

# Evaluation of IEEE 802.11b and Mobile IPv6 Handoff Times

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## Mobile IPv6



- **Mobile IPv6 (MIPv6) retains connectivity through a single, well-known Home Address of the Mobile Node when it changes its attachments to different subnets**
- **Mobile Nodes use a Care-of Address (CoA) to communicate when not at home.**
- **MIPv6 handoff: MN changes from one subnetwork to another.**
- **Handoff latency: the period that communication between MN and CN is disrupted**



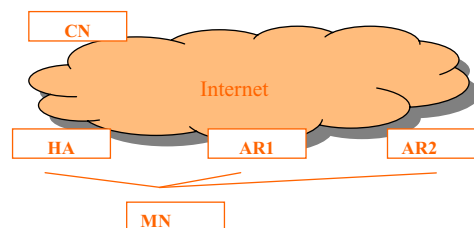
# Talk outline

- **MIPv6 handoff steps defined by RFC 3775**
  - **Detection movement step**
    - **Methods for L3 detection**
  
- **Implementation of KAME**
  
- **Experimental setup and results for 802.11b and MIPv6 handoff times**
  
- **Evaluation of the results**
  
- **Handoff Impact on application performance**



# MIPv6 Handoff procedures (RFC 3775)

- **MN operations for handoff**



- **Movement Detection**
- **Forming New Care-of Addresses (Stateful or stateless Address autoconfiguration)**
- **Sending Binding Updates to the Home Agent (Registration/Deregistration)**
- **Wait for HA perform DAD**
- **Receiving Binding Acknowledgements**
- **Correspondent Registration**



# Movement Detection (RFC 3775)



- **Detect L3 handoffs. Generic method that uses the facilities of IPv6 Neighbor Discovery**
  - **When MN has no packets to send, no frequent Router Advertisements or indications from the link-layer, must depend on other available information (e.g., from lower protocol layers)**
  
- **After detects an L3 handover, MN performs DAD on its link-local address**
- **Selects a new default router as a consequence of Router Discovery**
- **Performs Prefix Discovery with that new router to form new CoA**

# L3 handoff detection methods (RFC 3775)



- **IPv6 Neighbor Discovery**
  - **Router Discovery and/or NUD**
  
- **Router Discovery: Information in received Router Advertisements either to detect prefix changes or to discover expired lifetime for RA**
  - **There might be multiple routers on the same link hearing a new router does not necessary to constitute L3 handoff**
  - **Multiple routers on the same link might advertise different prefixes.**

## Detection methods (continued)



- For L3 movement confirmation
  - Expired lifetime for RA
    - Advertisement Interval option in RA: indicates the frequency expected to continue to receive future RAs from that router
    - The MN can then implement its own policy to determine how many lost RAs from its current default router and constitute an L3 handover indication.
  - NUD to detect the default router is no longer bi-directionally reachable, in which case the MN must discover a new default router

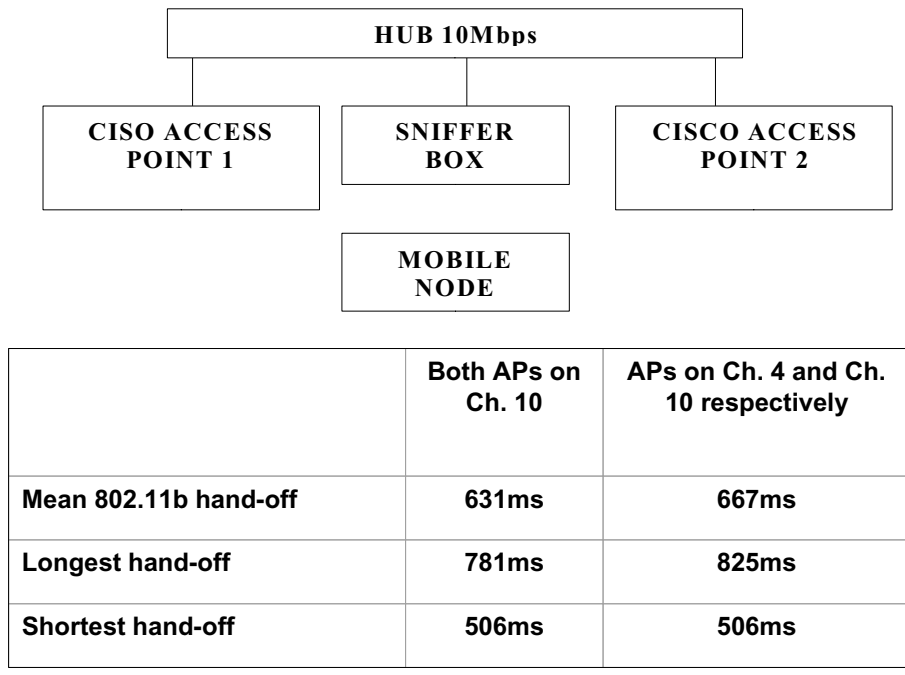
## MIPv6 Implementation by KAME



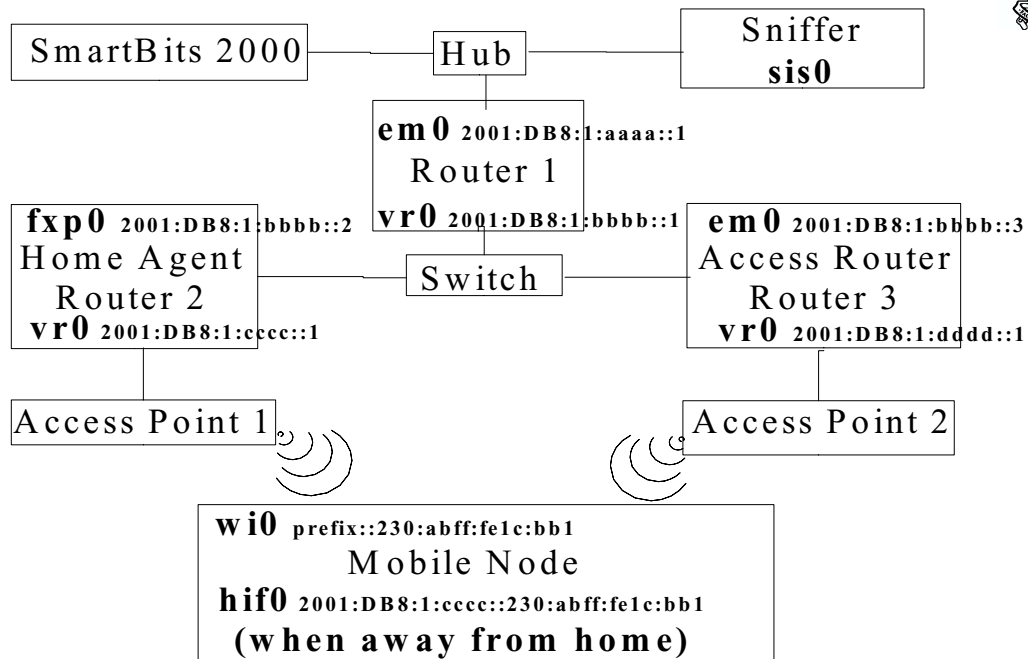
- MN receives new RAs
- Form new CoAs and start DAD:
  - IPv6 address auto-configuration mechanism.
  - DAD is performed to ensure MN's link local address not duplicated
- Movement detection: NUD mechanism. Can performed simultaneously with DAD
- After L3 detection, select a new CoA
- Sending Binding Updates to the Home Agent
- Wait for HA perform DAD
- Receiving Binding Acknowledgements
- Correspondent Registration



# IEEE 802.11b layer handoff



# MIPv6 testbed

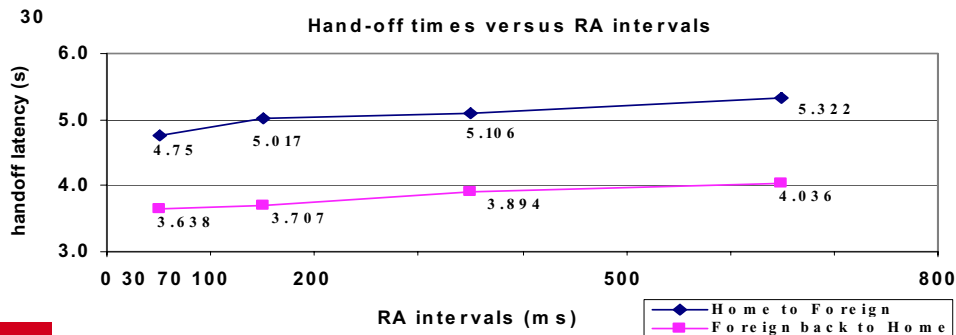




# MIPv6 handoff times

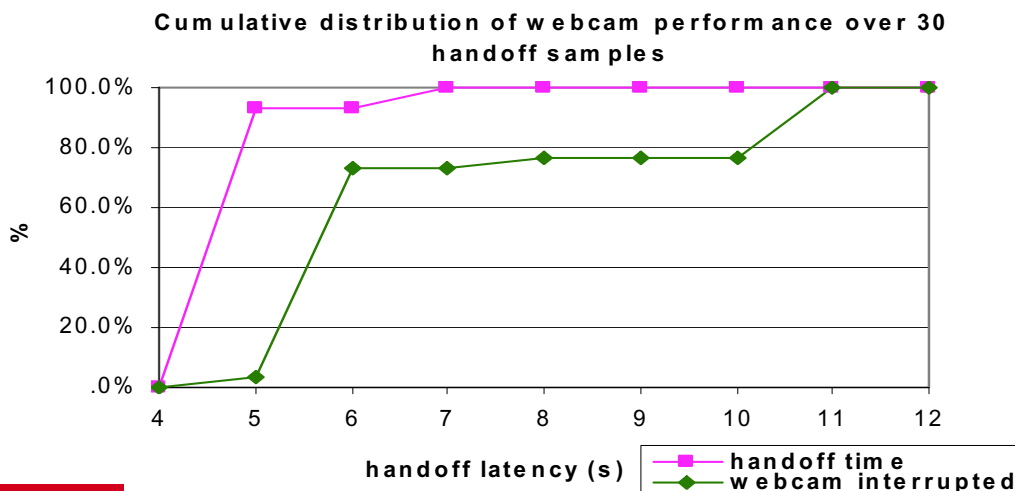
- **NUD takes 3 seconds**

| MIPv6 hand-off including link layer hand-off   | Average hand-off from home to foreign network (in s) | Average hand-off from foreign back to home network (in s) |
|--|--|---|
| CN is MIPv6 node (RA interval: 30ms –70ms)     | 4.770  | 3.779   |
| CN is non MIPv6 node (RA interval: 30ms –70ms) | 4.75   | 3.638   |



# Handoff impact on application performance

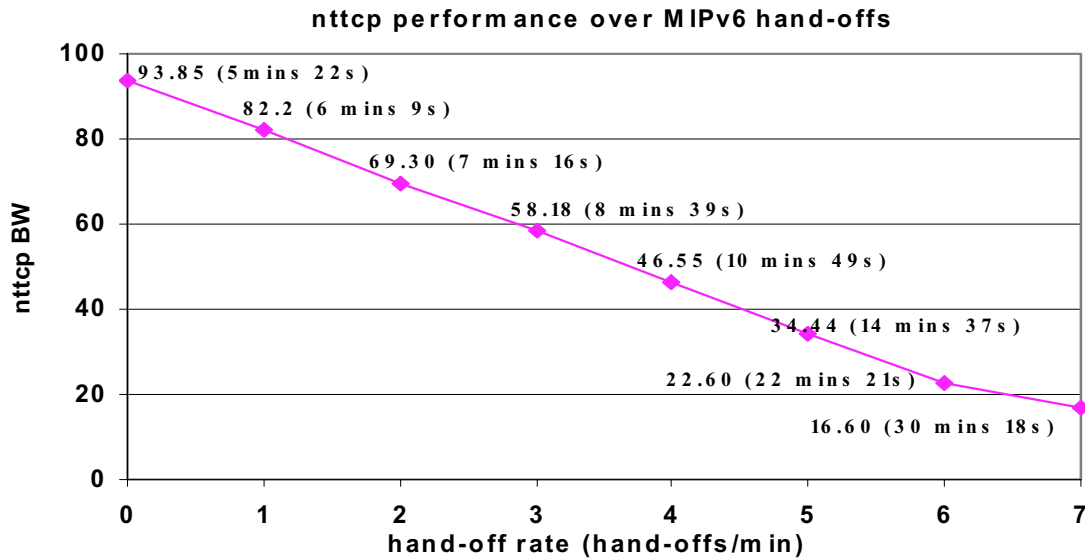
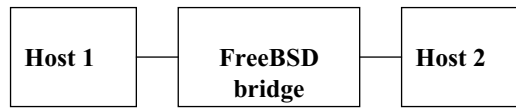
- **On common webcam application**



# Handoff impact on application performance



- On TCP bulk data transfer



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