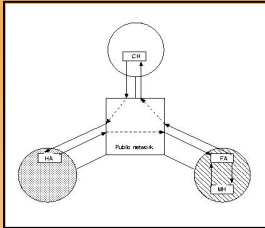


SIMULATION OF ROUTE OPTIMIZATION IN MOBILE IP

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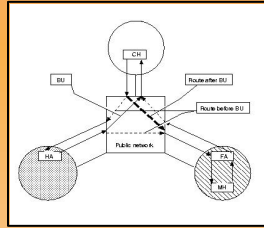
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MOTIVATION



Mobile IP and triangle routing

- Mobile IP: the mobility support for IP that enables an MH to send datagrams (routed by HA and FA) to the CH directly.
- Triangle routing: packets from CH to MH have to be routed through three different sub-networks: CH subnet, HA subnet, and FA subnet where the MH is currently located. Therefore, packets destined to the MH are often routed along paths that are significantly longer than optimal.

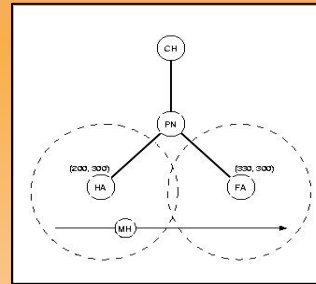


Route optimization in mobile IP

- Route optimization: extension of basic mobile IP, addressing the "triangle routing" problem by requiring all hosts to maintain a binding cache containing the care-of-address of MHs. It includes four messages: BU, BW, BR, and BA.

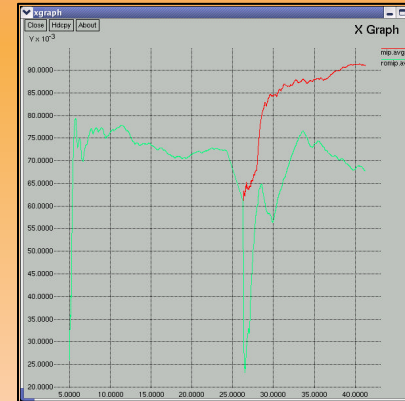
- MH: mobile host
- HA: home agent
- FA: foreign agent
- CH: correspondent host
- BU: binding update
- BW: binding warning
- BR: binding request
- BA: binding acknowledgment

SIMULATIONS

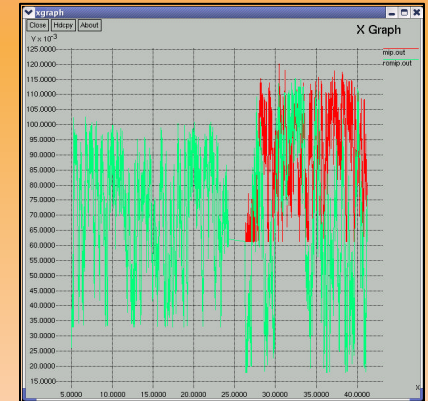


Simulation scenario 1: one FA

Parameter	Scenario 1: one FA	Scenario 2: two FAs
Radio coverage	75 m	75 m
Position of HA	(200, 300)	(200, 300)
Position of FA	(330, 300)	(350, 300)
Position of FA2	n/a	(500, 300)
Move MH from	(150, 275)	(150, 275)
Move MH to	(410, 275)	(560, 275)
Move MH start	10 s	10 s
Speed of MH	8 m/s	5 m/s
Traffic type	CBR	CBR
Traffic start	5 s	5 s
Traffic stop	50 s	90 s
Link delay (CH -- HA)	25 ms	25 ms
Link delay (CH -- FA)	10 ms	17 ms
Link delay (CH -- FA2)	n/a	10 ms

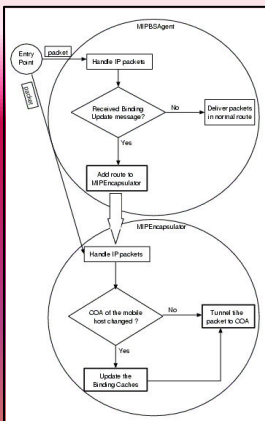


Average end-to-end packet delay



End-to-end packet delay

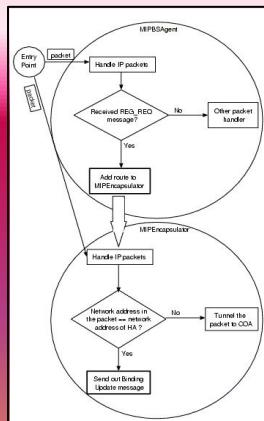
IMPLEMENTATIONS



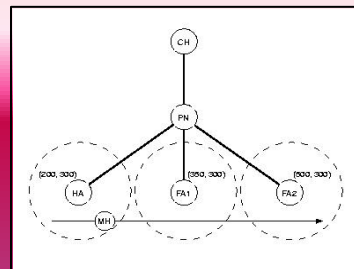
Receiving binding update

Tools:

ns-2
NAM
xgraph
C++
OTCL
Perl



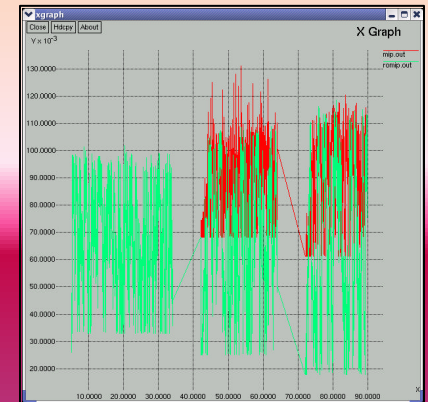
Sending binding update



Simulation scenario 2: two FAs



Average end-to-end packet delay



End-to-end packet delay

References:

- [1] C. Perkins *IP mobility support for IPv4*, <http://www.ietf.org/rfc/rfc3220.txt> (January 2002).
- [2] C. Perkins *Mobile IP: Design Principles and Practices*. Reading, MA: Addison-Wesley, 1998.
- [3] K. Fall and K. Varadhan (Eds.) *The ns manual*, <http://www.isi.edu/nsnam/ns/doc/index.html>.
- [4] Network simulator - ns-2, <http://www.isi.edu/nsnam/ns> (August 2002).
- [5] P. Zhou and W. Yang "Reverse routing: an alternative to MIP and ROMIP protocol," in *Proc. Canadian Conference on Electrical and Computer Engineering* Edmonton, AB, Canada, May 1999, vol. 1, pp. 150-155.