Offline-First Apps with PouchDB

Node.js Interactive
Wednesday, December 9, 2015
Bradley Holt, Developer Advocate
Unable to connect to the Internet

Image Credit: A mockup of the golden Apple iPhone 5S by Zach Vega, on Wikimedia Commons

Wi-Fi and mobile data are unavailable.
Solitaire

No Connection

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

Try Again
Not just mobile first...
Offline First

Because being offline shouldn't be an error condition.
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
Offline-first is the only way to achieve a true, 100% always-on user experience.*

*assuming the device is reliable
Faster User Experience

Image Credit: Speed DLR on Doklands by Umberto Rotundo, on Flickr
Works Offline

Image Credit: Lynn Camp Prong (Explored) by AllieKF, on Flickr
Battery and Bandwidth

Image Credit: Panorama of the Molasses Disaster site by Boston Public Library, on Flickr
Whoops!
We're having difficulty loading your orders. Please try again later.
Turn Off Airplane Mode or Use Wi-Fi to Access Data

Settings  OK

Image Credit: A mockup of the golden Apple iPhone 5S by Zach Vega, on Wikimedia Commons
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Frontend Web Apps

- Build responsive mobile web apps that work offline
- PouchDB adapters available for many popular frameworks
- Enable full offline usage with service workers
Backend Web Apps

- Use PouchDB as the database for your Node.js applications
- Installable via npm (`pouchdb`)
- Use PouchDB Server (`pouchdb-server`) as a drop-in replacement for CouchDB
Mobile Apps

- Hybrid Mobile Web Apps
  - HTML5, CSS and JavaScript apps compiled into native mobile apps
  - Fully-featured, cross-platform native apps
  - High-fidelity prototypes

- Native Mobile Web Apps
  - Cloudnat Sync for iOS
  - Cloudant Sync for Android
Desktop Apps

- Use Electron to build cross-platform desktop apps with web technologies
- Formerly known as Atom Shell
- HTML5, CSS and JavaScript apps compiled into native desktop apps
Internet of Things (IoT) Apps

- Headless Node.js apps
- PouchDB includes a LevelDB adapter for use in Node.js
- Redis, Riak, and in-memory adapters are also available
- Good for:
  - Internet of Things (IoT) applications
  - Content delivery networks (CDN)
  - Purpose-built devices
PouchDB Code Examples
Code examples and snippets of offline-first (and related) tools

<table>
<thead>
<tr>
<th>File</th>
<th>Description</th>
<th>Latest commit</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>pouchdb</td>
<td>Update PouchDB examples</td>
<td>186b535</td>
<td>5 days ago</td>
</tr>
<tr>
<td>LICENSE.txt</td>
<td>Create README and LICENSE files</td>
<td></td>
<td></td>
</tr>
<tr>
<td>README.md</td>
<td>Add section on related boilerplates and tools</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Offline First**

This repository contains code examples and snippets of offline-first (and related) tools.
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
    }
}
```
Creating a Local PouchDB Database

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

https://github.com/bradley-holt/offline-first/blob/master/pouchdb/01-create-local-database.js
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(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);
});

Deleting a Document

db.put(
    {
        _id: "2014-11-12T23:27:03.794Z",
        kilowatt_hours: 14
    }
).then(function(response) {
    // Get the document
    return db.get(response.id);
}).then(function(doc) {
    // Remove the document from the database
    return db.remove(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: "2014-11-13T02:52:01.471Z", 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 `allDocs` (in PouchDB)
• Map functions transform documents into indexes
• Reduce functions aggregate results of Map functions
  • `_sum`
  • `_count`
  • `_stats`
Querying a Database with PouchDB Find

- Based on Cloudant Query (Mango)
- MongoDB-style query language
- Define fields to index

Image Credit: Mango with section on a white background by bangdoll, on Flickr
var changes = remoteDb.changes({
    since: "now"
}).on("change", function(change) {
    // A document has changed
    console.log(change);
}).on("complete", function(info) {
    // changes() was canceled
    console.log(info);
}).on("error", function(error) {
    // changes() has errored
    console.log(error);
});

Bidirectional, Live Replication

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

Bidirectional, Live Replication

```javascript
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);
});
```

Offline First

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

- A mockup of the golden Apple iPhone 5S by Zach Vega, on Wikimedia Commons
  <https://commons.wikimedia.org/wiki/File:IPhone_5s.png>
- Joan Touzet (@wohali), ASF Member, CouchDB PMC Member
  <https://twitter.com/wohali/status/595689720933445632>
- Device landscape by Jeremy Keith, on Flickr
  <https://flic.kr/p/anLcHu>
- Cloud Formation Over the Adirondacks by Bradley Holt
  <https://twitter.com/BradleyHolt/status/623030107679002624>
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- Internet Splat Map by Steve Jurvetson, on Flickr
  <https://flic.kr/p/5Gky>
- Tangled Network by Bruno Girin, on Flickr
  <https://flic.kr/p/7sdJw>
- Wired by Alexandre Duret-Lutz, on Flickr
  <https://flic.kr/p/2ZCmpx>
- connect me to BR549 by frankieleon, on Flickr
  <https://flic.kr/p/a1C62U>
- Pneumatic Central by Sleestak, on Flickr
  <https://flic.kr/p/mRvRQ>