

# Efficient End-to-End Mobility Support in IPv6

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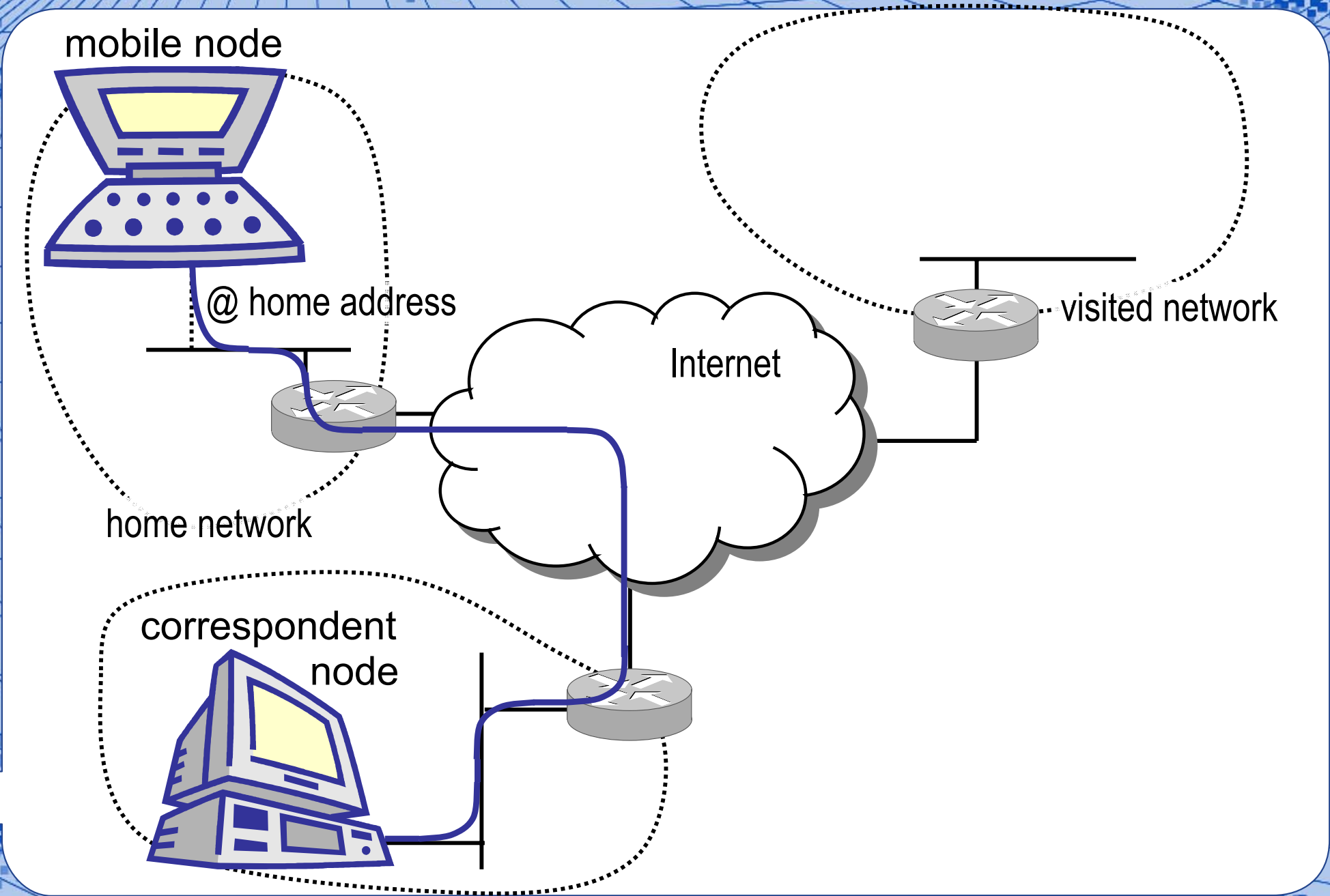
**Mark Doll**, [doll@tm.uka.de](mailto:doll@tm.uka.de)

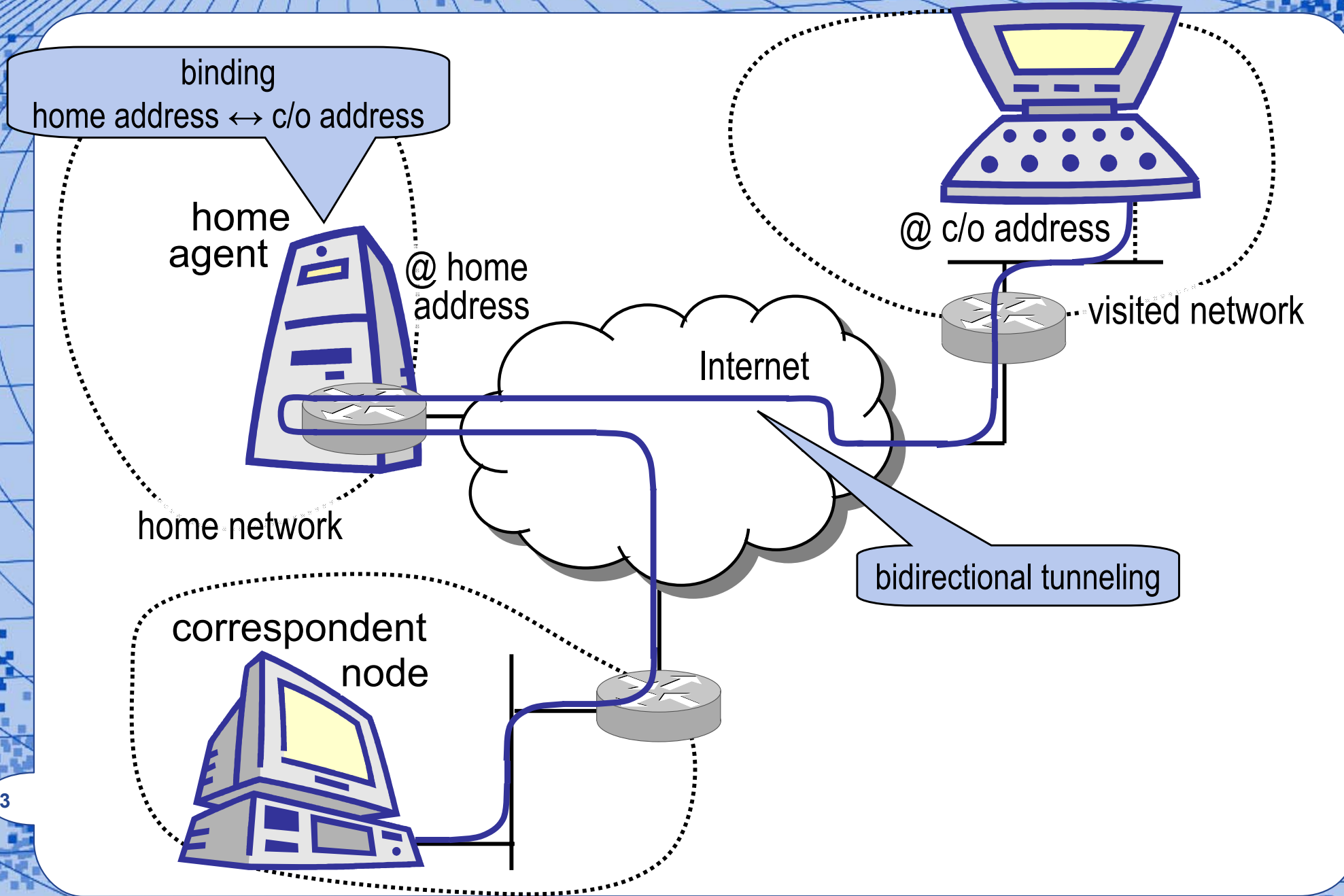


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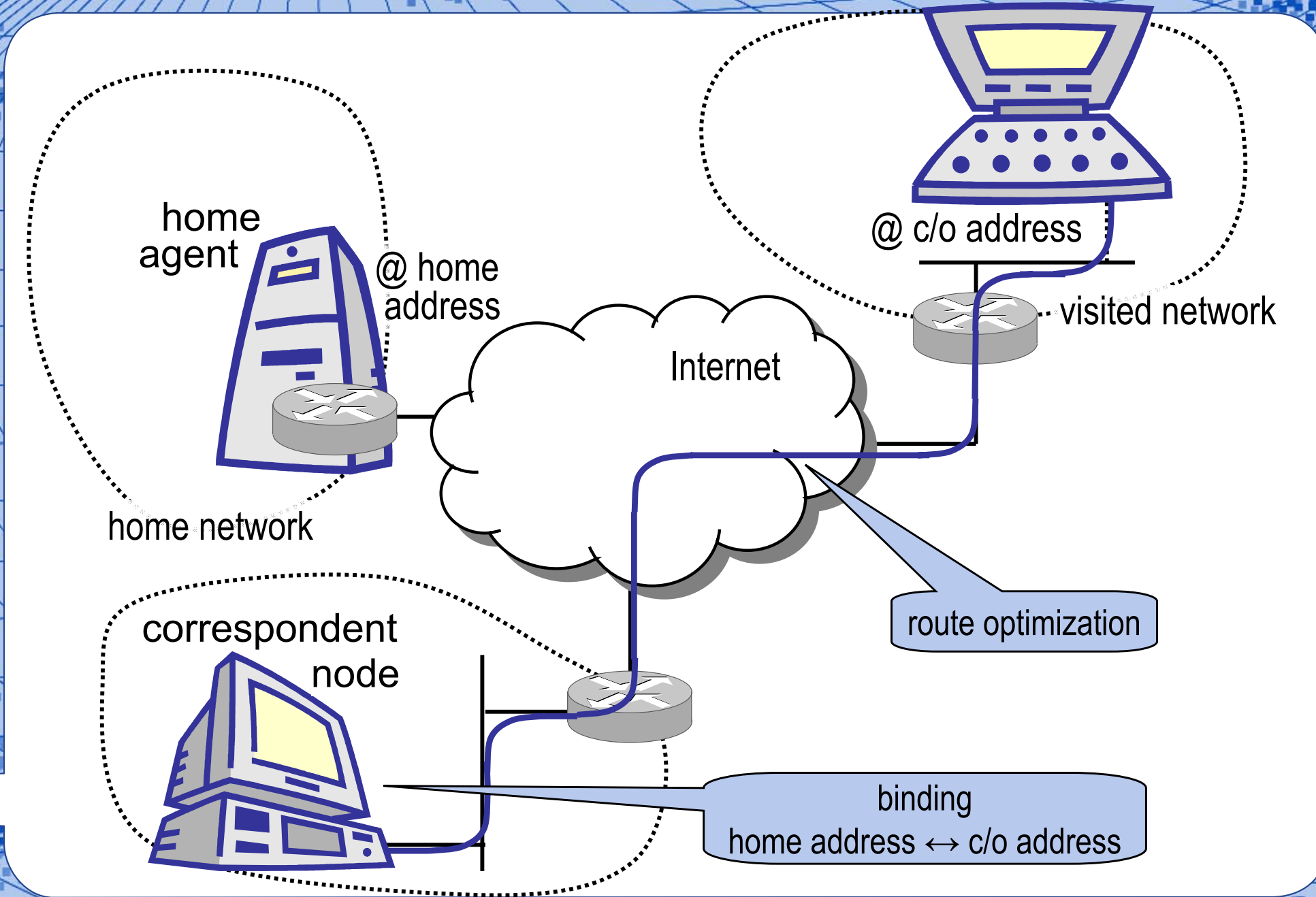






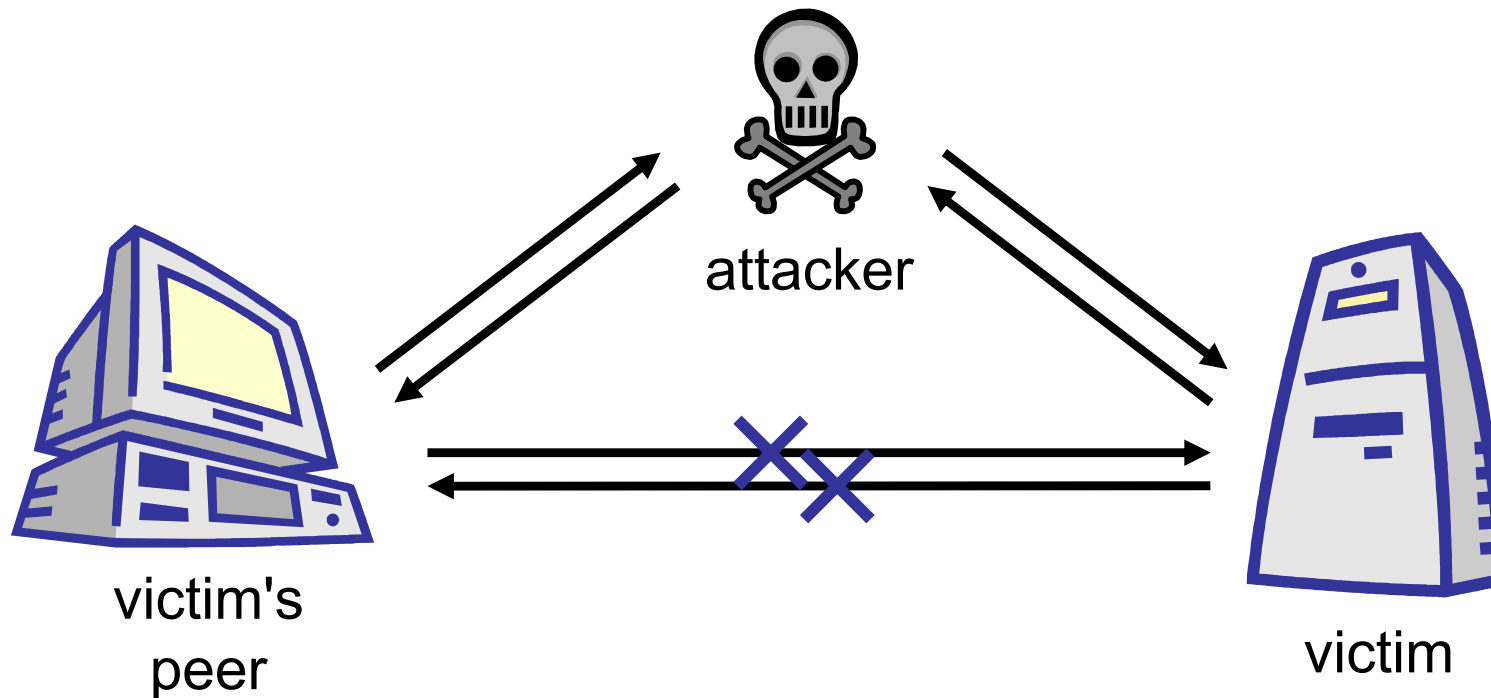


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## Issue 1: Connection hi-jacking

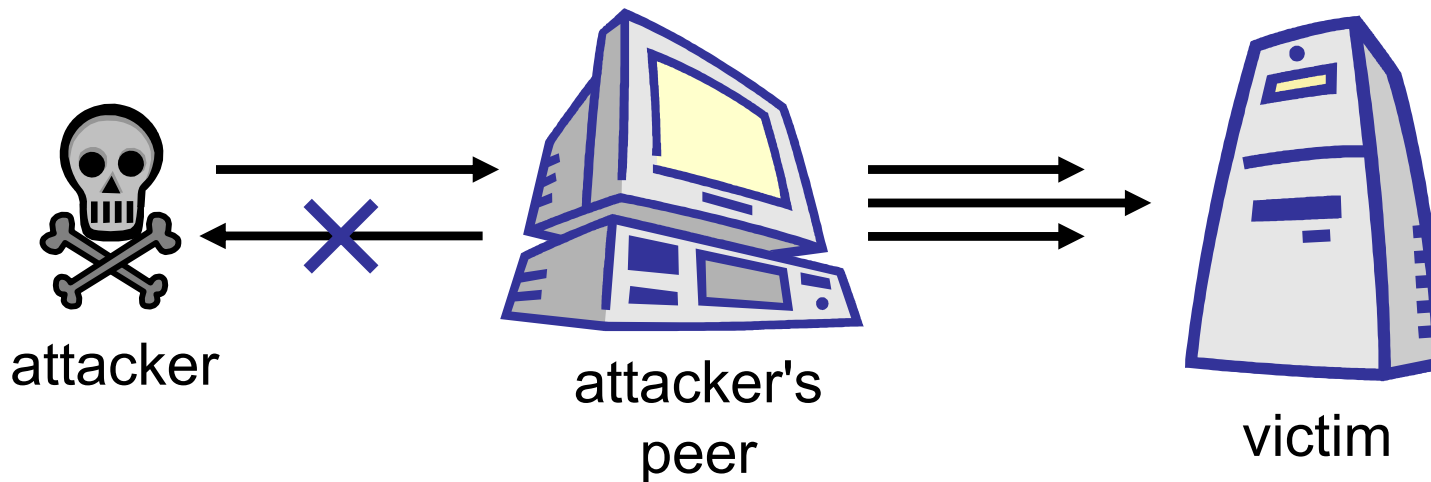
- Attacker pretends to own victim's (home) address



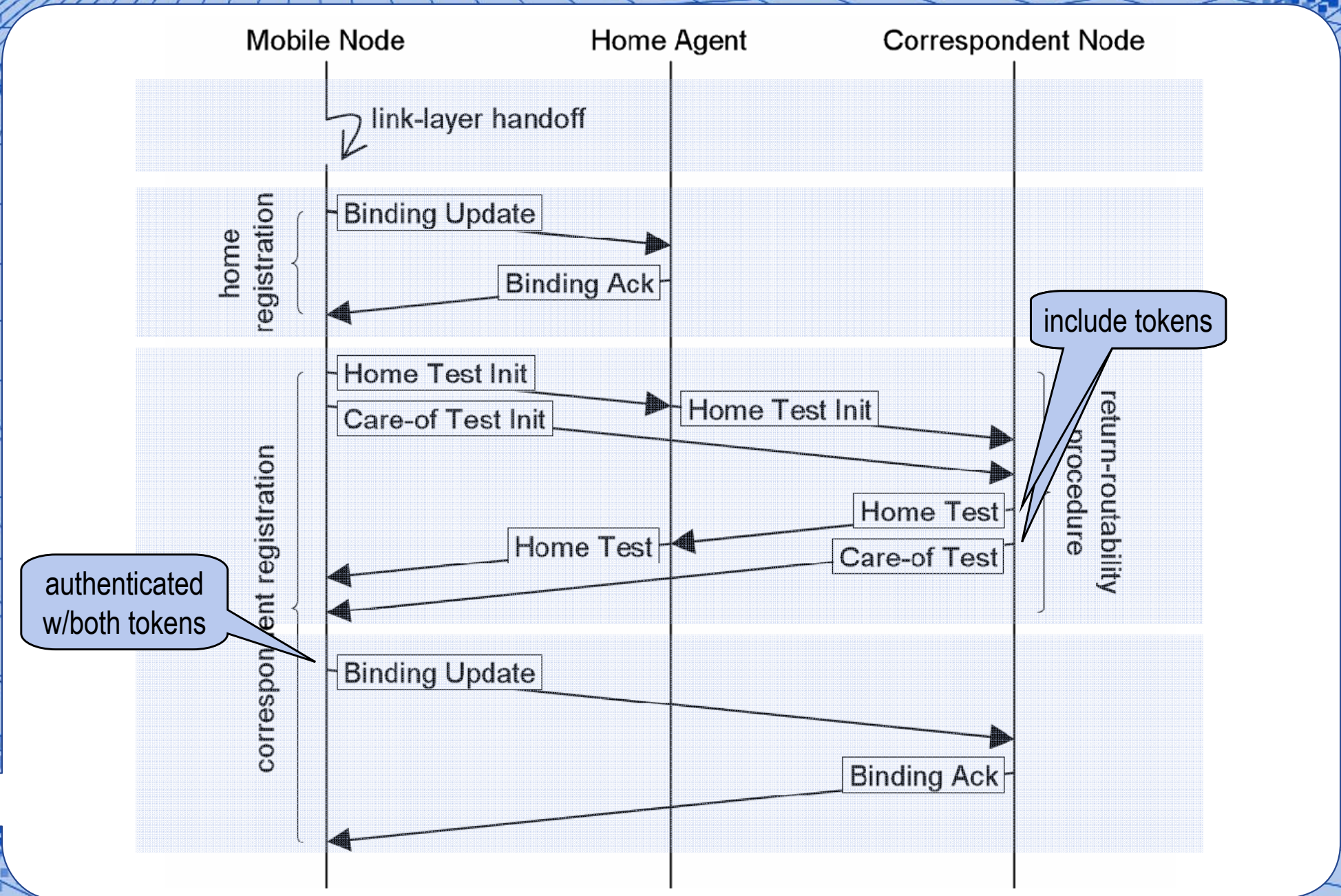
- Solution: Verify reachability at home address

## Issue 2: Redirection-based flooding

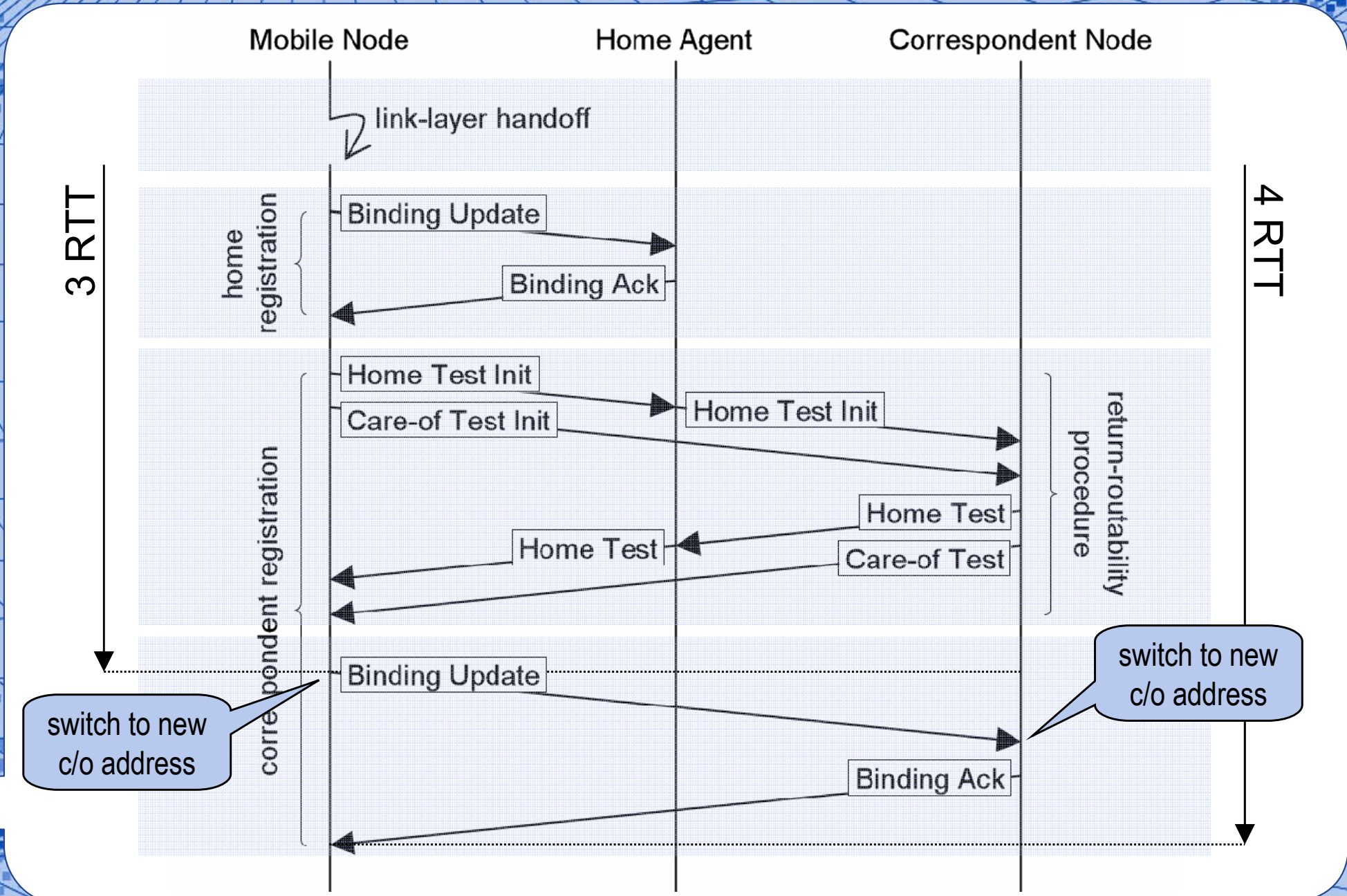
- Attacker pretends to be at victim's (c/o) address

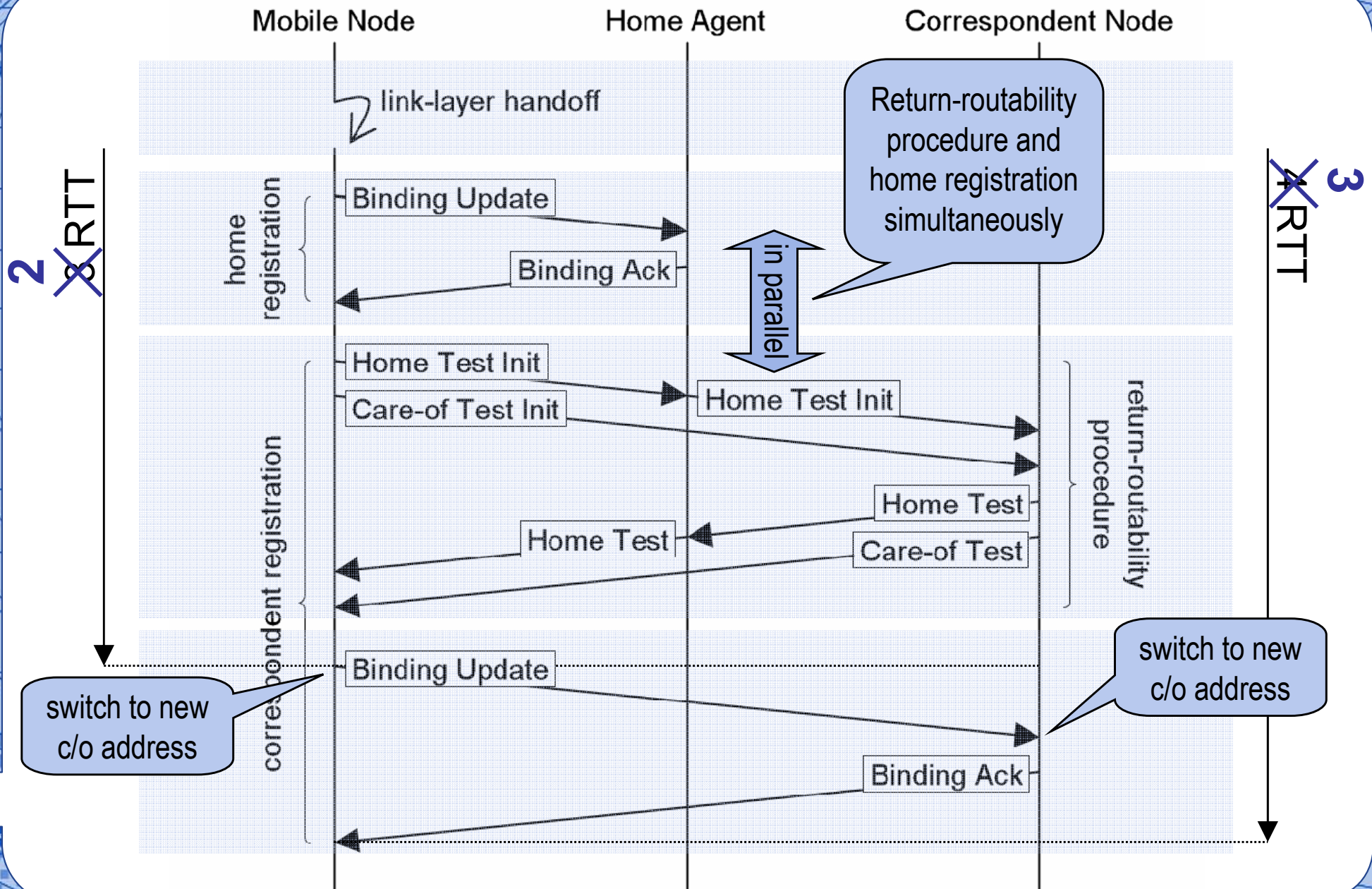


- Solution: Verify reachability at c/o address



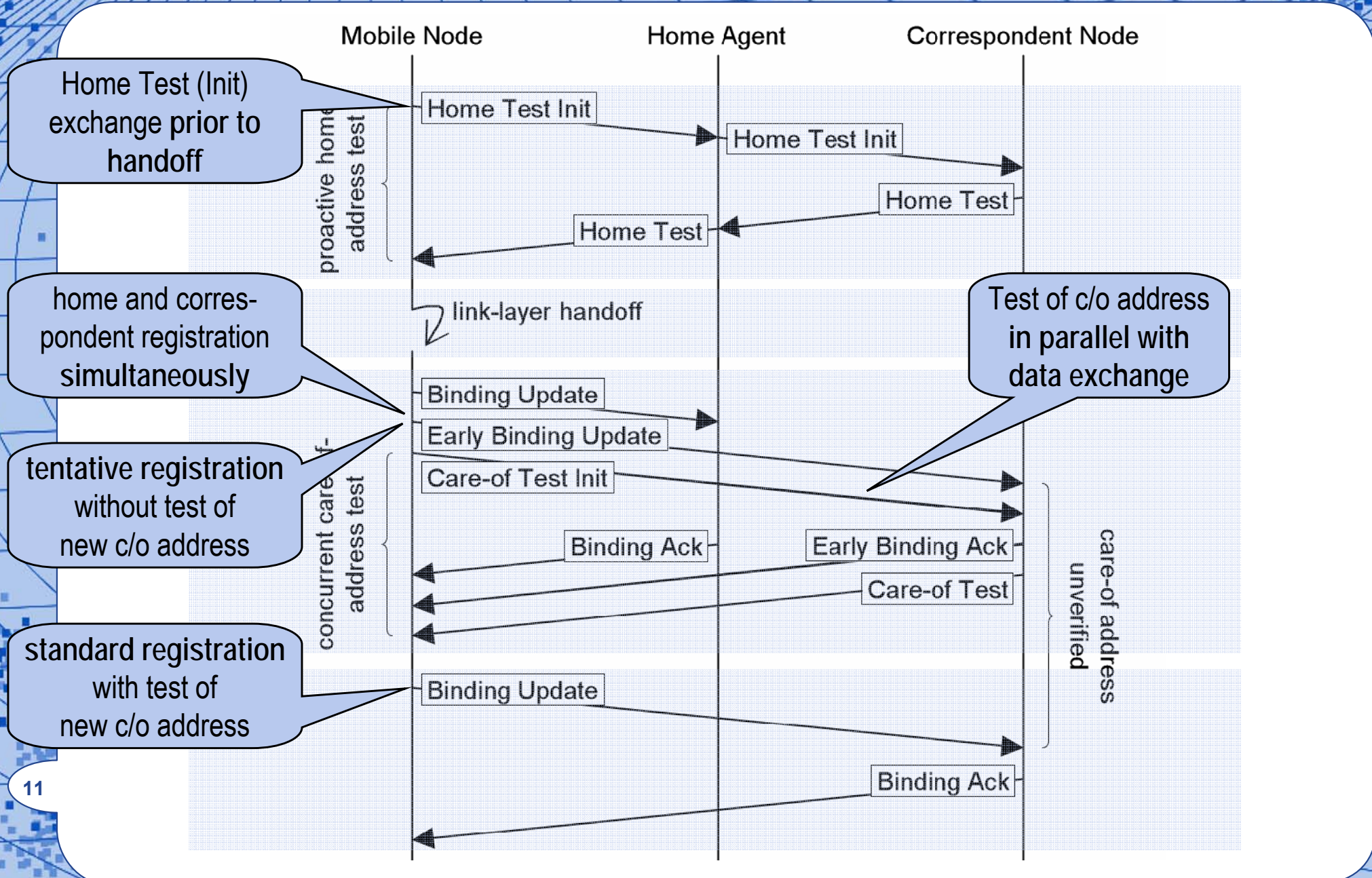


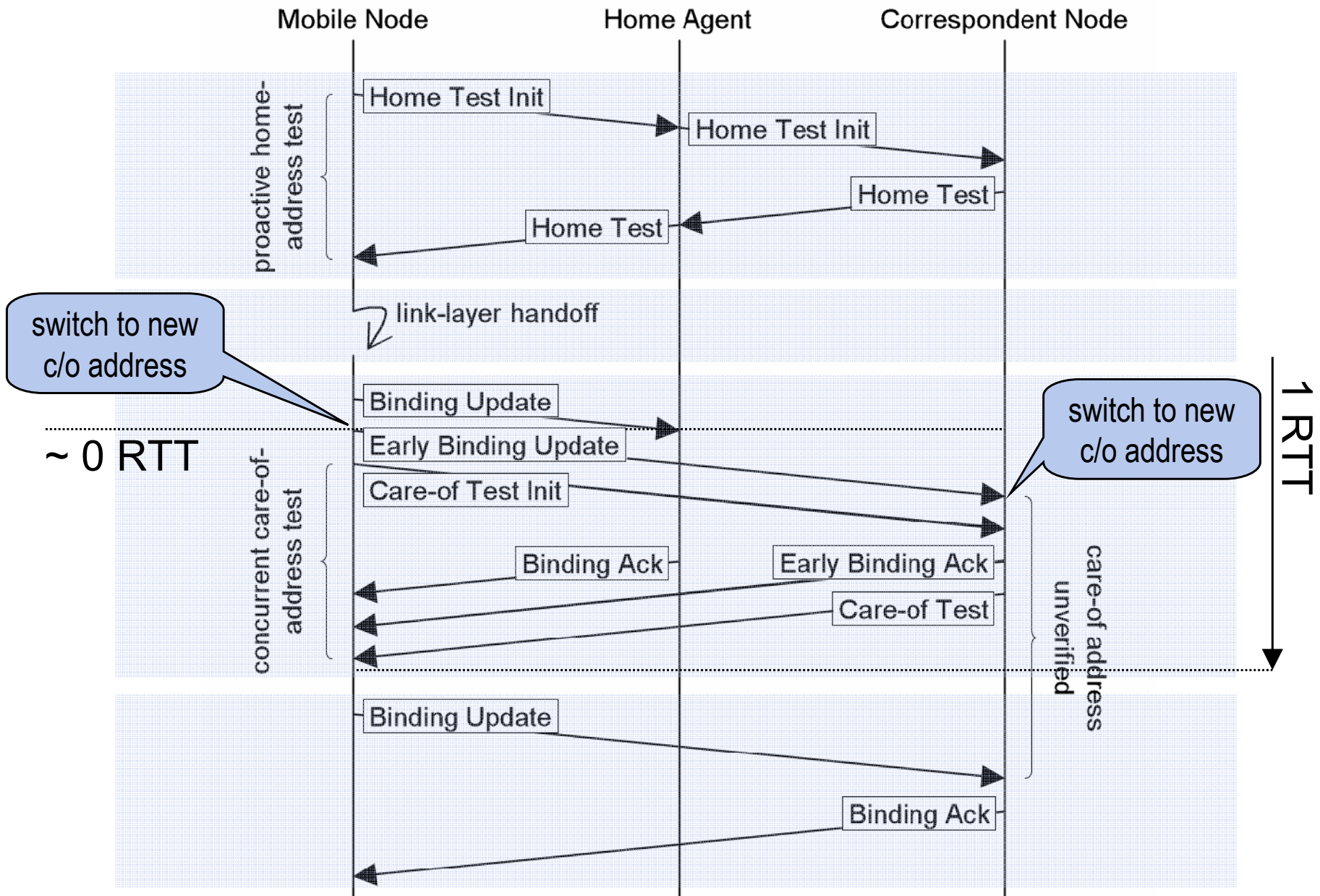


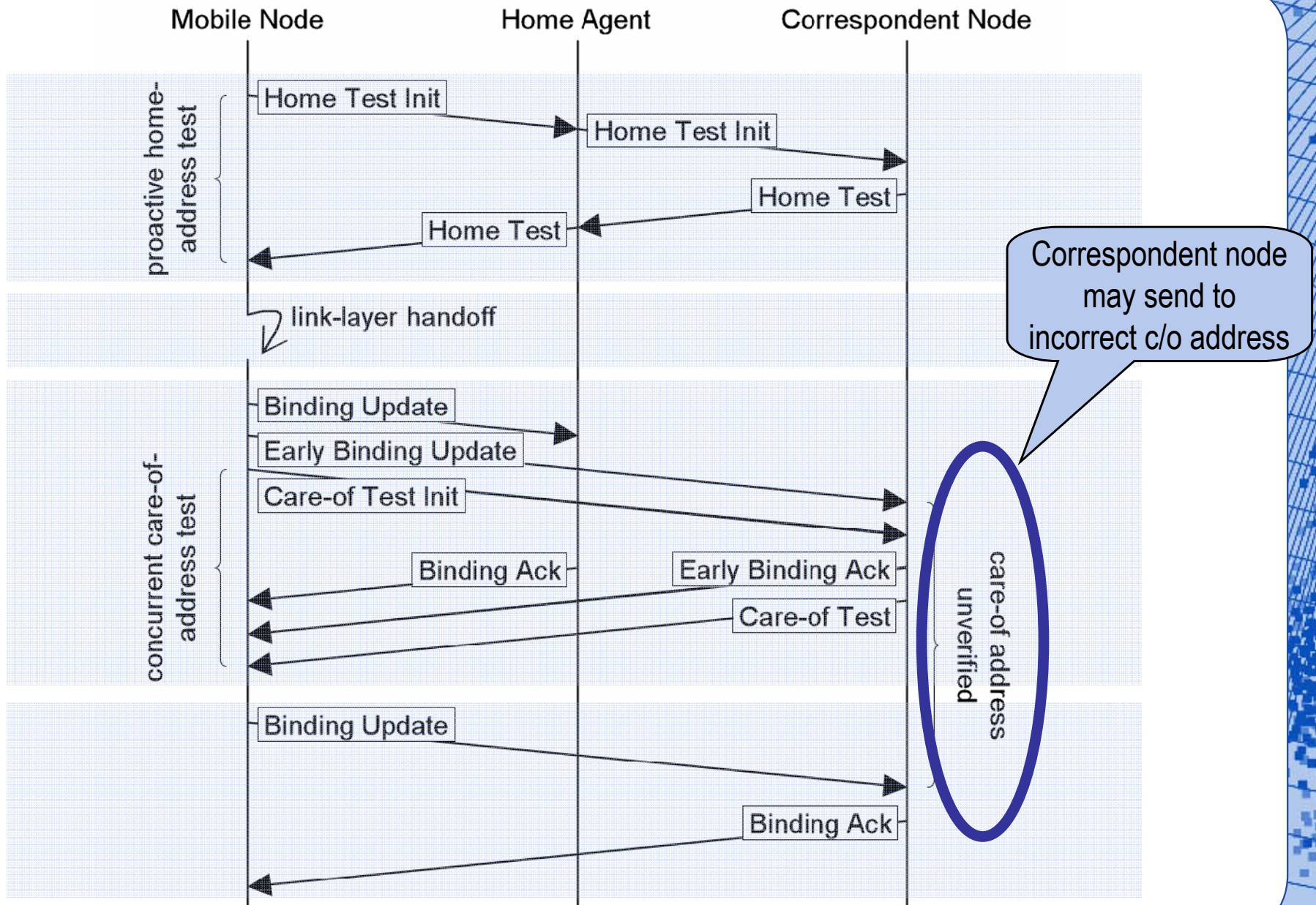


# Reduce handoff latency

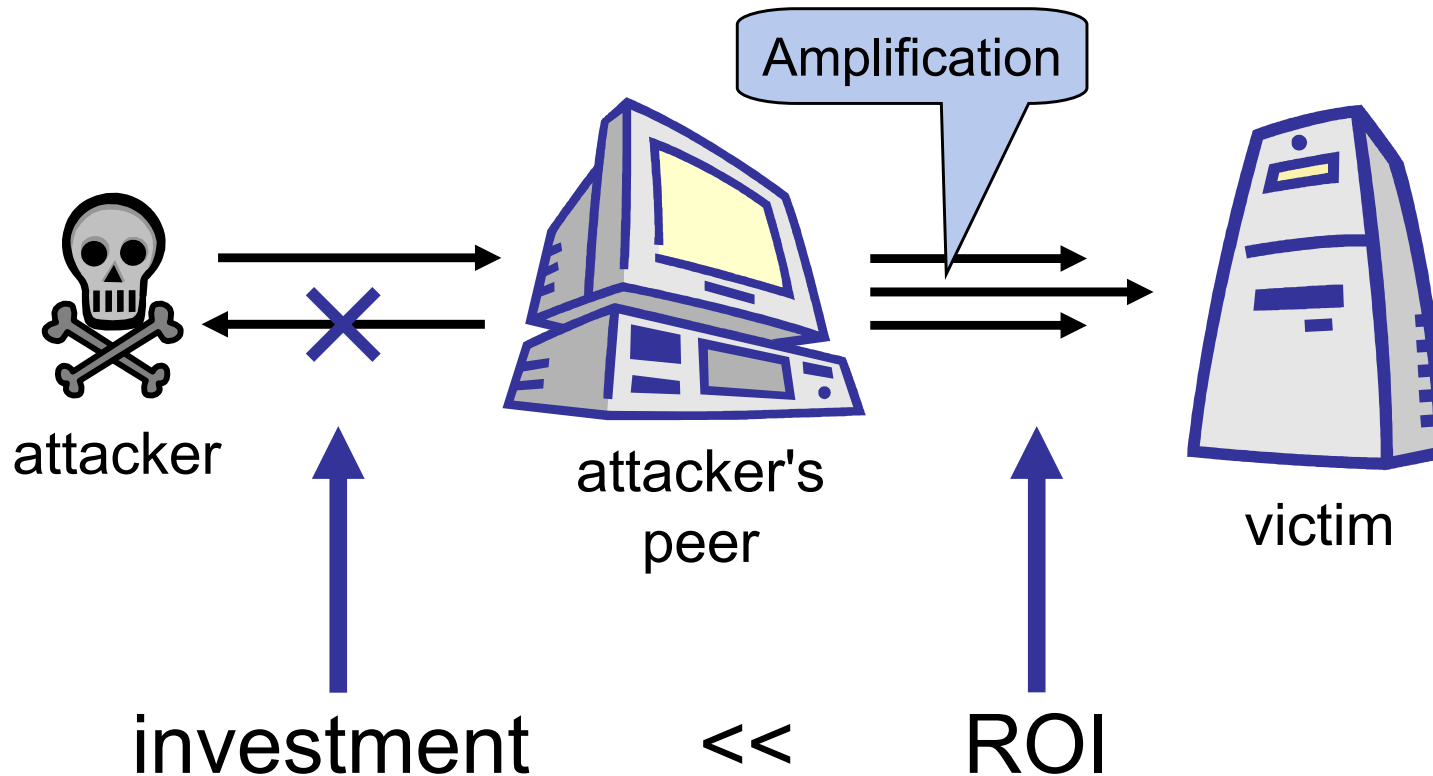
Early Binding Updates for Mobile IPv6  
Credit-Based Authorization



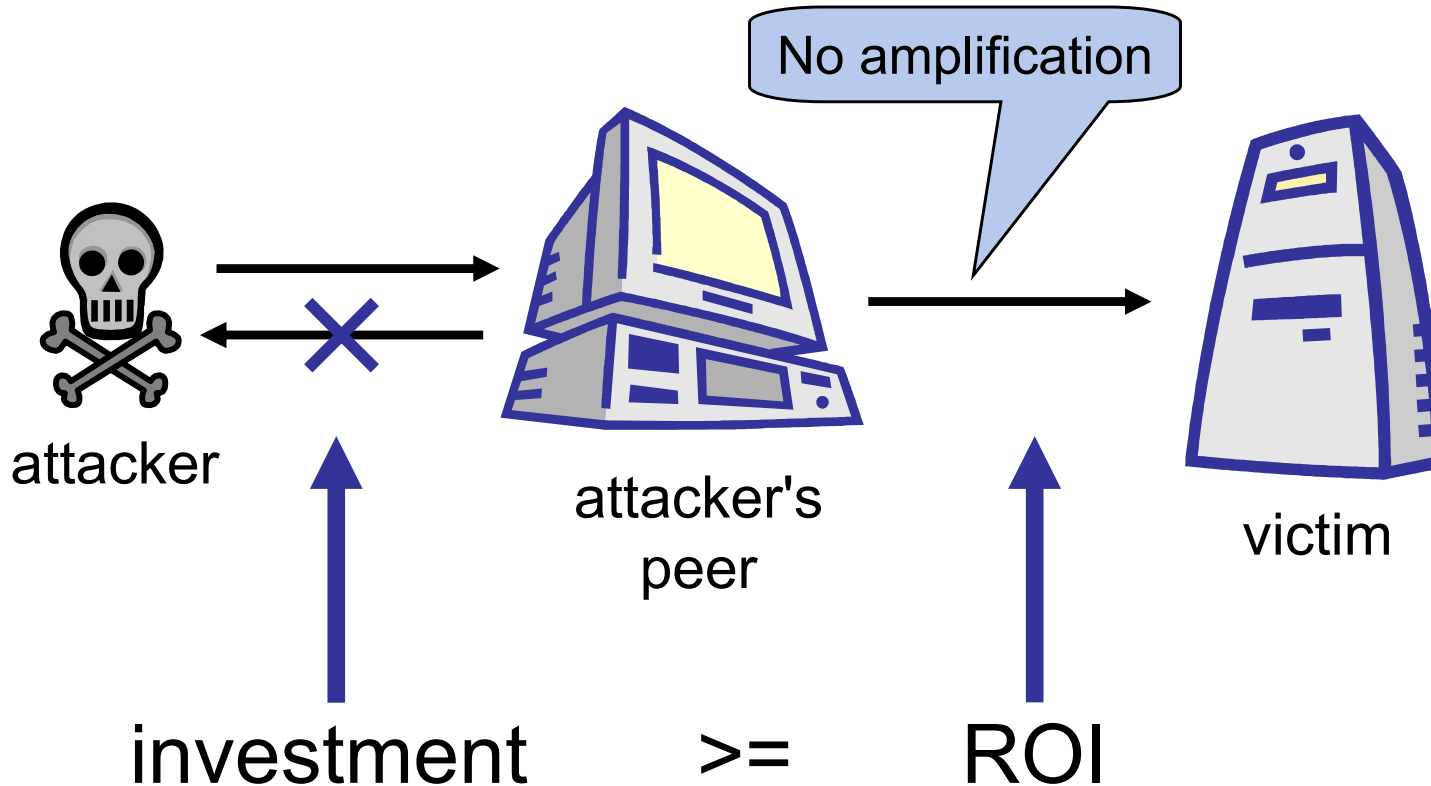




Without protection  
 ⇒ amplified redirection-based flooding

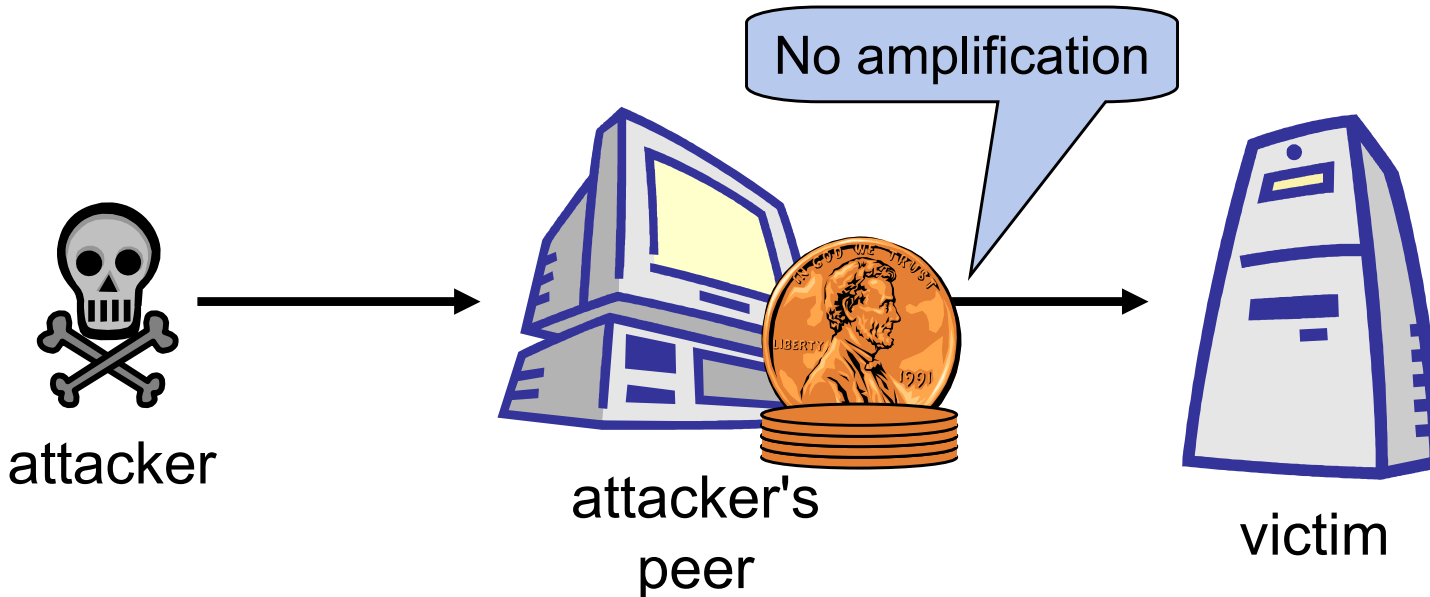


Credit-Based Authorization precludes amplification  
 ⇒ redirection-based flooding unattractive



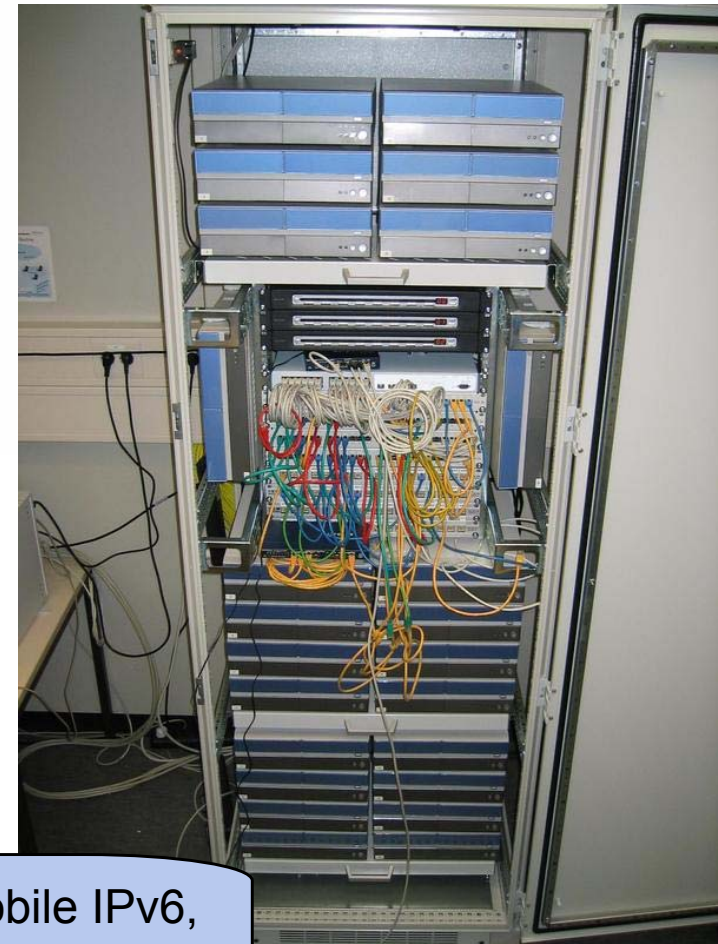
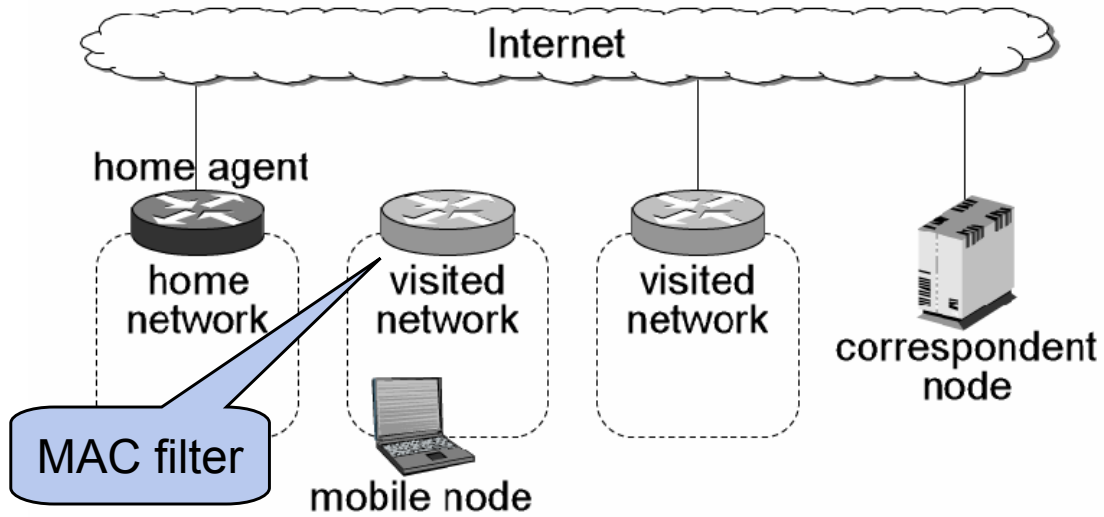


Credit-Based Authorization precludes amplification  
 ⇒ redirection-based flooding unattractive



Correspondent node counts bytes recently received from mobile node

Sends no more bytes to unverified c/o address



- FreeBSD
- Kame-Shisa Mobile IPv6

extended to support optimistic Mobile IPv6,  
Early Binding Updates, Credit-Based Auth.

## Application

- bidirectional
- 64 kbps payload
- 10ms chunks
- 164B per packet (IPv6, IPv6 extensions, UDP, RTP)

## Round-trip times

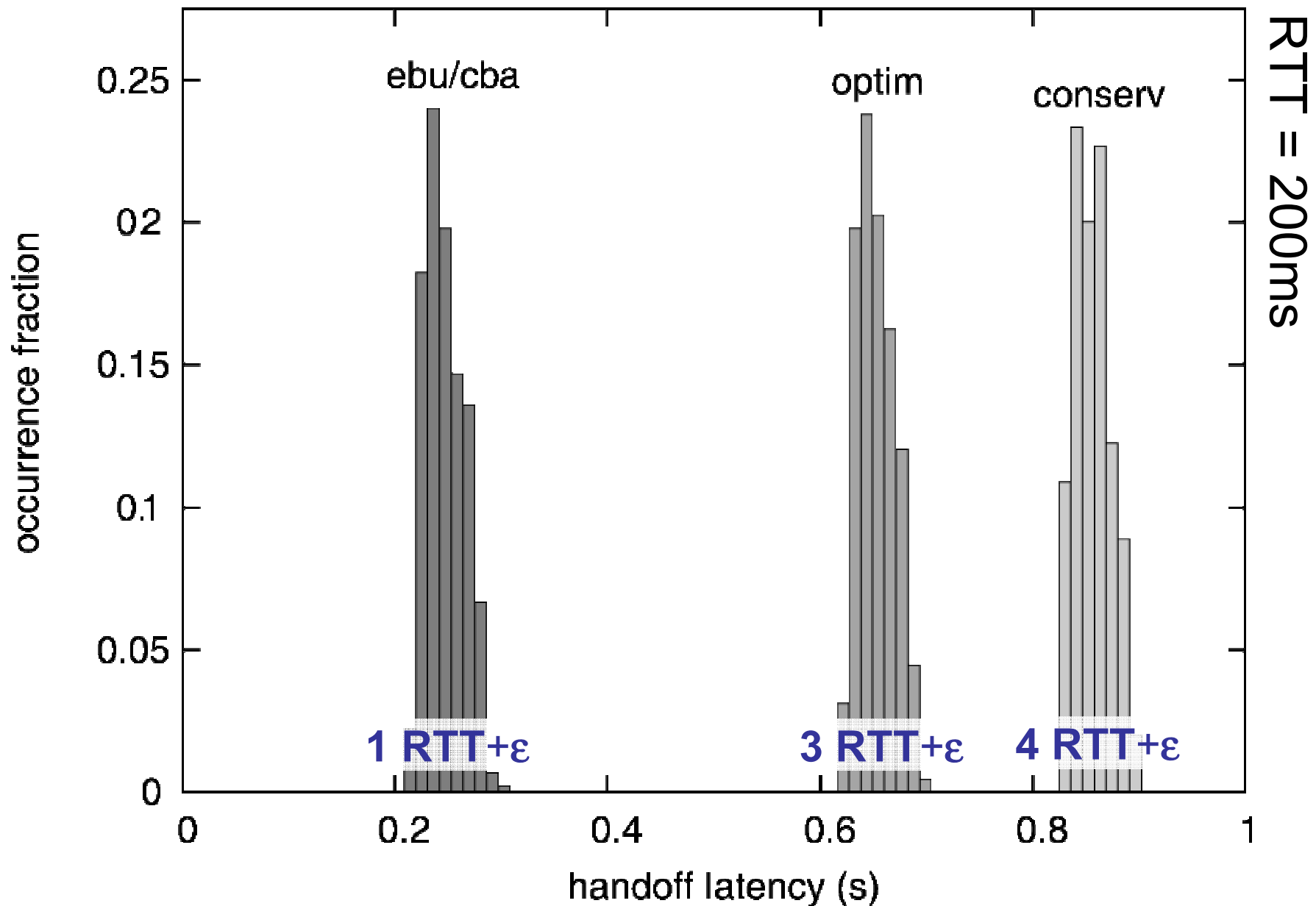
- 200ms btw. home agent, routers, correspondent node

## Mobile IPv6 versions

- conservative
- optimistic
- Early Binding Updates, Credit-Based Authorization

## Confidence

- 500 handoffs per Mobile IPv6 version



## Application

- unidirectional download: correspondent node to mobile node
- 60s duration
- 1024 kbps bandwidth
- TCP Reno

## Round-trip times

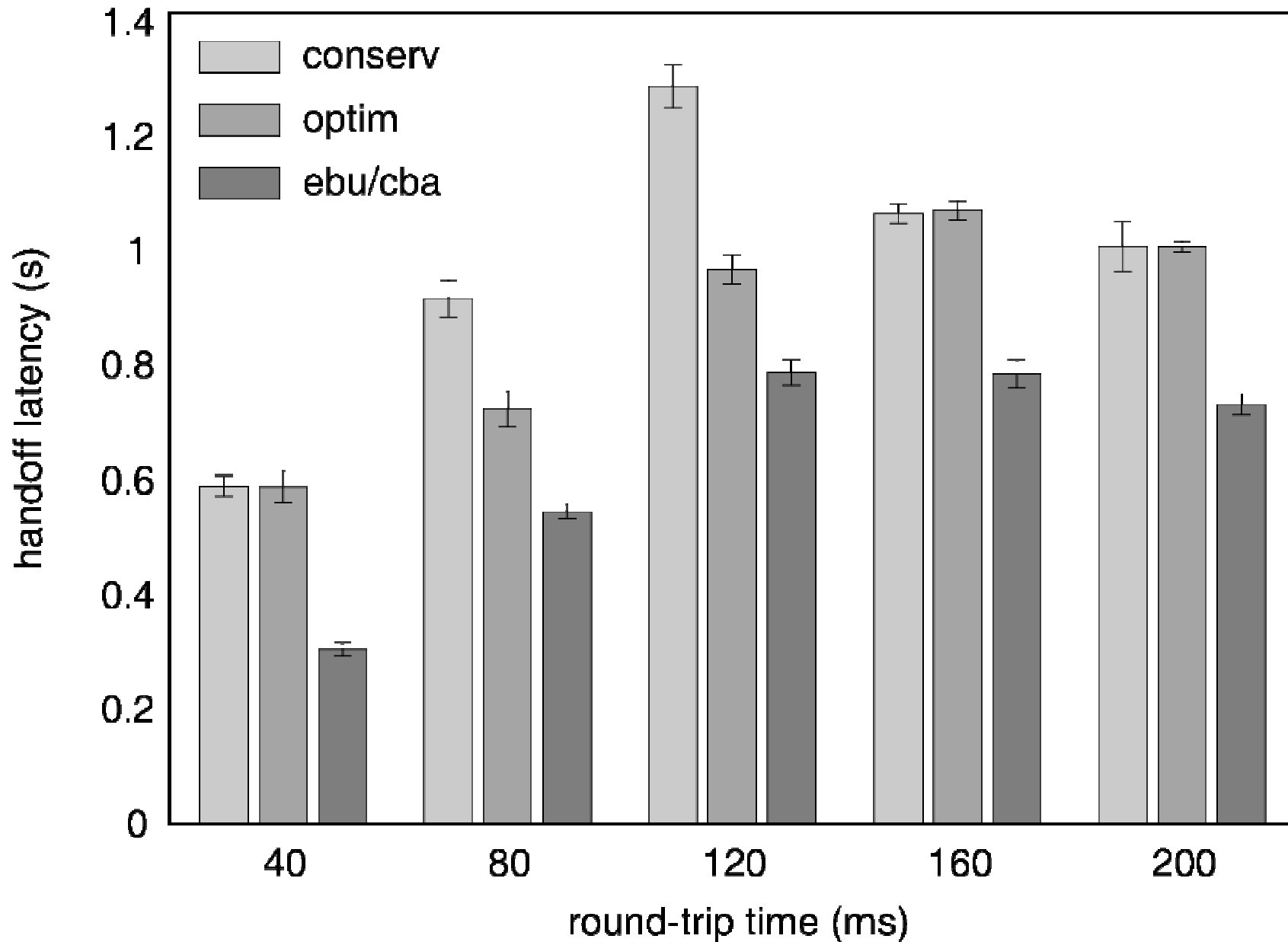
- 40ms to 200ms btw. home agent, routers, correspondent node

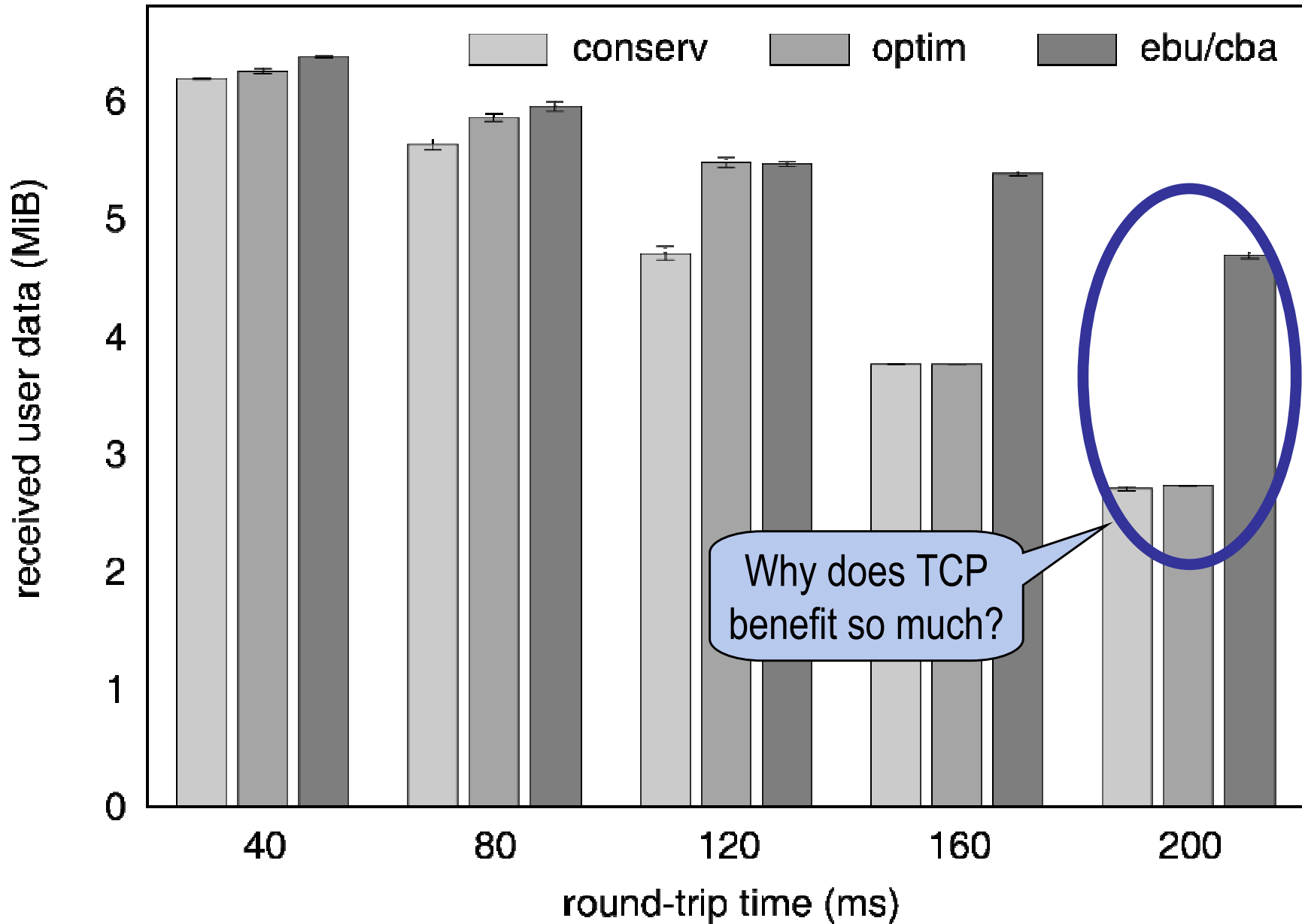
## Mobile IPv6 versions

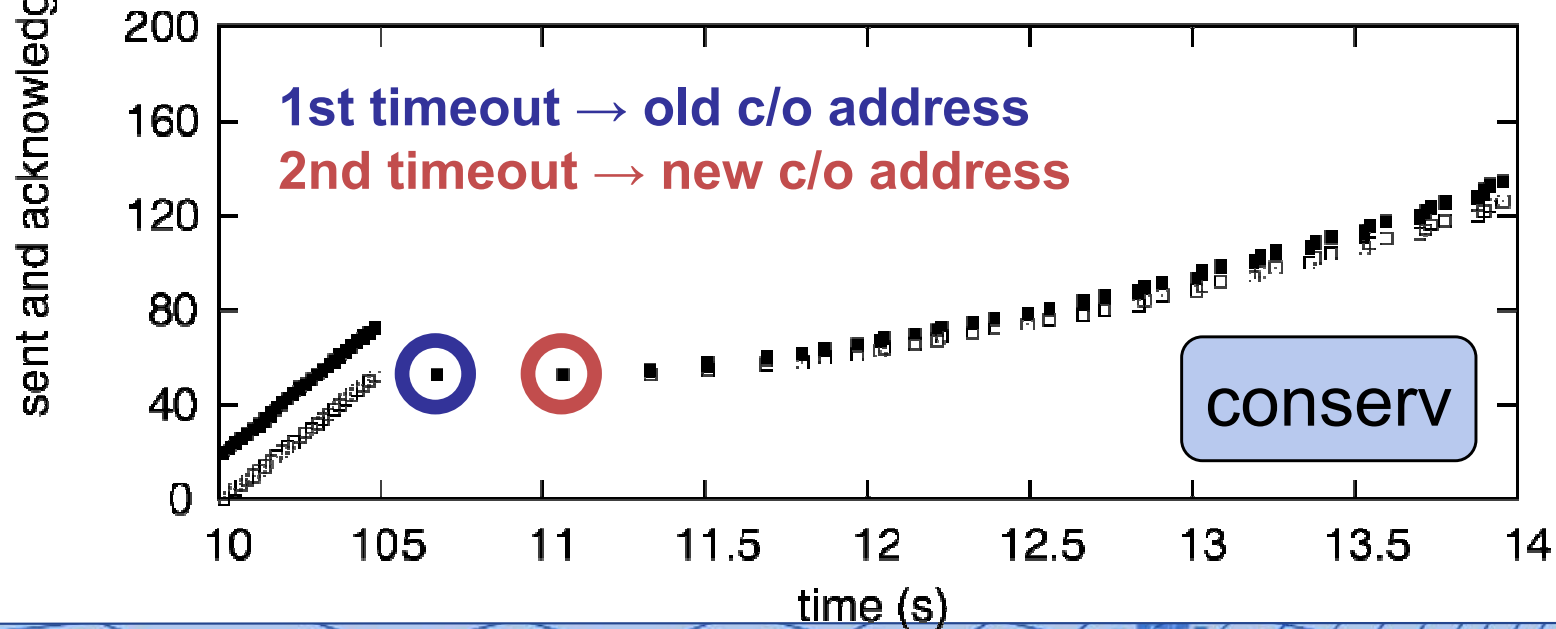
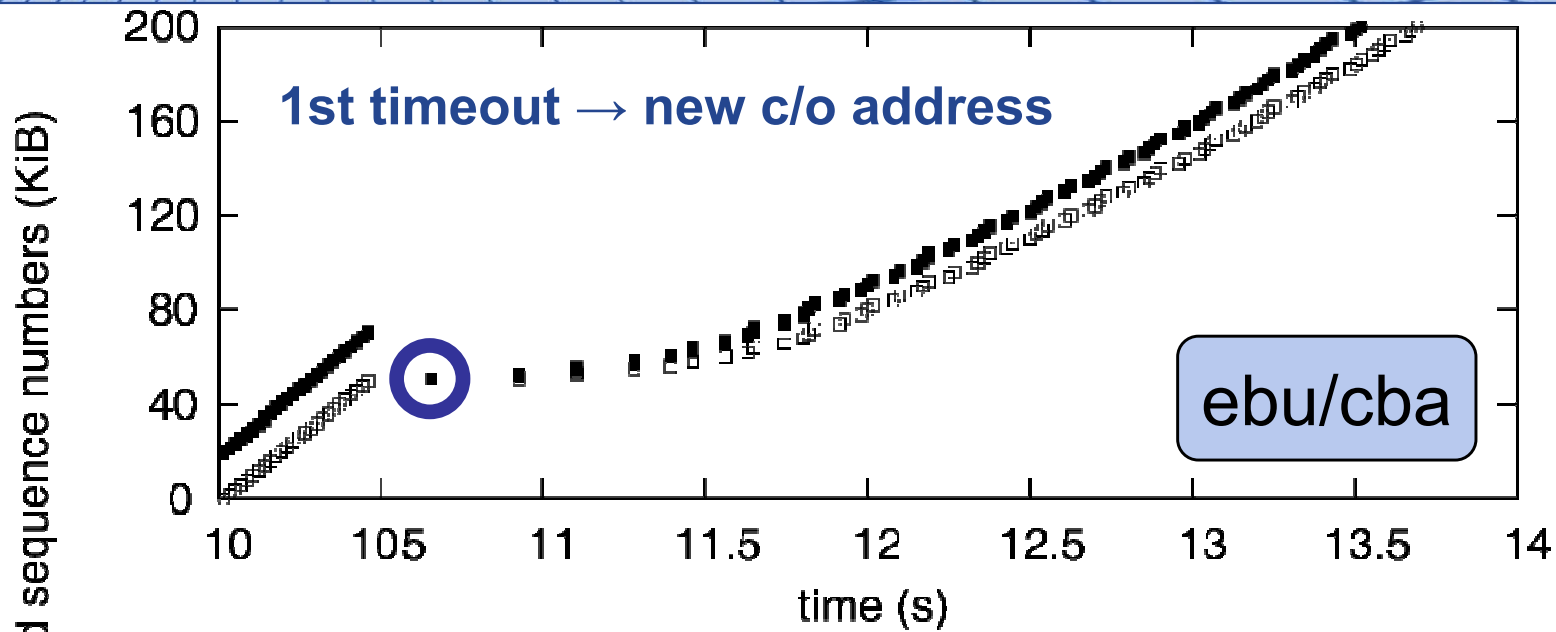
- conservative
- optimistic
- Early Binding Updates, Credit-Based Authorization

## Confidence

- 20 experiments per round-trip time per Mobile IPv6 version
- 5 handoffs per experiment









## After 1st timeout

- set cwnd = 1
- set ssthresh = flightsize
- **do Slow Start until cwnd > ssthresh**

## After 2nd timeout

- set cwnd = 1
- set ssthresh = 2 (minimum)
- **skip Slow Start, do Congestion Avoidance**

- Handoff latencies are high in standard Mobile IPv6
  - 4 RTT in conservative Mobile IPv6
  - 3 RTT in optimistic Mobile IPv6
- Early Binding Updates, Credit-Based Authorization → 1 RTT
  - disadvantage: some additional signaling
- UDP, TCP applications benefit significantly
  - Handoff latencies down by  $\leq 75\%$  in UDP
  - 1 TCP retransmission timeout instead of 2
  - ⇒ Faster throughput ramp-up after handoff
- Efforts within IETF and IRTF
  - Adopted by Mobopts research group
  - Credit-Based Authorization adopted by Mipshop, HIP working groups
- Current work: Proactive registration before handoff
  - ⇒ Eliminate/reduce remaining 1 RTT handoff latency