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14. ABSTRACT
Mobile devices have had a major advancement in recent years as they are becoming as powerful as normal household computers. Most people use them daily across the world for communication through emails, phone calls, text, chat rooms, etc. But for most these devices to work for the average user, they need to be connected to some kind of Structured Network. This becomes a problem when there is some kind of crisis and the user of these devices can't communicate with anyone because the Structured Network is disabled or inaccessible. There is still a

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Case Studies for the Feasibility of a MANET in Different Scenarios Using NS-3

ABSTRACT

Mobile devices have had a major advancement in recent years as they are becoming as powerful as normal household computers. Most people use them daily across the world for communication through emails, phone calls, text, chat rooms, etc. But for most these devices to work for the average user, they need to be connected to some kind of Structured Network. This becomes a problem when there is some kind of crisis and the user of these devices can't communicate with anyone because the Structured Network is disabled or inaccessible. There is still a way to handle this situation through the use of the mobile device. These devices are advance enough that they may be able to connect or create a network of their one. For such a small and portable device, this type of network is called a Mobile Ad-hoc Network (MANET). A MANET is a network composed of mobile devices that communicate between each other. Each device communicates with the other devices within its radio range and uses those devices as intermediates to communicate with even further devices. This research will prove the feasibility of a MANET to help in the management of certain scenarios where there is no Structured Network to connect to.

Case Studies for the Feasibility of a MANET in Different Scenarios Using NS-3 - Oscar Perez Cruz

I. Abstract

Mobile devices have had a major advancement in recent years as they are becoming as powerful as normal household computers. Most people use them daily across the world for communication through emails, phone calls, text, chat rooms, etc. But for most these devices to work for the average user, they need to be connected to some kind of Structured Network. This becomes a problem when there is some kind of crisis and the user of these devices can't communicate with anyone because the Structured Network is disabled or inaccessible. There is still a way to handle this situation through the use of the mobile device. These devices are advance enough that they may be able to connect or create a network of their one. For such a small and portable device, this type of network is called a Mobile Ad-hoc Network (MANET). A MANET is a network composed of mobile devices that communicate between each other. Each device communicates with the other devices within its radio range and uses those devices as intermediates to communicate with even further devices. This research will prove the feasibility of a MANET to help in the management of certain scenarios where there is no Structured Network to connect to.

II. Background/Introduction

Network. It is a construct of entities connected by different means to achieve the goal of communication. Communication. It is the means different entities use to form a relation between each other. With technology how it is in the current day, most of the communication is being done digitally over the World Wide Web, also known as the Internet. But what if something happened that would disable or incapacitate our means of digital communication between other entities?

During this day and age, a large amount of the world's population use the Internet or Cellular Networks to communicate through e-mails, chat rooms, video and audio calls, texting, etc. This can all be done through mobile devices, like cell phones, smartphones,

laptops, portable gaming systems, etc. Most of them will have the capability to connect to a network or create a standalone network, also known as a Mobile Ad-hoc Network (MANET).

A MANET is a network of wireless mobile devices that can dynamically self-organize in temporary network topologies constantly changing. These devices communicate between each other while they are in range wirelessly of each other. If a device needs to communicate with another device outside their range, they use each other as intermediate.

Through this research, the feasibility to use a Mobile Ad-Hoc Network (MANET) for certain situations where the infrastructure network is either disabled or inaccessible will be proposed. In the next sections of this document, the problems, goals, question, issues, and approaches for this research will be addressed.

III.   Problem Statement

Currently through our current means of communication, each town or city should have some kind of emergency plan should a crisis emerge. These plans most of them time depend on our normal means of communication, like phone lines, cell towers, etc. If by any means these routes of communication become unavailable during a moment of crisis, the performance of these plan decline. This problem has always existed since this sort of crisis is unpredictable in the time of occurrence and its magnitude. The difference now is that it can be handled through the use of mobile devices, which the majority of the world's population have close at hand most of the time.

IV.   Dissertation Goal

The goal of this research is to prove the feasibility of a MANET with a large amount of nodes and still have an acceptable amount of availability that would be required for certain scenarios. The performance will be measured through the average latency and throughput of each node in the network.

V.   Research Questions

- What is the maximum number of nodes within range of a single mobile device before the failure of communication of the device?
- What is the minimal number of nodes to achieve desired density in a MANET?
- What is the saturation point of a unicast, multicast, and TCP/IP MANET?
- According to the simulations, would this system be feasible to be implemented?

VI.   Relevance and Significance

An example scenario that is perfect for MANET would be a disaster scenario. This kind of problem affects everyone as no one knows where or when an emergency of catastrophic proportions may strike. Currently, the government has an emergency response system which may mostly depend on landline communication. If theses communication resources fail, the public may not have a way to be informed of the state of the emergency. The benefit of handling this problem through mobile devices is that the majority of the people have one in handy most of the time. Since these devices can create a network of their own, for this scenario, emergency responders could start such a network and broadcast messages to all other devices within range, while normal users can connect to this network. This could serve as a 911 emergency system in a way for this kind of situation if needed.

By proving the feasibility of such a network in the different scenarios that will be presented for this research, communication problems for such cases could be avoided up to a certain point. Also, this research will add knowledge to the MANET area as different case studies will be developed. This is something that can be continued by any researcher in the area, as they compared the results they achieve with the results of these case studies.

VII.   Issues and Approach

This research is in a way difficult to do as there are many types of mobile devices that have very different hardware and software specifications that keep improving and changing over the years. Also there are many scenarios where the measurement of an acceptable performance for a network may be completely different. To deal with these

issues, the network simulator called NS3 will be used to create simple nodes that may emulate the behavior of a mobile device, both in transmission and movement. Due to the fact that this is a virtual simulation, the results in the behavior and communication between the nodes may not be 100% accurate but it would provide an idea on how the research may go if it was being done with real mobile devices. This method will save money, effort and time from a researcher's perspective. The approach that will be done to accomplish this research will follow these steps:

1. Learn how to use the NS-3 Simulator
2. Research mobility and network traffic generation models. Samples of mobility models:
   - Random Way Point
   - Human Following
   - Custom Mobility Model
3. Research samples of NS-3 Mobile Network Simulation
4. Design and research several scenarios where a MANET may be useful. Samples of scenarios:
   - City Block Scenario
   - Open Field Scenario
   - Disaster Scenario
5. Develop Mobility and Traffic Generation Models based on the researched scenarios
6. Analyze simulations results and compare throughput and latency of the network and their nodes to determine network availability

VIII. Milestones

1. November 2011 till February 2012: Decide dissertation problem to address for a Research in Mobile Ad-hoc Networks (MANET)
2. March 2012 till May 2012 – Study NS3 Manuals and Tutorials for the Development of Network Simulations

3. June 2012 till August 2012 – Research Wireless Networks simulation samples done by Other Researchers and Design MANET Simulations for Different Scenarios

4. September 2012 till October 2012 – Develop MANET Simulation from the Designed and Researched Scenarios Using NS3

5. November 2012 till December 2012 – Write dissertation and Perform more simulations to gather more results if necessary