

WiFi-Reports: Improving Wireless Network Selection with Collaboration

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Users of mobile devices increasingly expect Internet connectivity wherever they travel. Despite the roll-out of wide-area wireless broadband, many devices, such as iPods and portable game stations still rely on local area WiFi networks to obtain connectivity. Even smart phones may prefer WiFi over 3G and WiMAX to improve the performance of high throughput applications or to avoid data charges. Fortunately, there is often a large selection of WiFi service providers to choose from. For example JiWire,¹ a hotspot directory, reports 400 to 1000 commercial WiFi networks in each of the top ten U.S. metropolitan areas. Nevertheless, in a study of commercial hotspots in Seattle, we found significant diversity in performance and functionality due to differing back-haul capacity, port blocking, and poorly functioning WiFi access points. Unfortunately, there is no way for a user to determine which networks will be sufficient to run their applications before purchasing access.

We present *WiFi-Reports*, a collaborative service that provides WiFi clients with historical information about networks to improve wireless network selection. Wireless clients that participate in WiFi-Reports automatically submit reports on WiFi networks that they use. Reports include metrics such as estimated back-haul capacity, ports blocked, and connectivity failures. An aggregate report is generated from previously submitted reports on each network to predict its performance. Our initial study of hotspots in Seattle suggests that even if a user is only selecting amongst networks at a single location, WiFi-Reports would improve network selection over existing techniques such as maximum-SNR and Virgil [2] because it could provide information on commercial networks that cannot be tested beforehand. Even the “official” network for a hotspot is not always the optimal choice because, for example, the access point next door may have a better back-haul connection.

The key challenge in WiFi-Reports is to obtain accurate user-submitted reports. This task is hard because two

conflicting goals must be addressed in a practical system: preserving users’ anonymity and limiting fraudulent and erroneous reports. Since the use of a wireless network implicitly reveals a location that a user visits, users may be reluctant to participate in WiFi-Reports if their identity can be linked to their reports. Thus, user reports should be *anonymous*. To be robust against inference attacks that can reveal a user’s entire location history [1], a single user’s reports should not even be linkable to each other. However, some users may have an incentive to submit fraudulent reports, e.g., to promote networks that they own. Thus, each user should also have *limited influence* on a network’s aggregate report. That is, a small number of users should not be able to alter a network’s aggregate report if most other submitted reports disagree. We present a simple cryptographic protocol based on electronic cash that achieves both anonymity and limited influence. Using this protocol, participating users do not have to worry about anyone tracking their movements (including the WiFi-Reports service) and aggregate reports are robust to a small percentage of fraudulent reports. Although we use this protocol in the context of WiFi-Reports, we believe it is applicable to many collaborative reporting services.

REFERENCES

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¹<http://www.jiwire.com>