Mobile IPv6 in FreeBSD

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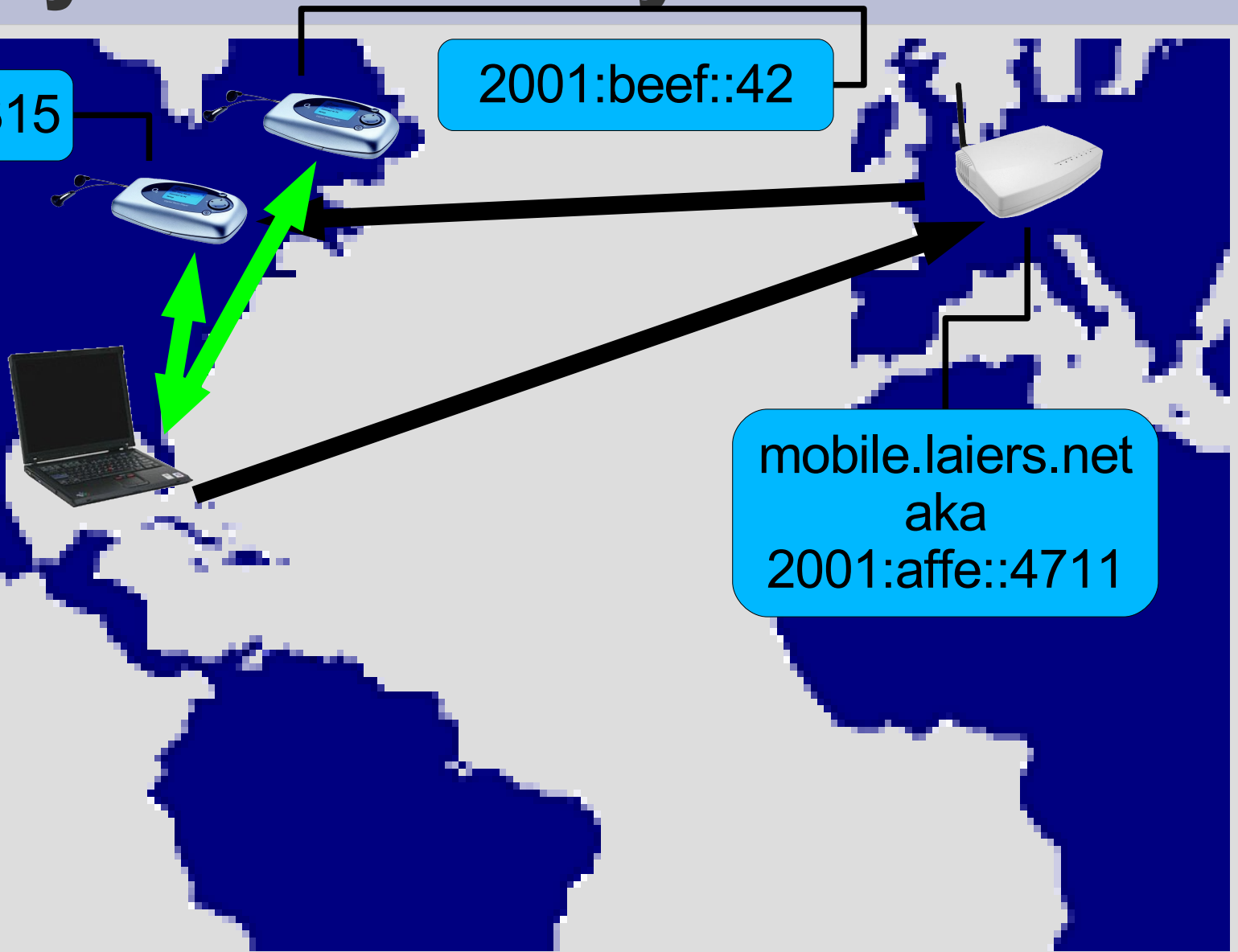# Mobile IPv6 Overview

- Introduction
  - Motivation
  - Application
- Basic Operations
  - Tunnel
  - Route Optimization
  - Problems
- Enhancements
  - Early Binding Updates
  - Credit-Based Authorization
  - Proactive Handoffs
- More Problems
- Implementations
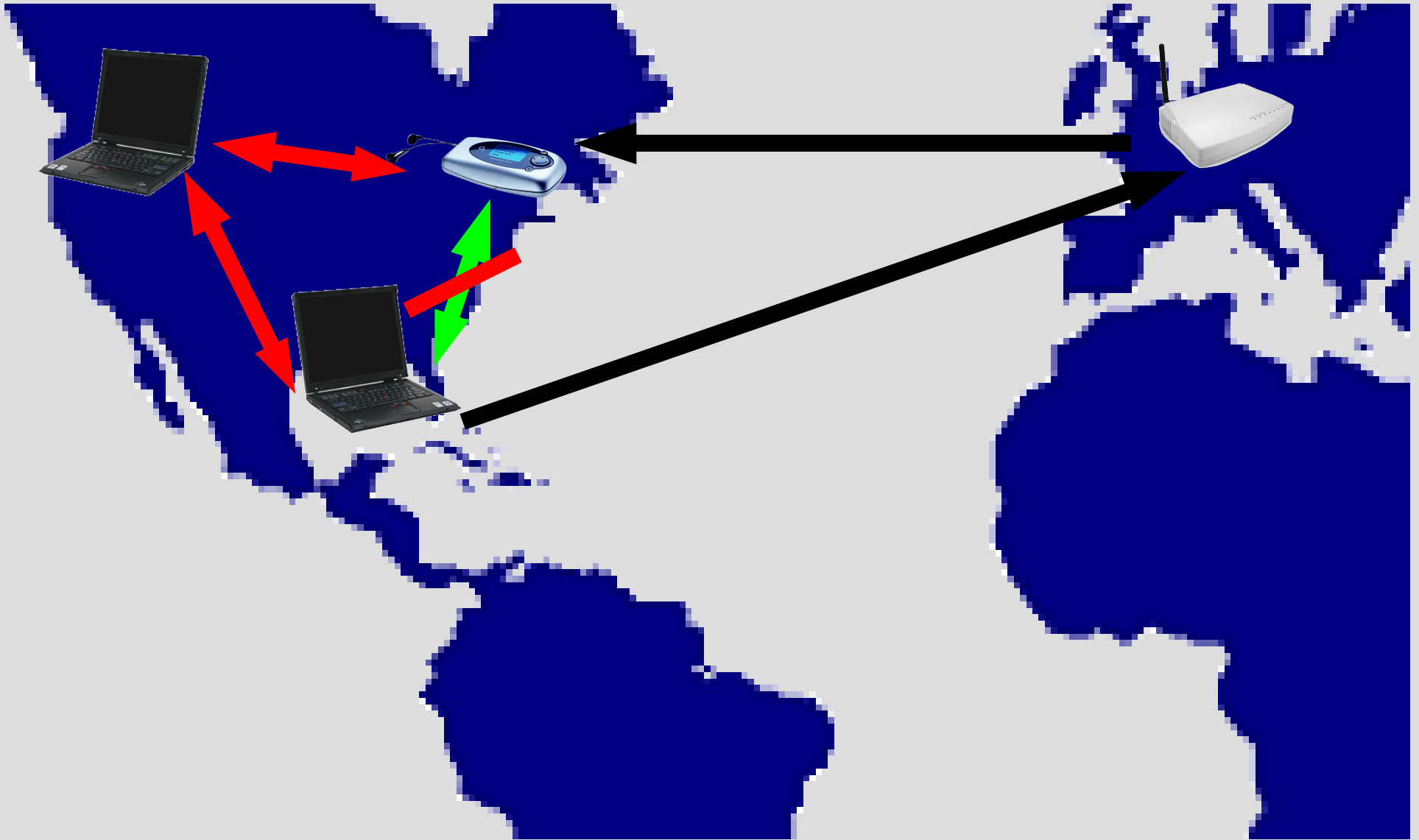
Mobility and Reachability Anytime and Anywhere
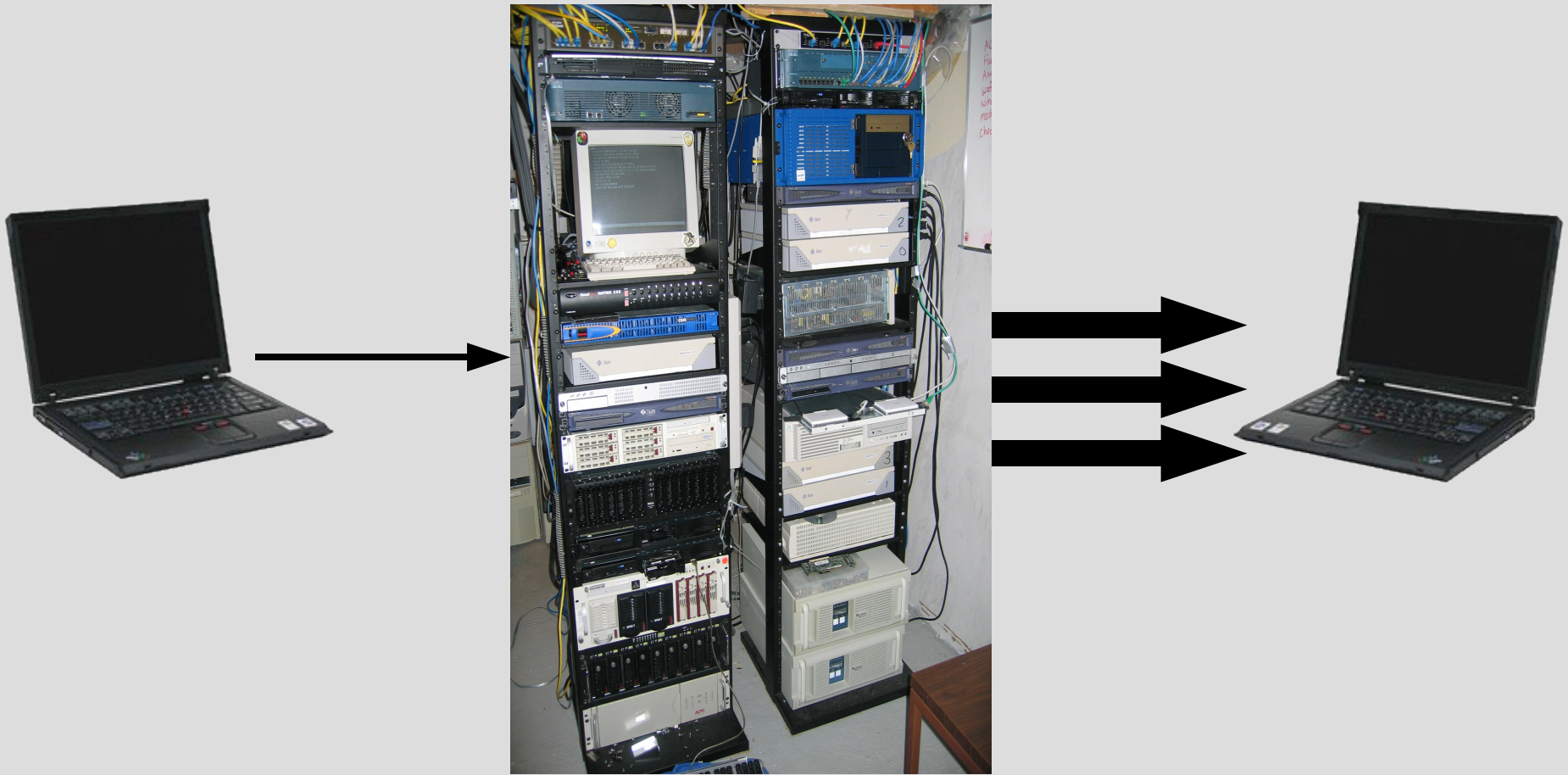

2001:cafe::0815

2001:beef::42

mobile.laiers.net
aka
2001:affe::4711

Challenges: Unauthenticated redirection

Challenges:
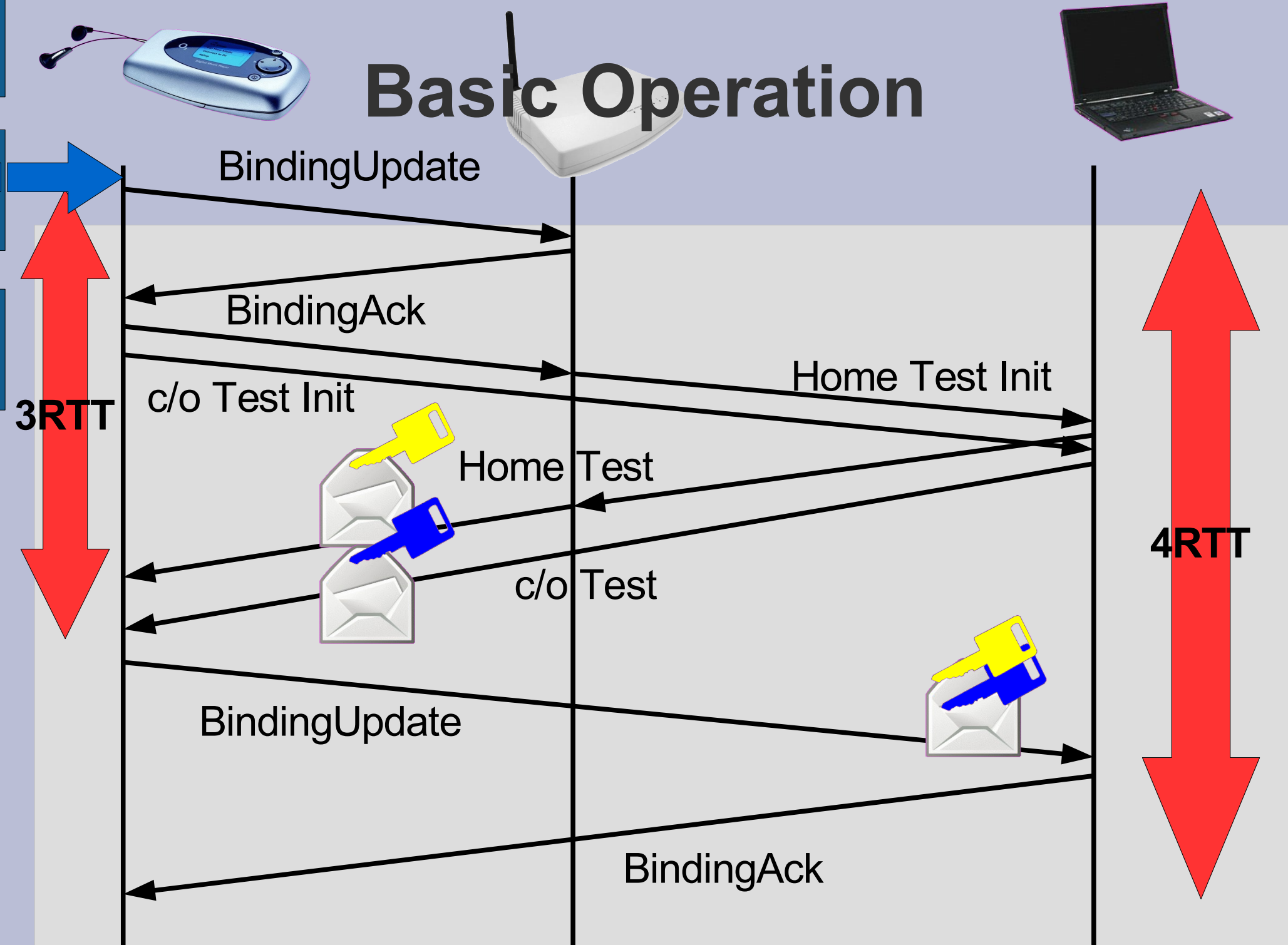# Unauthorized Redirection

Basics (1)
Tunnel

- Home Agent listens on Home Address
- Mobile Node registers from Care-of Address
- HA keeps "binding" between CoA and HoA
- Signaling over tunnel secured w/ IPSEC
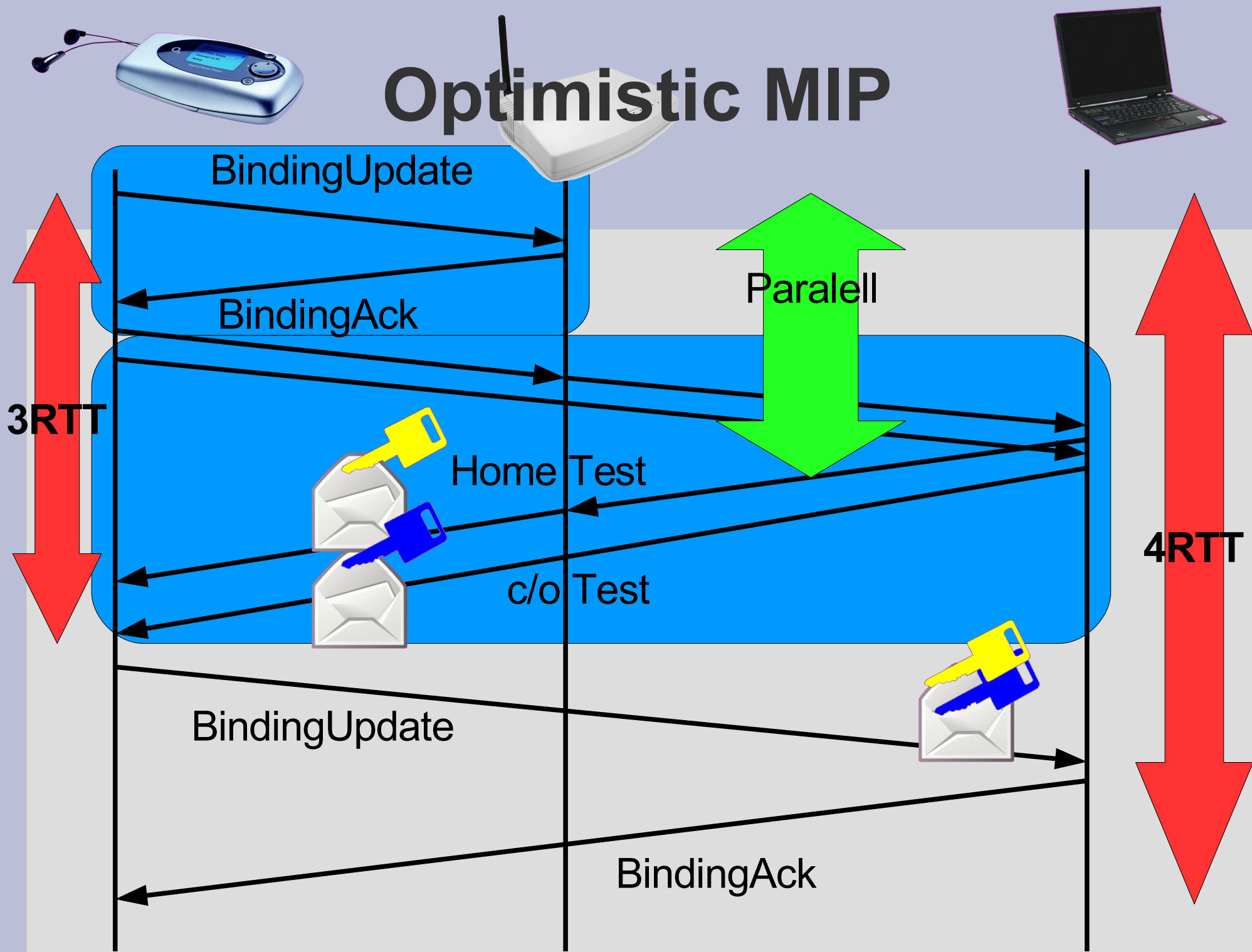- Data over tunnel can also be secured

Basics (2)
Route Optimization

- MN registers CoA w/ Correspondent Node
- CN has to make sure that
  - MN is the "owner" of the HoA
  - MN is at the CoA
- CN sends packets to CoA directly
- MN replies from CoA
- HoA available for upper layers through
  - Destination Option   MN => CN
  - Routing Header   CN => MN
  - No requirements from transportation nodes

Basic Operation

BindingUpdate

BindingAck

3RTT

c/o Test Init

Home Test Init

Home Test

c/o Test

4RTT

BindingUpdate

BindingAck

Optimistic MIP

3RTT

4RTT

BindingUpdate

BindingAck

Paralell

Home Test

c/o Test

BindingUpdate

BindingAck

Optimistic MIP

BindingUpdate

BindingAck

Paralell

3RTT
2RTT

Home Test

c/o Test

4RTT
3RTT

BindingUpdate

BindingAck
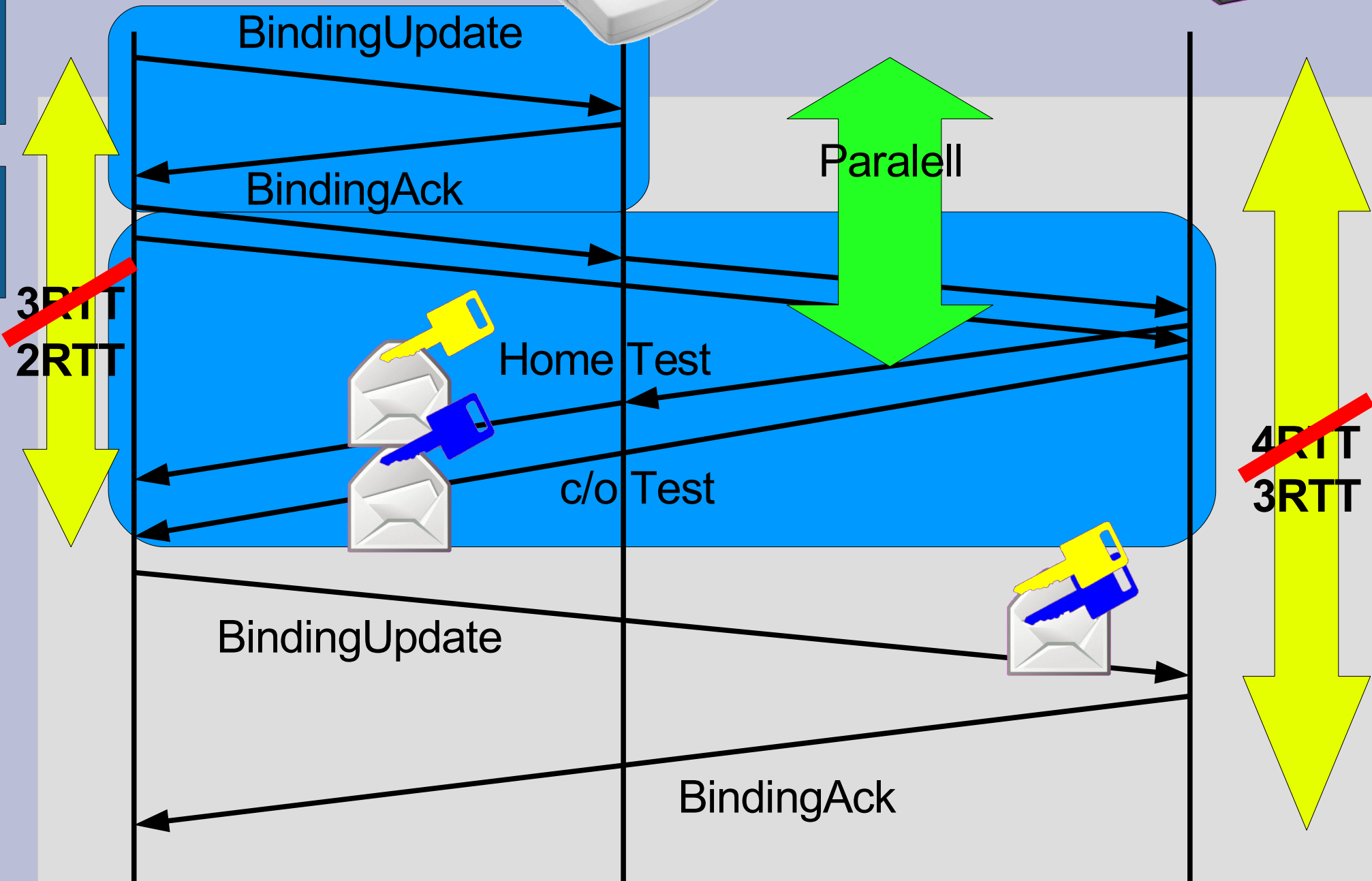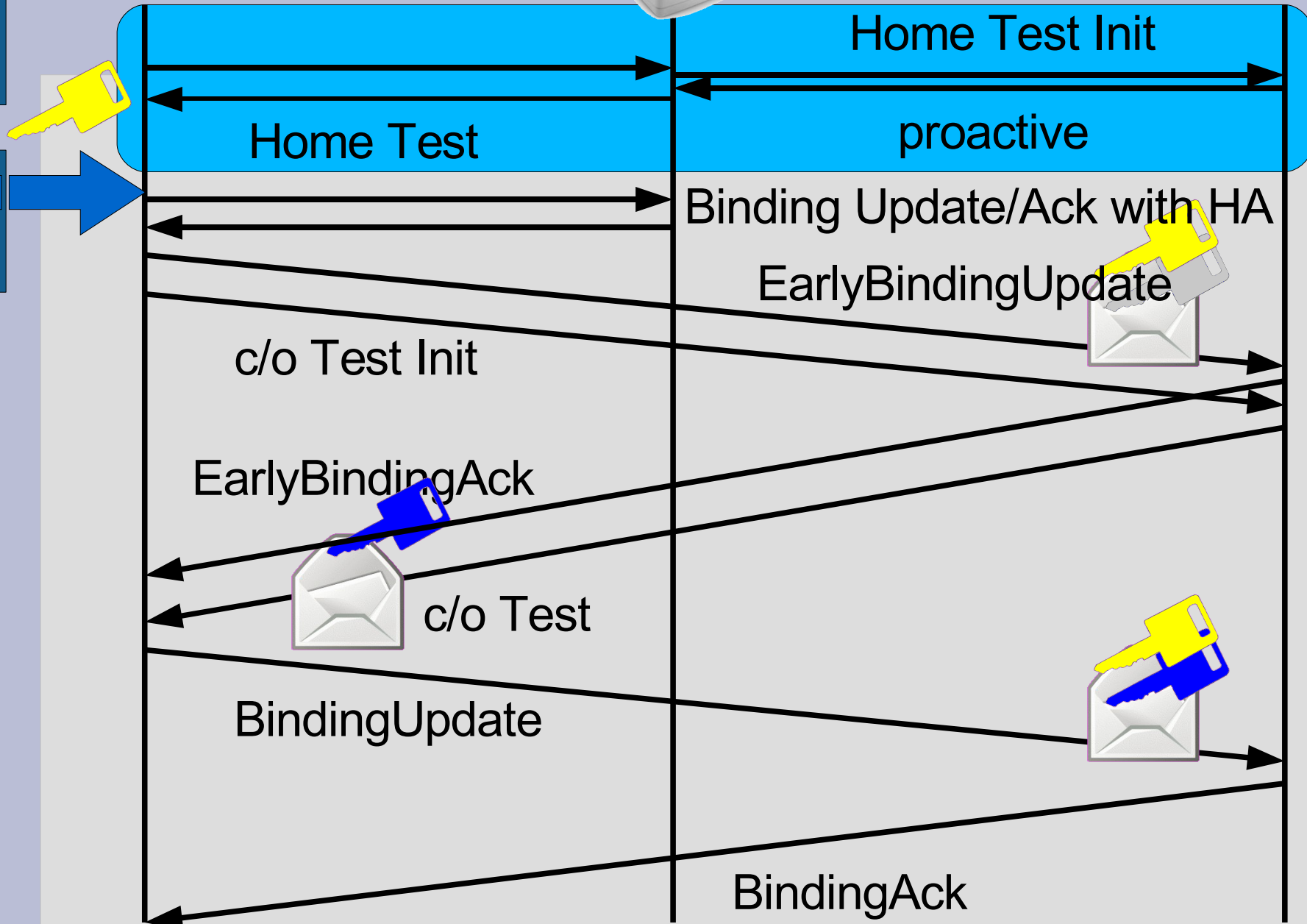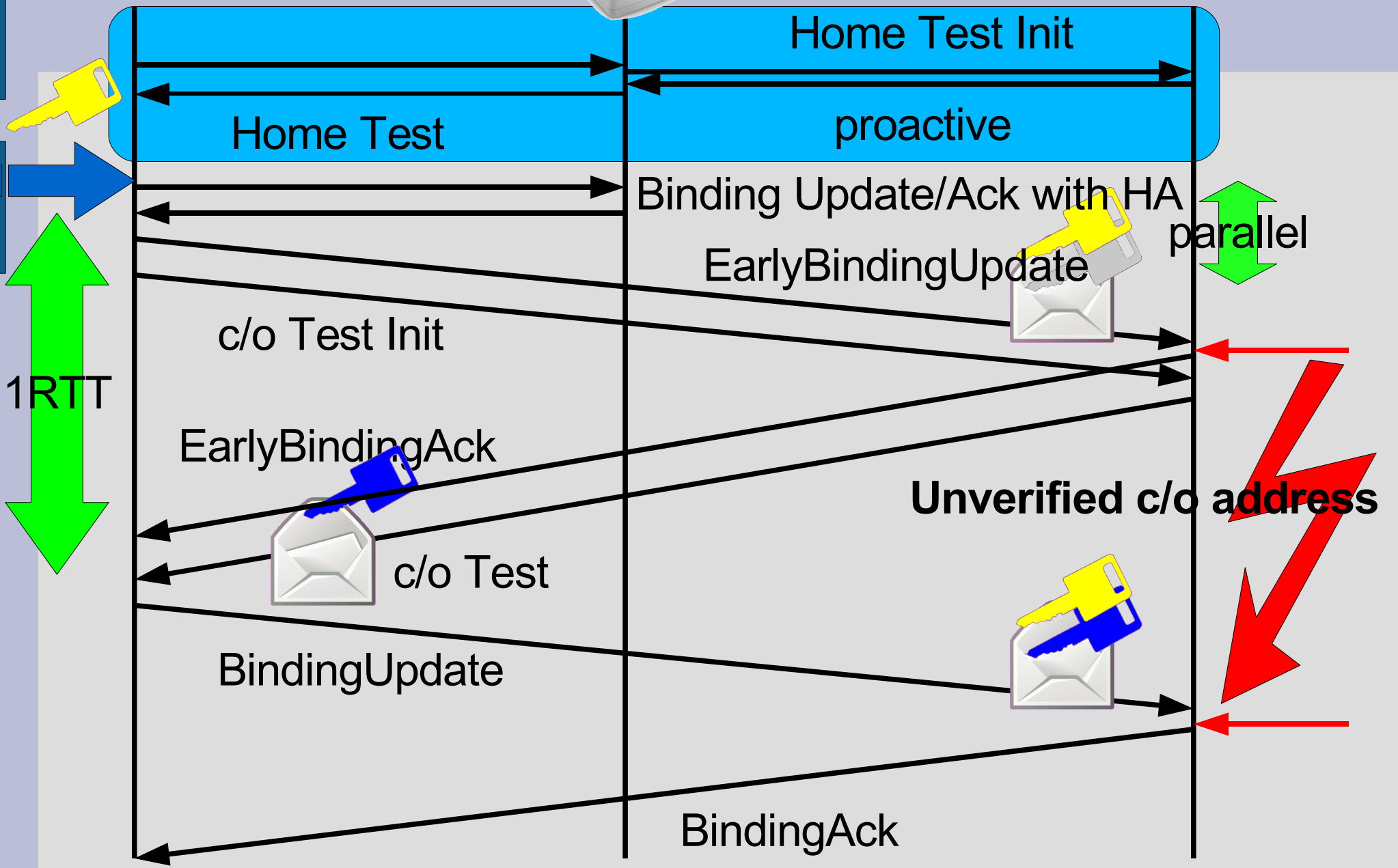
Enhancement
Early Binding Updates

- Speed things up

- Binding Update w/ HA can happen in parallel
- Home Test can happen anytime
  - No relation to CoA
  - Just need a "fresh" (valid) token
- Allow a "short" time of uncertainty about reachability at CoA

  ➡ Can send Binding Update right away

Early Binding Updates

Home Test Init

proactive

Home Test

Binding Update/Ack with HA

EarlyBindingUpdate

c/o Test Init

EarlyBindingAck

c/o Test

BindingUpdate

BindingAck

Early Binding Updates

Early Binding Updates

- No IANA requirements

- Early Binding Update = Binding Update w/o c/o-Test Token (all zero)
  - CN supporting EBU can reply
  - CN not supporting EBU will either see a corrupted or timed out c/o-Test Token and reply with a NACK

Credit-Based Authorization

- No Amplification, no fun

- Grant credit for every packet the MN sends
- Consume credit for every packet sent to an unverified CoA
- Stop sending when credit runs out

- Credit aging
- Asymmetric protocols (TCP)
- Spot Checks

Proactive Handoffs

- Figure out possible prefix/address before handoff
- Signal CN from old CoA
- Do the switch as soon as CN acknowledges

- Needs L2 support
- Late alpha stage, might be subject to change

Problems

- L2 handoff delay
- Router/Prefix discovery
- Duplicate Address Detection (DAD)

Router discovery

- Router send Router Advertisements periodically
- Default interval too big
- MobileIP extension available, but still ~70ms

- Passive waiting not suitable

Duplicate Address Detection

- Need (at least) **unique** link-local address before sending a Router Solicitation
- IPv6 auto configuration requires DAD before use of addresses
- Takes a long time

- Optimistic DAD (RFC 4429) improves the situation

- Still, router won't reply right away
  - See "Detecting Network Attachment" in IETF for further reading

Implementations

- KAME snapshots
  - Conservative

- Institute of Telematics
  http://www.tm.uka.de/~chvogt/ebucba/
  - Optimistic MIP
  - Early Binding Updates
  - Credit Based Authorization
  - Proactive Handoffs (TBD)
  - Currently GPLed :-(

Further Reading

- http://www.tm.uka.de/itm/projects.php?id=10
  - draft-vogt-mobopts-simple-ebu-00
  - draft-vogt-mobopts-simple-cba-00
  - vogt-2006-delay-analysis...
- RFC 3775

- /usr/src/...
  - Sooner or later

Acknowledgments

- Christian Vogt
  - Code, work, proof-reading, everything
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- SixXS.net
- FreeBSD Foundation
  - Travel

- You