

Progressive Scaling: A Methodology for Tuning and Validating Large Simulations of Wireless Ad Hoc Networks

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Abstract:

The high costs and large number of parameters associated with the implementation of very large ad hoc networks (today) limit the availability of useful empirical data. Hence, experimental validation of large scale ad hoc network simulation data is generally infeasible. Compounding this problem are the high costs and long timeframes required for the simulations themselves. Hence, the use of high-fidelity simulation has also proven impractical. Consequently, large scale ad hoc networks are typically studied by means of low-fidelity simulation models; components including physical-layer and MAC characteristics are abstracted without understanding the effects on system performance or a providing a clear indication of the impact on the accuracy and limitations of the results. This paper presents a novel approach for evaluating and improving the quality of large scale ad hoc network simulation at a reasonable cost, namely, 'Progressive Scaling.' The proposed methodology is illustrated by example based on the authors' experience in applying it to the study of scalable routing in ad hoc networks. The use of Progressive Scaling is intended to provide a systematic methodology to the research community for increasing confidence in the validity and conclusions reached using data from large ad hoc network simulations.