Accuracy, Security, and Architecture Impacts and Challenges of Mobile and Web Technologies: Geolocation Field Data Collection in Washington State Water Resources

Abstract

The purpose of this paper is to examine accuracy, security, and architecture impacts and challenges of mobile and web technologies through the case study of collecting geolocation field data in Washington (WA) State water resources. Effective management of water as a public resource relies on the capture, storage, and retrieval of accurate geographic position data. This is also true of a broad range of business domains beyond water resources, such as earth sciences, city planning, and navigation to name a few. Application developers must
choose how to capture this information (with enough accuracy to be useful for its intended application) and get that data to a place where it can be processed and used. A traditional monotonic application using a Global Positioning System (GPS) and a mobile app using a smartphone are available today. The advent of HTML 5 now allows the development of a mobile web app, which is not dependent on any particular smartphone platform. These multiple technical options lead to two research questions: How does an HTML5 mobile web app solution work in terms of accuracy, security, and architecture, compared with a GPS-based solution and a mobile native app solution for collecting geolocation field data? And second, as HTML5 mobile web apps are a relatively new technology, what best practices can we uncover to assist in the process of choosing between an HTML5 mobile web app and a mobile native app, and also what are the best practices for building a mobile web app that can operate offline? To answer these questions, we build an HTML5 mobile web app called LocationSharpener for collecting GPS locations leveraging three of the new HTML5 features: IndexedDB, AppCache, and GeoLocation. We use the mobile web app to collect locations of water resources facilities like wells and diversions and analyze how accurately the app collects the geolocation data. We apply threat risk modeling to the mobile web app to analyze its security and privacy compared to that of the native mobile app approach.

In addition, by documenting the architecture of the mobile web app with multiple views, we analyze how HTML5 affects the architecture and present best practices for building a mobile web app that can operate online and offline. The analysis of location accuracy shows the HTML5 mobile web app approach provides acceptable location accuracy even when offline. Threat modeling demonstrates that, in contrast to native mobile apps, mobile web apps offer a clear advantage to users and developers: an isolated execution environment makes it more difficult for a malicious mobile web app to read private data; As an outcome of the architecture documentation we also propose new best practices of developing a mobile web app using HTML5: the developer must consider two subsystems for online and offline use cases and a sequence of connected, disconnected, and connected deployment modes. Also, standards-based web apps are portable across virtually any operating system. This also eases the burden on developers, since they can write mobile web app once and deploy anywhere.

References

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Keywords

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