Performance evaluation of Mobile IP in Home and Foreign Network

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Abstract- *Current versions of the Internet Protocol (IP) assume that the point at which a computer attaches to the Internet or a network is fixed and its IP address identifies the network to which it is attached. Datagrams are sent to a computer based on the location information contained in the IP address. If a mobile computer, or mobile node, moves to a new network while keeping its IP address unchanged, its address does not reflect the new point of attachment. Consequently, existing routing protocols cannot route datagrams to the mobile node correctly. In this situation, you must reconfigure the mobile node with a different IP address representative of its new location, which is a cumbersome process. Thus, under the current Internet Protocol, if the mobile node moves without changing its address, it loses routing; but if it does change its address, it loses connections.*

Keywords- Mobile IP, home address, care-of address (COA), wireless networks, Home Agent (HA), Foreign Agent (FA), Mobile Node (MN)

I. INTRODUCTION

Mobile IP (Internet Protocol) enables the transfer of information to and from mobile computers, such as laptops and wireless communications. The mobile computer can change its location to a foreign network and still access and communicate with and through the mobile computer's home network.

Mobile IP solves this problem by allowing the mobile node to use two IP addresses: a fixed home address and a care-of address that changes at each new point of attachment. Mobile IP enables a computer to roam freely on the Internet or an organization's network while still maintaining the same home address. Consequently, computing activities are not disrupted when the user changes the computer's point of attachment to the Internet or an organization's network. Instead, the network is updated with the new location of the mobile node

Mobile IP framework.

1. The Internet host sends a datagram to the mobile node using the mobile node's home address (normal IP routing process)
2. If the mobile node is on its home network, the datagram is delivered through the normal IP process to the mobile node. Otherwise, the home agent picks up the datagram.
3. If the mobile node is on a foreign network, the home agent forwards the datagram to the foreign agent.
4. The foreign agent delivers the datagram to the mobile node.
5. Datagrams from the mobile node to the Internet host are sent using normal IP routing procedures. If the mobile node is on a foreign network, the packets are delivered to the foreign agent. The foreign agent forwards the datagram to the Internet host.

In the case of wireless communications, the illustrations depict the use of wireless transceivers to transmit the datagrams to the mobile node. Also, all datagrams between the Internet host and the mobile node use the mobile node's home address regardless of whether the mobile node is on a home or foreign network. The care-of address is used only for communication with mobility agents and is never seen by the Internet host.

II. MOBILE IP FUNCTIONAL ENTITIES

Mobile IP introduces the following functional entities:

1. **Mobile Node (MN)–**Host or router that changes its point of attachment from one network to another. It is a pue mobile node which can roam between home network and foreign network.
2. **Correspondent Node (CN):** Correspondent node (CN) is a node that is intended to communicate with a MN. It may be mobile or a stationary node
3. **Home Agent (HA):** Router on a mobile node's home network that intercepts datagrams destined for the mobile node, and delivers them through the care-of address. The home agent also maintains current location information for the mobile node. It is responsible for forwarding of packets to MN whenever MN is in home network.

4. **Foreign Agent (FA) :** Router on a mobile node's visited network that provides routing services to the mobile node while the mobile node is registered. FA is responsible for forwarding of packet whenver MN is in foreign network.

5. **Care of Address (COA) :** COA is a temporary IP address for a mobile device. This allows a home agent to forward messages to the mobile device.

A separate address is required because the IP address of the device that is used as host identification is topologically incorrect - it does not match the network of attachment. The care-of address splits the dual nature of an IP address, that is, its use is to identify the host and the location within the global IP network.

6. Internet: The Internet is the global system of interconnected computer networks that use the Internet protocol suite (TCP/IP) to link devices worldwide. It is a network of networks that consists of private, public, academic, business, and government networks of local to global scope, linked by a broad array of electronic, wireless, and optical networking technologies.

III. HOW MOBILE IP WORKS

Mobile IP enables routing of IP datagrams to mobile nodes. The mobile node's home address always identifies the mobile node, regardless of its current point of attachment to the Internet or an organization's network. CN, the sender in the architecture wants to initiates the communication will forward the packet to the IP address of MN after encapsulation is done. In the process of encapsulation, CN will attach a Header in front of a data packet which reveals information such as name of sender, name of receiver and the length of the data.

When away from home, a care-of address associates the mobile node with its home address by providing information about the mobile node's current point of attachment to the Internet or an organization's network as shown in Fig. 1. Mobile IP uses a registration mechanism to register the care-of address with a home agent. It is the responsibility of MN to inform HA about its COA whenever he is visiting a Foreign network for correct delivery of data. HA also decapsulates the packet on behalf of MN whenever MN is in home network.

The home agent redirects datagrams from the home network to the care-of address by constructing a new IP header that contains the mobile node's care-of address as the destination IP address as shown in Fig. 2. This new header then encapsulates the original IP datagram, causing the mobile node's home address to have no effect on the encapsulated datagram's routing until it arrives at the care-of address. This type of encapsulation is also called tunneling. After arriving at the care-of address, each datagram is de-encapsulated and then delivered to the mobile node.

The following illustration shows a mobile node residing on its home network, Network A, before the mobile node moves to a foreign network,Network B. Both networks support Mobile IP. The mobile node is always associated with its home network by its permanent IP address, 128.226.3.30. Though Network A has a home agent, datagrams destined for the mobile node are delivered through the normal IP process.

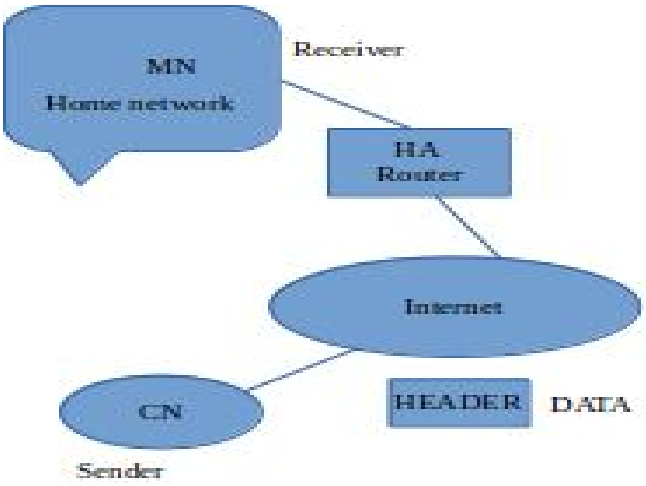

Fig.1: Mobile Node Residing on Home Network

The following illustration shows the mobile node moving to a foreign network, Network B. Datagrams destined for the mobile node are intercepted by the home agent on the home network, Network A, encapsulated, and sent to the foreign agent on Network B. Upon receiving the encapsulated datagram, the foreign agent strips off the outer header and delivers the datagram to the mobile node visiting Network B.
The care-of address might belong to a foreign agent, or might be acquired by the mobile node through Dynamic Host Configuration Protocol (DHCP) or Point-to-Point Protocol (PPP). In the latter case, a mobile node is said to have a co-located care-of address.

The mobile node uses a special registration process to keep its home agent informed about its current location. Whenever a mobile node moves from its home network to a foreign network, or from one foreign network to another, it chooses a foreign agent on the new network and uses it to forward a registration message to its home agent.

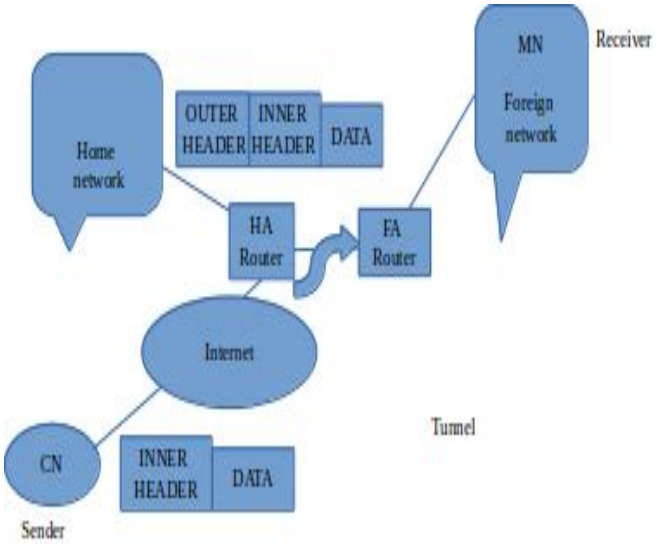

Fig. 2: Mobile Node Moving to a Foreign Network

When the mobile node detects that it is located on its home network, it operates without mobility services. If returning to its home network from being registered elsewhere, the mobile node deregisters with its home agent

Mobility agents (home agents and foreign agents) advertise their presence using agent advertisement messages. A mobile node can optionally solicit an agent advertisement message from any locally attached mobility agents through an agent solicitation message. A mobile nodereceives these agent advertisements and determines whether they are on its home network or a foreign network.

IV. SECURITY CONSIDERATIONS

In many cases, mobile computers use wireless links to connect to the network. Wireless links are particularly vulnerable to passive eavesdropping, active replay attacks, and other active attacks.

Though Mobile IP cannot reduce or eliminate this vulnerability, Mobile IP can authenticate the Mobile IP messages. The default algorithm used is MD5, with a key size of 128 bits. The default operational mode requires that this 128–bit key precede and succeed the data to be hashed. The foreign agent also supports authentication using MD5 and key sizes of 128 bits or greater, with manual key distribution. Mobile IP can support more authentication algorithms, algorithm modes, key distribution methods, and key sizes.

Tunneling can be a significant vulnerability, especially if registration is not authenticated. Also, the Address Resolution Protocol (ARP) is not authenticated, and can potentially be used to steal another host's traffic.

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