Offline-First Mobile Web Apps with PouchDB, IBM Cloudant, and IBM Bluemix

OSCON
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Not just mobile first...
Offline First

Because being offline shouldn't be an error condition.

Image Credit: Cloud Formation Over the Adirondacks by Bradley Holt
Doesn't ubiquitous connectivity make offline-enabled apps unnecessary?
No.
Quite the opposite, in fact.
Ubiquitous connectivity is driving the demand for offline capabilities.
How?
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

Text Credit: The Eight Fallacies of Distributed Computing by Peter Deutsch | Image Credit: Pneumatic Central by Sleestak, on Flickr
Offline-first is the only way to achieve a true, 100% always-on user experience.*

*assuming the device is reliable
Benefits of Offline First

• Better, faster user experience, both offline and online
• Allow your users to work offline or with limited connectivity
• Potentially saves battery life and bandwidth usage
Offline Patterns & Anti-Patterns

• Don't return an error for no reason
• Do let users view cached/saved data
• Do synchronize data when connected
Offline Patterns & Anti-Patterns

- **Don't** return an error for no reason
- **Do** let users view cached/saved data
- **Do** synchronize data when connected
Offline Patterns & Anti-Patterns

• Don't return an error for no reason
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Offline Patterns & Anti-Patterns

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Introducing PouchDB
PouchDB

• A database in your web browser
• Can synchronize with any database that implements the CouchDB Replication Protocol
• Makes create, read, update and delete operations extremely fast
JSON Documents

```json
{
    _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
    }
}
```
PouchDB Framework Adapters
Responsive Mobile Web Apps or Hybrid Mobile Web Apps
Responsive Mobile Web Apps

- HTML5, CSS and JavaScript mobile web apps
- Responsive design
- Enhanced to enable offline usage
Hybrid Mobile Web Apps

- Native mobile web apps built with HTML5, CSS and JavaScript
- Good for:
  - Fully-featured, cross-platform native apps
  - High-fidelity prototypes
Apache CouchDB
Apache CouchDB

- JSON document database
- HTTP API
- Master-master replication
IBM Cloudant

- Globally distributed data layer for web and mobile applications
- MongoDB-style queries
- Advanced geospatial capabilities
- Full text search indexing
PouchDB and Cloudant Replication
CouchDB Replication Protocol

• One-off, one way operation
• Peer-to-peer (masterless)
• Incremental
• Conflict detection
Apache Cordova, PhoneGap and Ionic
Apache Cordova and PhoneGap

Image Credit: build.phonegap by Andrés Álvarez Iglesias, on Flickr
Ionic

- Mobile-optimized HTML, CSS and JavaScript components
- Builds on Apache Cordova
- Utilizes AngularJS
- CLI installable via npm
Using Cordova and Ionic

$ npm install -g cordova ionic
$ ionic start energy-monitor tabs
$ cd energy-monitor
$ ionic platform add ios
$ ionic build ios
$ ionic emulate ios

Image Credit: Getting Started with Ionic
HTML5 Offline Application Cache
HTML5 Offline Application Cache

- Enables fully-functional offline web apps
- Stores files and assets for offline browsing
- Makes page loads very fast, even when online
Cache Manifest File

```html
<html manifest="example.appcache">
  ...
</html>
```

CACHE MANIFEST
# v1 - 2015-01-08
index.html
logo.png
app.css
app.js
Deploying a Web App to IBM Bluemix
About IBM Bluemix

• Platform-as-a-Service (PaaS) based on Cloud Foundry

• Catalog of boilerplates, runtimes, and services from which you can compose your applications

• Cloudant is one of the many services available

• Sign up at: https://bluemix.net/
Bluemix Runtimes

- IBM buildpacks
  - Java
  - Node.js

- Community buildpacks
  - Go
  - PHP
  - Python
  - Ruby
  - More…
Data Management and Big Data Services

- Cloudant
- BigInsights for Apache Hadoop
- IBM Analytics for Apache Hadoop
- Swift Object Storage
- More…
Location Tracker

- Stores data locally in PouchDB
- Front end built with AngularJS
- Authentication logic built with Node.js
- User interface built with Leaflet
- Replicates location data to Cloudant
- More info: https://cloudant.com/location-tracker/
Deploy to IBM Bluemix

One-Click Deployment

The fastest way to deploy the Location Tracker app to Bluemix is to click the Deploy to Bluemix button. Then skip ahead to learn how edit online or locally.

Don't have a Bluemix account? If you haven't already, you'll be prompted to sign up for a Bluemix account when you click the button. Sign up, verify your email address, then return here and click the Deploy to Bluemix button again. Your new credentials let you deploy to the platform and also to code online with Bluemix and Git. If you have questions about working in Bluemix, find answers in the Bluemix Docs.
PouchDB Code Examples
Installing PouchDB

```html
<script src="https://cdn.jsdelivr.net/pouchdb/3.5.0/pouchdb.min.js"></script>
```

CACHE MANIFEST
#

index.html
logo.png
app.css
app.js
https://cdn.jsdelivr.net/pouchdb/3.5.0/pouchdb.min.js
PouchDB Code Examples

• Creating a local PouchDB database
• Creating a remote PouchDB database
• Creating a new document
• Updating a document
• Querying a database
• Replicating PouchDB
Creating a Local PouchDB Database

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

Creating a Remote PouchDB Database

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

https://github.com/bradley-holt/offline-first/blob/master/pouchdb/02-create-remote-database.js
Cross-Origin Resource Sharing (CORS)

- Enable Cross-Origin Resource Sharing (CORS) on remote database
- Browsers place security restrictions on cross-site HTTP requests
- If you run into a problem, remember this warning!

Image Credit: Grunge Warning Sign - Do Not Read This Sign by Nicolas Raymond, on Flickr
Creating a New Document

```javascript
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() {
  return db.get("2014-11-12T23:27:03.794Z");
}).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`

```javascript
db.bulkDocs([{
  _id: "2014-11-13T00:52:01.471Z", kilowatt_hours: 15}, {
  _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
Querying a Database with Map/Reduce

• Most queries can be done with \texttt{allDocs} (in PouchDB)

• Map functions transform documents into indexes

• Reduce functions aggregate results of Map functions
  • \_\texttt{sum}
  • \_\texttt{count}
  • \_\texttt{stats}
Querying a Database with PouchDB Find

• Based on Cloudant Query (Mango)
• MongoDB-style query language
• Define fields to index
Bidirectionally Replicating a PouchDB Database

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

Bidirectionally Replicating a PouchDB Database

```
Promise.all([
    db.bulkDocs([
        {_id: "2014-11-12T23:27:03.794Z", kilowatt_hours: 14},
        {_id: "2014-11-13T00:52:01.471Z", kilowatt_hours: 15}
    ]),
    remoteDb.bulkDocs([  
        {_id: "2014-11-12T00:43:01.633Z", kilowatt_hours: 13}
    ])
]).then(function() {
    ...

```

Bidirectionally Replicating a PouchDB Database

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);
});

A Deep Dive into Offline-First with PouchDB and IBM Cloudant

Date: Thursday, August 27, 2015
Time: 1:00 PM - 2:00 PM EDT

Register at: https://cloudant.com/resources/webinars/
Visit IBM at booth #501 to talk to an IBM Recruiter @ OSCON

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- Getting Started with Ionic
  <http://ionicframework.com/getting-started/>

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