Web apps that work offline and sync using React, Redux, and PouchDB

A Software Presentation From

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Introduction

- [ ] Designing an offline capable web/mobile product is hard. Local storage. Sync. Multiple platforms.

- [ ] A great way to do it is by using React, Redux, and PouchDB/CouchDB

- [ ] I will demonstrate some code using open source libraries that will add offline capability and syncing to an app

- [ ] This project is on Github at react-redux-pouchdb

What is the Problem?

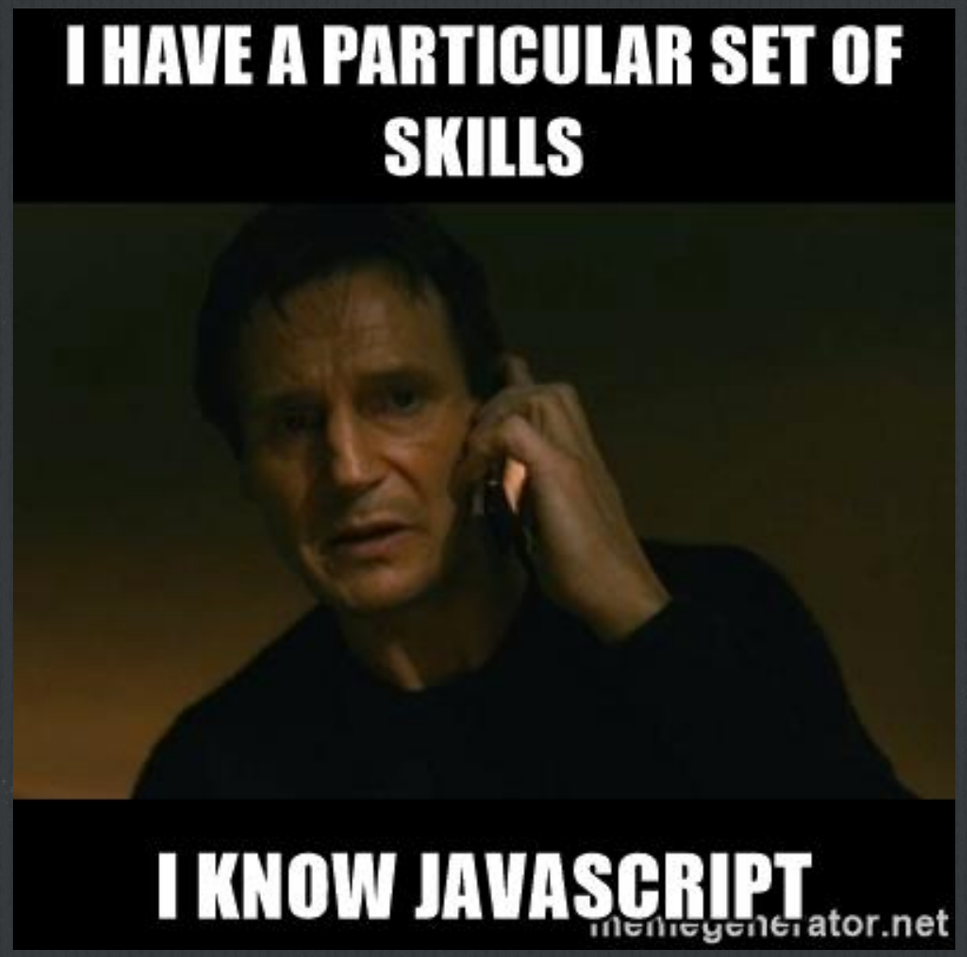
- ☐ We design our web apps and mobile apps SO differently.
- ☐ We always need to design mobile apps to work offline.
- ☐ But we rarely think of our web apps working offline.
- ☐ Multiple code bases, each handle state differently, users then get different experiences
- ☐ Web app offline capability and sync process can be hard to add later

Why do we need to solve this problem?

- If it wasn't hard to design a web app to work offline, we would just design it that way from the beginning.

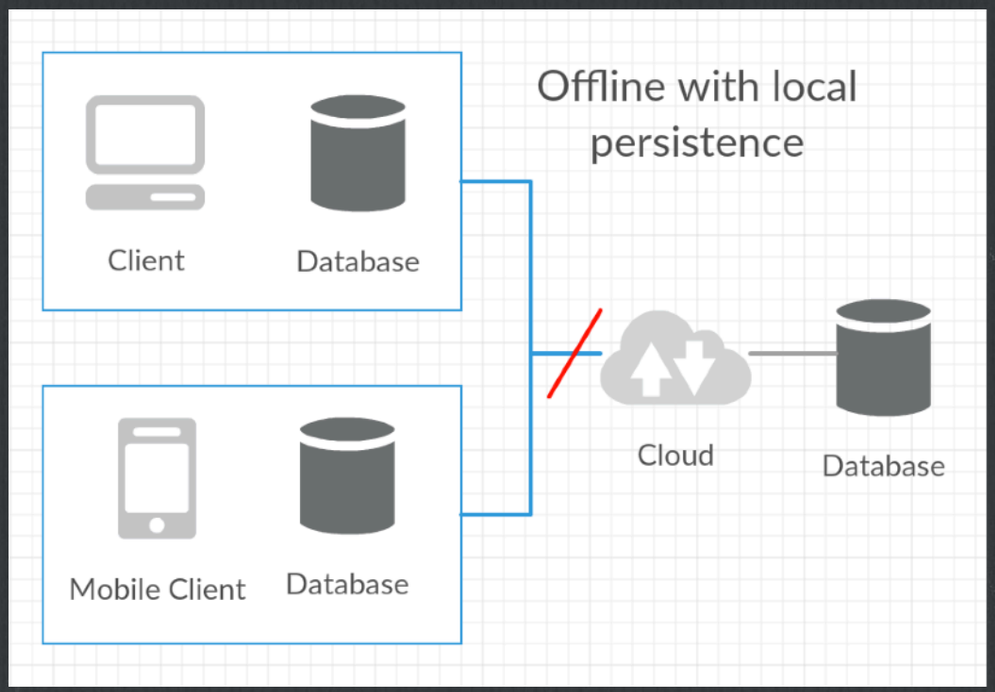
- One universal code base would reduce maintenance and easier to find developers with a particular set of skills.

- Sync is so tough, why does everybody roll their own? Hasn't that been solved yet?



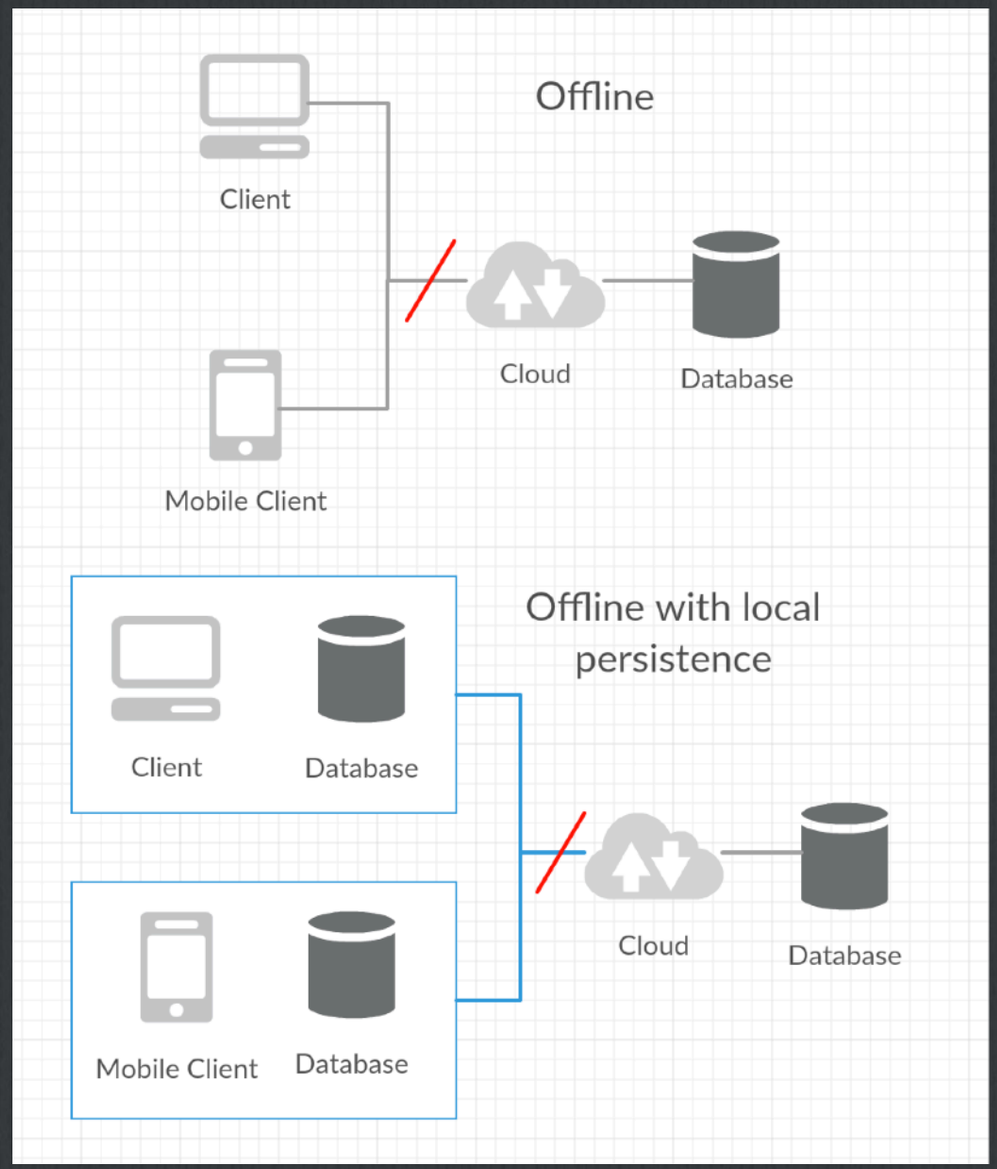
What would an ideal solution look like?

- ☐ Decouple in memory state changes from the API
- ☐ Our local store we use for persistence would be very similar to the server API store to make sync simple
- ☐ Ideally use someone else's sync logic and engine so we don't have to make it
- ☐ We should have the server notify clients of data changes
- ☐ Server keeps all document revisions to replay to clients
- ☐ Don't write code in 3 different technologies for web, Android, iOS
- ☐ Oh yeah, and it should be free



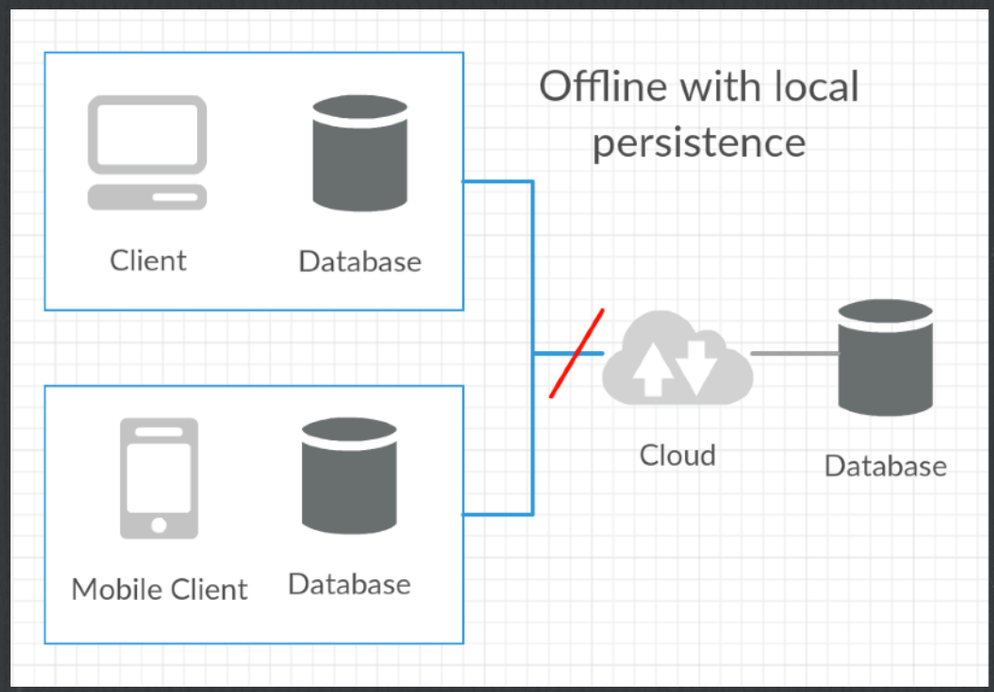
Basics of offline design

- ☐ Data store changes happen in memory, but API might not always be available to sync
- ☐ Must decouple in memory state changes and API calls
- ☐ Introduce a persistent local store
- ☐ You sync all in memory store changes to a local persistent store



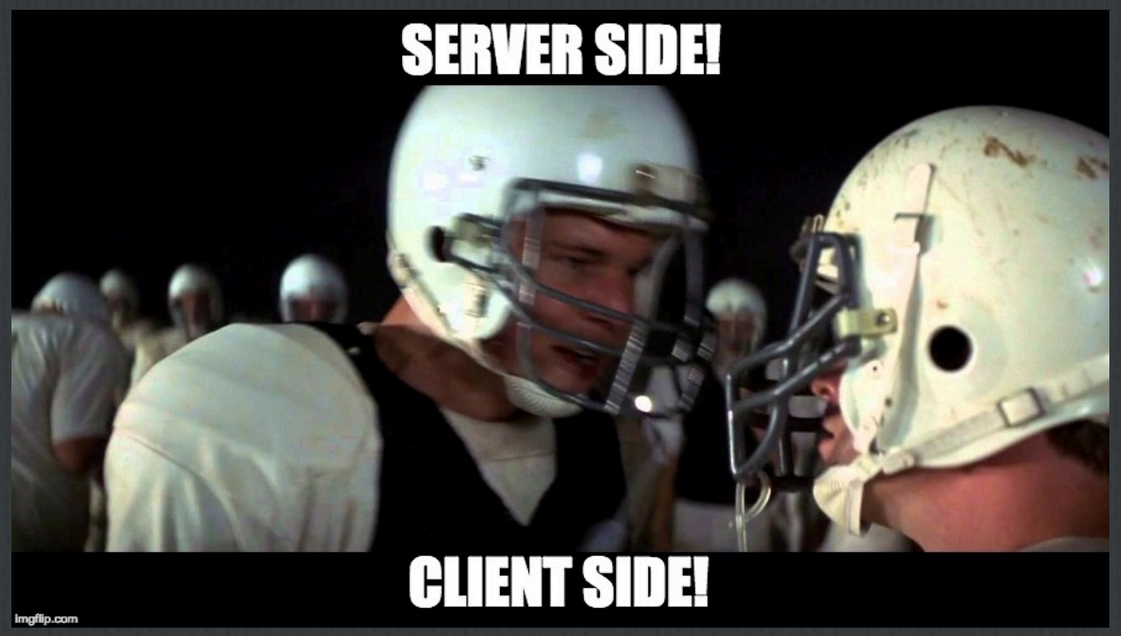
Basics of offline design - 2

- ☐ persistent on “disk” means something like IndexedDB, actual filesystem on mobile devices, sqlite
- ☐ If internet up, sync local disk store with API
- ☐ Never have direct connection between memory and API
- ☐ App hydrates in memory store from local disk store
- ☐ Memory store, local store, server store all in sync
- ☐ Server “pushes” changes to clients to sync



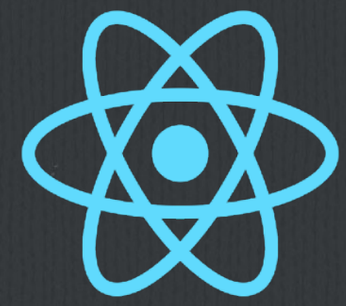
How do people try to solve this problem today?

- ☐ Writing an API that cares about conflicts and can resolve them properly is a lot of work
- ☐ Keeping track of revisions to reply is hard, usually just rely on timestamps to send back latest server copy
- ☐ Use IndexedDB in JS or sqlite on Android/iOS, they are a LOT different storage systems, no easy way to compare
- ☐ Communicate changes from server using socket.io or websockets
- ☐ Firebase is one option, but closed source, no JS offline capabilities



Meme courtesy of Zerrtech
CMO (Chief Meme Officer) Andrew Chumich

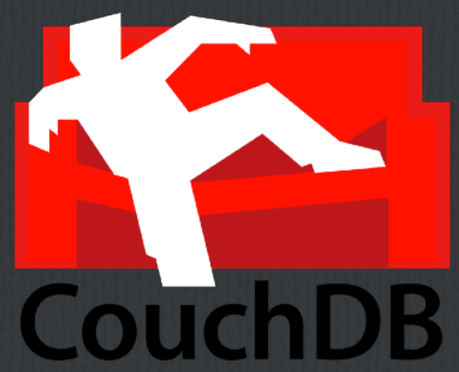
Open source solution



- [ ] Solve the multiple language/platform problems using React + Redux + React Native for mobile
- [ ] Use PouchDB for the local store, CouchDB for the server store
- [ ] Add Redux persistence library (redux-pouchdb) to write state changes to a local PouchDB store in a non-obtrusive way
- [ ] Set up the PouchDB local store to keep in sync with the CouchDB server store
- [ ] When a change hits CouchDB, the local PouchDB store should get the change, and then push back an action into Redux to set the state

What is this (P|C)ouchDB?

- Apache CouchDB is a database that you access using a HTTP/JSON REST API



- Document-oriented database, JSON docs

- Defined a CouchDB replication protocol, which allowed PouchDB to be created
- PouchDB is a JavaScript implementation of CouchDB, uses the same HTTP/JSON API

Why is CouchDB good at sync?

- ☐ Every document change creates a new rev
- ☐ When you do a document update, you need to provide the rev of the document you started with
- ☐ Exposes a changes feed that allows you out of the box to long poll to get changes as they happen

Details

- [ ] I built a sample app that would allow multiple users to increment a counter, offline, and will sync it to a server
- [ ] When online, one user sees the other's changes quickly
- [ ] Demo is on Github: jzerr/react-redux-pouchdb
- [ ] CouchDB on AWS: http://54.237.198.160:5984/_utils/index.html

Redux Design

- [ ] This is a React Redux app, where the counter state is in the Redux store using a Counter reducer
- [ ] Started with React Redux starter kit on Github: davezuko/react-redux-starter-kit
- [ ] We will add in the npm library redux-pouchdb
  - [ ] yarn add redux-pouchdb
  - [ ] yarn add pouchdb
- [ ] Very tiny diff here: Github diff

Counter Reducer Changes

src/routes/Counter/modules/counter.js

☐ **Before**

```
function counterReducer (state = initialState, action) {
  const handler = ACTION_HANDLERS[action.type]

  return handler ? handler(state, action) : state
}

export default counterReducer
```

After

```
import { persistentReducer } from 'redux-pouchdb'

function counterReducer (state = initialState, action) {
  const handler = ACTION_HANDLERS[action.type]

  return handler ? handler(state, action) : state
}

export default persistentReducer(counterReducer)
```

Reducers get initial state and changes from PouchDB via remote CouchDB

Counter Store Changes

src/store/createStore.js

☐ **Before**

```
// ========================
// Store Enhancers
// ========================
const enhancers = []
```

After

```
import { persistentStore } from 'redux-pouchdb'
```

```
// ========================================================
// Store Enhancers
// ========================================================
const enhancers = [
  // set the store to persist to the local PouchDB
  persistentStore(db)
]
```

PouchDB persists parts of the store when it changes

```
// ========================================
// Store Instantiation and HMR Setup
// ========================================
const store = createStore(
  makeRootReducer(),
  initialState,
  composeEnhancers(
    applyMiddleware(...middleware),
    ...enhancers
  )
)
```

Store Enhancers

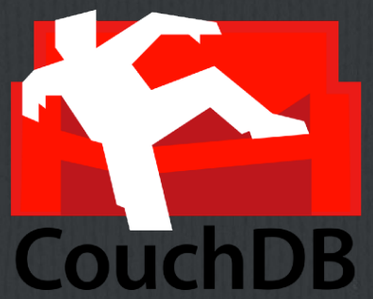
PouchDB

src/store/createStore.js

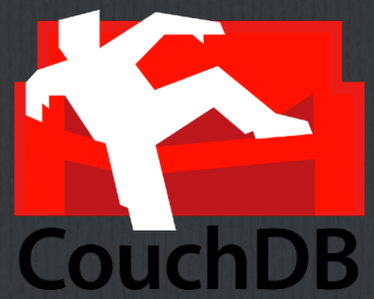
```
import PouchDB from 'pouchdb'
// for debugging with PouchDB development tools
window.PouchDB = PouchDB
```

```
// Set up the PouchDB remote, local, and sync the two
const remotedb = new PouchDB('http://54.237.198.160:5984/counter');
const db = new PouchDB('counter')
db.sync(remotedb, {
  live: true,
  retry: true
})
```

Make the local PouchDB sync to remote CouchDB.
Just a single command



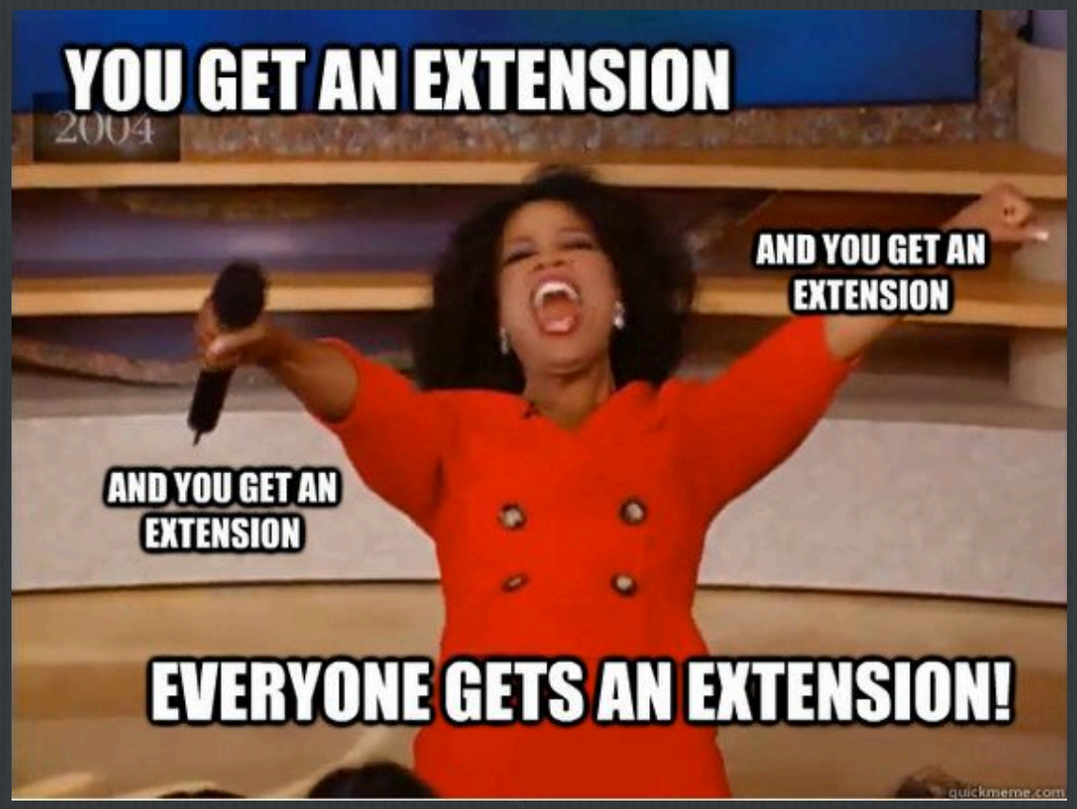
CouchDB Details



- ☐ Our server database: CouchDB
- ☐ Fire up an AWS EC2 instance
- ☐ Docker container: klaemo/couchdb
- ☐ docker pull klaemo/couchdb:latest
  - ☐ Gets you CouchDB 2.0
- ☐ docker run -d -p 5984:5984 -v $(pwd):/opt/couchdb/data klaemo/couchdb
- ☐ CouchDB GUI interface Fauxton at: http://54.237.198.160:5984/_utils/index.html

Chrome Extensions

- [ ] Redux Devtools Chrome Extension
  - [ ] Along with:
  - [ ] npm i --save-dev redux-devtools redux-devtools-log-monitor redux-devtools-dock-monitor
- [ ] PouchDB Inspector Chrome Extension



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