Towards Open eduroam Coverage Data

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Keywords: eduroam, crowd-sourcing

Abstract

In this paper we present work at the University of Southampton, undertaken with the support of JANET(UK), to develop an eduroam 'companion' application for the iPhone and Android platforms. The initial specification of the app included displaying 'official' eduroam locations drawn from KML data from the eduroam.org site, with application users allowed to contribute their own data points with the goal of crowd-sourcing more accurate and complete coverage maps. While the apps are attracting a lot of interest, they have also raised some higher level questions, in particular how eduroam coverage data should be represented, and how this can be done in a way that is scalable internationally, so that such a 'companion' app can be used worldwide.

Introduction

eduroam [1] has evolved over recent years to become a successful and widely deployed roaming infrastructure available to students, researchers and academics at thousands of participating sites worldwide. Yet despite being widely adopted, coverage data for eduroam remains somewhat patchy at best. Participating sites are requested to supply location data for their eduroam coverage. While some do supply high quality data, many provide only one default geolocation to represent their site, which may neither convey the scope of their deployment, nor even be a specific point at which eduroam is present.

Thus while the KML location file held at eduroam.org [2] may include all European sites, it does not as yet include enough meaningful data to help a user looking for accurate eduroam coverage information, nor does it help users travelling outside Europe.

We believe it is desirable that public, accurate open data about the location and coverage of eduroam networks is made available to all who need it. In this paper we describe a 'companion' app, developed for iPhone (iOS) and Android platforms, designed with the goal of allowing users to crowd-source such coverage data. Initial testing and use of the app has raised many interesting questions about how such a capability can be developed to support its use internationally. This paper intends to provoke discussion about those questions.

An eduroam 'companion' app

The initial companion app was developed for the iPhone platform by a student at Southampton. Its main features were to allow the user to view the 'official' eduroam locations by displaying markers at the locations listed in the KML file, and to allow users to tag their own new locations when they had eduroam coverage at the location they were visiting. The user-contributed data points were stored in a separate database at Southampton, and gathered by a simple clustering algorithm into small 'hotspot' locations. By assigning a confidence value in a location based on the number of different users contributing the data, users gained the ability to see both sets of official and crowd-sourced coverage data on the same maps. A sliding confidence threshold allowed users to 'tune' which user-contributed points they saw; setting this value very low would show all user-contributed data. Figure 1 shows some examples of such functions (though for the Android version of the app).

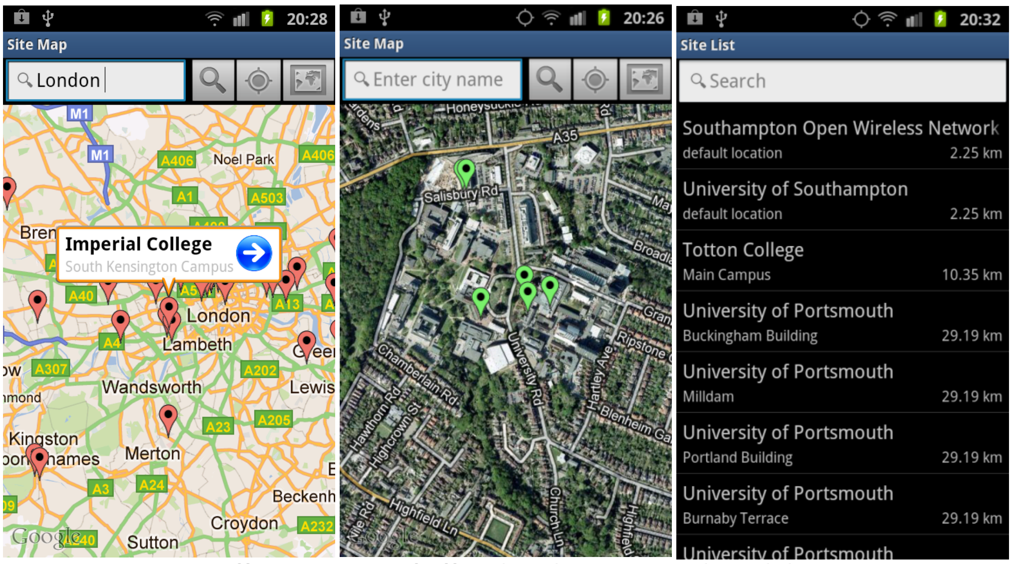

Figure1: Different views of official and user-contributed data points

One of the problems with the iPhone app was that, if the app were to appear in the Apple App Store, none of the network-specific configuration information was available. Thus when tagging a location as having eduroam coverage, the app was unable to assert whether the device was actually associated to an eduroam SSID at the time. Further, no signal strength or identifier of the AP the device is associated to was available.

The subsequent porting of the iPhone app to the Android platform was able to give a much richer set of data for the device to report. In late 2011, a student group project produced the Android port, and added significant new functionality.

One example of the new functions is the ability for a user to post their location and that they're using eduroam to their Facebook or Twitter accounts; this is a simple way to widen awareness of eduroam, and one can foresee extensions to give (for example) users Foursquare-like badges for achievements like 'checking in' in so many different eduroam locations in different countries.

Another example, also shown in Figure 2, is a heat map view derived from reported signal strengths at user-contributed coverage data points. Further, the Android app allows 'automatic' tagging of coverage by an 'active' mode that would report new points when the user moved more than a set distance (default 25m) from the last contributed point while remaining in eduroam coverage.

It is expected that the Android app will be available for download by the time of TNC2012, subject to agreements with Janet and the eduroam community. A demo version at the very least will be available to delegates.

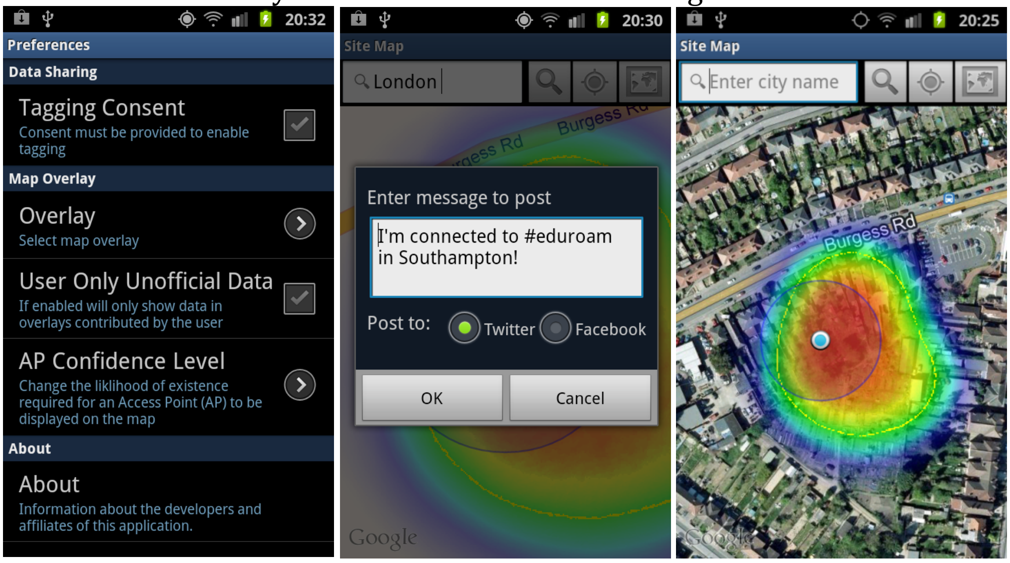

Figure 2: Some features in the Android version of the eduroam companion app.

Challenges Ahead

Through the two eduroam companion apps, users have a way to see both the official locations [2] of European eduroam sites, and user-contributed data points that mark additional more-specific locations (with some idea of the confidence level of those data points). This in itself is very useful. However, there are some interesting questions emerging from this new capability. These need discussion and agreement on a way forward both for the further development of apps such as the companion app, but also for the generalized availability of eduroam coverage data in general.

These questions are listed here:

- The app currently reports all data to one remote server. eduroam is an international service; Should one NREN's users send all reports to one server operated by their NREN, or should reports be sent to the NREN in which the user is roaming? In either model, how do NRENs then re-share the data? The app will also need to know from where to download data points. This is a particularly important question for scalability. Interoperability is key.

- How should the user-contributed and official data be merged, if at all? It may be possible for a site to 'bless' its user-contributed data points as official, and in doing so save itself the effort of submitting the data. User-contributed data may otherwise act as an incentive for a site to improve its official data.

- Can open linked data principles [3] as embraced at Southampton [4] be applied to the coverage data, to maximize the reusability of the data, and the ability for third party developers to access and use the data in innovative – and perhaps unexpected – ways?

- The Android platform allows the app to assert that it is associated to an eduroam SSID before reporting data, and it can supply much more valuable data, especially an identifier and signal strength for the location. It would be useful to define an extensible message format for such reports that can be used by any future new companion apps on any platform.

- There is an implicit trust in the user-contributed data points. More research is desirable in the trust and confidence algorithms applied to the contributed data points. Interestingly iPhones have persistent unique device identifiers, while Android devices generally do not, so establishing the reputation of data points coming from one device (without the user sending their personal data), may be a challenge.

- Should user-contributed data be aged over time? If it is, there may be a danger that new data is not contributed for sites that have mature user-contributed data.

- Further research into clustering and heat map algorithms may be desirable; this becomes easier when considering the richer Andoid-based data points.

The authors believe that the eduroam community should move rapidly to address these questions, to maximize the capacity of users to improve their own eduroam experience around the world, and to allow developers to create exciting new apps that include eduroam coverage in their context.

Acknowledgements

The original iPhone eduroam app was developed by Ashley Browning as an individual student project at the University of Southampton in 2010-2011. The Android app was developed by Stephen Tuttlebee, Tim Ledbetter and Alex Davenport as a Group Design Project at the University of Southampton in 2011. We would like to thank Miroslav Milinovic, Stefan Winter and Klaas Wierenga for their input during the application development.

References

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[4] Southampton Open Data, http://data.southampton.ac.uk/

Author Biographies

Dr. Tim Chown is a lecturer in Electronics and Computer Science at the University of Southampton. He was a member of the original TF-Mobility group that defined the eduroam standards and operational model, and of the JANET advisory group that contributed to establishing the JANET Roaming Service. His other research interests include community wireless networks, home networking, IPv6, network security and multicast. He is currently co-chair of the IETF 6renum WG.

Mark O'Leary is janet's network development group manager, with a background focus on access and identity management technologies. He has been an active member of TF-MNM for several years, and is currently workstream leader for location-aware aspects of mobility within that group. He assumed responsibility for janet's eduroam development programme in 2005 and since then has worked towards increased footprint, usability and ease of deployment. Along the way this has resulted in temporary self-configuring 'meeting support' eduroam instances, permanent eduroam coverage on public transport, and a roaming visualisation tool.