CouchDB

an introduction

Play Along

http://www.couchone.com/get
https://cloudant.com/

http://www.couchone.com/get

http://guide.couchdb.org/
http://wiki.apache.org/couchdb/

http://www.couchone.com/get

- NoSQL
- JSON Documents
- HTTP RESTful API
- Incremental Map/Reduce
- Durable, Crash-Only Design

http://www.couchone.com/get

- Erlang

- Replication / Conflict Resolution

- Data stored in B+Tree

- Single file for each database

- Database is never locked

- Writes are serialized

Futon

http://127.0.0.1:5984/_utils

Basic API

```
        curl -X GET http://127.0.0.1:5984

200 OK

{
  "couchdb":"Welcome",
  "version":"1.0.0"
}
```

Database

```
          curl -X PUT http://127.0.0.1:5984/mydb

201 Created

{"ok":true}
```

```
      curl -X GET http://127.0.0.1:5984/mydb

200 OK

{
  "db_name":"mydb",
  "doc_count":0,
  "update_seq":0,
  "compact_running":false,
  ...
}
```

```
        curl -X DELETE http://127.0.0.1:5984/mydb

200 OK

{"ok":true}
```

```
        curl -X GET http://127.0.0.1:5984/mydb

404 Object Not Found

{
  "error":"not_found",
  "reason":"no_db_file"
}
```

Documents

```
    curl -X PUT http://127.0.0.1:5984/mydb/mydoc \
                  -d '{"yo":"dawg"}'

201 Created

{
  "ok":true,
  "id":"mydoc",
  "rev":"1-a737e531d8f096d1aa78d9e11704ae50"
}
```

```
    curl -X GET http://127.0.0.1:5984/mydb/mydoc

200 OK

{
  "_id":"mydoc",
  "_rev":"1-a737e531d8f096d1aa78d9e11704ae50",
  "yo":"dawg"
}
```

IDs
and
Revisions

IDs

- Every document has an ID that is unique for a database

- The ID must be a string

- You can use special characters, but you have to URL escape them

- The default document ID is a UUID

Revisions

- MVCC (Multi Version Concurrency Control)

- Documents aren't updated in place

- Instead a new revision is created

- Does not give you versioning of documents for free!

- Old revisions are removed on compaction

```
    curl -X PUT http://127.0.0.1:5984/mydb/mydoc \
            -d '{"hello":"world"}'

409 Conflict

{
  "error":"conflict",
  "reason":"Document update conflict."
}
```

```
curl -X PUT http://127.0.0.1:5984/mydb/mydoc \
-d '{"_rev":"1-a737e531d8f096d1aa78d9e11704ae50",
                "hello":"world"}'

201 Created

{
  "ok":true,
  "id":"mydoc",
  "rev":"2-2e6854228b269fcb5d1899e894773211"
}
```

```
    curl -X GET http://127.0.0.1:5984/mydb/mydoc

200 OK

{
  "_id":"mydoc",
  "_rev":"2-2e6854228b269fcb5d1899e894773211",
  "hello":"world"
}
```

```
curl -X DELETE http://127.0.0.1:5984/mydb/mydoc?
      rev=2-2e6854228b269fcb5d1899e894773211

200 OK

{
  "ok":true,
  "id":"mydoc",
  "rev":"3-bdf9cf79f24b1cef35633d57a167023f"
}
```

```
    curl -X GET http://127.0.0.1:5984/mydb/mydoc

404 Object Not Found

{
  "error":"not_found",
  "reason":"deleted"
}
```

Attachments

```
        curl -H 'Content-Type: image/png' \
               -T image.png -X PUT \
 http://127.0.0.1:5984/mydb/mydoc/gnu.png?rev=1-15a4

201 Created

{
  "ok":true,
  "id":"mydoc",
  "rev":"2-1822fe627f299844df7412e254364b7b"
}
```

```
      curl -X GET http://127.0.0.1:5984/mydb/mydoc

200 OK

{
  "_id":"mydoc","_rev":"2-1822","hello":"world",
  "_attachments":{
    "gnu.png":{
      "content_type":"image/png",
      "revpos":2,
      "length":63573,
      "stub":true
    }
  }
}
```

curl -X GET -O \
http://127.0.0.1:5984/mydb/mydoc/gnu.png

200 OK

Views

Map/Reduce

Map

Map Function

```
function(doc) {
  emit(doc._id, doc);
}
```

Map Function

- Incremental

- Runs in isolation

- emit(key, value)

- Can call emit 0 to N times

- Results are ordered by key

- Key can be simple (number, string) or complex (array or hash)

- Value can be null, a number, string, array or hash (it is just another document)

Reduce

Reduce Function

```
function(key, values, rereduce) {
  var sum = 0;
  for (var i = 0; i < values.length; i++) {
    sum += values[i];
  }
  return sum;
}
```

Reduce Function

- Optional

- Aggregates the values emitted by Map

- Must be commutative

- $(a + b) = (b + a)$

- Must be associative

- $a + (b + c) = (a + b) + c$

- rereduce - Will be true if values being passed in are the results of a previous reduction

Design Documents

Design Documents

- System document that defines application logic

- The ID begins with _design/

```
curl -X GET http://127.0.0.1:5984/mydb/_design/myapp

200 OK

{
 "_id": "_design/myapp",
 "_rev": "1-2732c3d854ac67ec8717227134705623",
 "language": "javascript",
 "views": {
    "myview": {
      "map": "function(doc) { ... }",
      "reduce": "function(key, val, rered) { ... }"
    }
  }
}
```

```
{
  "_id": "Receipt-1",
  "_rev": "1-827",
  "created_on": "2010-09-07",
  "total": 1
}

{
  "_id": "Receipt-2",
  "_rev": "1-b2a",
  "created_on": "2010-09-01",
  "total": 2
}

{
  "_id": "Receipt-3",
  "_rev": "1-c92",
  "created_on": "2010-09-01",
  "total": 3
}

{
  "_id": "Receipt-4",
  "_rev": "1-9ff",
  "created_on": "2010-08-31",
  "total": 4
}
```

```
"views": {
  "myview": {
    "map": "function(doc) {
      emit(doc.created_on.split("-"), doc.total);
    }"
  }
}
```

curl -X GET http://127.0.0.1:5984/mydb/_design/
myapp/_view/myview

200 OK

```
{"total_rows":4, "offset":0, "rows":[
  {"id":"Receipt-4","key":["2010","08","15"],"value":4},
  {"id":"Receipt-3","key":["2010","09","01"],"value":3},
  {"id":"Receipt-2","key":["2010","09","01"],"value":2},
  {"id":"Receipt-1","key":["2010","09","07"],"value":1}
]}
```

```
curl -g -X GET 'http://127.0.0.1:5984/mydb/_design/
     myapp/_view/myview?key=["2010","09","01"]'

200 OK

{"total_rows":4, "offset":1, "rows":[
  {"id":"Receipt-3","key":["2010","09","01"],"value":3},
  {"id":"Receipt-2","key":["2010","09","01"],"value":2}
]}
```

```
curl -g -X GET 'http://127.0.0.1:5984/mydb/_design/
         myapp/_view/myview?startkey=["2010","09"]
                 &endkey=["2010","09",{}]'


200 OK


{"total_rows":4, "offset":1, "rows":[
  {"id":"Receipt-3","key":["2010","09","01"],"value":3},
  {"id":"Receipt-2","key":["2010","09","01"],"value":2},
  {"id":"Receipt-1","key":["2010","09","07"],"value":1}
]}
```

```
"views": {
 "myview": {
   "map": "function(doc) {
     emit(doc.created_on.split("-"), doc.total);
   }",
   "reduce": "_sum"
  }
}
```

```
curl -X GET http://127.0.0.1:5984/mydb/_design/
                 myapp/_view/myview
```

200 OK

```
{"rows":[
  {"key":null,"value":10}
]}
```

```
curl -X GET http://127.0.0.1:5984/mydb/_design/
              myapp/_view/myview?group=true

200 OK

{"rows":[
   {"key":["2010","08","15"],"value":4},
   {"key":["2010","09","01"],"value":5},
   {"key":["2010","09","07"],"value":1}
]}
```

```
curl -X GET http://127.0.0.1:5984/mydb/_design/
          myapp/_view/myview?group_level=2

200 OK

{"rows":[
  {"key":["2010","08"],"value":4},
  {"key":["2010","09"],"value":6}
]}
```

```
curl -X GET http://127.0.0.1:5984/mydb/_design/
          myapp/_view/myview?group_level=1

200 OK

{"rows":[
  {"key":["2010"],"value":10}
]}
```

View Query Options

- key

- startkey

- startkey_docid

- endkey

- endkey_docid

- limit

- stale

- descending

- skip

- group

- group_level

- reduce

- include_docs

- inclusive_end

Other Design Document Functions

- shows

- lists

- validate_doc_update

- filters

Indexers

Lucene
(full text search)

Geocouch
(geospatial queries)

Replication

```
curl -X POST http://127.0.0.1:5984/_replicate \
-d '{"source":"mydb","target":"http://me.com/mydb"}'

200 OK
```

```json
{"ok":true,
 "session_id":"bcc26cc1cbe708fc8f2d72c7cf831181",
 "source_last_seq":30,
 "history":[
  {"session_id":"bcc26cc1cbe708fc8f2d72c7cf831181",
   "start_time":"Tue, 28 Sep 2010 18:09:57 GMT",
   "end_time":"Tue, 28 Sep 2010 18:09:59 GMT",
   "start_last_seq":0,"end_last_seq":30,"recorded_seq":30,
   "missing_checked":0,"missing_found":6,
   "docs_read":7,"docs_written":6,"doc_write_failures":1
  }
 ]
}
```

Replication

- source and target can be local or remote

- {"continuous":true}

- If a conflict occurs during replication, a winner is deterministically chosen

- The loser is saved with the doc and can be accessed with ?conflicts=true

Replication Filters

```
{"filter":"myapp/myfilter"}

"filters": {
 "myfilter": {
   "function(doc, req) {
     if (doc.type == 'Post' &&
         req.userCtx.name == doc.author) {
       return true;
     } else {
       return false;
     }
   }"
  }
}
```

_changes

```
    curl -X GET http://127.0.0.1:5984/mydb/_changes

200 OK

{"results":[
  {"seq":1,"id":"doc1",
   "changes":[{"rev":"1-42dd"}]},
  {"seq":2,"id":"doc1",
   "changes":[{"rev":"2-9bf5"}]},
  {"seq":3,"id":"doc2",
   "changes":[{"rev":"1-737d"}]},
  {"seq":4,"id":"doc1",
   "changes":[{"rev":"3-8822"}],"deleted":true}],
"last_seq":4}
```

```
curl -X GET http://127.0.0.1:5984/mydb/_changes?
                    since=2

200 OK

{"results":[
  {"seq":3,"id":"doc2",
   "changes":[{"rev":"1-737d"}]},
  {"seq":4,"id":"doc1",
   "changes":[{"rev":"3-8822"}],"deleted":true}],
"last_seq":4}
```

```
curl -X GET http://127.0.0.1:5984/mydb/_changes?
                  feed=continuous

200 OK

{"seq":1,"id":"doc1","changes":[{"rev":"1-42dd"}]}}
{"seq":2,"id":"doc1","changes":[{"rev":"2-9bf5"}]}}
{"seq":3,"id":"doc2","changes":[{"rev":"1-737d"}]}}
{"seq":4,"id":"doc1",
 "changes":[{"rev":"3-8822"}],"deleted":true}}


...


{"seq":5,"id":"doc3","changes":[{"rev":"1-b12c"}]}}
```

_changes Options

- since

- feed (normal | longpoll | continuous)

- heartbeat

- timeout

- filter

- include_docs

Security

Admin Party

by default, everyone is an admin

Admin Rights

- Create and delete databases

- Create, update and delete design documents

- Trigger compaction

- Reading the task status list

- Restart the server

- Read and update the active configuration

Authentication

- HTTP Basic

- Secure Cookie

- OAuth

Authorization

- Can define admins for a particular database

- The admins can update design documents and create database readers

- Can define readers for a particular database

- Readers can read documents

- Database is public if no readers are defined

- Can define list of roles for admins and readers

Authorization

- Users stored in _users database

- Can use validate_doc_update to reject an update based on the currently logged in user

Sharding/Clustering

Lounge
(NGINX and python twisted daemon)

BigCouch
(Erlang)

Ruby Clients

Net::HTTP

RestClient

couchrest
couch_potato
couch_foo
relaxdb

couchrest_extended_document
Rails 2.x

couchrest_model
Rails 3.0

```ruby
class Page < CouchRest::Model::Base
  property :slug, String
  property :body, String
  property :authors, [String]
  timestamps!

  validates_presence_of :slug

  view_by :slug
end
```

Negative

- Slow compared to other NoSQL solutions

- CouchDB is a glutton for disk space

- Run compaction often

- Can't chain Map/Reduce (yet)

CouchApp

Bind your Couch to your public IP address