Context-Aware Resource Allocation for Media Streaming: Exploiting Mobility and Application-Layer Predictions

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INTRODUCTION – Recent studies have shown that 40 to 60% of the Smartphone traffic is caused by multimedia streaming [1]. Coping with this load is a challenge for mobile networks. In particular, reaching an acceptable network load without sacrificing the users' Quality of Experience (QoE) is a significant problem when wireless capacity is limited [2].

Fortunately, however, media streams and mobile users have unique properties that can be exploited: (i) The duration and load of many media streams is known in advance, (ii) Non-real time streams can be buffered at the receiver without losing QoE, and (iii) In many cases, the mobile users' motion path during the streaming session can be predicted [3].

Together, these traffic and mobility parameters provide information on the users' context [4]. Exploiting this context information to minimize the network load while keeping the users' QoE constraints will be described in this talk.

MAIN IDEA – Fig. 1 illustrates a simple scenario where predicted mobility and application context is useful. Fig. 1a shows how a user will be served in a traditional network. When the user moves to cell Y, it will overload the already congested cell by competing for resources. This can significantly degrade the QoE for all users. Our context-aware network in Fig. 1b operates differently. Being aware of user A's path and speed, the network allocates additional resources in A's "home" cell X. This reduces the resources that base station Y spends for A and, thus, avoids a QoE decrease in the congested cell.

AN OUTLOOK ON PREDICTIVE RESOURCE ALLOCATION – In this work, we propose a novel inter-cell resource allocation framework based on long-term predictions of the users' mobility and streaming requests. By jointly exploiting this context information we expect substantial gains in the overall network efficiency without degrading the users' QoE.

To realize this framework, we introduce mobility and application-layer predictors in the handhelds, long-term resource allocation procedures over multiple BSs, and protocols to exchange allocations and context information between BSs. The talk will detail these procedures and provide insight into the expected system performance. Although we will focus on video streaming it is worth noting that the described schemes can be applied to any non-real time service such as file downloads, advertisements, as well as weather and road condition notifications.

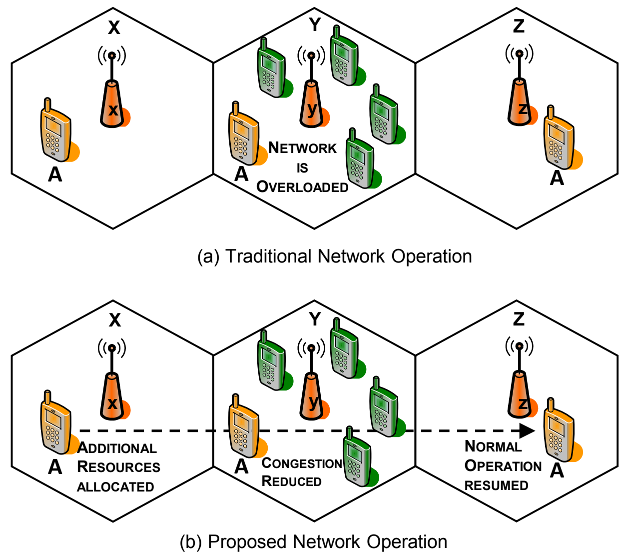

Fig. 1. (a) In a traditional network, User A competes with other users as it moves into the congested cell Y. This decreases the QoE for all users in Y. (b) By predicting the path of user A, base station x can allocate additional resources to user A and, thereby, free resources in the congested cell Y.

Our talk will conclude with an outlook on how future cellular networks can profit from the location and traffic-awareness of modern Smartphones and transport layer protocols.

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