Title: Equivalent queue model capturing end-to-end performance in mobile networks

Location: Blekinge Institute of Technology (BIT), Karlskrona, Sweden
Time frame: a period of 6-7 months during the Spring semester 2006
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Background and Objectives
The emergence of high-speed mobile networks providing Internet access has opened up many possibilities for the development of new services in a variety of application domains, including healthcare. A typical example is a service where patients with specific medical problems are equipped with sensors monitoring their medical state on a continuous basis, generating some kind of alarm in case of emergency. This type of applications poses strict constraints on the Quality of Service (QoS), for example in terms of service availability and end-to-end response-times. Typical response-time related performance metrics are end-to-end delay, delay variation and throughput.

Both the PIIT SA project [1] and the MobiHealth project [2] have measured such end-to-end performance metrics in real GPRS and UMTS networks and observed different kinds of bottleneck behaviors. Reference [3, 4] have defined the whole network path between two both endpoints as one equivalent bottleneck, described by a discrete fluid flow model. In order to allow for some kind of reverse engineering aiming at finding reasons for certain behaviors observed from the measurements, it would be interesting to identify a queueing model reflecting the properties of the traffic source and basic properties of the equivalent queue such as buffer size and server process. Such a model would also allow for both classical queuing analysis and the construction of realistic simulation models. Thus, the model would help to yield results that are hard to reach via measurements, i.e. scaling studies. Finally, the model can serve as a basis for the interpretation of measurement results, e.g. for deriving decisions about performance alarms from observed behaviors.

Objective
The goal of this project is to identify an equivalent queuing model capturing end-to-end bottleneck behavior in mobile links. The model should apply to single connections as well as to superpositions of connections and well approximate the end-to-end performance (throughput and delay) perception of measured traffic. It should be applied to scaling studies and for deriving criteria for performance alarms.

Approach
1. Relevant background research related to end-to-end delay and throughput measurements-based performance evaluation methodologies:
   - End-to-end delay, delay jitter and throughput measurements-based performance evaluation methodology developed in [2]
   - End-to-end throughput measurements-based performance evaluation methodology developed in [1]
2. Choose a queuing model and determine its parameters regarding the
   - Input process
   - Queue process
   - Server process
   for single and multi-connection scenarios
3. Carry out scaling studies
4. Propose thresholds for issuing performance alarms
5. Write thesis

Requirements: the MSc candidate should be affinity performance and basic knowledge in performance modeling.

Housing and salary: housing will be facilitated by the hosting institute, BIT. We are also trying to get additional funding.