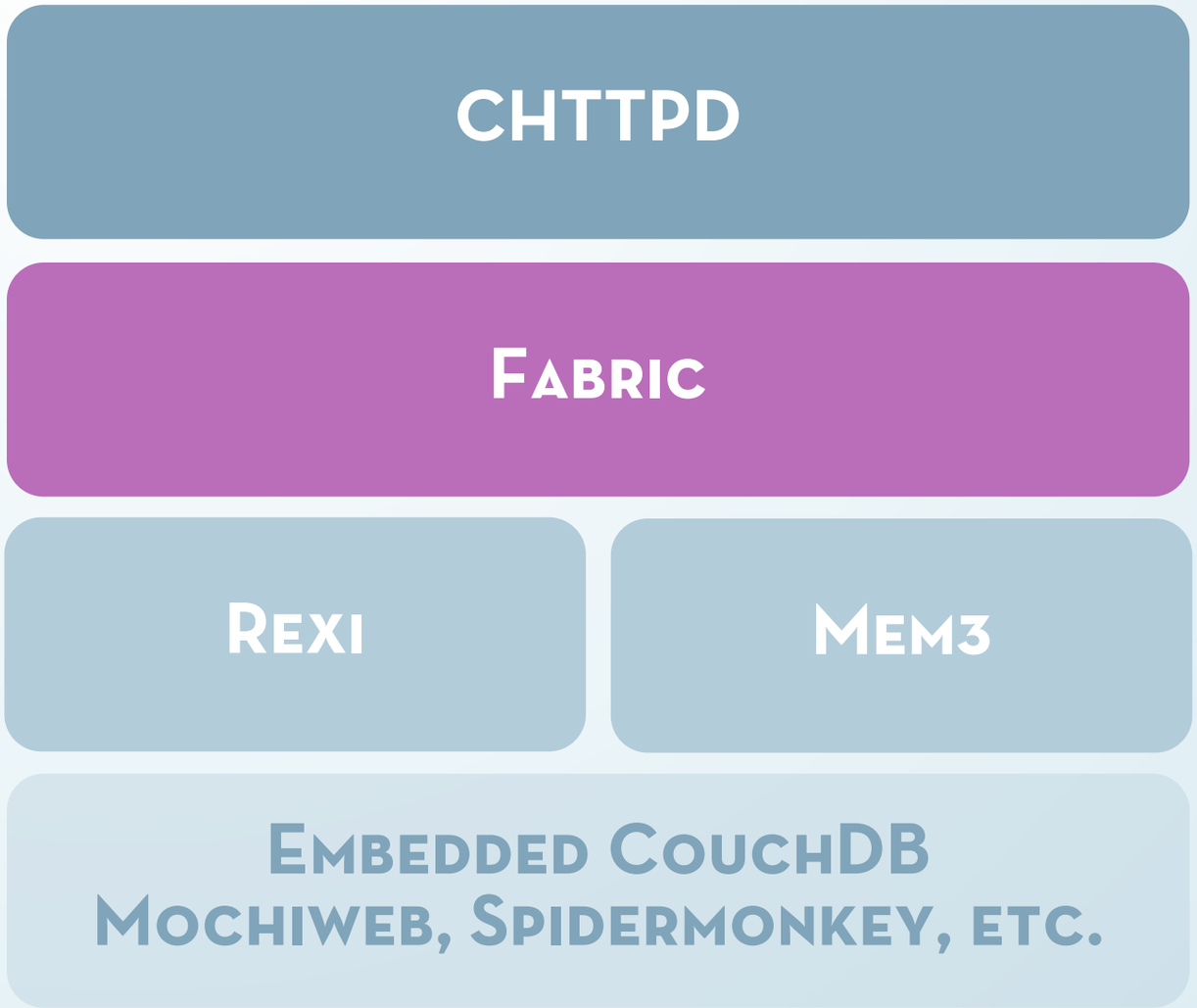
  Able to reach a single node (i.e. at the shard level)

  By default listens on port 5986

  Allows you to trigger local view updates, compactions, etc.

Hacker Portion

The BigCouch Stack



CHTTPD / FABRIC

- **Chttpd**

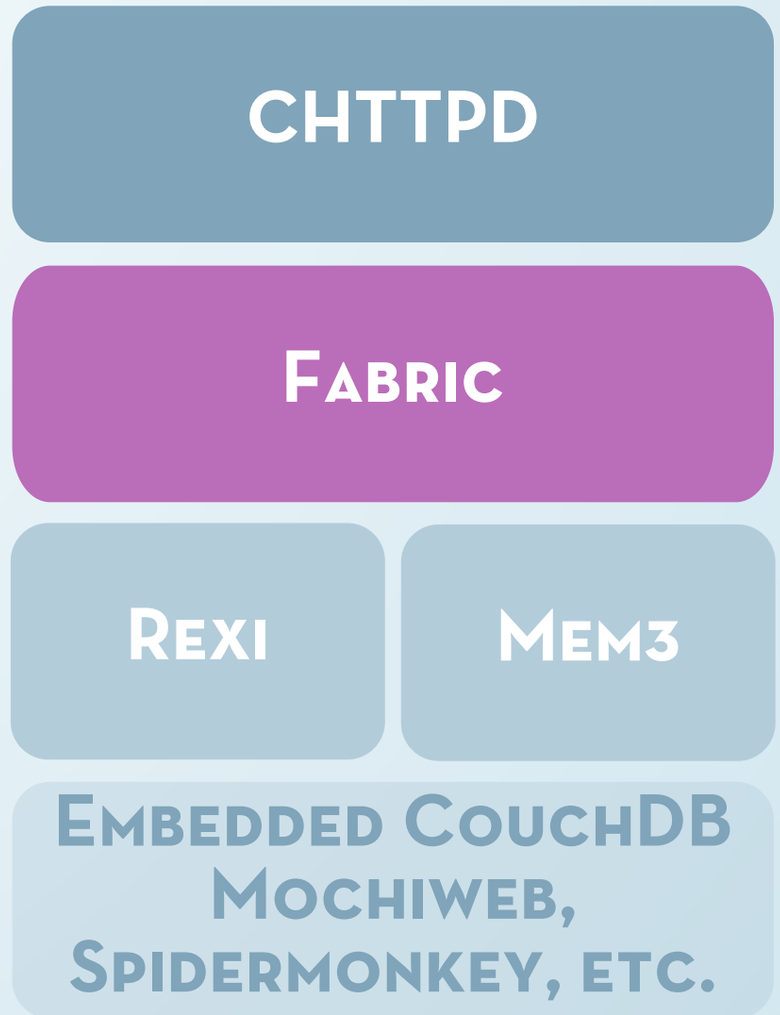
Cut-n-paste of couch_httpd, but using fabric for all data access

- **Fabric**

OTP library application (no processes) responsible for clustered versions of CouchDB core API calls

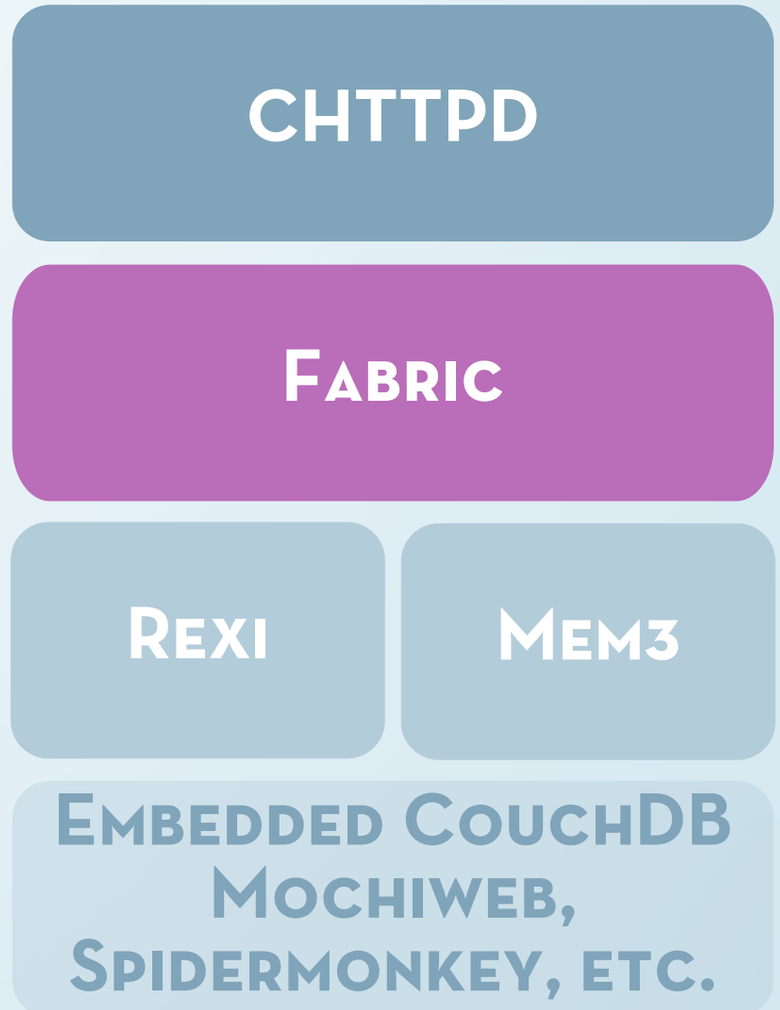
Quorum logic, view merging, etc.

Provides a clean Erlang interface to BigCouch



Mem3

- Maintains the shard mapping for each clustered database in a node-local CouchDB database
- Changes in the node registration and shard mapping databases are automatically replicated to all cluster nodes



Rexi

- **BigCouch makes a large number of parallel RPCs**
- **Erlang RPC library not designed for heavy parallelism**

promiscuous spawning of processes

responses directed back through single process on remote node

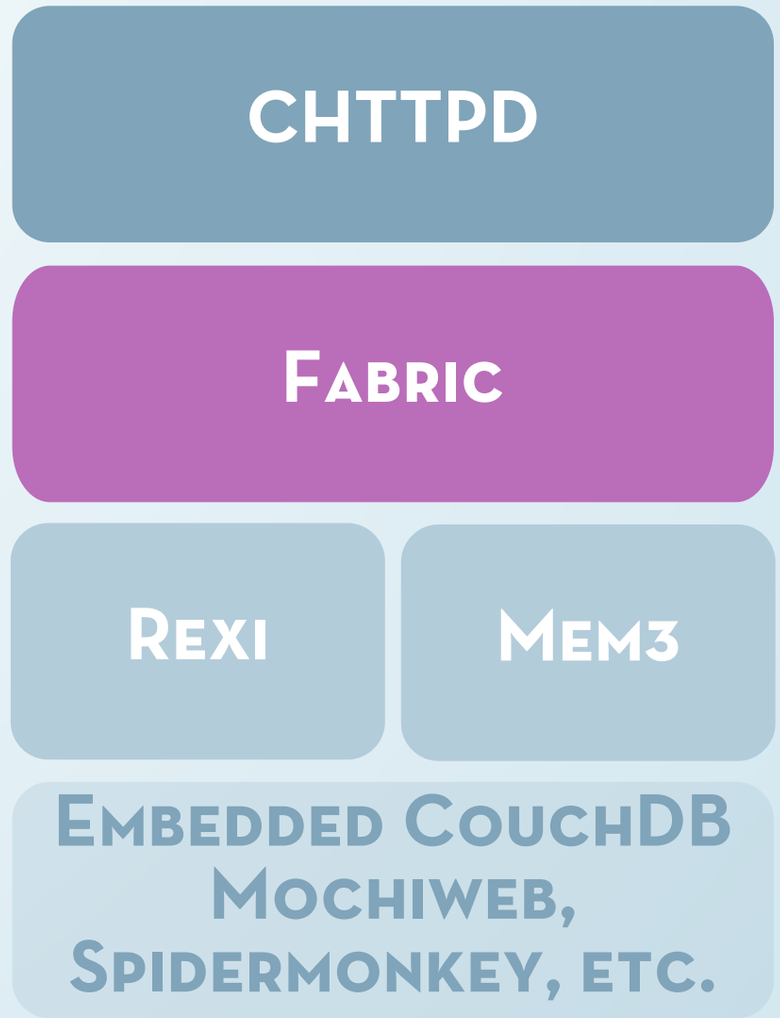
requests block until remote 'rex' process is monitored

- **Rexi removes some of the safeguards in exchange for lower latencies**

no middlemen on the local node

remote process responds directly to client

remote process monitoring occurs out-of-band



FUTURE

BIGCOUCH HAS NO FUTURE

THE FUTURE IS COUCHDB

WE'RE MERGING

THE MERGE

- Release BigCouch 0.5.0
- Release Apache CouchDB 1.3.0
- Merge them
- Release Apache CouchDB 2.0.0 (couchdb strikes back)

SUMMARY

- **BigCouch: putting the 'C' back in CouchDB**
- **Consistent hashing for database sharding (a la Dynamo)**
- **True horizontal scalability with CouchDB**
- **Download now and get started**

  https://github.com/cloudant/bigcouch.git