Impact of Traffic Models on Access Management for Heterogeneous Mobile Networks

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ABSTRACT

The widespread success of wireless and mobile communications has resulted in the creation of a large variety of wireless technologies, including second and third generation (2G and 3G) cellular, satellite, WiFi, and Bluetooth. Future telecommunications systems will allow that different technologies coexist together into a single network and collaborating to offer users the best experience in the telecommunications environment. Access management is used to decide whether or not to accept a new connection or handover request into a communication network without violating the service commitment made to already admit requests. The traditional access control procedure for homogeneous network determines whether a user may be admitted into the system. However, in a heterogeneous environment, the access control is additionally responsible for deciding which radio access network is best suited to accommodate the incoming request.

Due to the inherent complexity of the future wireless networks, it is impractical to investigate system architecture or the performance of radio resource management in a real world. So a common way of evaluate the performance of proposed solutions is by simulations. The main problem when we simulate the environment of the proposed solution is the traffic characterization. Traffic characterization for the dimensioning of mobile wireless networks has traditionally relied on Poisson models, with the underlying assumption that such networks would primarily carry voice traffic. However, future mobile networks increasingly carry a mix of voice, data and multimedia traffic. With multimedia mobile support, the traffic characterization becomes more difficult because multimedia data needs much more requirements of Quality of service. In particular, the advent of fourth generation (4G) systems brings about the need to consider the impact of high-speed data in designing, dimensioning and optimizing the network. It is well accepted that Poisson arrival assumptions do not accurately model service traffic, which often exhibits self-similar characteristics. Furthermore, the real behavior of the mobile users is different from the expressed by Poisson model.

Different traffic models must be used in the evaluation of proposed models. Traffic modeling in future mobile networks will have to deal with two main issues: the radio resource management scheme and the effect of the user mobility in the traffic volume per cell. From the traffic viewpoint, user mobility results in reduction of the resource occupation time compared to the total call duration (regarding a single cell), the radio resources of a cell should cater for both new call and incoming handover requests, and abnormal call termination due to lack of resources in the target cell (call dropping).

In this paper we analyze the impact that traffic models introduce on the performance of access management over heterogeneous mobile systems. Regarding the radio resource management issue, we define an access management schema for heterogeneous mobile environment in order to select the best cell based on a cost function (Fig. 1). On the other hand, we perform a study about user mobility in an urban zone of Barcelona city in order to get real behavior. We define a simulation scenario in order to compare the performance of the access management schema with different traffic models (Real traffic data, Poisson traffic, and sinusoid traffic). We analyze how each traffic model impacts on the performance of the proposed access management schema for heterogeneous mobile networks.

The results show that Poisson traffic obtains a higher value than the other traffic models with respect to the average delay of processing. With regard to the number of rejected requests, the Poisson traffic obtained the highest value of rejected requests. We observed that the percentage of rejected requests is due to the total capacity of the cells. The results presented in this paper also highlight the importance of an adequate traffic characterization in the determination of the total capacity and performance of a system. Real user mobility behavior data will express conditions more realistic that will allow replacing hypothesis taken to describe evaluation scenarios. These traffic models will help to obtain approximations of more realistic behavior and discovering real problems in the proposed solutions before to implement them. This will permit to provide operators guidelines for the deployment of mobile networks.

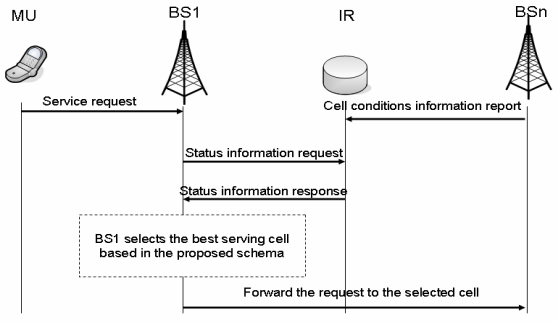

Figure 1. Proposed access management procedure.

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