

Offline-First Apps with PouchDB

O'Reilly Fluent

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Why offline first?



10:35 AM



ibm.biz/offline-first

1



Unable to connect to the Internet

Wi-Fi and mobile data are unavailable. The

Solitaire

No Connection

Solitaire is an online game
and requires an Internet
connection to play.

Try Again



Mobile First

Design for the smallest device first and then apply **progressive enhancement** techniques to take advantage of larger screen sizes when available

A photograph taken from an airplane window, showing a massive, white, cumulus cloud formation against a clear blue sky. The clouds are dense and fluffy, with some darker areas indicating depth. The perspective is from a high altitude, looking down at the clouds.

Offline First

Design for offline usage first and then apply **progressive enhancement** techniques to take advantage of network connectivity when available

Ubiquitous Connectivity

Why offline first in a world of ubiquitous connectivity?



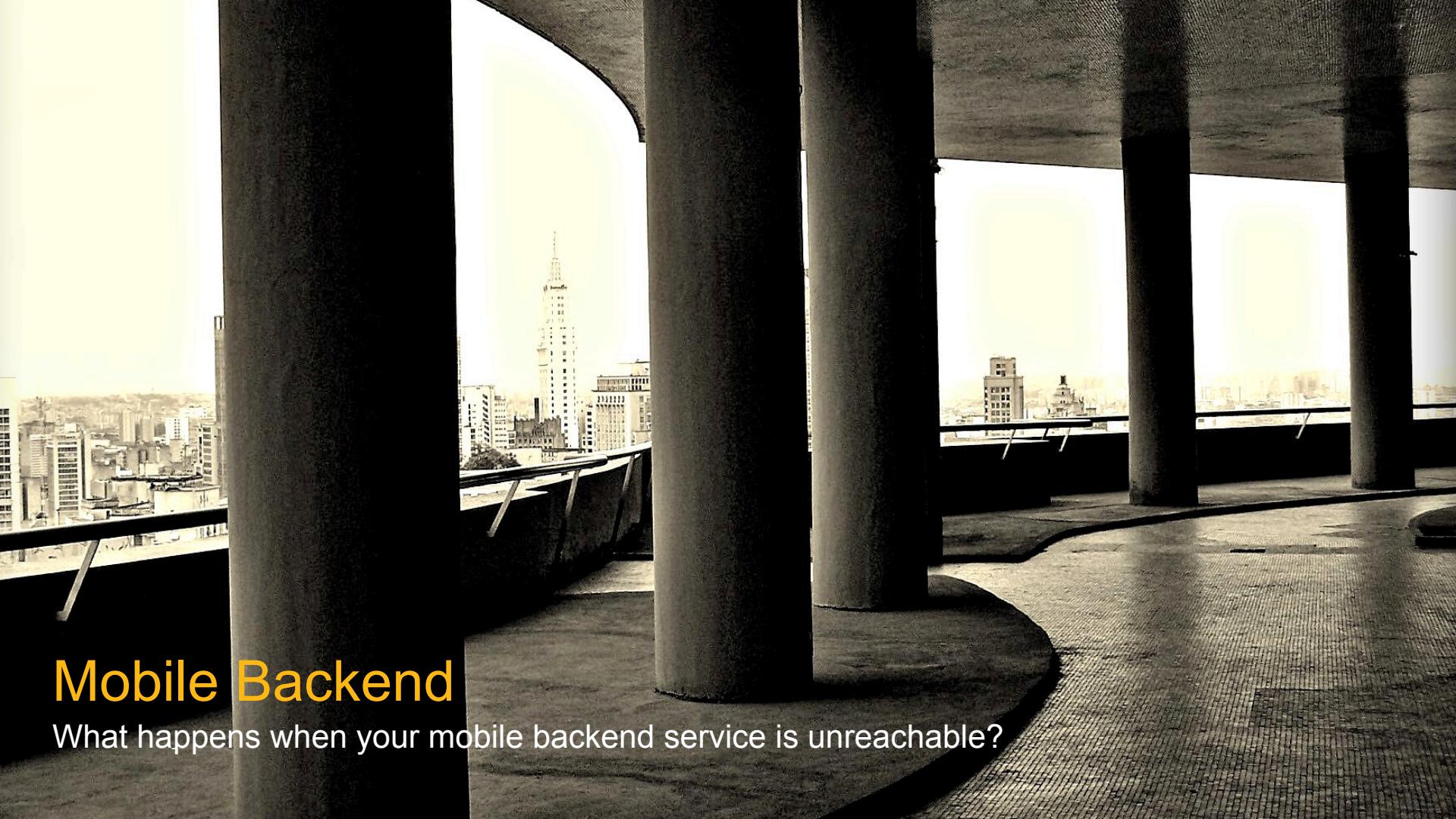
The Eight Fallacies of Distributed Computing

1. The network is reliable
2. Latency is zero
3. Bandwidth is infinite
4. The network is secure
5. Topology doesn't change
6. There is one administrator
7. Transport cost is zero
8. The network is homogeneous

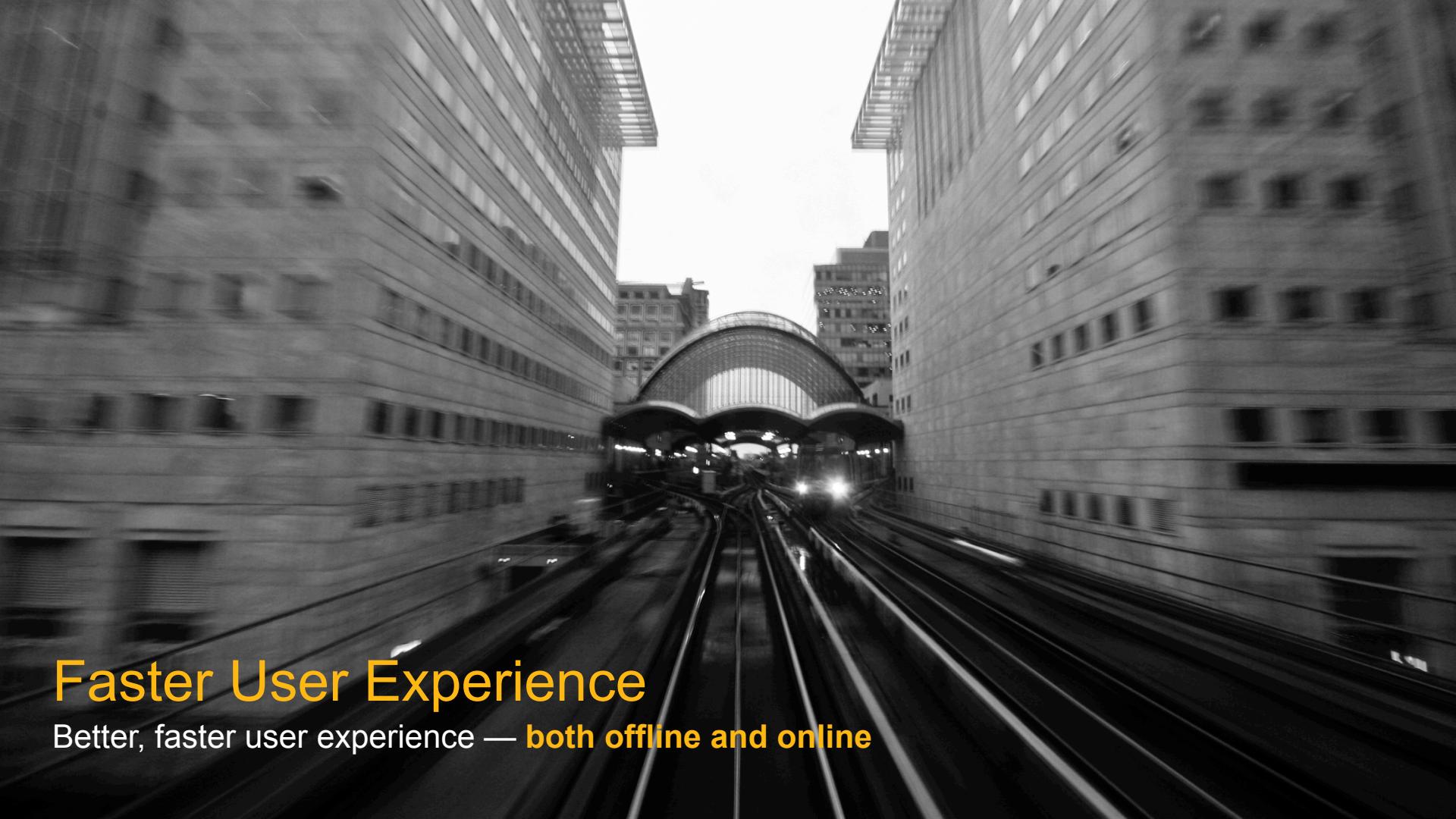


Mobile Backend

What happens when your mobile backend service is unreachable?

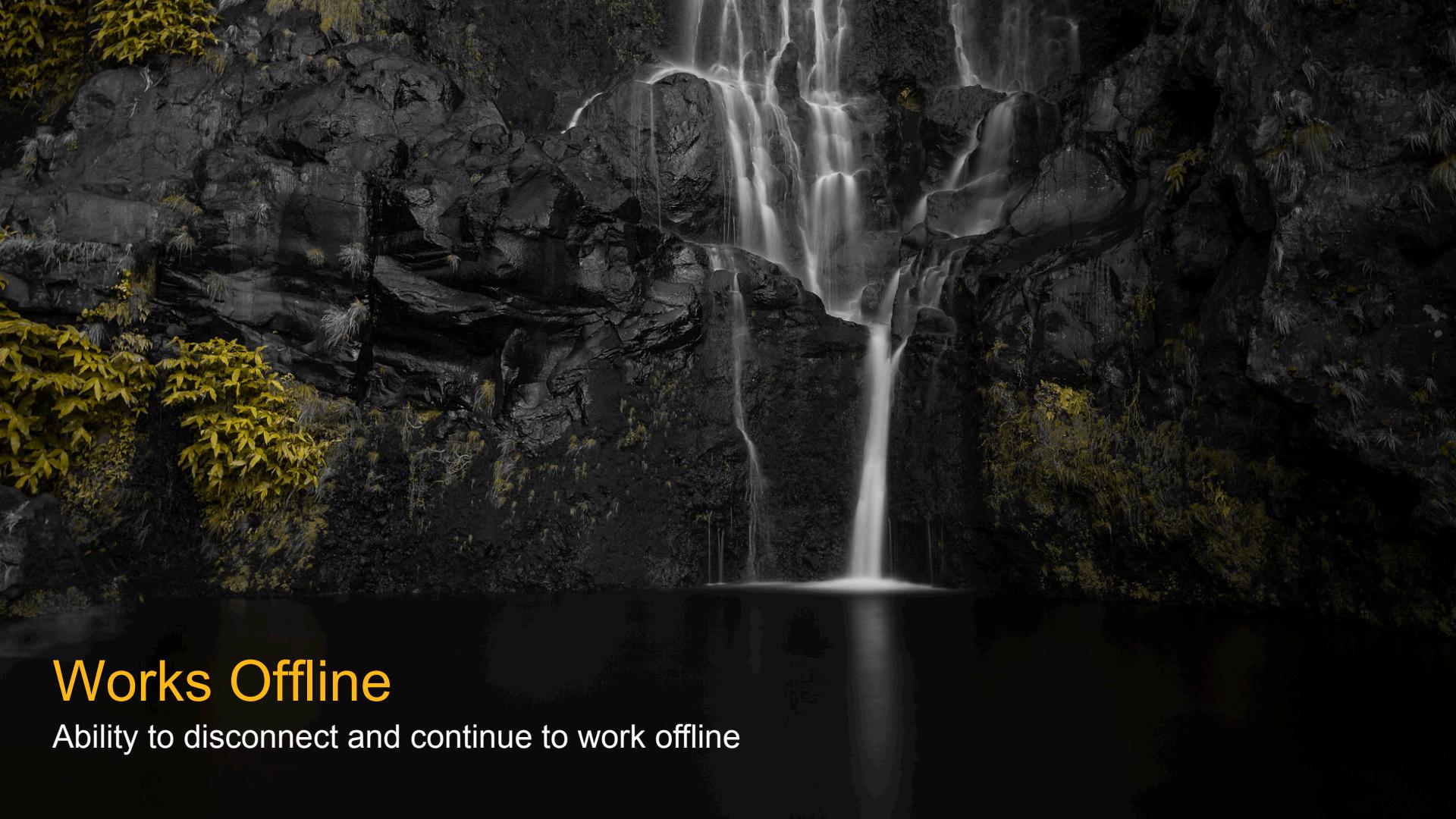


Benefits of Offline First



Faster User Experience

Better, faster user experience — **both offline and online**

The background image shows a waterfall in a dark, rugged landscape. The waterfall flows down a steep, dark rock face, creating a bright, glowing stream of water. The surrounding area is filled with dense, green foliage and bushes, some of which have yellow leaves, suggesting autumn or a specific type of vegetation. The overall atmosphere is serene and natural.

Works Offline

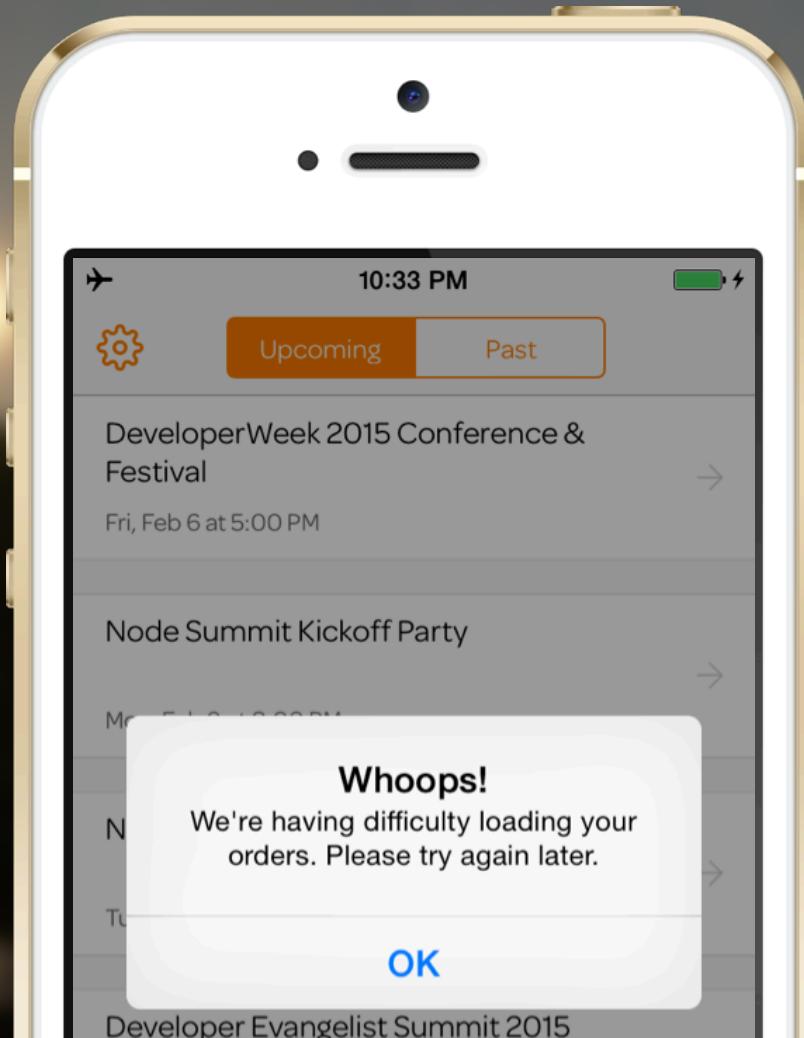
Ability to disconnect and continue to work offline

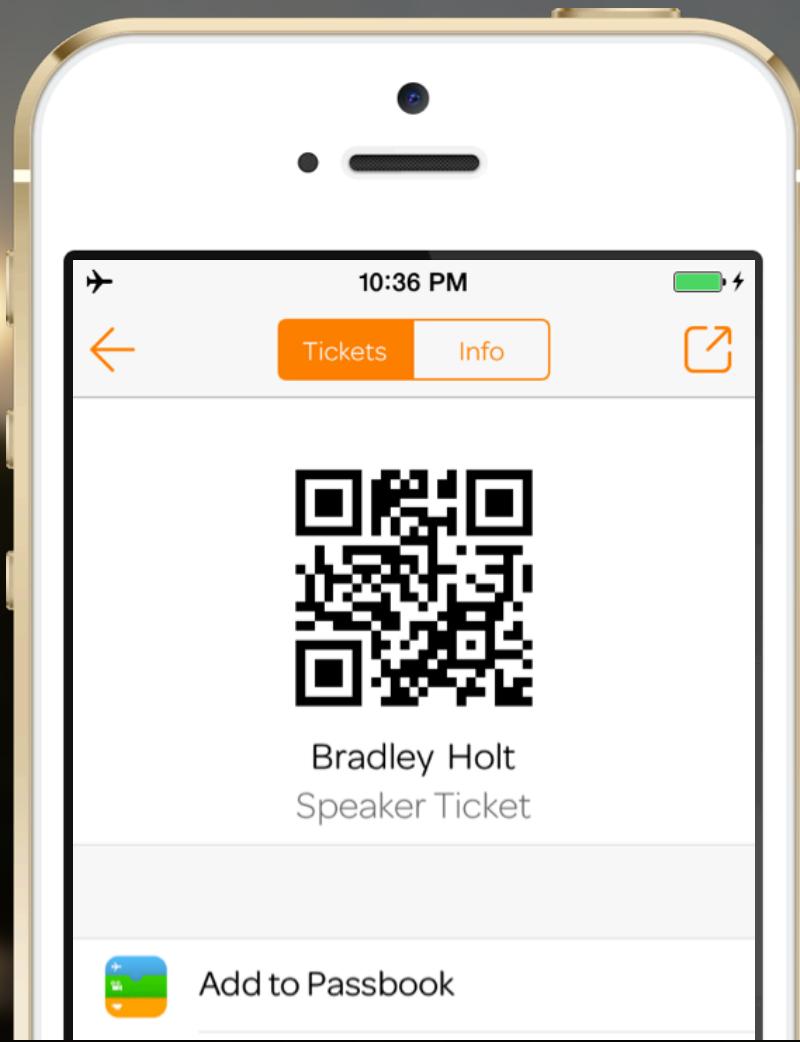


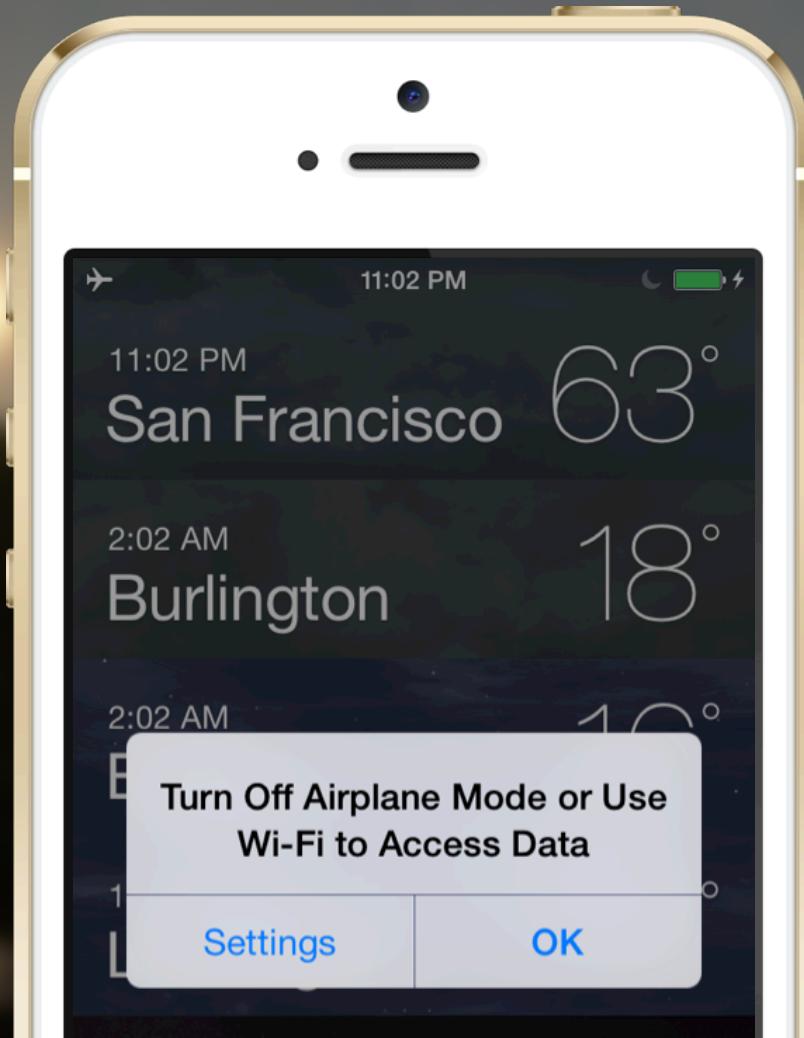
Battery and Bandwidth

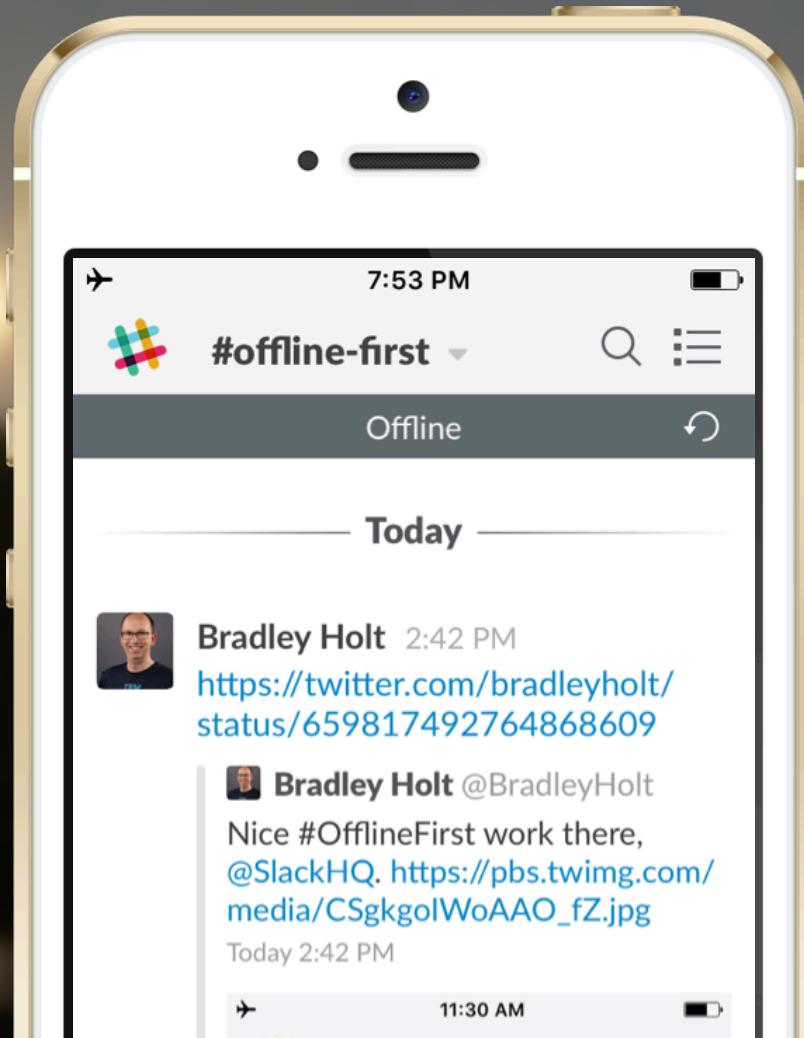
Limited access to power and communications infrastructure in **disaster scenarios**

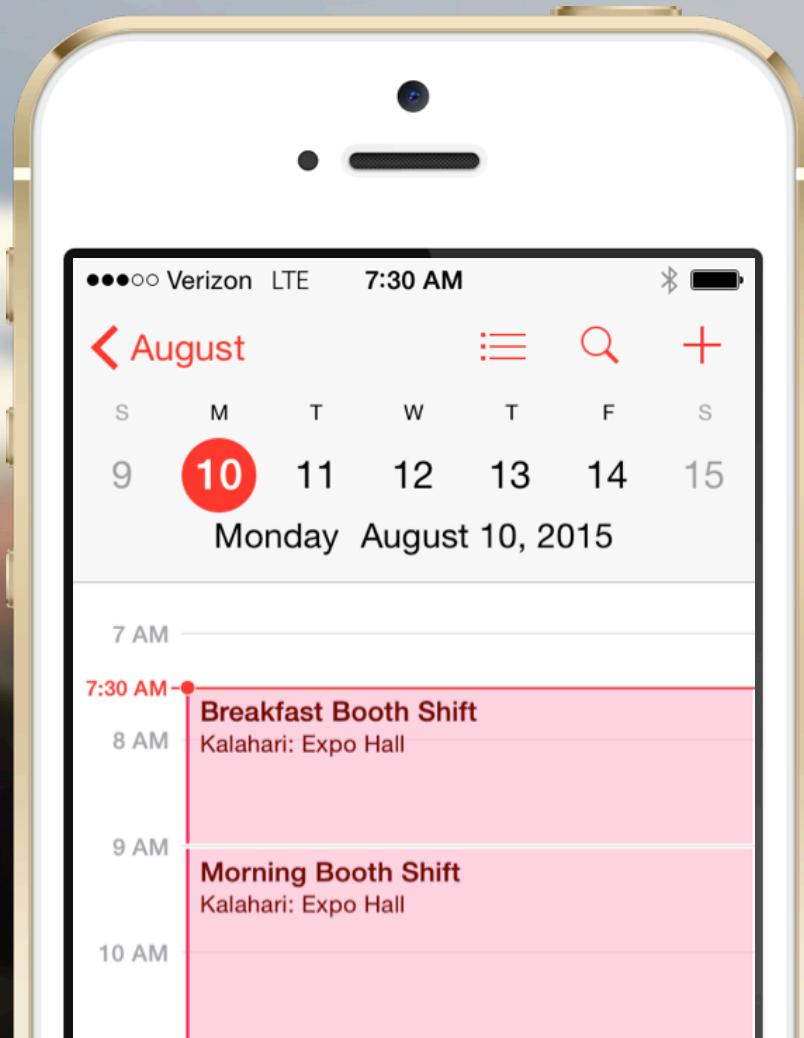
Offline-First Patterns and Anti-Patterns





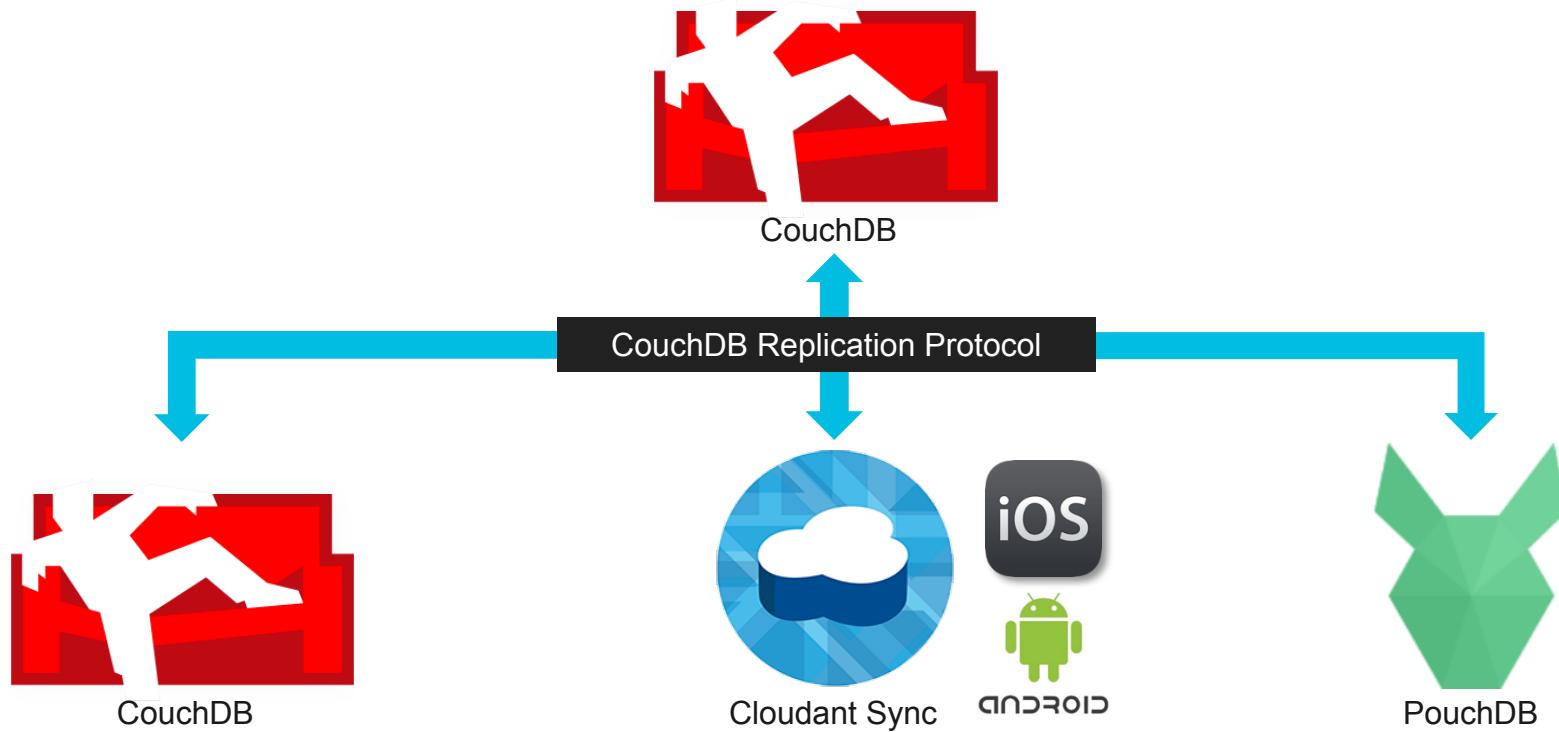






Tools and Use Cases

CouchDB Replication Protocol



The Database that Syncs!

PouchDB is an open-source JavaScript database inspired by [Apache CouchDB](#) that is designed to run well within the browser.

PouchDB was created to help web developers build applications that work as well offline as they do online.

It enables applications to store data locally while offline, then synchronize it with CouchDB and compatible servers when the application is back online, keeping the user's data in sync no matter where they next login.

[Learn more](#)

```
var db = new PouchDB('dbname');

db.put({
  _id: 'dave@gmail.com',
  name: 'David',
  age: 69
});

db.changes().on('change', function() {
  console.log('Ch-Ch-Changes');
});

db.replicate.to('http://example.com/mydb');
```



Cross Browser

Works in Firefox, Chrome, Opera, Safari, IE and Node.js



Lightweight

PouchDB is just a script tag and 46KB (gzipped) away in the browser, or `$ npm install pouchdb` away in Node.



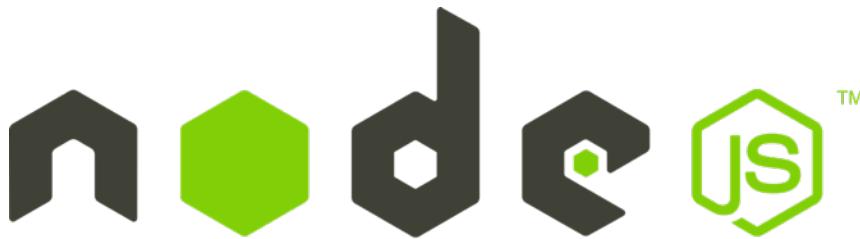
Easy to Learn

Requires some programming knowledge, however PouchDB is a piece of cake to learn.

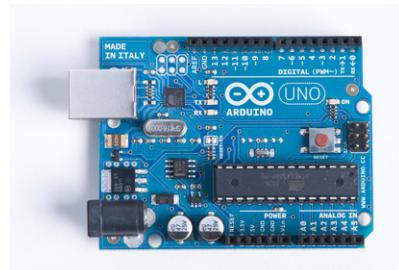


Open Source

Everything is developed out in the open on Github, contributors always welcome!



ELECTRON



PouchDB Code Examples

github.com/bradley-holt/offline-first

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Offline First

This repository contains code examples and snippets of offline-first (and related) tools.

JSON Documents

```
{  
  _id: "6EF9D2B0-13D3-1378-8D30-39E3CE0B36C2",  
  _rev: "1-0b457efcf82fb29492ef927ba5b6ee15",  
  type: "Feature",  
  geometry: {  
    type: "Point",  
    coordinates: [  
      -71.1028,  
      42.3691  
    ]  
  },  
  properties: {  
    session_id: "3486b13f-7b8a-8a96-dfbf-9b82800e367f",  
    timestamp: 1422928591717  
  }  
}
```



Creating a PouchDB Database

```
var db = new PouchDB("smart-meter");
```



Creating a New Document

```
var db = new PouchDB("smart-meter");
db.put({
  _id: "2014-11-12T23:27:03.794Z",
  kilowatt_hours: 14
}).then(function() {
  console.log("Document created");
}).catch(function(error) {
  console.log(error);
});
```



Updating a Document

```
db.put({
  _id: "2014-11-12T23:27:03.794Z",
  kilowatt_hours: 14
}).then(function(response) {
  return db.get(response.id);
}).then(function(doc) {
  // Update the value for kilowatt hours
  doc.kilowatt_hours = 15;
  // Put the document back to the database
  return db.put(doc);
}).catch(function(error) {
  console.log(error);
});
```



Querying a Database with allDocs

```
db.bulkDocs([
  {_id: "2014-11-12T23:27:03.794Z", kilowatt_hours: 14},
  {_id: "2014-11-13T00:52:01.471Z", kilowatt_hours: 15},
  {_id: "2014-11-13T01:39:28.911Z", kilowatt_hours: 16},
  {_id: "2014-11-13T02:52:01.471Z", kilowatt_hours: 17}
]).then(function(result) {
  // Get all documents
  return db.allDocs({include_docs: true});
}).then(function(response) {
  console.log(response);
}).catch(function(error) {
  console.log(error);
});
```



allDocs Options

- `include_docs`
 - `conflicts`
 - `attachments`
- `startkey`
- `endkey`
- `inclusive_end`
(true by default)
- `limit`
- `skip`
- `descending`
- `key`
- `keys`



PouchDB Data Storage Limits

	Firefox	Chrome	Opera 15+	Internet Explorer 10+	iOS Safari	Safari (desktop)	Android	PhoneGap / Cordova
Data Storage Limit	50MB (more with user permission)	calculated	calculated	250MB (prompts user at 10 MB)	50MB (prompts user at 5MB and at increments)	unlimited (prompts user at 5MB and at increments)	calculated / 200MB	unlimited
Adapter	IndexedDB	IndexedDB / WebSQL	IndexedDB / WebSQL	IndexedDB	WebSQL	WebSQL	IndexedDB / WebSQL	SQLite



Replication



Apache CouchDB

CouchDB is a document database featuring an HTTP API, JSON documents, and **peer-to-peer replication**





Build More, Grow More, Sleep More

Do more with the only fully-managed
NoSQL database-as-a-service (DBaaS)

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Customers

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Creating a Remote PouchDB Database

```
var remoteDb = new PouchDB("https://bradley-holt.cloudant.com/smart-meter");
```



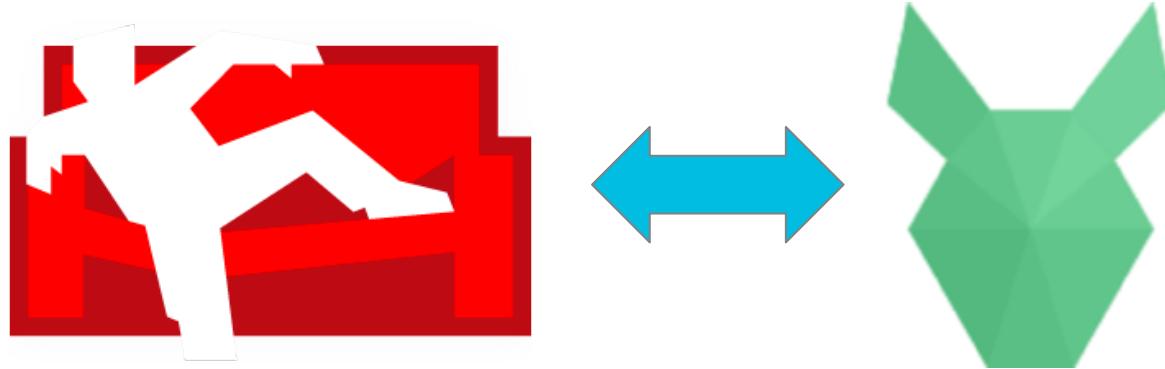


Cross-Origin Resource Sharing (CORS)

A **security restriction** implemented by browsers on cross-site HTTP requests



Bidirectional Replication

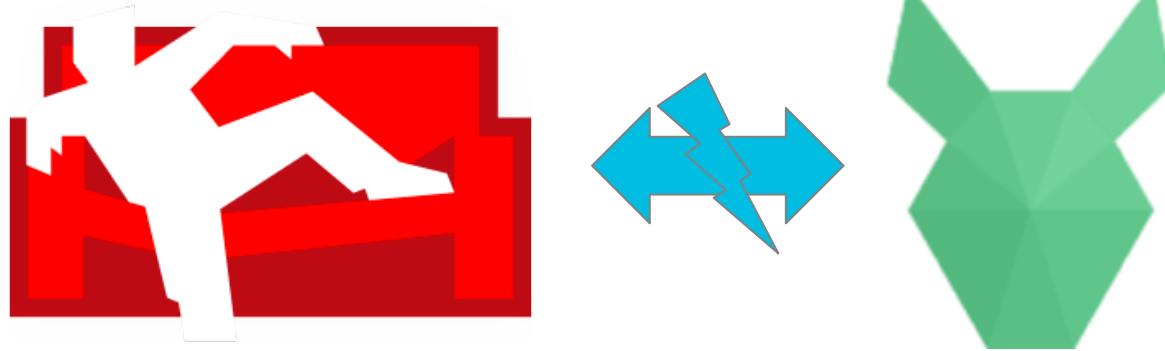


Bidirectional Replication

```
db.sync(remoteDb, {
  live: false,
  retry: false
}).on("change", function(info) {
  // Replication has written a new document
  console.log(info);
}).on("complete", function(info) {
  // Replication has complete or been cancelled
  console.log(info);
}).on("error", function(error) {
  // Replication has stopped due to an unrecoverable failure
  console.log(error);
});
```



Live Replication

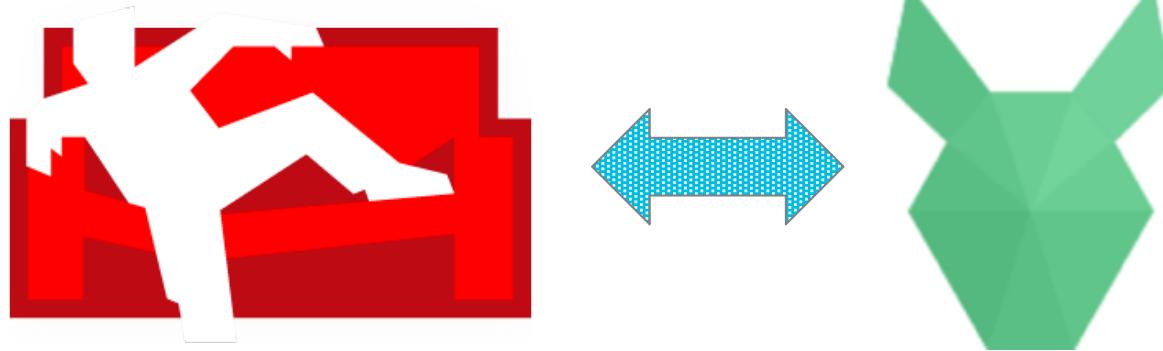


Live Replication

```
var sync = db.sync(remoteDb, {
  live: true,
  retry: true
}).on("change", function(info) {
  // Replication has written a new document
  console.log(info);
}).on("complete", function(info) {
  // Replication has complete or been cancelled
  console.log(info);
}).on("error", function(error) {
  // Replication has stopped due to an unrecoverable failure
  console.log(error);
});
```



Filtered Replication

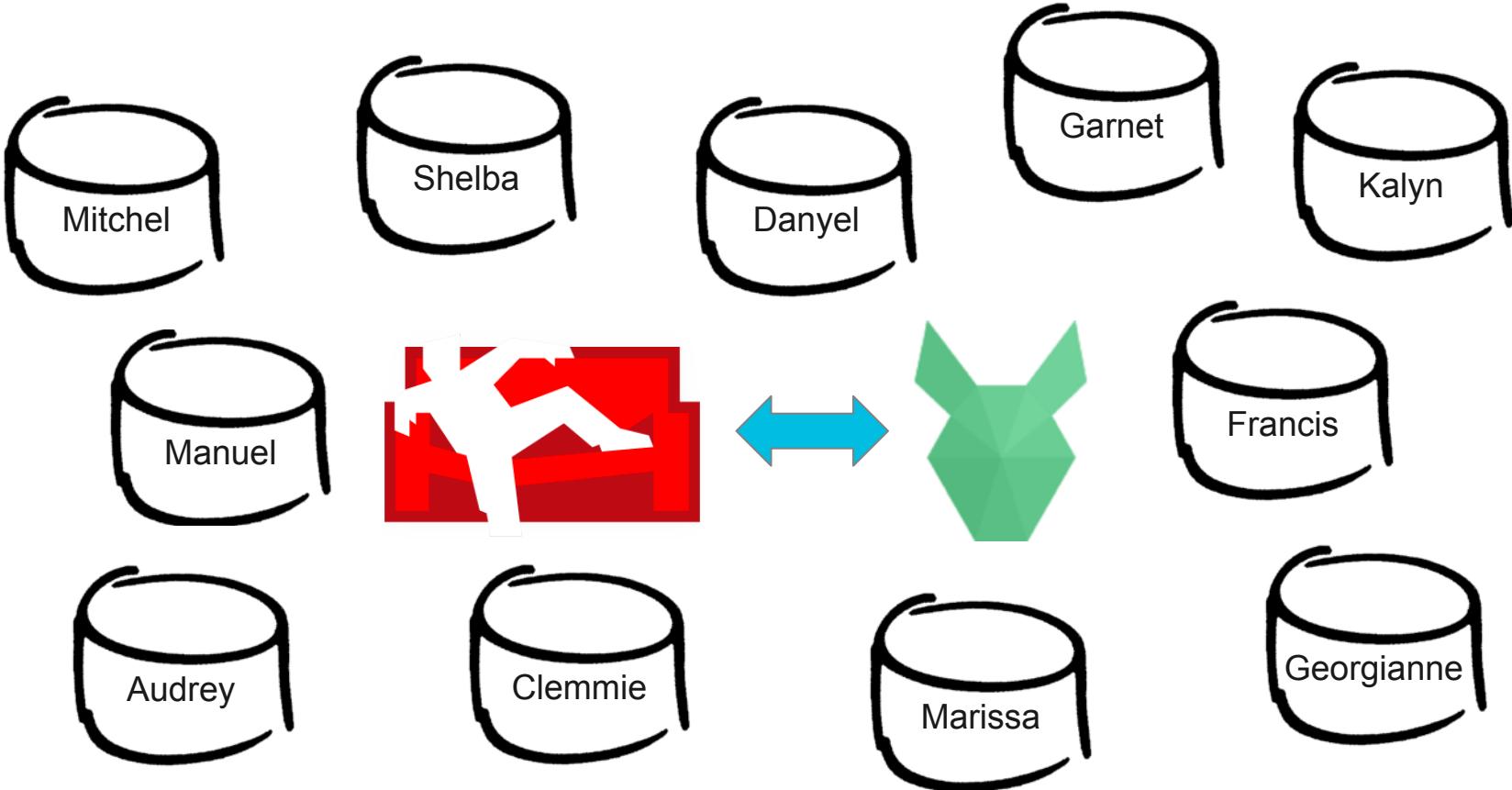


Filtered Replication

```
db.replicate.to(remoteDb, {
  filter: function(doc) {
    return doc._id >= "2014-11-13T00:00:00.000Z";
  }
}).on("change", function(info) {
  // Replication has written a new document
  console.log(info);
}).on("complete", function(info) {
  // Replication has complete or been cancelled
  console.log(info);
});
```



One Database Per User



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Offline First

This repository contains code examples and snippets of offline-first (and related) tools.

Boilerplates & Tools

▪ Frontend Web Apps

- React Boilerplate with Service Workers
[<https://github.com/mbrrio/react-boilerplate/tree/react-0.13-flummox-service>](https://github.com/mbrrio/react-boilerplate/tree/react-0.13-flummox-service)

▪ Backend Web Apps

- PouchDB npm Package
[<https://www.npmjs.com/package/pouchdb>](https://www.npmjs.com/package/pouchdb)
- PouchDB Server npm Package
[<https://www.npmjs.com/package/pouchdb-server>](https://www.npmjs.com/package/pouchdb-server)

▪ Mobile Apps

- PouchDB for Ionic Framework
[<https://github.com/nolanlawson/pouchdb-ionic>](https://github.com/nolanlawson/pouchdb-ionic)
- "Hello world" Cordova app with PouchDB
[<https://github.com/nolanlawson/pouchdb-cordova-hello-world>](https://github.com/nolanlawson/pouchdb-cordova-hello-world)
- "Hello world" Cordova app with PouchDB, using the SQLite Plugin
[<https://github.com/nolanlawson/pouchdb-cordova-hello-world-with-sqlite-plugin>](https://github.com/nolanlawson/pouchdb-cordova-hello-world-with-sqlite-plugin)
- Cloudant FoodTracker (uses Cloudant Sync for iOS)
[<https://github.com/ibm-cds-labs/cloudant-food-tracker>](https://github.com/ibm-cds-labs/cloudant-food-tracker)

▪ Desktop Apps

- PouchDB for Electron (formerly Atom Shell)
[<https://github.com/nolanlawson/pouchdb-electron>](https://github.com/nolanlawson/pouchdb-electron)
- PouchDB for Chrome packaged apps
[<https://github.com/nolanlawson/pouchdb-chrome-app>](https://github.com/nolanlawson/pouchdb-chrome-app)
- "Hello world" Chrome app with PouchDB
[<https://github.com/nolanlawson/pouchdb-chrome-app-hello-world>](https://github.com/nolanlawson/pouchdb-chrome-app-hello-world)
- PouchDB for NW.js (aka Node-Webkit)
[<https://github.com/nolanlawson/pouchdb-nw>](https://github.com/nolanlawson/pouchdb-nw)

▪ Internet of Things (IoT) Apps

- Node-RED
<http://nodered.org/>



Cloudant FoodTracker

An offline-first demo app built with Swift and Cloudant Sync for iOS

Carrier

11:27 PM



Edit

Your Meals



Chicken With Broccoli



Fried Rice in Lotus



Grilled Prawn



Spicy Steamed Sea Bass



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