Transparent and distributed client tracking in wireless mesh networks

Mots clés :
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Résumé du projet de recherche (Langue 1)
Over the last decade, we have witnessed the great success of wireless communications. This success is due to the widespread of wireless technology and the price of devices. In fact, in our daily life practically each electronic device is equipped with wireless interface as laptops, netbooks, mobile phones, handheld game consoles, and even video game consoles. Therefore, users become more mobile and pervasive. This new tendency has induced researchers to design new architectures. Wireless mesh networks fall in this category. Indeed, with their two-tier architecture, they concentrate routing on a stable wireless backbone, while mobile clients are totally free to move around this backbone. In this context, one of the main challenges is to provide an efficient localization service so that clients can communicate with each other. Most of the existing solutions rely on some variant of full or partial flooding, which causes the well known broadcast storm problem, and very often they need support from end-users’ devices. This thesis contributes in investigating mobility issues in wireless mesh networks by analyzing mobility management performance of a real testbed through measurements. We highlight the main issues, and from these problems, we propose "Enhanced Mobility Management" (EMM), a new efficient solution, which does not rely on any modification or additional software on the client side, thus being totally transparent for end-users. EMM takes advantage of the existing Neighbor Discovery Protocol (NDP) cache to keep track of the last client association and uses this information to trigger an update in order to reroute packets. Measurements we performed show how EMM is able to greatly improve performances of mobility management. However, EMM stills based on flooding, and for this reason, we design, implement, and test a new DHT-based location management scheme through logical and experimental evaluation on our wireless mesh testbed. The main features of our proposed scheme are that broadcast packets are totally avoided and node localization becomes transparent to the users. We compare it to our previous flooding-based location scheme (EMM). Our results show improved performance both in terms of dropped packets and handover latency introduced to re-establish open sessions after a user moves. As part of our contribution to investigate the stability of wireless network, we address some interesting questions related to the presence of both dominant and sub-dominant routes between nodes, in a real deployment. We focus on the persistence of the dominant route and the first four sub-dominant routes. The persistence is computed as the percentage of time that a given route is used. We note that source-destination pairs mostly use the dominant route and two sub-dominant routes to communicate, but with a low persistence. We also investigate the number of hops crossed by these routes and their impact on the stability. It turns out that the larger the number of hops, the larger the number of sub-dominant routes. However, when exceeding four hops, the notion of dominance fades.