Boosting Trustworthy Hotspots Rating with Implicit Hotspot QoS Evidence

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Abstract. Wi-Fi networks and its users are more and more numerous. Unfortunately, the risk of using one Wi-Fi or another varies and there is no means of selecting the most trustworthy hotspot. Furthermore, there are an increasing number of websites offering an assessment of the Wi-Fi networks available in a given location. We have analyzed some of these different websites and unfortunately only a few users rate the hotspots. We propose to use implicit hotspot connection session information to rate the hotspot which are not rated by the users. Our solution uses also this implicit information to avoid that the users can easily cheat about the quality of their experienced network sessions.

1 Introduction

The number of Wi-Fi networks is growing very fast because of the increasing number of shared free personal Wi-Fi access. For instance, WeFi [6], one of the websites that evaluates Wi-Fi networks, lists more than 30 million Wi-Fi networks over the world. In some locations, it is not rare to have more than five nearby potential Wi-Fi networks to be connected to. Unfortunately, it has been reported [7] that fake Wi-Fi networks have been set up in airports in order to capture users sensitive information as they surf the Web during their connection to these networks. Worse, the users have no means of knowing which Wi-Fi networks are trustworthy.

We propose to use implicit measurement of hotspot connection session Qualityf of Service (QoS) to avoid that the users can easily cheat and also use this implicit information like an evaluation when the evaluation of the user is missing. To evaluate whether our approach is viable, we have mined the main different Websites that list rated Wi-Fi hotspots for a total of more than 400 000 mined networks descriptions. The rest of this paper is organized as follows: Section 2 presents our study and result about the mining of these websites. In Section 3, we present our solution. Related work is presented in Section 4. Section 5 concludes the paper.

2 Results from Mining the Websites Listing Hotspots

Our approach proposes that users will be allowed to rate the networks they have used. For this reason, it is important to know if the users of current websites that offer the user to rate their network really participate in the evaluation process.

Thus, we have mined the main different Wi-Fi networks rating websites to know how many users are currently evaluating Wi-Fi networks when they are offered the possibility to rate. We used different tools to help us retrieve that information even from the main websites that do not offer convenient APIs to retrieve information. We have used Java applications and Java APIs such as HTMLParser, which is used among others to parse and extract data from an HTML page. For example, we found out that:

- In Journaldunet [8] there are 6858 hotspots and only 328 hotspots are evaluated. So only 4% of its hotspots have been evaluated.
- Freespot [9] has 552 hotspots and only one hotspot has been evaluated. So 0.1% of its Hotspots have been evaluated.
- Café Wi-Fi [10] has 136 hotspots and 135 hotspots have been evaluated. Café Wi-Fi is an exception with a very high percentage of access point evaluated, about 99%. Although it covers few hotspots, it may underline that the community spirit behind Café Wi-Fi motivates the users to rate their networks.
- Wifinder [11] has 38455 hotspots and only 495 hotspots have been evaluated. So only around 1% of its hotspots are evaluated.

If we concentrate on the two main Websites with the greatest number of Wi-Fi networks, namely, Wefi, more than 20 millions, and Jiwire [12], more than 250 000 Wi-Fi networks, the trend is the same. Very few networks are rated by the users and even fewer networks are rated more than once as shown in Figure 1. The percentages in Figure 1 correspond to a large sample of 443455 networks that have been mined on Wefi and Jiwire. The maximum number of ratings is 7 ratings for 3 networks.Thus, stronger incentives must be found if users ratings are expected. This is part of our future work.

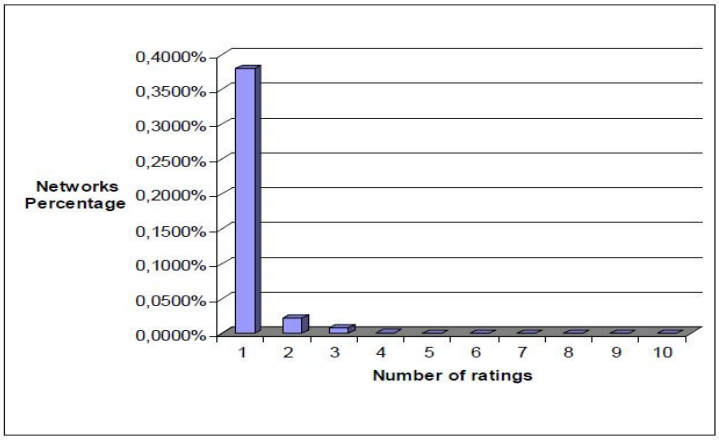

Figure 1. Percentage of networks with X ratings

3 Our Solution to Boost Hotspots Ratings

Our study revealed that the main problem of these websites is the lack of evaluation from users. There is also another problem which is users cheating. For instance, the user tries to cheat by giving an inappropriate evaluation to decrease or increase the rating of the hotspot.

First of all, our solution provides a way to assess the networks used by the users. It provides an Android application that runs in the background and analyzes the network session information to assess the quality of the network session based on the requirements of the used applications (video, voice, messaging). We distinguish different cases depending on the applications used, because different applications have different requirements. Our solution calculates a QoS confidence value based on the measured values compared to those required for the proper functioning of the application that has been used by the user. The parameters take into account:

- Packet loss [14] occurs when one or more packets of data traveling across a computer network fail to reach their destination.
- Jitter [15]: Packets from the source will reach the destination with different delays. A packet's delay varies with its position in the queues of the routers along the path between source and destination and this position can vary unpredictably. This variation in delay is known as jitter and can seriously affect the quality of streaming audio and/or video.
- Delay [15]: It might take a long time for a packet to reach its destination, because it gets held up in long queues, or takes a less direct route to avoid congestion. In some cases, excessive delay can render an application such as VoIP or online gaming unusable.

Our solution uses that QoS confidence value to control whether or not the user has cheated or not when she/he has rated the hotspot. If it seems that the user has cheated, her/his evaluation is discarded. Otherwise, it is shared between all the users after being sent to a central server that collects the validated user-provided hotspot ratings.

4 Related Work

The feedback of a user about his/her network session experience is called Quality-of-Experience (QoE) in the literature. [1] defines QoE and explains its importance for diverse network services like VoIP and IPTV where the QoE must be measured per unit time over time. This paper also presents the MDI (Media Delivery Index). The MDI is composed of new measures that can help Service Providers to monitor Video over IP and VoIP services for the component of QoE they have under their control. The MDI can be used to passively or actively monitor live voice and video over IP flows. The MDI is done per media flow basis and can be measured 24/7 for complete coverage of the media service. MDI provides a comprehensive and qualitative passive or active measurement that can be performed on live traffic per unit time for the duration of the media flow. MDI can help Service Providers, who

deliver Video and Voice over IP, to achieve maximum transport quality which is the foundation of QoE for their customer.

[2] propose to use conventional objective quality-assessment approaches to IPTV quality management scenarios. They proposed a new objective QoE assessment approach. The primary characteristic of the proposal is to use bitstream layer information, which enables the consideration of content dependence. They constructed the model for H.264 coding distortion based on the proposal and it confirmed that the proposal satisfies target accuracy.

In [3], they analyze the attributes of perceived quality, i.e. the QoE for video content consumption. They describe the factors that affect QoE. They divided the factors in three categories: session quality, audio quality and video quality and they discussed methods for addressing these variables to enhance overall video viewing experience of subscriber. They talk about the approach that leverages a combination of feedback-based encoding together with bitrate switching. This hybrid approach prepares a set of alternative representations of the content not only at various bitrates, but also using different preferred combinations of encoding and error resiliency tools.

In [4], they consider a multi-source streaming technique, based on the heterogeneous lifetimes of peers, for designing a P2P structure for delivering real-time video. This technique provides good quality to the end-users, mitigating the impact of losses coming from peers disconnections. The main results of this paper concerns the joint impact of different frame type losses on the QoE, using the PSQA (Pseudo Subjective Quality Assessment) methodology, and how to identify an optimal parameter setting, to obtain the best possible quality level for a given peers' dynamics.

[5] provides a brief description of a set of features that provide an acceptable level of QoE in video streaming applications for users in movement. These features neither do modify the play-out device, thus not requiring more advanced decoding techniques, nor do impose gap filling techniques to preserve the desired QoE.

5 Conclusion

The analysis of the main websites that offer to the users to rate the hotspots they have used has revealed a very low numbers of evaluations by the users. We propose a way to solve this problem by using implicit information in order to assess the hotspot. The application runs in the background of an Android phone for evaluating the degree of confidence that we can have on the QoS provided by the hotspot. To compute this, we use the following evaluation criteria: jitter, packet loss and latency. With our solution, it is also more difficult for users to cheat because we discard a user rating if it is too different from the QoS evaluation that has been computed based on the implicit information that we have collected. Our future work consists in evaluating the attack-resistance of the anti-cheating put in place with our solution.

Acknowledgments

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