

# Enabling Usage of Cloud-based Applications When Offline

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## 1 The Problem

The Internet is ubiquitous. Office and home environments are increasingly making use of cloud computing platforms to facilitate day to day tasks. The main cloud related challenges highlighted by academia include: server consolidation, energy management, data security, storage technologies and data management [2]. Cloud related research either does not mention issues pertaining to Internet connectivity or assumes that Internet connectivity is available (and rightly so), and as pointed out by [1]: “No Internet, no cloud computing - it’s that simple.” However, situations often arise whereby connectivity is limited or unavailable (such as whilst travelling) and access to the cloud is still required.

## 2 Current State of Affairs

A common solution to provide offline access to cloud-based applications is to implement a desktop based version of the cloud-based application. While desktop application based solutions do provide a sufficient means of accessing such applications offline, they require a substantial amount of effort from the development teams to implement/re-implement/port.

Adobe AIR allows developers to package HTML, JavaScript, Adobe Flash, Flex and ActionScript into applications that can be used offline. Whilst, the technique does allow for code reuse (between the online site and the desktop version), it requires that end-users install each offline web-based application that they require to use.

Google Gears, no longer available or supported, is a retired project that aimed to provide a framework that allows for offline browsing of web pages. It achieves this by caching (static) resources (HTML, Javascript, images, etc.) locally in the client browser and then serving them later when required. It also provides a local SQLite database on the client where any required offline data can be synced to. Caching and serving static pages does not meet the dynamic requirements of web applications. Therefore, application developers using Google Gears are required to implement the data model’s synchronisation logic on the client side (in Javascript); which must also be exposed from the server side (via HTTP requests); and also implement all logic that is to be used offline in the client-side part of the application (that is in the client-side Javascript). Therefore, to allow for offline usage a developer must either duplicate the logic both in the server-side and client-side, or else opt for client-side code only. That said, server-side code is

often intended to run on the server for good purposes (vicinity to data, bandwidth reduction, etc.). Google Gears was abandoned in aim of standardising the capabilities into HTML5. HTML5 inherently is client-side code and therefore the server-side/client-side discussion above applies to HTML5.

### **3 Vision**

Developers should be primarily concerned with the business logic specific to their application (as much as possible). Therefore, in this project we are investigating techniques to facilitate a framework for building cloud-based applications that allows for their usage when offline: without having to implement a desktop-based version; without having to implement client-side versions of server-side code; and without requiring application developers to implement synchronisation and offline/online switching logic themselves.

To achieve this undoubtedly changes would be required to the client web browser, in a similar to Google Gears. Initiatives behind HTML5 are heading towards standardisation and therefore the features implemented in HTML5 (and future versions) are likely to be supported by all browsers. The changes required will therefore be implemented by the browser developers.

As a first prototype towards the goals outlined above, we are implementing functionality on the client side that could eventually be integrated into the client web browser. We plan to achieve this by implementing language constructs that will define what parts of the code and data models can be used whilst offline.

### **References**

1. M. Miller. *Cloud computing: Web-based applications that change the way you work and collaborate online*. Que publishing, 2008.
2. Q. Zhang, L. Cheng, and R. Boutaba. Cloud computing: state-of-the-art and research challenges. *Journal of internet services and applications*, 1(1):7–18, 2010.