COMPARATIVE STUDY OF HOMOGENOUS AND HETEROGENEOUS MOBILE DEVICE ADHOC NETWORKS

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Abstract: *A comparative study of Homogeneous and Heterogeneous Clustered Adhoc Networks. Main focus is on the where the base station is remotely located and the Sensor Nodes are not Mobile. Since we are concerned with the Network related problem, we take the manufacturing cost of the hardware as well as the battery energy of the nodes. A Homogeneous Adhoc Network consists of identical nodes, while a Heterogeneous Adhoc network consists of two or more types of nodes .*

We consider single hop clustered Adhoc Network (nodes use single hop to reach the cluster heads). We use LEACH as the single hop Homogeneous Network, and a Adhoc Network with two types of nodes as a single hop Heterogeneous Network.

For Multi-hop Homogeneous Networks (Nodes use Multi-hopping to reach the Cluster Head), we analyze a Multi-hop variant of LEACH that we call M-LEACH. We show that M-LEACH has better energy efficiency than LEACH .We can compare the cost of Multi-hop Adhoc Networks with M-LEACH as the Homogeneous Network, and a Adhoc Network with two types of Nodes (that use in-cluster Multi-hopping) as the Heterogeneous Network.

Keywords: *MANET, Single hop, Multi hop, Traffic Types, Routing Protocol Issues.*

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I. INTRODUCTION

With the rapid development of computers and the wireless communication, the mobile computing has become the field of computer communications in high-profile link. MANET is a completely Wireless connectivity through the Nodes constructed by the actions of the Network, which usually has a dynamic shape and a limited bandwidth and other features, Network members may be inside the laptop, Personal Digital Assistant (PDA), mobile phones On the Internet, the original mobility is the term used to denote actions hosts roaming in a different domain; they can contain their own fixed IP address, without need to changing, which is Mobile IP technology.

Mobile IP nodes in the main idea is to deal with IP address Management, by home users and foreign users to the Mobile node to packet Tunnelling, the routing and fixed Networks are not different from the original. However, Adhoc Network to be provided by mobility is a fully wireless, can be any Mobile Network infrastructure, without a base station, all the Nodes can contact each other at the same time take router work with the Mobile IP Completely different levels of mobility. Early use of the military on the Mobile Packet Radio Networked (MPRN) in fact can be considered the predecessor of MANET, when the high-tech Communication equipment, the size, weight continuously decreases; power consumption is getting low, Personal Communication System (Personal Communication System, PCs) concept evolved, from the past few years the rapid popularization of mobile phones can be seen to communicate with others at anytime and anywhere, get the latest information, or exchange the required information. Military purposes, as is considerable danger in field environment, some of the major basic communication facilities, such as base stations, may not be available, in this case, different units, or if they want to communicate between the forces, they must rely on MANET networks infrastructure. In emergency relief, the mountain search and operations at sea, or any infrastructure cannot be comply with the topographical constraints and the pressure of time under the pressure, Adhoc Network completely wireless and can be any mobile Feature is suited to disaster relief operations when personal communication devices and more powerful, some assembly occasions, if need to exchange large amounts of data.

II. OBJECTIVES

Therefore, both computing and communication are considered to be two goals of mobile ad hoc Networks. both of them are rapidly deployed so they do not rely on a pre-existing infrastructure, for example, Base Station (BS) and Access point (AP).A peer to peer Network refers to MANET which has the ability to allow a communication between each wireless client that relies on any infrastructure. MANET can also be defined as a mobile nodes collection of which a highly resource constrained network and a dynamic topology are formed by this collection. A single hop network refers to WLAN Major functions within Network are being performed by the cooperation of the nodes. This process represents a Multihop Network that refers to the MANET.

There are some problems in MANETs. These comprise; security, QoS, routing and energy conversation. These problems came due to several reasons: High Mobility, Resource constrains such as Power, Storage, and bandwidth, its cooperative nature and the dynamic topology of nodes operating in MANET's environment.

III. APPLICATIONS

1) In Defence Advanced Research Projects Agency (DARPA) Packet Radio Projects.

2) Ad hoc Networking was initiated for military applications, specifically, for dynamic wireless networks since 1970s.

3) For MANET, a new Networking group was formed within the Internet Engineering Task Force so that the standard Internet routing support could be developed for mobile IP autonomous segments. Military battlefield, Military equipment currently is equipped with the state of the art computer equipment. Ad hoc networking help the military with the commonplace Network Technology to maintain information Network between Military personnel's, vehicles, and military information head quarters.
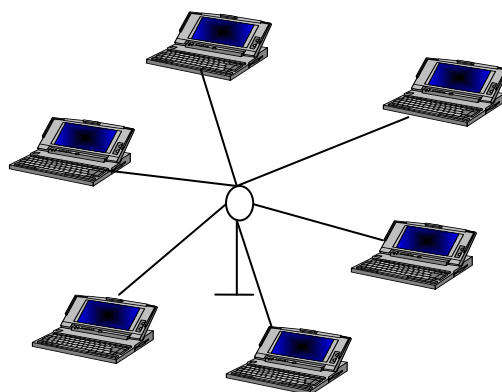
Commercial sector, Adhoc Network can be applied in emergency operations for disaster relief efforts for example in fire, flood, or earthquake and so on. Therefore proper infrastructure and rapid deployment of a communication network is badly needed. Information is relayed from one rescue team member to another over a small handheld device. Other commercial application includes for instance ship to ship ad hoc mobile communication and so on.
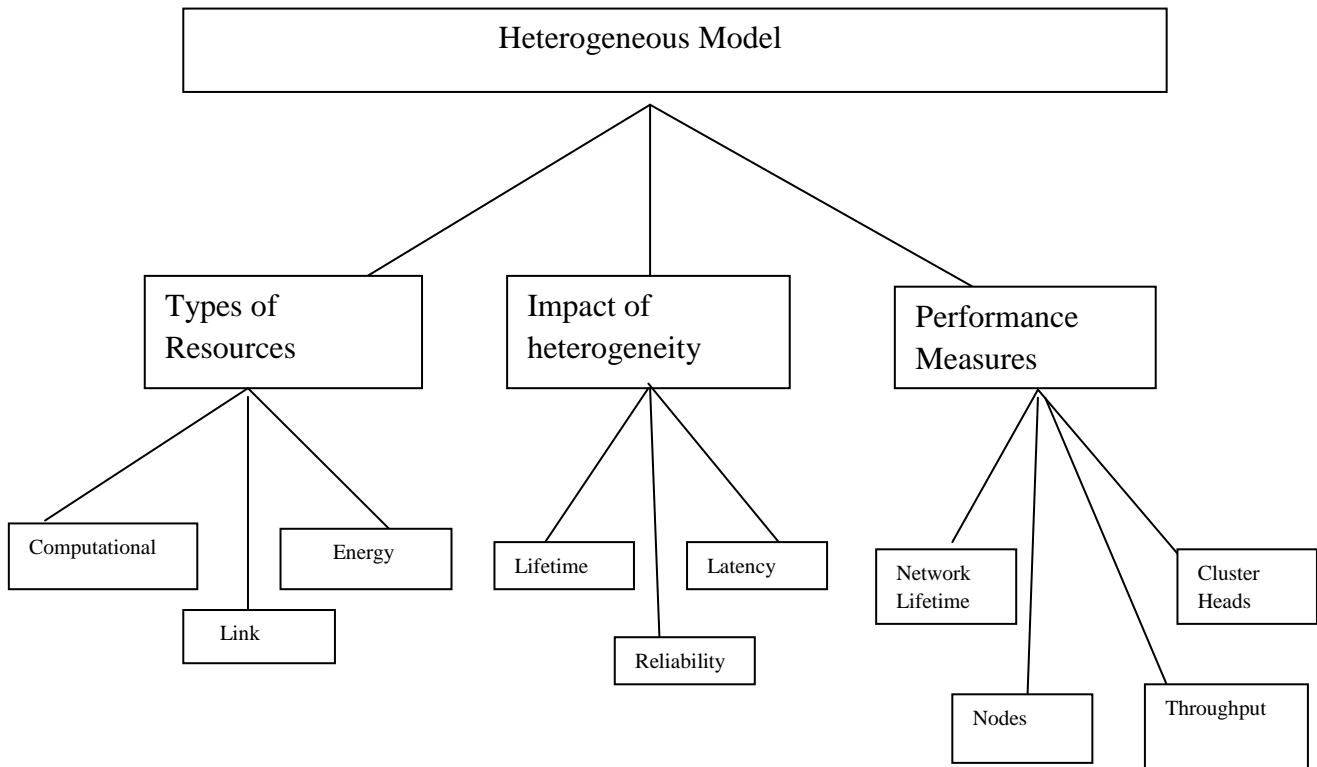
4) Local level, ad hoc networks can autonomously link immediate and temporary multimedia network by using notebook or palmtop computers to distribute and allocate information among conference or classroom participants. Besides, it can also be applied for home networks where devices can be link; other examples include taxicab, sports stadium, boat and small aircraft.

5) Personal Area Network (PAN), short-range MANET can simplify the intercommunication between a lot of mobile devices such as a PDA, a laptop, and a cellular phone and there are a lot of new devices in this for MANETs. Wired cables can easily be replaced with wireless connections. Ad hoc network enhances the access to the Internet or other networks by means of Wireless LAN (WLAN), GPRS, and UMTS. The PAN is an upcoming application field of MANET for the future computing technology.

- Personal communications (i.e. cell phones, laptops and ear phone).
- Cooperative environments (i.e. meeting rooms, sports stadiums, boats etc.).
- Conferencing (i.e. using Mobile nodes).
- Home Network (almost used for PANs).
- Wireless Mesh Networks (very reliable networks that are closely related to MANETs, the nodes of a Mesh Networks generally are not Mobile).
- Hybrid Wireless Networks (the goal is to cost savings, enhanced resilience to failures and performance improvements).

A Single Hop WLAN with one AP

Comparison between WLAN and MANET[1]

IV. COMPARISON

clustered Adhoc Networks because clustering allows for scalability of MAC and routing. Cluster heads also serve as fusion points for aggregation of data, so that the amount of data that actually transmitted to the base station is reduced.
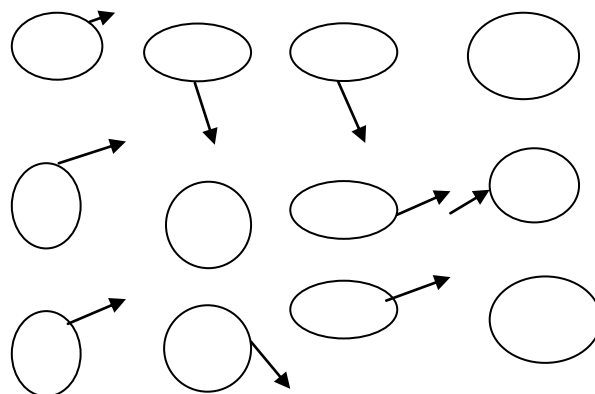
 Adhoc Networks can be classified into two types:

 Homogeneous and Heterogeneous Adhoc Networks.

In Homogeneous Networks all the sensor nodes are identical in terms of battery energy and hardware complexity. With static clustering (cluster heads once elected serve for the entire lifetime of the network).In a Homogeneous Networks, the cluster head nodes will be over-loaded with the long range transmissions to the remote base station, and the Data Aggregation and Protocol co-ordination. As a result the Cluster Head Nodes expire before other nodes. However it is to ensure that all the nodes run out of their battery at about the same time, so that residual energy is wasted when the system expires. One way is to rotate the role of a cluster head randomly and periodically over all the nodes as proposed in LEACH However a homogeneous network and role rotation is that all the nodes should be capable

of acting as cluster heads, and therefore should possess the necessary hardware capabilities. On the other hand, in a Heterogeneous Sensor Network, two or more different types of nodes with different battery energy and functionality are used. The motivation being that the more complex hardware and the extra battery energy can be embedded in few cluster head nodes, so reducing the hardware cost of the rest of the Network. the cluster head nodes means that role rotation is no longer possible. When the sensor nodes use single hopping to reach the cluster head, the nodes that are farthest from the cluster heads always spend more energy than the nodes that are closer to the cluster heads.

On the other hand when nodes use multi-hopping to reach the cluster head, the nodes that are closest to the cluster head have the highest energy burden due to there always exists a non-uniform energy drainage pattern in the network. Thus there are two desirable characteristics of a sensor network, through lower hardware cost, and uniform energy drainage. While Heterogeneous Networks achieve the former, the Homogeneous However both features cannot be incorporated in the same Network.

Nodes Moves in Different Direction And Different Speeds

The Objective of Networks the overall network cost by taking into account the above energy-hardware trade. Adhoc Networks could also be classified as Single hop and Multi-hop. A Single hop Network is one in which sensor nodes use single hopping to reach the cluster head.In a Multi-hop Network nodes use Multi-hopping to reach the cluster head. In both cases, the cluster heads use single hopping to reach the base station, since we assume a remote base station. We compare the costs of Homogeneity versus Heterogeneity in a Single hop network, and then in a Multi-hop Network. For a Multi-hop Network, propose

and analyze a data gathering scheme that we call M-LEACH or Multi-hop LEACH (since LEACH is single hop).

a. Single Hop Networks

In a Single hop Network, the sensor nodes communicate directly with the cluster head using a single hop transmission. The nodes are assumed to have power control features so as to adjust their transmit power.

b. Single Hop Homogeneous Network: LEACH

1) Since all the nodes are identical, the main design objective is to guarantee a certain network lifetime (in terms of number of data gathering cycles), and at the same time ensure that all the nodes expire at about the same time so that there is very little residual energy left behind when the network expires. Hence LEACH uses random and periodic rotation of the cluster heads for load balancing. Role rotation also ensures that a node which is located near the periphery of a cluster is nearer to the cluster head at some other time.[2]

2) Since each node has to be capable of acting as a cluster head, it is necessary for each node to have the hardware capable of performing long range transmissions to the remote base station, complex data computations (if required), and co-ordination of MAC and routing within a cluster.[2]

3) Since all the nodes are capable of acting as a cluster head, the failure of a few nodes does not seriously effect the working of the scheme. Thus the system is robust to node failures.[2]

c. Single Hop Heterogeneous Networks: Two Types of Nodes

Heterogeneous sensor networks use two or more types of nodes with different functionalities the propose for using two types of nodes; type 0 nodes which act as pure sensor nodes, and type 1 nodes which act as the cluster head nodes. Some of the salient features of such Networks are:

1) Since the cluster head nodes are predetermined, and the sensor nodes use single hop communication to reach the cluster head nodes, It is this worst case energy expenditure that has to taken into account in battery energy dimensioning. Thus there is a waste of energy due to the residual battery energy of the sensor nodes that are near the cluster heads.

2) Since only the cluster head nodes bear the responsibility of transmitting to the distant base station, the nodes can be designed with simple hardware that enables short range communication. Thus the hardware complexity is limited to only a few nodes.

3) A cluster head node serves as the fusion point, as well as the command centre of its cluster. As a result when a cluster head node fails, all the sensor nodes in that cluster have to be re-assigned to other neighbouring clusters.
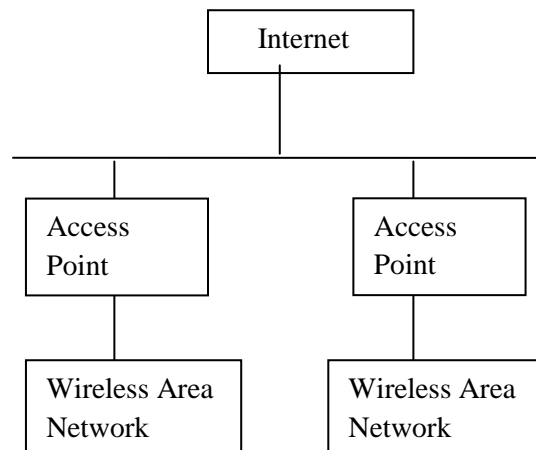
V. TRAFFIC TYPES IN ADHOC NETWORKS

The Traffic Types in the Adhoc Networks are so different from the infrastructure Wireless Network. The traffic types are classified into three types (peer to peer, remote to remote and dynamic traffic). Firstly, peer to peer is a communication between two nodes in the same area, that means which are within one hop. Network traffic (in bits per second) is usually fixed. Secondly, remote to remote is a communication between two nodes beyond a single hop, but maintain a stable route between them. a number of nodes, to stay within the range of each other in one area or may move as a group. Movement it's a similar to the standard Network traffic. Finally, dynamic traffic it will happen when the Nodes are move dynamically around and then the routers must be reconstructed.

a. Infrastructure wireless LAN

Network in any architecture will be an access point; its function is one or more of the Wireless Local Area Network and the existing cable Network systems to link, so that stations within the wireless local area network and external nodes can connect with each other. It is defined by a fixed and pre-positioning a good base station location, the static backbone Network Topology, a good environment and a stable connection, the base station that is doing a good job when you set up detailed plans.

b. Ad hoc wireless LAN

The Ad hoc Wireless LAN is an infrastructures relies on infrastructures wireless local area Network within the framework of each machine is able to be linked up into Networks, of whether the communication with the outside world, then such a structure, either one or two users can communicate directly with each other, and this structure is composed of at least composed of two or more work stations. no fixed base stations, network will be rapidly changing; dynamic Network Topology is vulnerable to interference, to automatically form a network without infrastructure and adapt to topology changes.

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VI. ADHOC NETWORK ROUTING PROTOCOL   ISSUES

The MANET with the traditional wired, fixed networks have many different characteristics, so to design a suitable routing protocol for MANET operating environment must also consider the different directions, the following qualitative and quantitative aspects are given

1. On the qualitative aspects, can be divided into:

a) Distribution operation: the existence of MANET where there is no prerequisite for the construction of the underlying network, so routing cannot rely on a particular node to operate.

b) Loop-freedom: All the routing protocol should be consistent with the characteristics we must ensure the normal work in order to avoid waste of bandwidth.

c) Demand-based operation: In order to reduce the burden on each node, if the link is not so much the demand should be considered when using On-demand approach to the establishment of the path, and only when the need for a particular path query, the establishment of the path.

d) Proactive operation: With the On-demand concept of the contrary, if the Network resources fairly adequate, proactive table-driven approach could speed up the path to the establishment of speed.

e) Security: Because it is the wireless environment, to how to ensure the security of the connection cannot be ignored will be part of network security is also a MANET from theory to implementation of the key challenges.

f) Sleep Period operation: As the MANET nodes are generally smaller Wireless Devices, using the battery as a power supply, how to save power consumption, or for no work, the node goes into sleep mode, can operate more smoothly so that MANET.

2. On the quantity, can be divided into:

a) End-to-end data throughput and delay: Data transmission rate and delay in the case that every routing protocol must take into account the focus should be how to find the best path. Considered more likely to make more complicated routing protocol, but it is possible to significantly improve the transmission quality.

b) Route Acquisition time: While the table-driven generally higher than on-demand performance good, if properly designed, for example, there is more commonly used in the path cache, or a certain fixed path , can improve the path to the establishment of time.

c) Efficiency: The simplest method, the smallest control overhead done the most complete, most powerful feature is a common goal for all routing protocol.

VIII. CONCLUSION

Routing Security in infrastructure-less and self-configuring mobile networks, such as MANETs, has been highlighted as one of the most challenging security issues in current and future Networks. Since there are a number of potential MANET security threats and many possible network environments (small, scalable, fixed, dynamic, homogeneous, heterogeneous, etc.) it is difficult to design a secure routing protocol providing protection from all types of attacks while at the same time being suitable for all types of MANET scenarios. We also proposed and analyzed a generalization of LEACH called M-LEACH (Multi-hop LEACH) which uses multi-hop communication within the cluster, and uses random and periodic cluster head rotation for load balancing.

Secure Routing Protocols based on computational load on all Network Nodes and are important to some types of DoS attacks. Trust-based secure Routing Protocols are computationally more light-weight and less important to DoS attacks but can consume more communication bandwidth, since each MANET Node monitors continuously the behaviour of a set of other MANET Nodes.

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