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Study of Ad- Hoc Networking Technologies and Optimization of The Broadcasting Process

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ABSTRACT

In this paper, we present about Ad-hoc networking technologies and optimization of the broadcasting process. In recent years, mobile computing has enjoyed a tremendous rise in popularity. The continued minimization of mobile computing devices and the extraordinary rise of processing power available in mobile laptop computers combine to put more and better computer-based applications into the hands of a growing segment of the population. At the same time, the markets for wireless telephones and communication devices are experiencing rapid growth. Projections have been made that, in nowadays there are more than billion wireless devices in use. Therefore, the wireless mobile computers or Mobile Ad Hoc Networks (MANET) have become very necessary.

Keywords: MANET, Ad-Hoc Network, Topology.

I. INTRODUCTION

A wireless ad hoc network is a collection of autonomous nodes or terminals that communicate with each other by forming a multihop radio network and maintaining connectivity in a decentralized manner. Since the nodes communicate over wireless links, they have to contend with the effects of radio communication, such as noise, fading, and interference. In addition, the links typically have less bandwidth than in a wired network. The network topology is in general dynamic, because the connectivity among the nodes may vary with time due to node departures, new node arrivals, and the possibility of having mobile nodes. Hence, there is a need for efficient routing protocols to allow the nodes to communicate over multihop paths consisting of possibly several links in a way that does not use any more of the network "resources" than necessary. In this research, we pay attention to the cost of communication regarding to the time in both send, receive and during route discovery as well. In this research we will use the routing protocol method.

II. METHODS AND MATERIAL

2.1 Genetic optimization

As explained in [Nas], genetic optimization works on a population of individuals representing possible solutions to a specific problem. Each individual is evaluated using a fitness value which is a measure of how well this individual is adapted to its environment. Individuals (which are represented by a genotype suitable sequence of bits) reproduction rate is proportional to their fitness. The bit-coded representation of individuals creates a quantization of the solution space. A genetic algorithm starts with an initial population of candidate solutions or individuals, and modifies it until the population converges to a solution. A problem-dependent fitness function must be chosen to measure the appropriateness of an individual. The modification of the population is achieved by using the application of three genetic operators which are: selection, crossover, and mutation.

2.2 Multi-objective optimization

Contrary to single objective optimization (which can be achieved by using genetic algorithms, as explained in Section 8.1), multi-objective optimization is not restricted to find a unique solution of a given multi-objective problem, but a set of solutions known as the Pareto optimal set. For instance, taking as an example the problem, we are dealing with, one solution can represent the best result concern the number of reached stations, while another solution could be the best one concerning the make span. These solutions are said non-dominated, that is there do not exist any other solution that consists in a Pareto-improvement of these. A pareto improvement is a solution that can make at least one individual better, without making any other individual worse. The result provided by a multi-objective optimization algorithm is then a set of non-dominated solutions (the Pareto optima) which are collectively known as the Pareto front when plotted in the objective space. The mission of the decision maker is to choose the most adequate solution from the Pareto front.

III. EXPERIMENTAL

cMOGA has been implemented in Java and tested on a PC with a 2.8 GHz Pentium IV processor with 512 MB of RAM memory, and running SuSE Linux 8.1 (kernel 2.4.19-4GB). The Java version used is 1.5.0 05. All the values presented are the average over 30 independent runs of cMOGA.

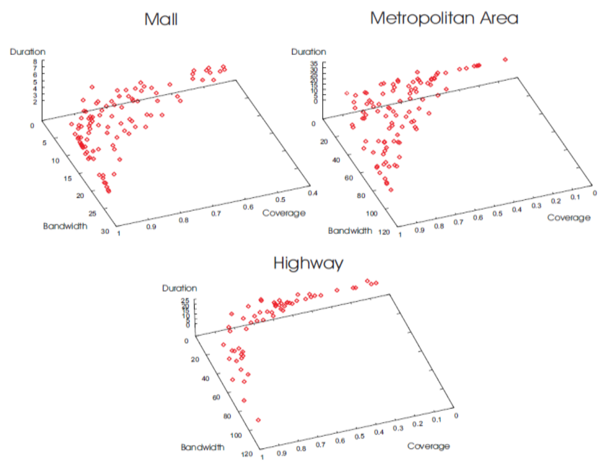

Figure 1: Pareto fronts for the solution of the DFCNT problem over three environments

The Pareto fronts on Fig.1 expose the design objectives of the DFCN protocol: most of the plots (in the center of the clouds) provide sets of parameters that make DFCN achieving a coverage rate close to 100%, keeping the network throughput very low. What makes the DFCNT problem particularly interesting from an applicative point of view is that it permits the decision maker to discard this default behavior by setting a degree of coverage for the broadcasting application. Indeed, not all applications require the maximization of the coverage rate. For example, local advertising which consists in spreading advertisement messages to devices a few hops away from the source needs the broadcasting process to cease after a while. Sometimes high coverage is even to be avoided. For example, trying to achieve a high coverage on metropolitan mobile ad hoc networks (which may realistically be made of thousands of devices) is harmful, since it is likely to lead to severe network congestions.

IV. RESULTS

As suggested before, all broadcasting protocols follow the next rule: the more opportunistic they are the faster they proceed (by not considering the impact of packet collisions), but the higher bandwidth they use. DFCN has been designed with this in mind: its behavior when used with appropriate parameters makes it break this rule. Herein, since we seek for Pareto-optimal set of parameters, our objective is different. Consequently, the common behavior exhibited by all broadcasting protocol shows up on the Pareto fronts illustrated on Figure 8.6. Achieving very short duration times entails high bandwidth and very low bandwidth is only achievable by using slow forwarding policies. Aside to these asymptotic behaviors, the Pareto fronts also show that DFCN can be tuned in such a way that it permits to obtain a reasonably short duration of the broadcasting process while keeping the network throughput (eg, the number of packet emission) low. Since good coverage is guaranteed, these settings are appropriate for most broadcasting applications.

V. CONCLUSION

The range of topics tackled include network broadcasting, network emulation, study of mobile ad hoc networks from the point of view of complex system research, topology control from hybrid networks and multi-objective optimization of network protocols. These applications had various requirements and imposes the design and implementation of different features. In all cases the consideration of networks consisting of thousands of nodes evolving in a metropolitan environment and the representation of several wireless networking technologies is required. In addition to this, fast simulation engine, a polished model and a friendly graphical user interface was strongly expected.

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