BRDP based Address Autoconfiguration

Teco Boot - 18 November 2008

Ad-Hoc Network Autoconfiguration (autoconf)
Finding solution for scalable MANETs by using a backbone

Connected MANETs have their problems:
  • Addressing
  • Multi-homing

Attempt to combine MANET and NEMO technology
  • Proposal not in line with Autoconf charter
  • I-D.boot-autoconf-nemo4manet (put on hold)

New attempt to get I-D in line with Autoconf charter and problem statement
  • Current: draft-boot-autoconf-brdp-01.txt
  • Any mismatch with charter and PS will be rectified
Related work

- Routing in multi-homed edge network: BRDP Based Routing
  - Solves ingress filtering problems
  - Supports make-before-brake BR handover
  - Supports load distribution
  - Draft: I-D.boot-brdp-based-routing
  - Presented in MANET, maybe in RRG

- Source address selection in multi-homed edge network:
  - Currently partly addressed in autoconf-brdp I-D
  - Separate document: work in progress
My illustrations are simplified

- Border Router is a router connecting the MANET to an ISP
- In practice, there is a Provider Edge (PE) and Customer Premises Equipment (CPE) router
- CPE – PE protocols are out of scope for this presentation
- PE may (should!) have ingress filter
My illustrations are simplified

- ISPs have their networks. Details on this are not important for BRDP
- Note the colors: Provider A is red, provider B is blue
Single-homed MANET:
no problems 😊
Multi-homed MANET

Here, BRDP is born. So far, so good. But:
In a MANET, nodes can move!

- MANET routing protocol converges to reflect the movement
- LFN is not aware of movement
Solution #1:
Direct traffic to BR that owns SA prefix

Feature of BRDP Based Routing!

Out of scope for Autoconf
Solution #2:
Adjust BR-b ingress filter for prefix BR-a

Not sure ISP is cooperative, so this is not the goal
Solution #3:
Select SA that corresponds to BR used

LFN2 would use “metrics” of BRs

Session continuity problems, doesn’t work in a MANET because of movements
Solution #4:
Address translation on BRs

Issues with IP header authentication and addresses in payload
Goal: support for multi-homed edge networks with multi-homed nodes

Feature of BRDP and BRDP Based Routing!

Benefits depend on transport layer or application layer adjustments

Download your files twice as fast!
How does it work?

Border Router Discovery Protocol (BRDP):
- Provides valid prefix information to interior routers
- Distributes Border Router Information Option (BRIO) via Neighbor Discovery Router Advertisements.
- BRIOs are distributed in the MANET
- BRIOs provide metrics for paths from and to DFZ (Default-Free Zone)
- BRDP uses link metrics from routing protocol or other source
  - Use link metrics for both directions
- BRIOs provide DHCP relay information
- BRDP is a Distance-Vector protocol
BRIO flooding using Neighbor Discovery Router Advertisements

- Routers already send RA
- BRIOs piggy-backed on RA

Results:
1. All routers learn prefixes for BRs, with metric information
2. All routers learn DHCP addresses for relay or prefix delegation
BRIO flooding with scoping (needed in large MANETs)

- Reduction of forwarded BRIO set is acceptable, as only the best paths would be used

Internet

BR-a
BR-b

BRDP based Address Autoconfiguration

BR

IETF-73 - BRDP based Address Autoconfiguration
### BRIO format

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<thead>
<tr>
<th>Type</th>
<th>Length</th>
<th>Prefix Length</th>
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**Border Router Address**

**BR address and valid prefix for this BR**

**Metric for this prefix**

*Is a bidirectional metric between DFZ and this BR*

**D=1: BR is DHCP server or relay**

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**BRDP based Address Autoconfiguration**

- **BR address and valid prefix for this BR**
- **Metric for this prefix**
  - Is a bidirectional metric between DFZ and this BR
  - **D=1: BR is DHCP server or relay**
### RA with Prefix Information and BRIOs

**Prefix Information option**
- **Router initiated**

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- **Valid Lifetime**
- **Preferred Lifetime**
- **Reserved2**

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- **BR initiated**

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**IETF-73 - BRDP based Address Autoconfiguration**
RA in MANET with 3 ISP uplinks

Prefix Information
ISP-a
Prefix Information
ISP-b
Prefix Information
ISP-c
BRIO
ISP-a
BRIO
ISP-b
BRIO
ISP-c
OK, the RA packet size increases.
MANET Address generation

- Select best Border Router based on metrics

- Use already unique Interface Identifiers:
  - Use /64 prefixes (as Ethernet, RFC2464)
  - Unique 64-bit IIDs:
    1. EUI-64 format-based Interface Identifier [RFC4291]
    2. Generation of randomized Interface Identifier [RFC4941]
    3. Well-distributed hash function [RFC3972]
  - Duplicate Address Detection may be used

- Source address selection is related to Border Router selection:
  - To be addressed in other document
  - Work in progress
### BR selection

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**Select best BR**

- **BR-a**
  - Border Router Address

- **BR-b**
  - Border Router Address

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IETF-73 - BRDP based Address Autoconfiguration
Address generation

BR /64 prefix

64-bit IID

MANET Address

MANET /128 prefix
Support for DHCP

- DHCP may be used for configuration parameters or prefix delegation
- D-flag in BRIO indicates the BR is DHCP server or relay
- MANET Router uses unicast to BR, with generated MANET address as source address
Next steps

- Support for IPv4 (based on IPv6 connectivity and DHCP)
- Finish BRDP implementation (Linux, Opnet)
- Implement BRDP Based Routing (Linux, Opnet)
- Post document for BRDP based Source Address Selection
  - Website: [http://www.inf-net.nl/brdp.html](http://www.inf-net.nl/brdp.html)
  - Any help is welcome!
  - Any comment is welcome!
Thanks for your attention!