Edge Handovers

`draft-moore-mobopts-edge-handovers-01`

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- The modular approach to Fast Handovers.
- Edge Handovers Overview
- Our results so far

Modular Approach

- Rather than trying to solve the whole problem in one draft, we're splitting the big delays into more easily managed chunks.
- Each solution addresses one or more delays.
- All solutions work together.
- Not all solutions needed on all Link Layers.
  - ◇ EG: Not all link layers need DAD

Four Delays

Movement Detection Delay	$\rightsquigarrow$	DNA WG
Router Advertisement Delay	$\rightsquigarrow$	Fast RA; FRD
Address Configuration Delay	$\rightsquigarrow$	Optimistic DAD
Binding Update RTT	$\rightsquigarrow$	HMIPv6; **Edge Handovers**

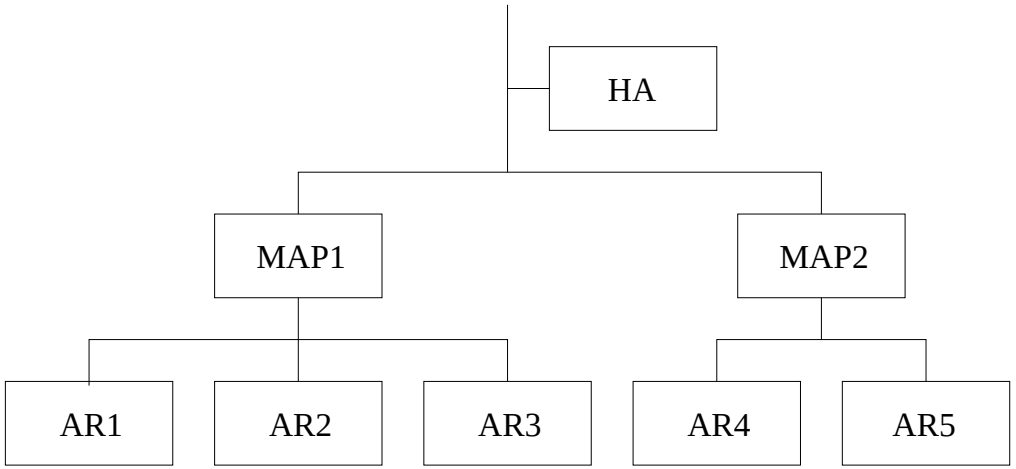
Edge Networks

We're making some assumptions about the characteristics of the Edge Network compared to the Internet:

- High bandwidth
- Low latency
- Low Cost

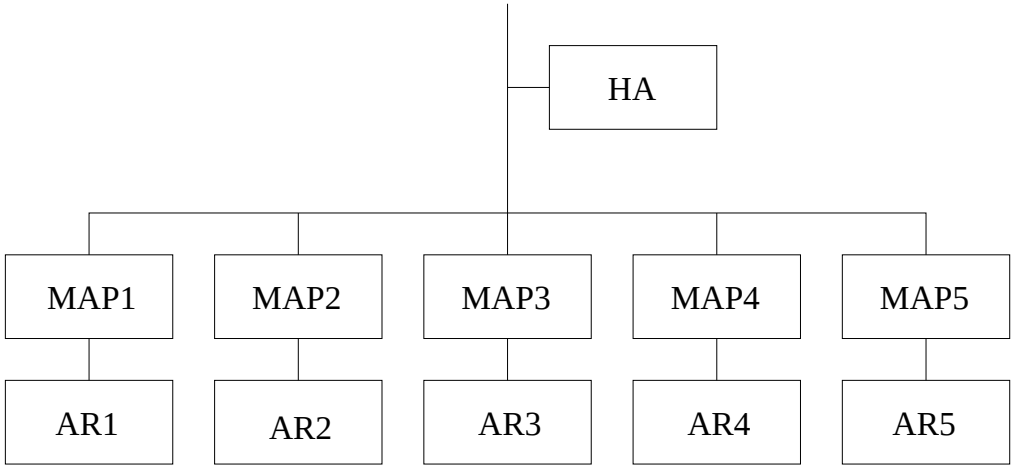
Edge Handovers trades spends Edge Network resources to save Internet resources.

HMIPv6



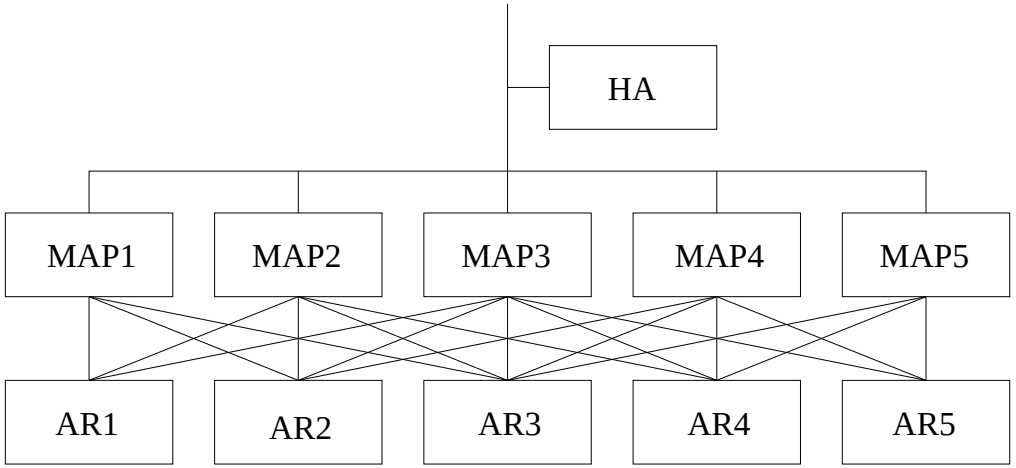
- `draft-ietf-mipshop-hmipv6-01`
- *Mobility Anchor Point* (MAP) between HA and MN.
- Signalling to HA only required when MN leaves coverage area of its MAP.
- Establishes *Bindings* from a *Regional Care-of Address* (RCoA) to a *Local Care-of Address* (LCoA).

HMIPv6 at the Edge



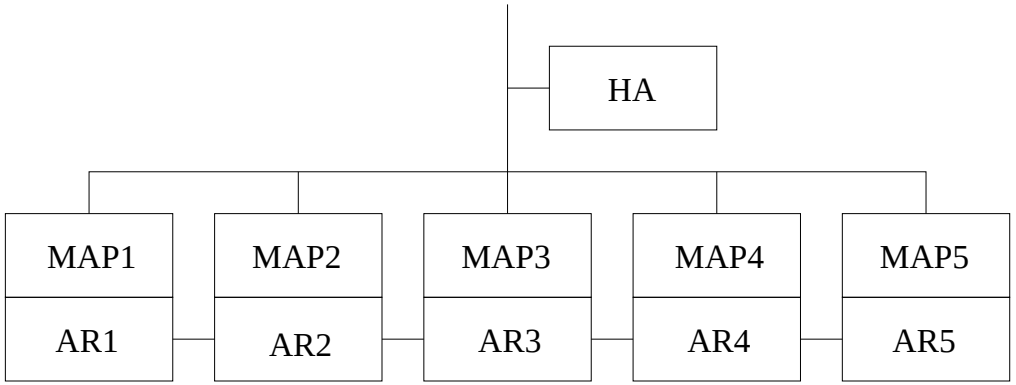
- Trend is towards ‘stupid network’ with intelligence at edge.
- Migrate MAPs down to access routers.
- Described in section 10.2 of the HMIPv6 draft.
- Degenerate case of HMIP? (1-hop tunnels, RCoA and LCoA)
- **To be useful, improved MAP-to-MAP handovers are needed.**

Edge Mesh



- If MAP1 could continue to provide service to the MN for some time after it moves to AR2, the signalling required for the handover to MAP2 would be removed from the critical path of the handover.
- If MAP1 could continue providing service for the MN when it moves from AR2 to AR3, the handover to MAP2 need not be performed, eliminating that MAP-to-MAP handover entirely.

Edge Network



- MAP functionality can be integrated into the AR for a simplified network.
- A single physical device can easily perform both MAP and AR functions at each location.

Handover Heuristic

Handovers between MAPs are decoupled from handovers between ARs ... the AR can choose when it wishes to update its HA and CNs.

- as soon as the critical path of the AR handover is complete.
- every N AR handovers.
- once the MN has been on the same AR for N seconds.
- if an AR handover has crossed an administrative domain.
- The LBAck has taken $> N$ routing hops.
- ???

Tuning of the heurisitic is an optimization beyond the scope of the draft.

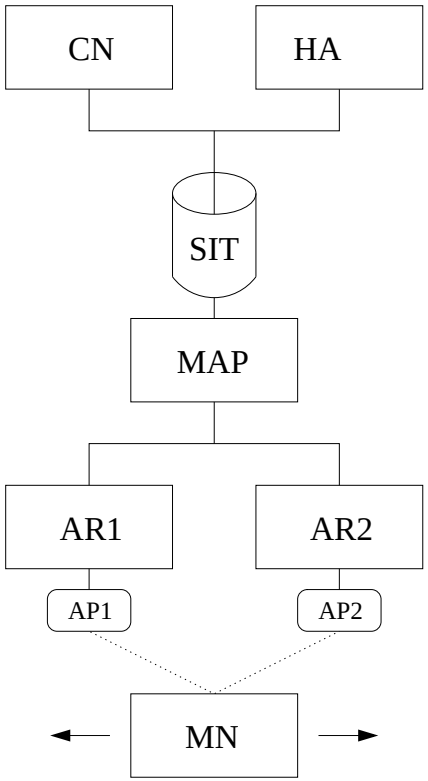
Linux Implementation

Our implementation of HMIPv6 and Edge Handovers is available on our website as a patch to Linux 2.4.22. Mipl 1.0 must be applied first.

`http://www.ctie.monash.edu.au/ipv6/fastho/`

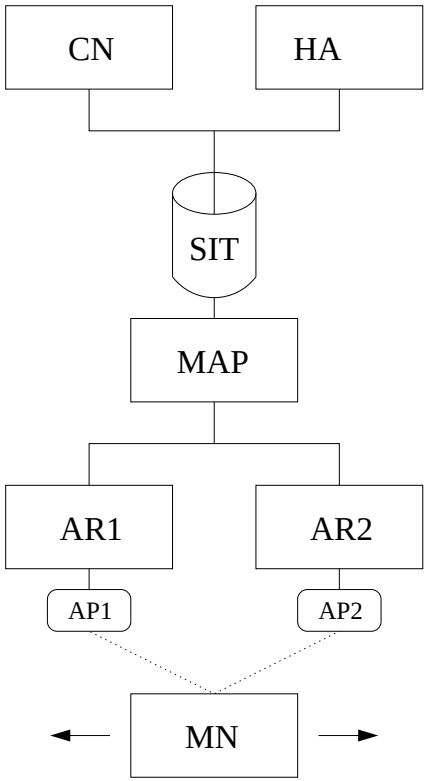
We have released it under the GNU General Public License.

Testing ... 1



- AR1,2, and MAP are x86, Linux 2.4.22 with our HMIPv6/EH patch.
- HA is x86, Linux 2.4.19 with MIPL 1.0.
- CN runs Linux 2.4.22 without patches. No Route Optimisation.
- All fixed network links are 100Mbps full-duplex Ethernet.

Testing ... 2

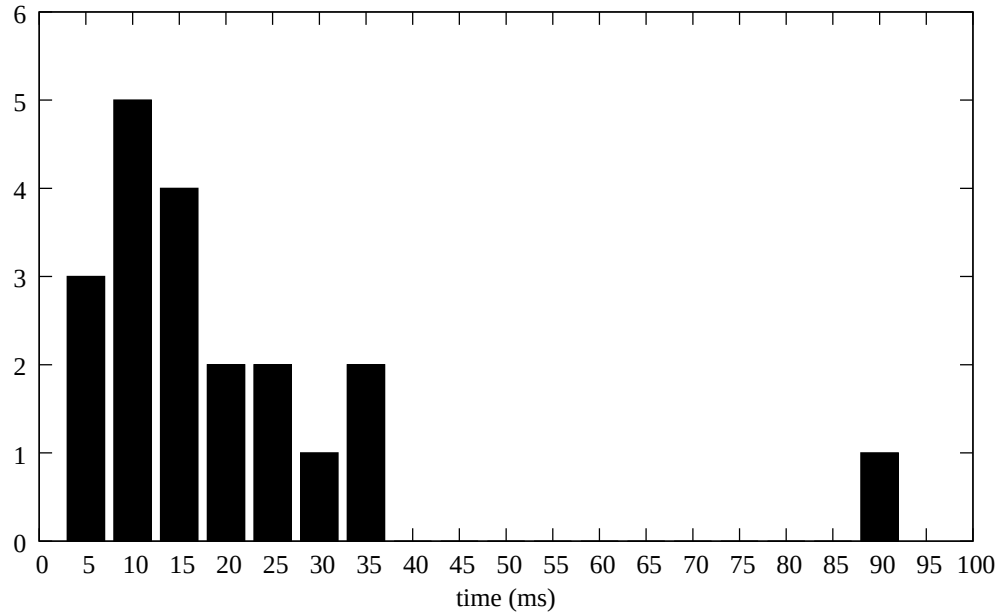


- SIT (IPv6 over IPv4) tunnel allows us to introduce delays into the network & reduces MTU to 1480.
- AP1,2 are *D-link DWL1000* APs with *Intersil Prism II* hardware.
- MN is a Dell 800MHz Pentium 3 with MONMIPL2 patch and a *Samsung MagicLan SWL-2100E* (Intersil Prism II chipset).

Experiment

- Scripts on MN cause alt reassoc. AP1, AP2.
- Very simple heuristic: 15s holddown timer.
- Handovers are triggered roughly every 30s: MAP-to-MAP handover will generally occur.
- 'ping6' command loads network.
- time from the reception of the first RA after movement to reception of first BAck from the Bound MAP.
- this indicates the length of time spent on address configuration and binding

Results



- $\approx 15ms$ median.
- $\approx 20ms$ mean.
- Outlier at $87.9ms$ ... packet loss at L2?

Ongoing Work

- More solution modules for the Modular Approach.
- Simulation with `OMNeT++`.
- Work on Handover Heuristic.
- Testing in reality and in simulation.