S-MIP : A Seamless Handoff Architecture for Mobile IP

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Objective

To reduce the MIP handoff latency by

§ reducing home network registration time through a hierarchical management structure

§ minimizing the lengthy address resolution delay by address preconfiguration through fast-handoff mechanism

Introduction

§ Generally, when MN moves, it obtains a new IP address, all existing IP connections are terminated and it reconnect to the new network.

§ To avoid this, MIP introduces indirection at the IP layer, achieved by network agents.

- * Each MN is identified by static home network address from it's home network
- * MN updates home agent about it's current IP
- * Home agent intercept any packet for MN and tunnels them to MN

§ **Causes of Handoff Latency**

Time taken for a MN to {register its location with home agent
{configure a new network care of address

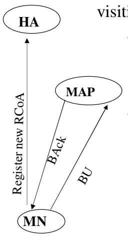
§ **Solution proposed**

- * hierarchical network management structure
- * preconfiguration

Background & Related Works

§ **A Hierarchical Mobile IPv6**

MAP - placed at the edge of the network above the access router
- maintain a binding between itself and mobile nodes currently visiting it's network domain



Whenever MN attaches to a new network

* MN registers with MAP
* MAP intercept every packet to MN, tunnel then through LCoA
*. if LCoA changes, new LCoA is required
*. if MN moves to another MAP, new RCoA and LCoA is required

MAP Binds RCoA to LCoA

Background & Related Works

B Fast-Handoff mechanism

Router Solicitation for Proxy (*RtSolPr*)
Proxy Router Advertisement (*PrRtAdv*)
Handover Initiation (*HI*)
Handover Acknowledgement (*HAck*)
Fast Binding Acknowledgement (*F-BAck*
Fast Binding Update (*F-BU*)
Fast Neighbor Advertisement (*F-NA*)

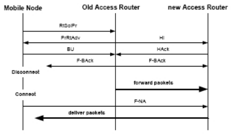


Figure 1 Fast-handoff Message Interaction

Even with this, packet loss at IP still exist

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Builds on fast handoff and hierarchical scheme

Introduce the use of an intelligent handoff mechanism

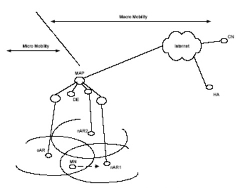

Figure 2 S-MIP Architecture

A. Design

Extreme Low Handoff Latency

Minimal Handoff signaling

Indoor Large open space Environment

Scalability, High Availability, Fault Tolerance

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§**Causes of Packet Losses**

- Ł segment {MAP & access routers }
- Ł edge {last access router & mobile device}

§**Solution to Packet Loss**

- Ł keep anchor point for forwarding mechanism close to MN
- Ł use newly developed synchronized packet –Simulcast(SPS) scheme and a hybrid handoff mechanism

  * SPS –multicast packet to **both** current and future location of MN (s-packet & f-packet)
  * Hybrid - MN initiated –best knowledge about current position to initiate handoff

  Ø***Synchronize feedback* -** movement tracking

  1. linear,
  2. stochastically
  3. stationary

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B. S-MIP Network Architecture

Introduction of Decision engine and Sync Packet Simulcast

messages	***flow***	***information***
CTS	MN Ł DE	location tracking information
CLS	ARs Ł DE	Number of mobile device AR manages
HD	DE Ł ARs	outcome of the DE handoff decision
HN	oAR Ł MN	which nAR, MN handover to
Scast	oAR Ł MAP	triggers the start of the SPS process
Soff	nAR Ł MAP	terminates the SPS process

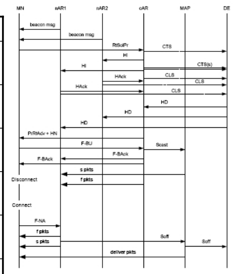

Figure 3 Mobile Node Initiated, Network Determined Linear Handoff

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B. S-MIP Network Architecture(contd.)

Types of HD messages

	Movement Tracking	**HD message (DE to AR)**
If the MN{	stochastic moving state	anticipation mode AR's still maintain binding, in case of ping-ponging
	near the boundary between 2 network areas	multiple binding using more one CoA simultaneously
	linear	which AR, the MN handoff to

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B. Movement Tracking

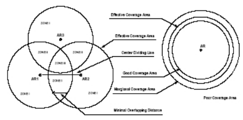

Figure 4 Coverage Model

§***Coverage area and zone definitions signal strength***

* Effective - no packet loss, high SS
* Logical - inside the eff. area
* Marginal - outside the eff. area (packet loss below 5%)
* Poor - other remaining area

§***Location Tracking*** – Zone ii & iii

* ***Zone ii***

if MN { is closer to the interception of 1 & 2 – auxiliary ref AR3, CLS message

{ located at center of zone ii, -- marginal coverage cal. Inference

* ***Zone iii*** – use triangular technique

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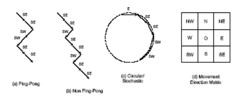

Figure 5 Movement Pattern

C. Movement Tracking (contd.)

§***Movement Pattern Detection***

dependent

sampling period

MN moving speed

The movement direction is calculated by

§Determining the location position using SS value.

§Differential of the location position at 2 different time interval

Performance Evaluation

To examine the packet loss and re-ordering behavior of S-MIP

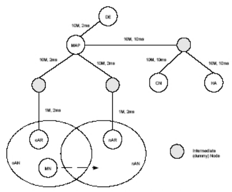

Figure 6 Simulation Network Topology

§Access router - 70 meters apart

§Lucent WaveLan card running 802.11

§Coverage area of 40 meter radius

§TCP Tahao –go back n model

§ns TCP source attached to Corresponding Node (CN)

§ns TCP sink agent attached to MN

§FTP session between MN and CN

Performance Evaluation Result

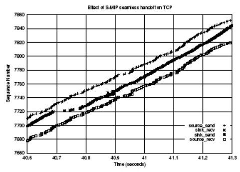

Figure 7 Handoff Result for S-MIP

source_send + CN's TCP sending buffer.

sink_recv * MN's TCP receiving buffer

sink_send ▫ MN's TCP sending buffer

source_recv *x* CN's TCP receiving buffer

Conclusion

§Combined scheme can provide lossless handovers at the IP layer, with minimal increase in signaling overheads

§SMIP is capable of providing an effective seamless handover in IP

Advantages/ Disadvantages

§ S-MIP eliminates the L3 disruption perceived by communication end-host.

§ No packet loss at IP layer.

§The need of re-ordering packet

§The need of waiting for the Handoff Decision(HD) message

Critique

§The paper is a good paper.

§Eliminates packet loss at L3.

§The author did not give details of how location tracking was performed.

§The symbols use in fig 7 handoff is confusing

§ The need for doubling buffering at the Access Routers so as not to activate the TCP congestion control mechanism

Questions

§ Explain why the old access router send duplicate fast binding Acknowledged and not just one .

§ What is the usefulness of adding Decision Engine to the S-MIP Network Architecture.

§ What is the reason behind sending a s-packet and f- packet.

§ Explain what type of messages are contained in Handover Acknowledgement and what happens.

§ What could be the cause of edge packet loss.