PERFORMANCE STUDY OF VOICE OVER INTERNET PROTOCOL IN MOBILE IPv6

HASHIMAH BINTI HASSAN

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Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

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FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

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Tajuk Projek : Performance Study of Voice Over Internet Protocol in Mobile IPv6

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FAKRULRADZI BIN IDRIS
Pensyarah
Fakulti Kejuruteraan Elektronik Dan Kejuruteraan Komputer
Universiti Teknikal Malaysia Melaka (UTeM)
Karung Berkunci No 1752
Pejabat Pos Durian Tunggal
76109 Durian Tunggal, Melaka

Tarikh: 28 APRIL 2010

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Signature :

Supervisor's Name : En.Fakrulradzi Bin Idris

Date : APRIL 2010

DEDICATION

To my mother, father and beloved family,and to my beloved friends thank you for spiritual and supportive

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ABSTRACT

Mobile IPv6 is a version of Mobile IP which is a network layer IP standard used by devices to exchange data across a packet switched internetwork. Mobile IPv6 allows an IPv6 node to be mobile or arbitrarily change its location on an IPv6 network. The key benefit of Mobile IPv6 is that even though the mobile node changes locations and addresses, the existing connections through which the mobile node is communicating are maintained. The connections to mobile nodes are made (without user interaction) with a specific address that is always assigned to the mobile IPv6 node, and through which the mobile node is always reachable. This paper present the Voip in the Mobile IPv6 by using OPNET. The objectives of this project are to study the architecture of Mobile IPv6 and to analyze the performance of VoIP in multi-user condition (more than one mobile nodes and corresponding nodes). The purpose of this paper also wants to minimize the mitigating latency and jitter in VoIP that occur during sending and receiving data packet process. This mobility architecture achieves lower handover delay and less packet loss than using either MobileIPv6 or SIP and hence presents a powerful handover mobility scheme for next generation IP-based wireless systems.

ABSTRAK

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Mobile IPv6 adalah versi Mobile IP yang merupakan lapisan jaringan IP yang standard digunakan oleh peralatan (telefon) untuk bertukar data dengan melintasi sebuah packet suis yang berada di dalam kawasan. Mobile IPv6 memungkinkan sebuah node IPv6 untuk menjadi mobile atau mengubah lokasi dengan sewenag-wenangnya pada jaringan IPv6. Manfaat utama Mobile IPv6 adalah meskipun terdapat perubahan pada lokasi dan alamat node mobile, sambungan yang digunakan oleh mobile node tersebut masih tidak berubah. Sambungan ke mobile node dibuat (tanpa interaksi pengguna) dengan alamat tertentu yang selalu di alamatkan ke node mobile IPv6. Projek ini mengkaji tentangVoIP di dalam Mobile IPv6 dengan menggunakan OPNET. Objektif projek ini dijalankan adalah untuk mempelajari struktur Mobile IPv6 dan untuk menganalisis VoIP dalam keadaan banyak pengguna(lebih dari satu node mobile dan node correspondent). Tujuan projek ini juga adalah untuk meminimumkan latensi dan jitter dalam VoIP yang terjadi semasa proses penghantaran dan penerimaan paket data.Struktur mobile ini dapat mengurangkan masa kelewatan penghantaran dan penrimaan paket data dengan menggunakan MobileIPv6 yang menyediakan skema penghantaran data yang baik untuk generasi mobiliti IP seterusnya.

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HA	-	Home Agent
MN	-	Mobile Node
SIP	-	Session Internet Protocol
VoIP	-	Voice over Internet Protocol
CN	-	Correspondent Node
MIPv6	-	Mobile Internet Protocol version 6
CoA	-	Care of Address
QoS	-	Quality of Service
UAC	-	User Agent Client
UAS	-	User Agent Server
WLAN	-	Wireless Local Area Network
PSTN	-	Public Switched Telephone Network
IP	-	Internet Protocol

CHAPTER 1

INTRODUCTION

1.1 Introduction

Mobile IPv6 allows an IPv6 node to be mobile to arbitrarily change its location on an IPv6 networkand still maintain existing connections. When an IPv6 node changes its location, it might also change its link. When an IPv6 node changes its link, its IPv6 address might also change in order to maintain connectivity. There are mechanisms to allow for the change in addresses when moving to a different link, such as stateful and stateless address autoconfiguration for IPv6. However, when the address changes, the existing connections of the mobile node that are using the address assigned from the previously connected link cannot be maintained and are ungracefully terminated.

The benefit of Mobile IPv6 is that even though the mobile node changes locations and addresses, the existing connections through which the mobile node is communicating are maintained. To accomplish this, connections to mobile nodes are made with a specific address that is always assigned to the mobile node, and through which the mobile node is always reachable. Mobile IPv6 provides Transport layer connection survivability when a node moves from one link to another by performing address maintenance for mobile nodes at the Internet layer.

Mobile IPv6 is expected to be used in IP over WLAN, WiMAX or BWA. By using OPNET, the performance of jitter and delay for Mobile IPv6 will be analyze. The characteristic of Mobile IPv6 will be analyzed. This mobility architecture achieves lower handover delay and less packet loss than using MobileIPv6 hence presents a powerful handover mobility scheme for next generation IP-based wireless systems.

From this project, the understanding and the knowledge about the characteristic and the overall concept of Mobile IPv6 will achieved. The Quality of Service for Voice over Internet Protocol by using Mobile IPv6 coding schemes when mobile nodes change their location in the network will be analyzed. In this project the OPNET can be used to simulate and implement Mobile IPv6 network.

1.2 Problem Statement

The mobile nodes in fixed IPv4 network cannot maintain the previously connected link (using the address assigned from the previously connected link) when changing location. While, the underlying IP network is inherently unreliable, in contrast to the circuit-switched public telephone network, and does not inherently provide a mechanism to ensure that data packets are delivered in sequential order, or provide Quality of Service (QoS) guarantees, VoIP implementations face problems mitigating latency and jitter.

1.3 Objectives

The objectives of this project are to study the architecture of Mobile IPv6 and to analyze the performance of VoIP in multiuser condition (more than one mobile nodes and corresponding nodes). This project also has aim to understand the overall concept of Mobile IPv6 and measure the Quality of Service for Voice over Internet Protocol by using different coding schemes when mobile nodes change their location in the network The purpose of this project also want to minimize the mitigating latency and jitter in VoIP that occur during sending and receiving data packet process.

1.4 Scope of Work

The scope of this project can be divided into two parts. First parts are to study about the Mobile IP,IPv6, VoIP and about the OPNET software and its coding. Voice over Internet Protocol (VoIP) is a general term for a family of transmission technologies for delivery of voice communications over IP networks such as the Internet or other packet-switched networks. After that, study the characteristic and the structure of Mobile IPv6. The scope of work for first part for this project is done. The second part of this project is to simulate all the coding for this project via OPNET. Apply and measure the Quality of Service for Voice over Internet Protocol.

1.5 Methodology

This project will start with the study of characteristic of Mobile IP. This is done by find out all the journal, articles and books that related to this project either in website or any materials.. In this project, designing and simulation is done by using a simulation tool based on OPNET. OPNET is used to simulate Mobile IPv6 network model. After all the simulation process is done, the performance of the network based on Quality of Services (QoS) parameter is analyzed. The QoS has to measure the effect of added the number of the corresponding nodes to the network.

CHAPTER 2

LITERATURE REVIEW

2.1 Mobile IPv6

Mobility for IPv6, or Mobile IPv6 (MIPv6) was develop to allow an IPv6 node to change points of network attachment without disrupting applications or services. In the MIPv6 specification, three network roles: mobile node, correspondent node and home agent are essentially defined. A mobile node is a node that can change its point of attachment from one link to another, while still being reachable via its home address. The mobile node maintains two IPv6 addresses, home address and care-of address. The home address is used as a permanent address of the node and is also used as an identifier by the transport sessions. The care-of address is essentially used as a current location identifier of the mobile node by the home agent. It also allows the correspondent node to send packets directly to the mobile node. A correspondent node is a peer node with which a mobile node is communicating. A home agent is the route optimization has also been incorporated into MIPv6. As such, it is therefore the primary candidate for global mobility management in the next generation mobile networks. [1}

The components of Mobile IPv6 are the following:

Host and Router

According to Neighbor Discovery in IPv6,the main difference between a host and router is the handling of different control messages necessary for neighbor discovery such as router advertisement, router solicitation, neighbour advertisement and neighbour solicitation. Therefore, a class inheritance approach (shown in Figure 2.0) is used to express the relationships between a router and host as it also allows the transition between the two roles. Only one instance of inherited class is created depending on whether the node is a router or host at startup . The instance Fig. 2.0 Class inheritance diagram of neighbour discovery is created in Neighbour Discovery, a simple module that resides in ICMP module. This approach provides extensibility when adding MIPv6 extensions, particularly the signaling and handover optimisations by allowing new subclasses to reuse the capabilities of the base class as well as override certain functions to test different algorithms accordingly.

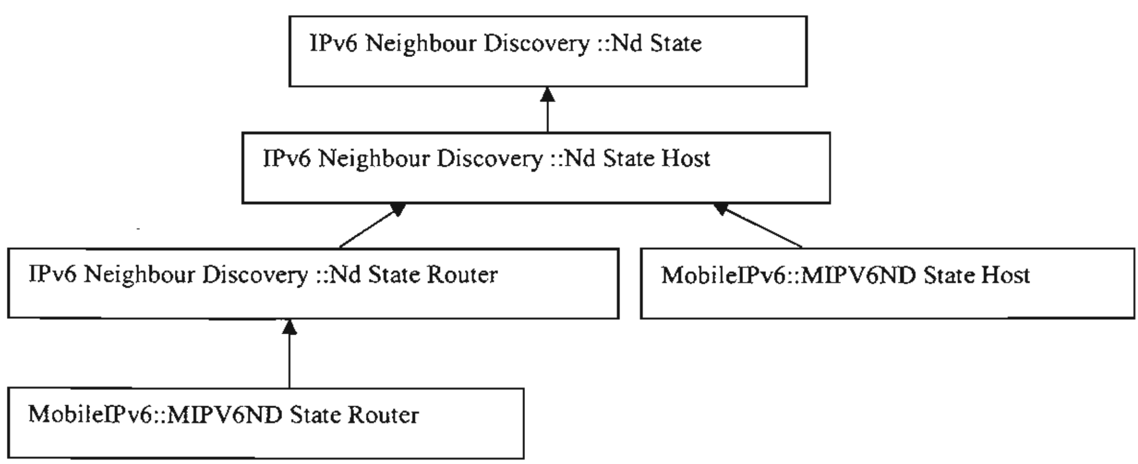

Fig. 2.0 Class inheritance diagram of neighbour discovery

Mobile Node, Correspondent Node and Home Agent

The mobile node, correspondent node and home agent process the messages differently. The base class MIPv6 Mobility State as shown in figure 2.1 provides the common behaviour for the different MIPv6 roles. The assignment of a node to a specific MIPv6 role is done via XML configuration.

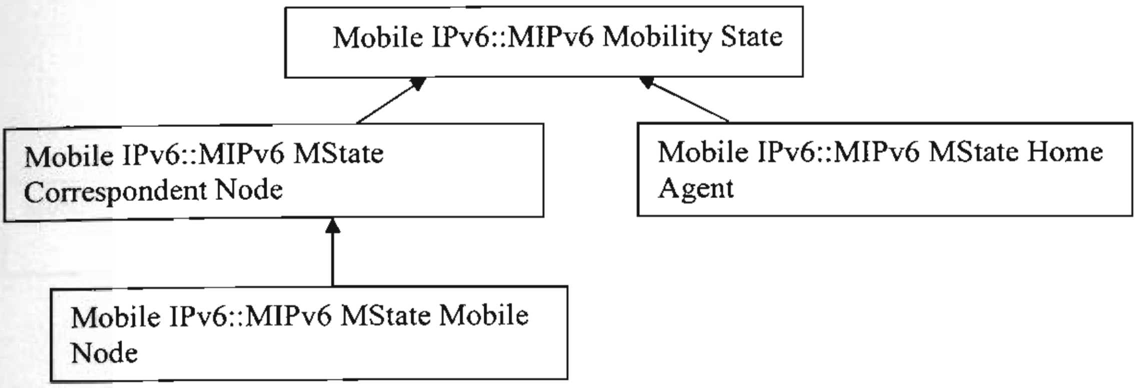

Fig. 2.1 Class inheritance diagram of MIPv6 network role

Conceptual Data Structure

In the MIPv6 specification, the conceptual data structures are described as follows:

Binding Cache: A cache of bindings 1 for other nodes.

This cache is maintained by home agents and correspondent nodes. Each entry in the cache contains information about the home address that is visible for the upper layer protocols and the care-of address that corresponds to the home address.

Binding Update List: This list is maintained by each mobile node. The list has an item for every binding that the mobile node has or is trying to establish with another node. Both correspondent and home registrations are included in this list. Entries from the list are deleted as the lifetime of the binding expires.

Home Agents List: Home agents need to know which other home agents are on the same link. This information is stored in the Home Agents List. The list is used for informing mobile nodes during dynamic home agent address discovery. The base class `MIPv6CDS` contains the binding cache. The mobile node interface contains binding update list and the home agent contains the home agent list. The instance of specific interface is instantiated in Mobility module. As the node is assigned to a particular MIPv6 role, the specific class instance is created accordingly.. The figure 2.2 shows the design of MIPv6 conceptual data structures.[4]

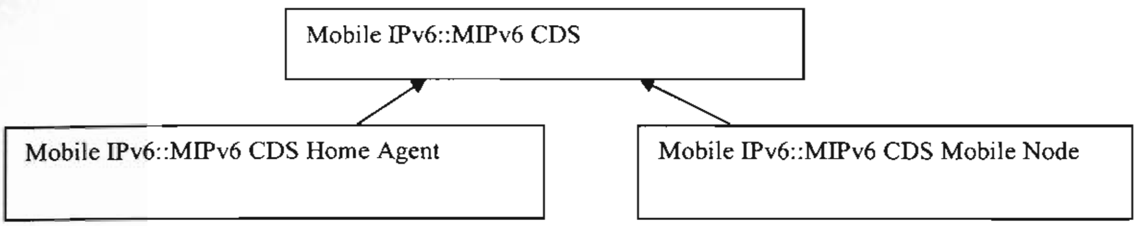

Fig. 2.2: Design of MIPv6 conceptual data structures

2.1.1 Mobile IPv6 Technology

In MIPv6, each Mobile Node (MN) is identified with a static IPv6 address called home address. The MN can always be reached using the fixed home address. When a MN is on its home link, it acts as a fixed host; When the MN is attached to a foreign link, it requires a new Care of Address (CoA). The CoA provides information about the MN's current location, so the HA or CN shall map the home address to its corresponding currently CoA by binding mechanism for location management and packets routing. The MN registers the CoA with the HA (i.e. home registration), and it may also inform the acquired CoA to CNs (i.e. correspondent registration). There are two possible routing mechanisms between the MN and the CN. The first is bidirectional tunnelling, which does not require MIPv6 support from the CN. The second is route optimization, which requires the MN to register its current CoA binding at the CN. Therefore, packets from the CN can be routed directly to the CoA of MN. The basic sequences of communication and interactions between entities for the two routing mechanisms are depicted in figure 2.3.

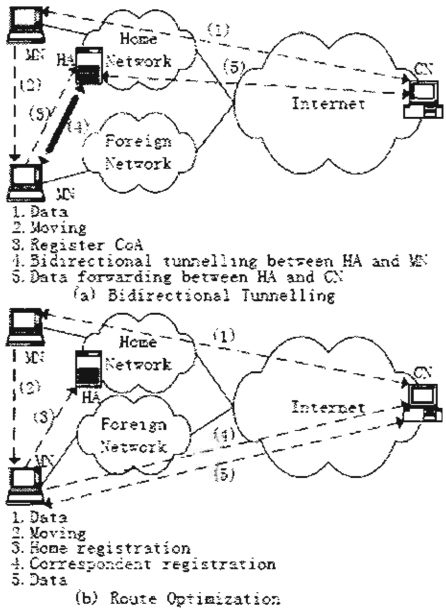

Figure 2.3 MIPv6 routing mechanisms

The following subsections detail the major functional elements of MIPv6 that make use of MIPv6 features.

(1) Movement Detection

When a MN moves, it must detect its current location. In MIPv6, a MN can determine its current location by listening to the router advertisements and comparing the network prefix of the source address within this advertisement with the network prefix of its home link. If the network prefix of the source address within the router advertisement equals the network prefix of the home address of MN, then the MN is on its home link. Otherwise the MN is on a foreign link.

(2) Acquisition of the CoA

When a MN attaches to a foreign link, it will need to acquire a new CoA. To obtain a CoA, the MN can use either stateful or stateless address auto-configuration methods. In the first situation, the MN obtains a CoA from a Dynamic Host Configuration Protocol for IPv6 (DHCPv6) server. In the latter situation, by using the Neighbor Discovery protocol, a MN is able to find the network prefix at any point of attachment that it might select and then adds a unique interface identifier to form a CoA for that point of attachment. After a CoA is obtained or formed, it must be checked whether this is a unique address or not by Duplicate Address Detection (DAD) mechanism.

(3) Registration and Binding Management

When a MN moves to a foreign link and acquires a CoA, it then registers to the HA or CNs in its list to inform them of its current location by using the IPv6 Mobility header . Mobility header messages related to the management of bindings include Binding Update message, Binding Acknowledgement message, Binding Refresh Request message etc. The MN performs the binding registration by sending a Binding Update message to the HA or CNs. The HA or CNs reply to the MN by returning a Binding Acknowledgement message. In the correspondent registration, as a part of this procedure, a return routability test is performed in order to authorize the establishment of the binding. The Binding Refresh Request message is mainly used to refresh binding when nearing the end of the current binding lifetime.

(4) Location Tracing and Packets Routing

Finally, after registering and binding, the CN can trace the MN and route packets to it continuatively. In bidirectional tunnelling mechanism, Packets from the CN to the MN are routed to the home address of MN, the HA shall uses proxy Neighbour Discovery to intercept any IPv6 packets addressed to the MN's home address on the home link. Each intercepted packet is tunnelled to the MN's current CoA . Packets to the CN are tunnelled from the MN to the HA, which is called reverse tunnelling, and then routed normally from the home network to the CN.

In route optimization, the HA no longer exclusively deals with the address mapping, but each CN can have its own binding cache. In the direction from the MN to the CN, packets sent by the MN are delivered to the CN with the Home Address option in the Destination Option Extension header when the MN is away from its home network. In this case, the MN sets the IPv6 header's source address as its CoA and adds a Home Address option with the MN's home address to IPv6 header. When the CN receives the packet from the MN, it replaces the MN's home address to be the IPv6 header's source address before delivering the packet to the upper layer. This way, the MN not only keeps mobility transparent to its upper software, but also passes the packet