

A Scalable and Decentralized Publish/Subscribe-based Weather Alert System

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Background

Our work was motivated by the limitations we observed with the existing severe weather warning system at Vanderbilt University, which is a centralized solution that sends out reports to all users who are registered with the system. There are two major problems with this solution. First, the centralized nature of the system adversely impacts scalability. Second, because alerts are sent to all registered users, a user who is currently not in the area of hazardous weather may still receive an alert thereby resulting in false alarms for that user.

Purpose

The purpose of the project was to overcome the limitations in the existing, centralized warning system by investigating a decentralized, scalable, and easy-to-use solution for the severe weather warning system where Android devices in the vicinity of the hazardous weather event can post data to a server including the approximate location of a severe weather. The server in turn can distribute messages scalably to Android devices that are in the proximity of the weather event and eliminate false alarms.

Design/Method

For a decentralized and scalable solution, we used the Google Cloud Messaging (GCM) service, which allows data from servers to be sent to Android devices using publish/subscribe messaging. We designed a RESTful web server, which distributes information to devices by communicating with GCM server. We implemented an Android application that registers an Android device with the GCM server and sends its registration ID to the server. The server stores the ID in a MySQL database. For ease-of-use, we extended the application to include an option allowing a user to send the device's location to the web server; the web server in turn would disseminate the data via notifications to all other Android devices whose registration IDs it stores. To eliminate false positives, we studied ways of blocking notifications when a device is located outside a certain severe weather radius.

Results

The insights we gained thus far are qualitative. We learned that the GCM technology makes it possible to eliminate the requirement for an application to query the server for the content, because the server itself initializes the distribution of data to relevant devices. We were also able to experiment the system with a server and a few Android devices.

Conclusions

This poster describes a decentralized, scalable, and easy-to-use design of a severe weather warning system based on publish/subscribe communications. This project incurred a steep learning curve and integration challenges. Our future work involves large-scale experimentation. It also involves populating the application with more advanced features and extending the application to Android devices that do not support GCM.