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Optimization of Packet loss in Mobile IP on Overlap Area Width using Genetic Algorithm

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Abstract

Mobile Internet Protocol has been proposed by IETF to support portable IP addresses for mobile devices that often change their network access points to the Internet Mobile ips (mip) is an internet protocol that allows mobile nodes to have continuous network connectivity to the internet without changing their ip addresses while moving to other networks. Packet lose is the major problem in today's wireless network during handover and change in points of attachments.

However Overlap area width is key factor in Mobile IP handover computing. In this thesis we optimize the number of packet lose on the basis of overlap area width in Mobile IP hand over using genetic algorithm. Dissertation proposes a new technique based on genetic algorithm to improve the performance of the original mip during the handoff. The proposed technique reduces the delay, the packet loss and the registration time for all the packets transferred between the cn and the mn.Loss of information during handover in Mobile IP network cannot be avoided, in this thesis we optimized the performance of system using genetic algorithm in order to improve the overall IP mobility performance. This thesis pointed on the network handover mobility protocols, proposes enhancements to Mobile IP. The optimization schemes using genetic algorithm will simulated on MATLAB

The objective of this thesis is to design and simulate a network performance during handover. Here we consider Overlap Area width; the size of the overlap area between two Foreign Agents is one of the key factors that affect the performance of a handover. In this thesis we optimized the packet lose using genetic algorithm on MAT LAB. In general, there are still many mobility-related issues waiting to be done like Mobile Node speed, Agent advertisement interval, Data Packet Interval and Network Traffic load, which are affecting Mobile IP handover performance will examine in future.

Keyword: -Mobile ip, Packet loss, Genetic Algorithm, Handover

Introduction

Mobile IP is a standard that allows users to move from one network to another without losing connectivity. Mobile devices have IP addresses that are associated with one network and moving to another network means changing IP address. Using the mobile IP system will allow users to achieve this and at the same time make the underlying process transparent for a user. Mobile IP, wireless LANs, protocol tunneling and mobility management are areas of growing interest these days. Mobile users roaming in foreign networks with their laptop – or even smaller – computers is a trend of the future.

Roaming mobile users are willing to get the same services as they would get when attached to their office LAN using Ethernet and IP-protocol. Internet technology is widespread throughout the world, offering access to varieties of information and resource. Traditionally, however, the service is only available when people settle down in their offices, homes or any other authorized areas, typically by plugging a physical jack into a wall. Although the development of wireless communication technologies has made wireless Internet access possible and more and more portable devices, such as PDAs (Personal Digital Assistants), digital cellular phones, and laptop computers and so on provide Internet access functionality, it does not mean that Internet communication activities can remain uninterrupted while users are moving.

The Mobile IP protocol allows location-independent routing of IP datagram's on the Internet. Each mobile node is identified by its home address disregarding its current location in the Internet. While away from its home network, a mobile node is associated with a care-of address which identifies its current location and its home address is associated with the local endpoint of a tunnel to its home agent. Mobile IP specifies how a mobile node registers with its home agent and how the home agent routes datagrams to the mobile node through the tunnel.

Mobile computing and portable computing are two different concepts. If mobile users only need to be able to launch communication sessions actively before other network nodes can communicate with them when they are roaming, and do not mind reestablishing sessions every time they change their access link, portable computing is sufficient to offer the service. However, mobile computing provides mobile users anytime, anywhere bidirectional reliable access, and that includes the requirement that ongoing communication sessions do not need to be restarted even when the point of attachment to the Internet changes.

Since the *Internet Protocol* (IP), the core protocol of the Internet, was originally designed for fixed networks, IP addresses are associated with a fixed network location, and they are required to remain unchanged during an IP session. Obviously, this is unable to satisfy the requirements of mobile computing. Therefore, Mobile IP [1] [2] was proposed by the IETF (Internet Engineering Task Force) in order to offer mobile users a seamless computing environment.

The basic idea of Mobile IP is to allow a mobile node to have a temporary IP address in addition to its original fixed IP address. The temporary address is associated with the current point of attachment to the Internet, while the original fixed IP address represents the location where other network nodes think the mobile node is always located. This makes it possible that during the movement of the mobile node, its original fixed IP address remains unchanged, and therefore an ongoing IP session will not be interrupted.

However, before Mobile IP can be widely deployed, there are still many technical obstacles, including handover performance, routing efficiency and security issues. As a result, many Mobile IP supplemental protocols have also been proposed by the IETF in order to enhance the overall performance and functionality of Mobile IP. Therefore, Optimization of packet loses in wireless network design are necessary in order to improve the overall IP mobility performance. This thesis we optimize the packet loses using genetic Algorithm on the basis of overlap area width, genetic Algorithm is a robust stochastic optimization technique based on the movement and intelligence of genetic. It uses a number of agents (particles) that constitute a swarm moving around in the search space looking for the best solution. Each particle is treated as a point in a N-dimensional experience of other particles. Therefore, Loses of information during handover in Mobile IP network cannot be avoided, in this thesis we optimized the performance of system using genetic Algorithm in order to improve the overall IP mobility performance. This thesis centers on the network handover mobility protocols, proposes enhancements to Mobile IP, analyzes the impact that handover mechanisms cause to IP mobility performance and the implications of IP mobility on the transport layer, and designs optimization schemes using MATLAB on Genetic Algorithm to achieve seamless mobile computing in a heterogeneous wireless access environment.

Applications of Mobile IP

Mobile IP is most often found in wired and wireless environments where users need to carry their mobile devices across multiple LAN subnets. Examples of use are in roaming between overlapping wireless systems, e.g., IP over DVB, WLAN, WiMAX and BWA. Currently, Mobile IP is not required within cellular systems such as 3G, to provide transparency when Internet users migrate between cellular towers, since these systems provide their own data link layer handover and roaming mechanisms. However, it is often used in 3G systems to allow seamless IP mobility between different packet data serving node (PDSN) domains. In many applications (e.g., VPN, VoIP), sudden changes in network connectivity and IP address can cause problems. mobile ip protocol was designed to support seamless & continuous Internet connectivity.

Introduction to Genetic Algorithms

Modern Genetic Algorithms (GAs) were introduced by John Holland in the early 1970’s to solve problems using the processes of natural evolution. Holland was inspired by Darwin's theory about evolution and constructed GAs based upon the fundamental principle of the theory: survival of the fittest. The theoretical basis for the GA is the Schema Theorem, which states that individual chromosomes with short, low-order, highly fit schemata or building blocks receive an exponentially increasing number of trials in successive generations. A typical GA is started with a set of solutions (chromosomes) called a population . A chromosome in the GA is a legal solution to the problem and has the form of a string of genes that can take on some value from a specified finite range or alphabet. An initial population of chromosomes is then constructed at random. All the chromosomes in the population are evaluated using a fitness function. The chromosomes from one population are selected and used to form a new population according to certain selection methods. The common selection schemes are roulette wheel selection and tournament selection. Several further operations such as crossover and mutation are then applied on the newly selected individuals to mimic inheritance and mutation in

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natural evolution. Crossover is a key operator in the GA, and is used to exchange the main characteristics of parent individuals and pass them on to the children. Mutation is applied after crossover to maintain the genetic diversity of the population and recover possible lost characteristics during crossover. This process is repeated again and again until some terminating condition is met (for example, the desired number of generations is reached).

To use a genetic algorithm, you must represent a solution to your problem as a

1. *Genome* (or *chromosome*). The genetic algorithm then creates a population of
2. Solutions and applies genetic operators such as mutation and crossover to evolve
3. The solutions in order to find the best one(s).

APPLICATIONS OF GA

Traditional methods of search and optimization are too slow in finding a solution in a very complex search space, even implemented in supercomputers. Genetic Algorithm is a robust search method requiring little information to search effectively in a large or poorly-understood search space. In particular a genetic search progress through a population of points in contrast to the single point of focus of most search algorithms. Moreover, it is useful in the very tricky area of nonlinear problems. Its intrinsic parallelism (in evaluation functions, selections and so on) allows the uses of distributed processing machines.

Basically, Genetic Algorithm requires two elements for a given problem:

1. Encoding of candidate structures (solutions)

Method of evaluating the relative performance of candidate structure, for identifying the better solutions

Objective

The objective of this thesis is to design and simulate a network performance during handover. Here we consider Overlap Area width; the size of the overlap area between two Foreign Agents is one of the key factors that affect the performance of a handover. In this thesis we optimized the packet loss using genetic algorithm on MAT LAB. In general, there are still many mobility-related issues waiting to be done like Mobile Node speed, Agent advertisement interval, Data Packet Interval and Network Traffic load, which are affecting Mobile IP handover performance will examine in future.

Concept of Overlap Area Width

The size of the overlap area between two FAs is one of the key factors that affect the performance of a handover, since it directly affects the length of the rendezvous time .Figure 5.8 shows both in theory and from simulation the handover effect (the number of lost packets) with different settings of the overlap area width between every two FAs. The MN performs 12 intra-domain handovers and 4 inter-domain handovers without any handover enhancing techniques in this scenario. Note that since the MN is moving around the circle shown in Figure : 1

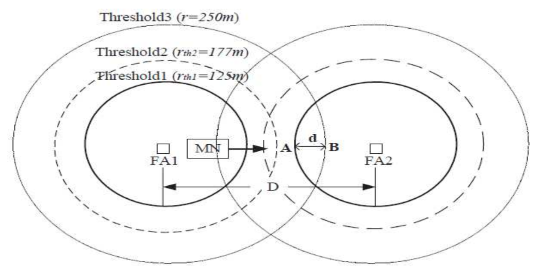

Figure: 1 Effective Overlap Area Width

Macro-Mobility and Micro-Mobility

To address the problems of the long handover latency and the large amount of signaling traffic possibly caused by Mobile IP, many hierarchical models have been proposed that the Internet is separated into different administrative domains, and each domain has at least one gateway router with special mobility support functions connecting every node inside the domain with the global network, for example, [10] [11]. MNs moving inside each administrative domain are called micro-mobility, while MNs moving between different administrative domains is called macro-mobility (Figure 3.1). The model can also be extended to a multi-level hierarchy. Generally, the domain where a certain MN's home network is located is called the home domain, while a domain other than the MN's home domain is called a foreign domain.

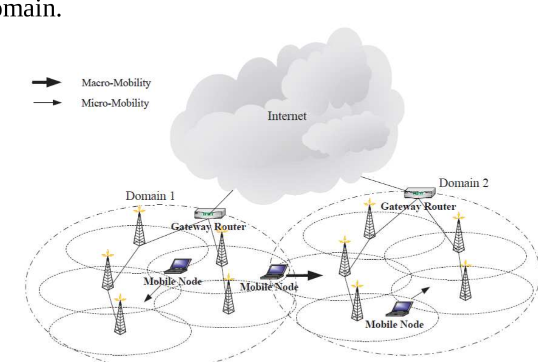

Figure 2: Macro-Mobility and Micro-Mobility

Packet Burst

Another implication of packet reordering is packet burst, since an ACK triggered by a late-arriving packet may fill up the hole in the transmit window, causing the TCP window to slide forward by several packets suddenly. Consider a scenario where the MN has two interfaces and it is able to communicate with both the old and the new APs simultaneously on a handover (Figure 3). Assuming the wireless links are the bottleneck of the whole TCP transmission path, a number of packets will be buffered at the old AP before the handover. The total number of outstanding packets is determined by the TCP window size (the minimum of cwnd and rwnd, 8 packets in the scenario depicted in Figure 3). The packet forwarding speed of the new link is much faster than that of the old link. After the MN connects to the new AP and starts sending packets (including ACKs) via the new link, it continues receiving packets from the old AP. The TCP sender is not able to send a new packet until the ACKs for the outstanding packets return. Once the No. 1 and No. 2 packets reach the MN from the old AP, the MN sends an ACK in response (assuming the delayed ACK mechanism is used). On receipt of the ACK, the TCP sender is then able to send 2 new packets (packet No. 9 and No. 10). The new packets are forwarded to the MN through the new fast link and their ACKs are returned immediately. This repeats, until the ACK for packet No. 7 and No. 8 arrives at the TCP sender. At this time, the TCP sender should have sent packet No. 13 and No. 14 and received their ACKs. Thus the ACK for No. 7 and No. 8 fills up the hole from packet No. 7 to No. 14, causingthe TCP window to suddenly slide to from packet No. 15 to No. 22. Therefore, a packet burst consisting of 8 packets (a window) is produced.

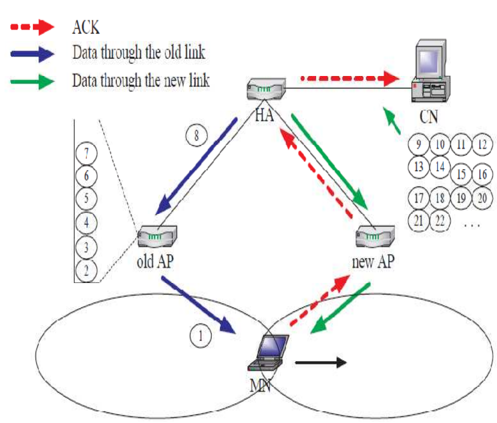

Figure 3: Packet Burst Caused by Handovers

Conclusion

This work based on algorithm Random link state algorithm has been given in paper [2] Ji Zhang, Communications Research Group Department of Electronics University of York September 2005 “Cross-Layer Analysis and Improvement for Mobility Performance in IP-Based Wireless Networks”. This thesis proposes Genetic algorithm rather than Random delay algorithm descried in [2] and find perfectly optimized result of packet lose during handover in mobile IP network.

Future Work

Some other parameters which affects loses of information during handover like in overlap area are MN Speed, Agent Advertisement Interval, Data Packet Interval and Network Traffic Load optimized in future.

1. Number of Lost Packets - MN Speed
2. Number of Lost Packets - Agent Advertisement Interval
3. Number of Lost Packets - Data Packet Interval
4. Number of Lost Packets - Network Traffic Load

Number of Lost Packets - MN Speed

The actual effect of changing the speed of the MN is similar to that of changing the overlap area width, since they both affect the time needed for the MN to travel through the effective overlap width.

Number of Lost Packets - Agent Advertisement Interval

How the value of Agent Advertisement interval (*I*) affects handover performance. When the Agent Advertisement interval is shorter than 1000 ms, it can be guaranteed that the MN can get and accept at least one Agent Advertisement when it is in the effective overlap area,

Number of Lost Packets - Data Packet Interval

It should be obvious that the number of packets lost during a handover also depends on the data packet interval, since all the packets arriving during the handover disruption time will be lost without any handover smoothing techniques.

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Packet burst usually has an adverse effect on networks, since it can suddenly overflow a buffer located somewhere on the path, causing multiple packet losses, especially when the TCP window size is large. However, this phenomenon is not rare in vertical handovers from a low data rate link to a high data rate link (e.g. from a GPRS link to an 802.11b link). The simulation results presented in chapter 5 will also show this phenomenon. Some TCP algorithms maintain a variable called maxburst to limit the maximum number of packets that can be sent in a burst by the TCP sender [15] [10]. This is an effective means to regulate TCP transmissions in any case that packet bursts may be produced.