High Performance Middleware for Mobile Wireless Publish/Subscribe Systems

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Abstract

Publish/subscribe middlewares are becoming popular for distributed applications because of their flexible and scalable nature. Anonymous and loosely-coupled communication between publisher and subscriber, along with the inherently asynchronous nature of these systems, help them adapt quickly to changing environments, making them a good choice for mobile networks. Although there has been a lot of work on publish/subscribe systems in the context of fixed networks, there is very little research on the behavior of these systems in the context of mobile networks.

This thesis investigates the extension of publish/subscribe middleware to mobile cellular networks with the focus on their performance in such networks. As a first step, the thesis characterizes a popular implementation of publish/subscribe system for the mobile domain, studying and analyzing the effect of different mobility parameters, which to the best of our knowledge is the first experimental research on the performance behavior of publish/subscribe systems in a mobile wireless domain. As a second step the thesis presents the design and evaluation of middleware level handoffs, a well known solution to extend publish/subscribe systems to a mobile domain, and identifies the performance concerns of such extensions. The results show that such handoff protocols involving two brokers are impractical from a performance perspective under highly dynamic and unreliable mobile wireless settings. As a final step the thesis introduces a

novel technique called *semi-durable subscriptions* to overcome the challenges faced by current implementations and traditional solutions in a mobile wireless environment and through rigorous experimentation prove its quality and efficacy in such settings. The thesis presents the design and implementation of its prototype and its evaluation in different mobility environments. Through a comparison of the performance of semi-durable subscriptions technique with other alternatives the thesis provides an experimental validation that it leads to significant benefit in performance. Semi-durable subscriptions provide a rich system parameter space and the thesis demonstrates how it can be controlled to configure a system according to the desired characteristics and/or the needs of the environment. The thesis concludes with a discussion as to how the concept of semi-durable subscriptions can be extended to deal with regionalism.