Data Management on the Client Side

Local Storage

IndexedDB

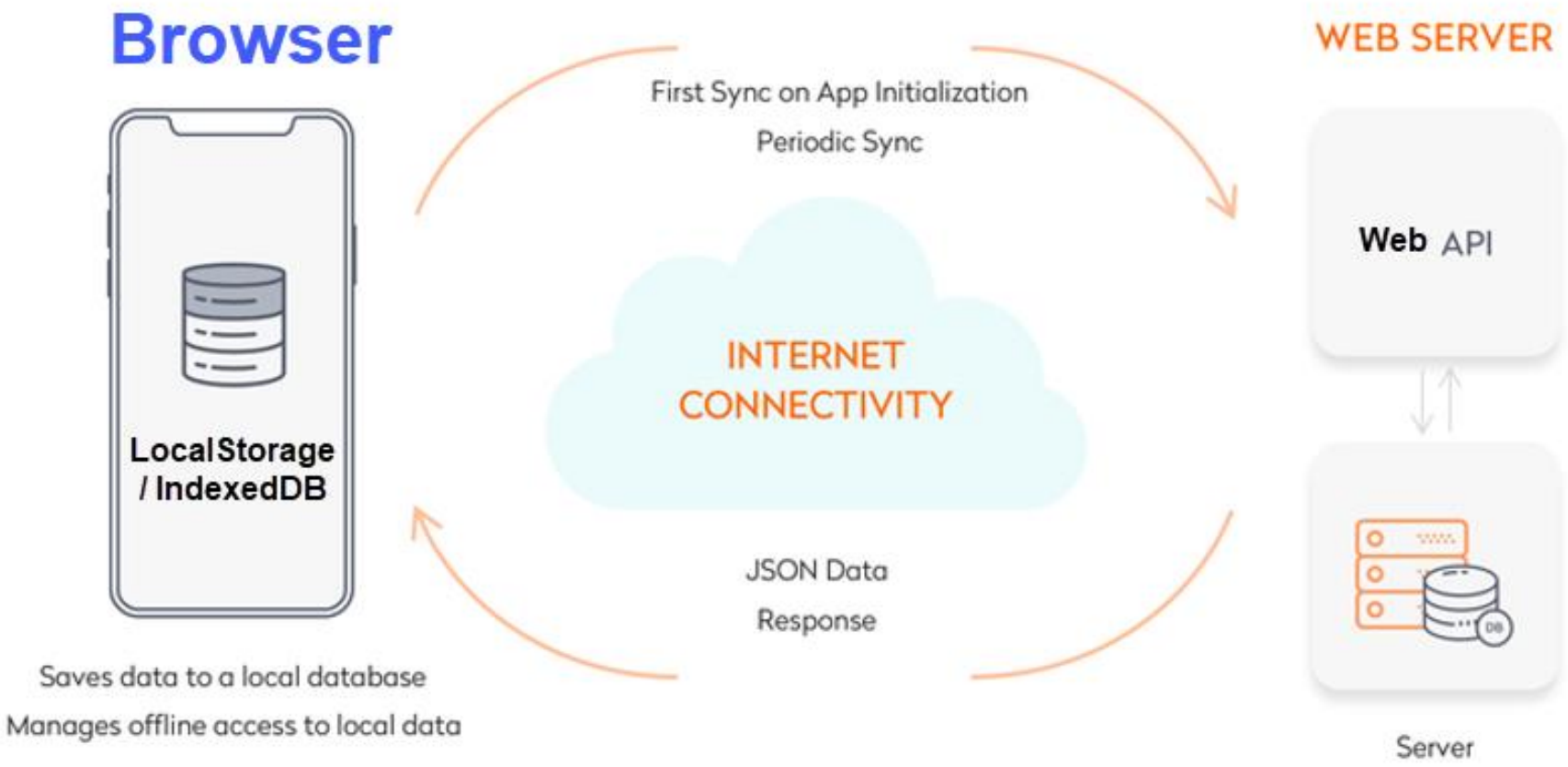
Outline

1. Web Storage API
2. IndexedDB

Web Storage API

Local Storage

Offline Web app with Sync



- **Cache** relevant pieces of data on the device. App continues to work offline when a network connection is not available.
- When the network connection is available, the app's repository may **sync** the data with the server.

Web Storage API

- The Web Storage API provides mechanisms to **store key/value pairs** locally within the user's browser
- The Web storage limit is at least 5MB and information is never transferred to the server
- Web storage is per origin (per domain and protocol). All pages, from one origin, can store and access the same data.
- It provides two objects for storing data on the client:
  - **`localStorage`** - stores data with no expiration date
  - **`sessionStorage`** - stores data for one session (data is lost when the browser tab is closed)

The localStorage Object

- The localStorage object stores the data with no expiration date. The data will not be deleted when the browser tab is closed.

```
// Store
localStorage.setItem("lastname", "Saleh");
// Retrieve
console.log( localStorage.getItem("lastname") );
```

Note:
Name/value pairs are always stored as strings. Remember to convert them to desired format!

- The example above could also be written like this:

```
// Store
localStorage.lastname = "Saleh";
// Retrieve
console.log(  localStorage.lastname );
```

- The syntax for removing the "lastname" localStorage item is as follows:

```
delete localStorage.lastname;
```

localStorage Example

- Store the number of times a user has clicked a button
  - clickCount is converted to a number to be able to increase the counter

```
function clickCounter() {
    if (localStorage.clickCount) {
        localStorage.clickCount = parseInt(localStorage.clickCount) + 1;
    } else {
        localStorage.clickCount = 1;
    }
    document.querySelector("#count").innerHTML = `Button clicked
      ${localStorage.clickCount} times.`;
}
```

sessionStorage Object

- The **sessionStorage** object is the same as the localStorage object, except that it stores the data for only one session. The data is deleted when the user closes the specific browser tab.
- The following example counts the number of times a user has clicked a button, in the current session

```
function clickCounter() {
  if (sessionStorage.clickCount) {
      sessionStorage.clickCount = parseInt(sessionStorage.clickCount) + 1;
  } else {
       sessionStorage.clickCount = 1;
  }
  document.querySelector("#count").innerHTML = `Button clicked
      ${sessionStorage.clickCount} times.`;
}
```

2

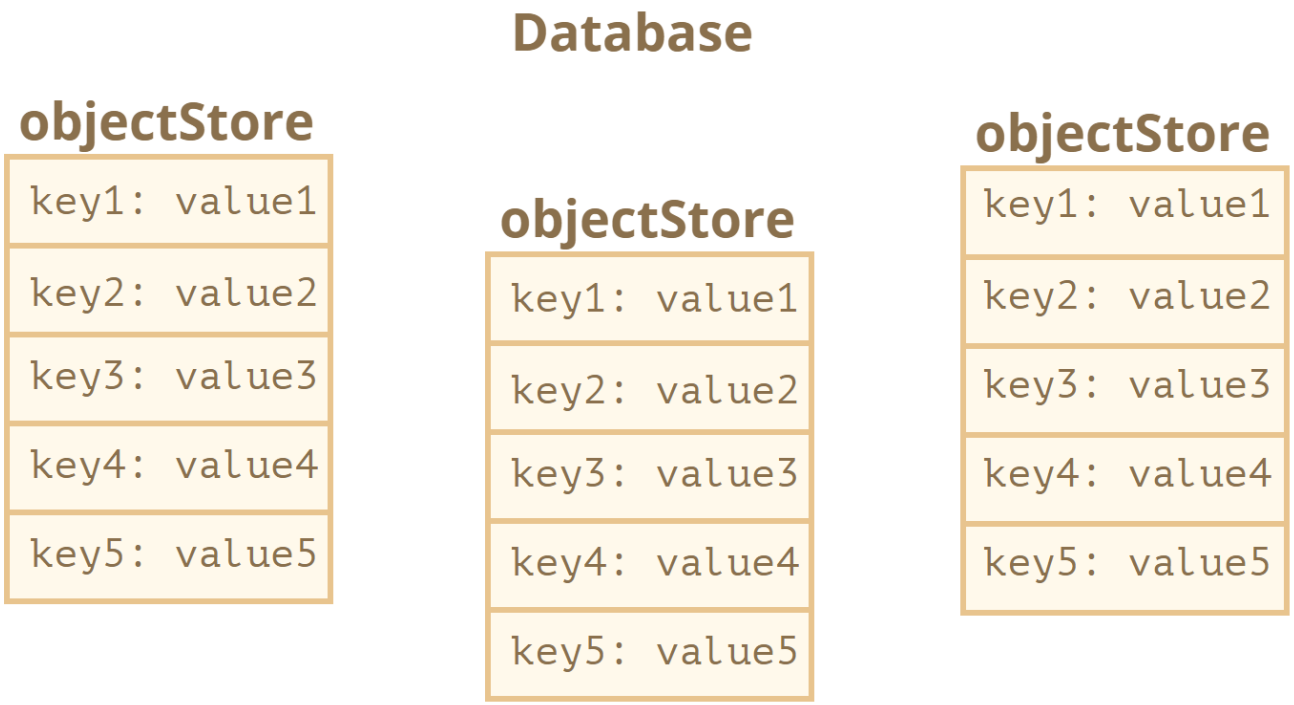
IndexedDB

IndexedDB

- IndexedDB is a database built into the browser and allow storing and querying JSON documents.
- IndexedDB database is a collection of Object Stores
- Object Store: stores a **collection** of objects, similar to tables in a relation database.
- Object: could be a json object.
- Its API is bit complicated hence IDB library https://github.com/jakearchibald/idb could be used to simply interacting with IndexedDB
  - IDB library is an async/await **wrapper** for IndexedDB

IndexedDB Structure

- Objects can arrange in object stores
  - Objects in a store usually **have similar purpose** but they may have slightly different schema
  - Objects within a Store have unique identifiers (primary key)



Open and Created Database and ObjectStore

```
import { openDB } from 'https://unpkg.com/idb?module';
const dbName = 'heroes-db';   // database name
const dbVersion = 1;   // database version (not IndexedDB version)
const heroesStoreName = 'heroes';  // Name of the objects store
const db = await openDB(dbName, dbVersion, {
        // This callback only runs ONE time per database version.
        // Use it to create object stores.
        upgrade(db) {
            if (!db.objectStoreNames.contains(heroesStoreName)) {
              /* keyPath: specify the primary key for each object in the object store.
                 Set autoIncrement to true if you want IndexedDB to handle primary
                 key generation for you */
                db.createObjectStore(heroesStoreName, {
                    keyPath: 'id', autoIncrement: true,
                });
            }
        },
    },
);
```

openDB method

- The **upgrade** callback passed to openDB only runs ONE time per database version
  - use db.**createObjectStore** to create object stores
    - **keyPath**: specify the primary key for each object in the object store
    - Set **autoIncrement** to true if you want IndexedDB to handle primary key generation
  - Use it store.**createIndex** to create an index to speed-up queries by properties other than the primary key
    - In IndexedDB, an index is just another "shadow store" that's based off the main store
    - Adding an index is like creating the same store with a different 'keyPath'
    - Just like how the main store is auto sorted by the primary key, the index store is auto sorted by the index key

CRUD Operations

```
// Get all
await db.getAll(heroesStoreName);
// Get object by id
await db.get(heroesStoreName, heroId);
// Add object
await db.add(heroesStoreName, hero);
// Update object
await db.put(heroesStoreName, hero);
// Delete object
await db.delete(heroesStoreName, heroId);
```

Query using an Index

- Index allows one to query on properties other than the primary key
- Use the index to return all the objects where the index value matches a parameter

```
// Get all using the index to return objects where the index value = heroType
await db.getAllFromIndex(heroesStoreName, 'heroTypeIndex', heroType);

// Get a single object using the index to return the object where the index value = studentId
await db.getFromIndex(studentsStoreName, 'studentIdIndex’, studentId);
```

Query by Range

- Whenever you call **.get**() or **.getAll**(), you can substitute the key with a **range**, whether querying by a primary key or index key.
  - const goodRange = **IDBKeyRange.lowerBound**(3);

    query where key >= value
  - const midRange = **IDBKeyRange.bound**(2.01, 2.99);

    query where lowerBound <= key <= upperBound
  - const weakRange = **IDBKeyRange.upperBound**(2);

    query where key <= upperBound
  - Range works on strings too, e.g.,

    IDBKeyRange.bound('ae1234', 'ss6777')

More info @ https://developer.mozilla.org/en-US/docs/Web/API/IDBKeyRange

Resources

- Web Storage API

https://developer.mozilla.org/en-US/docs/Web/API/Web_Storage_API

- IndexedDB

https://javascript.info/indexeddb

https://developer.mozilla.org/en-US/docs/Web/API/IndexedDB_API