Conditional Router Advertisements
for
Enterprise PA Multihoming

draft-ietf-v6ops-conditional-ras

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Enterprise Multihoming: Requirements

- Using Provider-aggregatable address space
- No BGP
- No NAT
- No changes on hosts
Problems with IPv6 PA Multihoming

Q: How to send packets to the correct uplink?

Q: How to implement policies?

Q: How to react to links failure/recovery?
Selecting the Uplink

Various Solutions Available/Being Developed

- *Good Old* Policy Based Routing
- Source-Address Dependent Routing
- IPv6 Segment Routing

etc...
Mutihomed Hosts: Work Being Done

- Multiple Provisioning Domains (mPVD)
  - Work in progress, takes a while to deploy
- MultiPath Transport (MPTCP, QUIC etc)
  - Other protocols?
  - Systems w/o multipath transport support?
Limiting the Scope

● Two uplinks used for Internet access (primary/backup or active/active)
  ○ No “walled gardens” etc

● Simple network topologies
  ○ so even policy based routing would work...
Problems to Solve: Signalling Events to Hosts

Uplink failure:

Addresses from that ISP prefix SHOULD NOT be used

Uplink recovery:

Addresses from that ISP prefix can be used again

Primary/Backup uplinks:

Addresses from the backup ISP SHOULD NOT be used if the primary uplink is up.
Existing Mechanism: SLAAC

"Addresses in the prefix can be used"

Preferred addresses (preferred lifetime > 0)

"Addresses in the prefix should not be used"

Deprecated addresses (preferred lifetime == 0)
Solution

Uplink failure:
Send RA with PIO preferred_lifetime = 0

Uplink recovery:
Send RA with PIO preferred_lifetime > 0

Primary/Backup uplinks:
Backup prefix preferred_lifetime = 0 if the primary uplink is up
Backup prefix preferred_lifetime > 0 if the primary uplink is down
Proposed Approach

- Router Advertisement fields values set conditionally
- Network events trigger new RAs being sent

prefix 2001:db8:1:1::/64
preferred lifetime 604800

prefix 2001:db8:1:1::/64
if SOME_CONDITION is true
then
preferred lifetime 604800
else
preferred lifetime 0
Potential Triggers
- Interface state
- Route presence
- Smth else...

Fields to Be Updated
- PIO Preferred Lifetime
- RDNSS Lifetime
- Router Lifetime
Example Scenarios
2001:db8:1::/48

if Uplink_A is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

2001:db8:2::/48

if Uplink_A is up:
Preferred lifetime 0
else:
Preferred lifetime 7d

2001:db8:1:1::/64
Preferred lifetime 7d
Preferred lifetime 0

2001:db8:2:1::/64
Preferred lifetime 0
Preferred lifetime 7d

2001:db8:1::/48 preferred
2001:db8:2::/48 deprecated
2001:db8:1::/48
if Uplink_A is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

2001:db8:2::/48
if Uplink_A is up:
Preferred lifetime 0
else:
Preferred lifetime 7d
If Uplink_A is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

2001:db8:2::/64
Preferred lifetime 7d
if Uplink_B is up:
Else:
Preferred lifetime 0

Preferred Lifetime: 604800
Prefix: 2001:db8:1::/64

Preferred Lifetime: 604800
Prefix: 2001:db8:2::/64

Non-zero preferred lifetime for the active uplink prefix

Condition: Uplinks Status

2001:db8:1::/48
R1
2001:db8:2::/48

ISP_A
ISP_B

Active/Active Uplinks

2001:db8:1:1::/64
Preferred lifetime 7d
if Uplink_A is up:
Else:
Preferred lifetime 0

2001:db8:2:1::/64
Preferred lifetime 7d
if Uplink_B is up:
else:
Preferred lifetime 0

Non-zero preferred lifetime for the active uplink prefix

2001:db8:1::f00/64 preferred
2001:db8:2::f00/64 preferred
ISP_A

ISP_B

Active/Active Uplinks

Condition: Uplinks Status

2001:db8:1::/48

2001:db8:2::/48

R1

host

2001:db8:1::/64 if Uplink_A is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

2001:db8:2::/64 if Uplink_B is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

Non-zero preferred lifetime for the active uplink prefix

Zero preferred lifetime for the failed uplink prefix

2001:db8:1::f00/64 deprecated
2001:db8:2::f00/64 preferred
2001:db8:1:1::/64
if Uplink_A is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

2001:db8:2:1::/64
if Uplink_A_route:
Preferred lifetime 0
else:
Preferred lifetime 7d
2001:db8:1::/64
if Uplink_A is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

2001:db8:2::/64
if Uplink_A_route:
Preferred lifetime 0
else:
Preferred lifetime 7d

R1 Policy:
2001:db8:1:1::/64
if Uplink_A is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

R2 Policy:
2001:db8:2:1::/64
if Uplink_A_route:
Preferred lifetime 0
else:
Preferred lifetime 7d

Non-Zero preferred lifetime for the backup uplink prefix
2001:db8:1:1::/64
if Uplink_A is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

2001:db8:2:1::/64
if Uplink_B is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

R1 Policy:
2001:db8:1:1::/64
if Uplink_A is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

R2 Policy:
2001:db8:2:1::/64
if Uplink_B is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

Non-Zero preferred lifetime for the active uplink prefix
2001:db8:1:1::/64
if Uplink_A is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

2001:db8:2:1::/64
if Uplink_B is up:
preferred lifetime 7d
else:
Preferred lifetime 0

R1 Policy:
2001:db8:1:1::/64
if Uplink_A is up:
Preferred lifetime 7d
Else:
Preferred lifetime 0

R2 Policy:
2001:db8:2:1::/64
if Uplink_B is up:
preferred lifetime 7d
else:
Preferred lifetime 0
2001:db8:1::/64 if Uplink_A_route:
Preferred lifetime 7d
Else:
Preferred lifetime 0

2001:db8:2::/64 if Uplink_B_route:
Preferred lifetime 7d
Else:
Preferred lifetime 0

R3 Policy:
Active/Active Uplinks, Dedicated Border Routers

Non-Zero preferred lifetime for the active uplink prefix

Non-Zero preferred lifetime for the active uplink prefix
et cetera, et cetera...
Connection Preservation:

- **Uplink failure:**
  - connections interrupted (like IPv4 NAT)

- **Uplink recovery:**
  - connections are NOT interrupted (unlike IPv4 NAT)
Not Something New

IPv6 CPE L-13 requirement (RFC7084):

- Explicit prefix invalidation
- Homenet routers deprecate prefixes
Deploying Right Now

While we are awaiting for vendors to implement it...

We can still use it!

Example: JunOS event policies/even scripts
QUESTIONS?