



Couchbase

# Couchbase Mobile

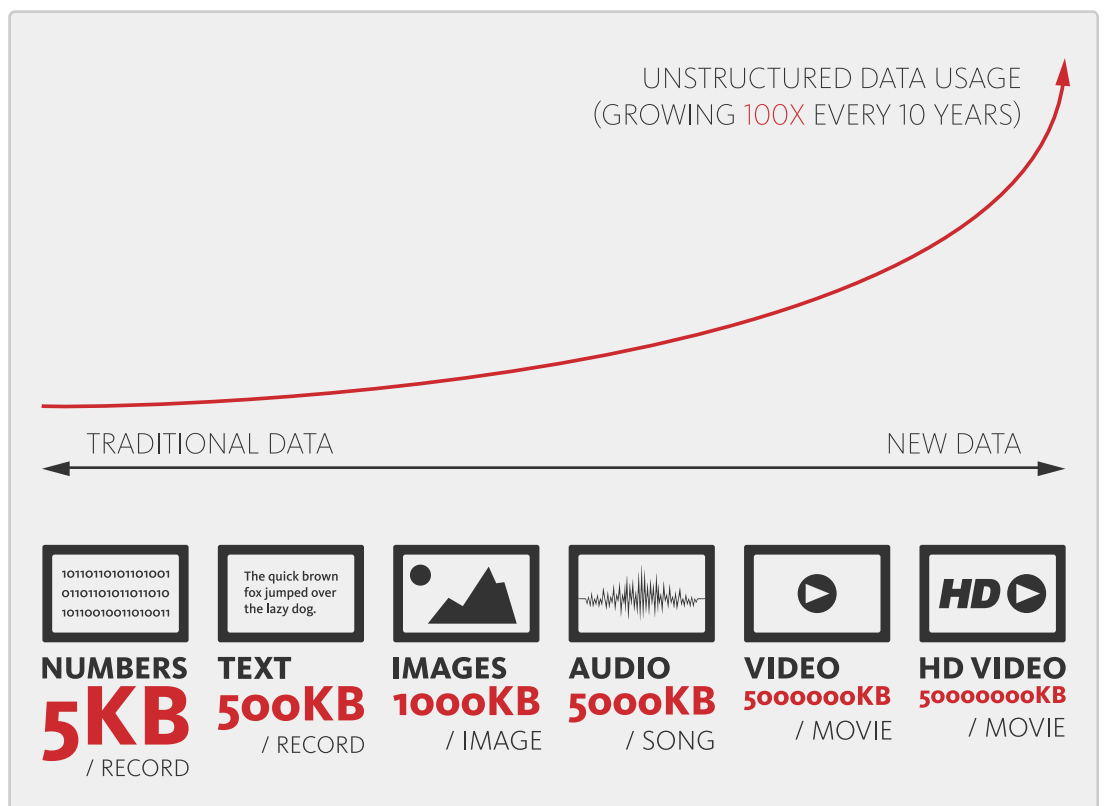
Building Always-Available, Always-Responsive Apps

## Introduction

This whitepaper introduces Couchbase Mobile, its impact on mobile app development, and provides several examples of how it is being used today.

## The Mobile App Experience of Yesterday

Apps have evolved beyond using just text and numbers-based data. Today's mobile apps incorporate rich multimedia content. Social media apps, such as Facebook and Twitter, allow users to share a growing number of rich data types in the form of text, pictures, and videos. The amount of data we are creating and sharing has exploded, and the ability to generate and manage this data has become integral to the value and richness of mobile applications.



Source: Datanami

## App Development Obstacles

It's been difficult for apps to access and use these new data types using existing older technology. App development has been hindered by developers having to use inflexible data structures to try to accommodate flexible data types. More specifically, the storage and access of these new data types in mobile devices using traditional embedded relational database technology has been problematic for several reasons.

In relational databases, an operation can sometimes requires the collection and processing of data from across a large number of interrelated tables, in turn hindering performance. Data can only be written into pre-defined tables of rows and columns. It is difficult to add a field or delete a field

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WE HAVE TONS OF CUSTOMERS WHO SAY ‘DATA SYNC, DATA SYNC, DATA SYNC — THIS IS OUR NO. 1 PROBLEM IN MOBILE.’

— Nat Friedman  
CEO,  
 Xamarin

of data or re-organize the data in order to accommodate new data structures. Much of the new data is unstructured, so developers need a database that is capable of efficiently storing it. Unfortunately, the rigidly defined, schema-based approach used by relational databases makes it impossible to quickly incorporate new types of data, and is a poor fit for unstructured data.

In addition, a data-rich app can become unresponsive if it is dependent on network connectivity in order to operate. Apps like social media sharing platforms, productivity and collaboration apps, lifestyle management apps, run slowly when network connectivity is slow and not at all when network connectivity is unavailable. Other apps, such as Triplt, try to bridge the divide with light caching of previously accessed data during offline situations. This helps some, but this is primarily read-only for a limited amount of content. At the end of the day, even the best developers using the best software tools and best test methodology can’t prevent a lack of cellular connection at the beach or the WiFi network being slow at a busy coffee house.

## A New Age for Mobile: More Resources, More Data and Smarter Apps

Today’s mobile apps can leverage the latest technology and powerful hardware that reside in tablets and smartphones. These devices enable users to easily capture, store, share, and consume rich multimedia content.

In addition, today’s mobile apps are utilizing and absorbing a variety of rich data via RESTful APIs to get real-time data on sports, news, weather, real-time traffic and social feeds. Companies such as the New York Times, ESPN, Foursquare, Facebook, and Weatherbase, offer APIs that enable developers to tap into their rich databases of data (predominately in JSON format) that can be leveraged in mobile apps.

Mobile apps are, and will continue to be, more data-driven in nature. Users expect that their apps and data will be available anytime and anywhere, regardless of network connectivity.

### Today’s Mobile Apps Need Offline Capabilities

Mobile apps need to be prepared for “offline” support. This means using a local data store within your app to capture and store app data while offline, and then sync this data with the cloud when back online. This allows users to continue using an application (e.g., access, modify, and share data, pictures and videos) without being affected by network connectivity or speed. From a user perspective, apps just work. When you have network connectivity, it’s useful to have, but apps should still be able to run when you don’t. In order to do this, developers need to have sync functionality built into their app, in addition to a fast local database.

## How to Get Sync

So, how hard is it to implement “offline” functionality in a mobile app today? What does it take in order to implement your own database, sync code, and cloud server backup solution? Or alternatively, what commercially available products exist today that can be leveraged to do this?

The best-known mobile database is SQLite, an embedded relational database that is a default option on iOS and Android platforms. However, SQLite doesn’t come with built-in sync functionality. And, SQLite and all other traditional RDBMS database solutions use rigid and complex schemas for data storage and access, making them difficult to use for today’s flexible and rapidly evolving mobile experience.

As for Sync, many software engineering teams have belatedly discovered after years of effort that defining the architecture and writing and testing the actual sync code is a lot more difficult and time-consuming than it might first appear. Most companies would rather spend the time developing their app and getting it quickly to market, rather than bother writing their own sync code.

“The ability to have offline apps in mobile, so you can deal with more intelligent syncing between the apps, and the ability to move off network or get into a place with very bad connectivity and still use that application and have that data uploaded back to the cloud once you’re ready to do so is really important and necessary.”

— **Drew Garner**  
Senior Director, R&D,  
**C-ncur**

## Introducing Couchbase Mobile: JSON Anywhere

Couchbase Mobile is the first and only native NoSQL JSON mobile database solution. Couchbase Mobile consists of three components: an embedded full-featured JSON database on the device called Couchbase Lite, a highly scalable sync tier called Couchbase Sync Gateway, and a highly scalable, high performance, NoSQL database in the cloud, Couchbase Server. With Couchbase Mobile, you can develop rich mobile applications that are always available, always responsive, and not affected by network availability or latency. Couchbase Mobile enables mobile app developers to easily create a new breed of always-available apps that are still fast and responsive even when the network is unavailable or slow.



- A lightweight, native embedded JSON document database
- Currently supports iOS, Android, and REST SDKs that include full document read/write access, index and querying, sync and conflict resolution



- Sync server that effortlessly syncs local app data to a remote Couchbase Server database for updates, replication, or collaborative sharing
- Configure your cloud in one page of programmable sync code. Easily authenticate users and determine mobile device access to selected documents and channels distribution



- Couchbase Server is a high performance, easily scalable, always-on NoSQL backend document database optimized for interactive web applications
- Provides a flexible JSON data model – including indexing and querying, full-text search integration and incremental Map Reduce features

## Couchbase Lite

Couchbase Lite is a lightweight, document-oriented syncable JSON database designed from the ground up for mobile apps. In addition to native APIs for iOS and Android, REST APIs are also available, along with integration support in popular cross-platform tools such as Phonegap and Xamarin. A portable Java SDK is also available that runs on any platform that supports a J2SE compliant JVM, including Linux, OSX, and Windows. Couchbase Lite can also work on its own as a NoSQL solution for local data storage, or as a facilitator for peer-to-peer replication. Most commonly, it is used in conjunction with Couchbase Sync Gateway and Couchbase Server.

### COUCHBASE LITE — KEY FEATURES

### BENEFITS

#### Document-Oriented and Schemaless

- Stores records in flexible JSON format instead of requiring pre-defined schemas or normalization, as is the case with relational databases
- Documents can have binary attachments, such as multimedia content
- Application data format can easily evolve over time without any need for explicit and difficult migrations
- No data transformations are necessary as JSON is used throughout Couchbase Mobile

#### Full document index, querying, and sync capabilities

- Native and REST API support for full-featured databases
- MapReduce indexing provides fast lookups without needing to use special query languages
- Create views (indexes) and apply them to create ordered key-value pairs that can be queried

#### Advanced filtering and replication features

- Supports continuous or one-shot replications, as well as defining filter functions to determine which documents are replicated and which are not

#### Peer-to-peer replication support

- Your app can also accept connections from other devices running Couchbase Lite and sync data with them

#### Advanced conflict resolution features

- Multi-version Concurrency Control (MVCC) is used to manage document conflicts; A flexible revision tree scheme is used to manage conflicts without data loss



WE SEE THE INTEGRATION BETWEEN COUCHBASE AND XAMARIN PROVIDING A CRITICAL COMPONENT THAT ENTERPRISES NEED TODAY FOR NEXT-GENERATION APPLICATIONS THAT REQUIRE EASY-SYNC.

— Nat Friedman  
CEO,  
 Xamarin

## Couchbase Sync Gateway

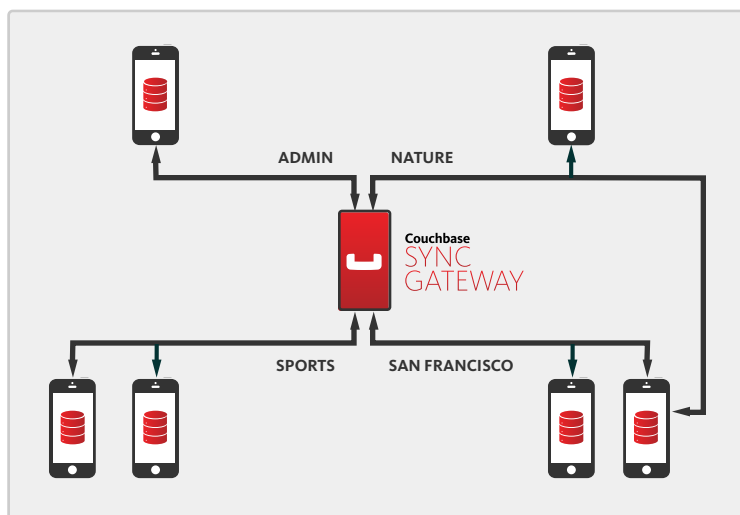
Couchbase Sync Gateway makes JSON stored in Couchbase Server available to mobile devices over the Internet. It provides features for routing data to users, authentication, change validation, and access control. Some of the key features and benefits are shown below.

SYNC GATEWAY — KEY FEATURES	BENEFITS
100x less code with Sync API and custom configuration features	<ul style="list-style-type: none"><li>■ Configure your cloud in just one page of programmable sync code</li><li>■ Specify all data routing required for your app</li><li>■ Sync Gateway abstracts the network layer for you; no need to maintain REST web services stacks and make periodic network API calls</li></ul>
Custom data flow	<ul style="list-style-type: none"><li>■ Sync Gateway supports multi-master replication of data to and from Couchbase Server and client devices</li><li>■ Specify uni-directional and bi-directional data flow patterns of routing between Couchbase Server and client devices, as well as routing between devices, for maximum flexibility</li></ul>
Fine-grain control of data routing, authentication, change validation, and access control	<ul style="list-style-type: none"><li>■ You can specify document access with fine grain filter controls, and authentication options</li><li>■ Use pre-built authentication features like Facebook, or plug-in your existing authentication methods</li></ul>
Scalable	<ul style="list-style-type: none"><li>■ Sync Gateways are stateless and developers can easily add additional ones to meet need for additional load</li></ul>

Couchbase Sync Gateway configures data routing using a concept called “channels”, which defines what slices of data stored on Couchbase Server can be visible to a given user. A user can be granted access to one or several of these channels. For example, a user may express interest in the Sports category of a News reader app. That user will then subsequently be granted access to the “Sports” channel, where they can then read all documents that are assigned to the “Sports” channel.

Another user could be assigned access to multiple channels (e.g., such as “San Francisco” and “Nature”) for access as shown in the figure at right.

If a user writes a document and then uploads it to Couchbase Server, this is considered a change (create, delete, or modify operation). The configured Sync Gateway Sync function will decide whether or not to allow the change.



## Couchbase Server

Thanks to a flexible JSON model, Couchbase Server makes it easy to modify your applications without the constraints of a fixed database schema. Submillisecond, high-throughput reads and writes give you consistent high performance. Couchbase Server is easy to scale out, and supports topology changes with no downtime.

### Easy Scalability

It's easy to scale your database layer with Couchbase Server, whether within a cluster or across clusters in multiple data centers. With one click of a button, no downtime, and no changes to your app, you can grow your cluster from 1 to 25 to 100s of servers while keeping the workload evenly distributed.

### Always On

With Couchbase Server, your application is always online, 24x365. Whether you are upgrading your database, system software or hardware – or recovering from a disaster – you can count on zero app downtime with Couchbase Server.

### Consistent High Performance

Couchbase Server's consistent submillisecond response times means an awesome experience for your app users. Consistent, high throughput lets you serve more users with fewer servers. Data and workload are equally spread across all servers.

### Flexible Data Model

You shouldn't have to worry about the database when you change your application. With Couchbase Server, there is no fixed schema so records can have different structure, and be changed any time, without modification to other documents in the database.

“PhoneGap is a project that relies on a massive community of hundreds of thousands of developers. PhoneGap allows users to easily create apps using the web technologies developers know and love – HTML, CSS and JavaScript. We see JSON and sync as core components to the future of mobile data, and the Couchbase Lite plugin for PhoneGap will allow our developers to deliver next generation applications where data sync is becoming the norm.”

— **Brian LeRoux**  
Principal Product Manager,



## Couchbase Mobile Use Case Examples

There are many potential use cases for Couchbase Mobile. Here are just a few examples to get you started thinking about the possibilities.

### **Education / Social Interaction**

One customer of Couchbase Mobile is applying it in an educational setting. A central database of instructional content is used to selectively push learning modules / multimedia lessons to individual students on their mobile devices. Teachers and students can use customized mobile apps to chat with each in real time, so that students can ask questions during a lecture with real-time response. In addition, homework assignments can be completed offline anywhere.

### **Point-of-Sales**

Couchbase Mobile can be applied to Point-of-Sales applications where orders can still be entered off-line on a mobile device, and later synced via Sync Gateway to Couchbase Server and available when later on-line.

### **Product Catalog (E-commerce)**

Leverage Sync Gateway's selective sync capabilities to push the latest products information or special promotions and sales to only those customers interested in specific product categories, for offline consumption on their smartphones. App users would only receive contextual information and offers that they care about, for better retail sales conversion. Use Big Data analysis to better understand your customers' needs, but use Couchbase Mobile to better reach your customers with targeted contextual information that turn into actual purchases

### **Expense Report and Other Enterprise Apps (e.g., HR / Payroll / Field Service, etc.)**

Almost every Enterprise or commercial productivity app can benefit from offline apps access. Apps that are always available means users that are always productive no matter where they are (at the airport, in the subway, or at a customer's site).

### **Real-time 'Off-the-Grid' Chat Applications via Bluetooth (Or on the Network with WiFi)**

Couchbase Mobile offers a 'peer-to-peer replication' feature. By adding an extra HTTP listener component, your app can accept connections from other devices running Couchbase Lite and exchange data with them over Bluetooth, without having to be connected to the network at all.

These are just a few patterns we've seen with Couchbase Mobile usage. There are many potential types of apps that can take advantage of Couchbase Mobile and we are just getting started.



“We needed to provide an educational experience as engaging as the apps students love to use everyday. The ability to work online/offline and seamlessly sync across devices and between users was critical to delivering the experience they need for both in the classroom, and off campus. We investigated the market for an ultra-lightweight NoSQL mobile database with easy sync and Couchbase was the only choice.”

— **Mike Lamb**  
Principal Software Engineer,



## Conclusion

Mobile apps are becoming increasingly more data-driven than ever before. Apps must run fast and be always available, as users expect rich interactive content to be always available to them wherever they are. Mobile sync and offline apps functionality is quickly becoming the norm. Couchbase Mobile can help you get to market quickly with differentiated apps that supply “content-on-demand”, regardless of network connectivity.

For additional information on Couchbase Mobile, please visit [couchbase.com/mobile](http://couchbase.com/mobile).



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## About Couchbase

Couchbase provides the world's most complete, most scalable and best performing NoSQL database. Couchbase Server is designed from a simple yet bold vision: build the first and best, general-purpose NoSQL database. That goal has resulted in an industry leading solution that includes a shared nothing architecture, a single node-type, a built in caching layer, true auto-sharding and the world's first NoSQL mobile offering. Couchbase Mobile, announced in 2013 is a complete NoSQL mobile solution comprised of Couchbase Server, Couchbase Sync Gateway and Couchbase Lite – a lightweight NoSQL database designed for the device. Couchbase counts many of the world's biggest brands as its customers, including Amadeus, Bally's, Beats Music, Cisco, Comcast, Concur, Disney, Orbitz, Rakuten / Viber, Sky, Tencent, Walmart and Verizon, as well as hundreds of other household names worldwide. Couchbase is headquartered in Silicon Valley, and is funded by Accel Partners, Adams Street Partners, Ignition Partners, Mayfield Fund, and North Bridge Venture Partners.