Draft summary
Reviewers' comments
Mailing-list discussion

NETLMM Security Threats on the MN-AR Interface
draft-kempf-netlmm-threats-00.txt

James Kempf, kempf@docomolabs-usa.com
Christian Vogt, chvogt@tm.uka.de

65th IETF, Dallas, TX, March 21, 2006

- **MN authentication**: Initial authentication of MN for network-access authorization

- **MN identifier**: String based on which MN authentication can be accomplished

- **Data-origin verification**: Sender verification for IP packets sent by a MN for network-access and accounting purposes

- **Data-origin identifier** (formerly called a "per-packet identifier"): String/property based on which MN can be identified for data-origin verification of its IP packets

- **Locator**: Destination address of an IPv6 data packet (This is not a definition specific to NETLMM.)

- Thanks to Julien for raising the need for a better terminology

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James Kempf, kempf@docomolabs-usa.com
Christian Vogt, chvogt@tm.uka.de

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Institute of Telematics
Universität Karlsruhe (TH)

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- **Problem: Spoofed data-origin ID**
  - Attacker sends packets on behalf of victim
  - Attacker roams at a victim's costs
  - After initial MN authentication

- **Data-origin verification can prevent this**
  - May have to be bound to initial MN authentication
  - Only in MN-2-CN direction

- **External protection against bogus packets from malicious CN**

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- **Problem: Impersonation during DNA**
  - Impersonator mimics victim during DNA
  - NETLMM redirects victim's packets to impersonator
  - $\Rightarrow$ eavesdropping from off the path

- **Limitation: Impersonator cannot forward packets to MN if MN is on different link**
  - because impersonator uses same IP address as MN
  - Different than in Mobile IPv6, where impersonator's "c/o address" differs from victim's "home address"

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- **Problem: Impersonation during DNA**
  - Similar to off-path eavesdropping,…
    - Misuse of DNA
    - Redirection of victim's packets
  - …but intended to cause DoS to victim

- **Limitation: Attacker must redirect packets to itself**
  - because NETLMM delivers packets to where a MN is believed to be seen
  - Again different than in Mobile IPv6

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James Kempf, kempf@docomolabs-usa.com
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- Problem: Rouge AR acts as man in the middle

  - May eavesdrop on packets,

  - modify packets,

  - forward packets via a path outside NETLMM

- Limitation: Return packets go through NETLMM

  - Rouge AR may see return packets,

  - but may not be able to modify them

- But: Rouge AR may act as NAT box

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- Problem: Vulnerabilities of ND6/DNA
  - Apply to NETLMM…
  - …because NETLMM uses ND6/DNA
- SeND can prevent some attacks

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Location Privacy

- **Problem: MN identifier associated w/ IP address**
  - MN identifier leaks during MN authentication
  - Attacker associates identifier w/ IP address
  - Attacker then tracks victim's IP address

- **Threat 1: Attacker on access link**
  - Sends NS for victim
  - Address resolution or DAD

- **Do ARs forward ND6 signaling to other links?**
  - DAD requires this given that links have common prefix(es)
  - NA indicates that victim is inside NETLMM or on the same link

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- Threat 2: Attacker btw. ARs and MAP

  - Attacker eavesdrops on NETLMM signaling

  - Most effective close to MAP

  - Encryption can prevent this

- Threat 3: IP address tells victim is inside NETLMM

  - Limitation: NETLMM prefix not very precise

  - Traceroute, too, may not produce meaningful information due to the MAP-AR tunnel

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Some comments related to AR-MAP interface.
This summary focuses on MN-AR interface.

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- Data-origin ID may not show up in packets
  - Can be port of switch,
  - frequency slot,
  - time slot, etc.

- Identified by Julien

- Data-origin ID can be MN-MAP security context
  - MN perceives all ARs as a single, "virtual" MAP

- Identified by Gerardo

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- **Draft does not mention flooding of MN's IP address**
  - Mentions only flooding of ARs or MAPs

  > See also RFC 3756, "IPv6 Neighbor Discovery (ND) Trust Models and Threats", section 4.3.2

- **More dangerous for existing IP addresses**
  - Bandwidth of MAP's Internet attachment
  - Routing-table look-up at MAP
  - Encapsulation at MAP (special in NETLMM)
  - Bandwidth w/in NETLMM domain
  - Decapsulation at AR (special in NETLMM)
  - Neighbor Cache look-up at AR
  - New Neighbor Cache entry at AR
  - ND6 signaling w/in access network

- **Less dangerous for non-existing IP addresses**
  - MAP discards packet after routing-table look-up

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- **Identified by Julien**

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- # IGP security vs. NETLMM security unclear
  - ## Draft relates IGP security to NETLMM security, but…
    - routing protocol is hop-by-hop
    - NETLMM protocol is end-to-end (i.e., AR-to-MAP)
  - ## Clarify that in the draft
- # Identified by Vidya

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