DHCPv6/SLAAC Address Configuration Interaction Problem Statement

(draft-liu-bonica-v6ops-dhcpv6-slaac-problem)

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Regarding the Mailing List Discussion

- ML discussions was regarding an overview of DHC/ND cooperation topic
  - Some people love DHC-only (follow the IPv4 style)
  - Some prefer ND (think about light bulbs, sensors…)
  - What is the boundary between DHC and ND
  - How they could serve respectively/efficiently
  - …
- This is an important/fundamental topic might need to be worked out
  - [draft-yourtchenko-ra-dhcpv6-comparison]
- But for this draft, we're currently focusing on an existing specific problem of address configuration

About this Draft

- We already have two (automatic) address configuration mechanisms
  - DHCPv6 and SLAAC
  - They would be probably co-exist in one network
- And they are correlated by several defined flags
  - A flag, M flag, O flag, defined in ND protocol
- But the behaviors of interpreting the flags are ambiguous
  - Ambiguity might be a problem for OAM.
  - 6man tried to clear the ambiguity before, but failed.
- This draft aims to:
  - identify operational problems caused by ambiguity; provide cautions to operators/administrators
  - might consequently promote re-work on standard revision to fix the problems

The Flags

- ND RA messages include the following flags
  - "**A**utonomous Flag": indicates that a prefix can be used for SLAAC (included in the Prefix Information Option)
  - "**M**anaged Flag": indicates that addresses are available via DHCPv6
  - "**O**therConfig Flag": indicates that other configuration information (DNS .etc) is available via DHCPv6
- Neither [RFC4861] nor [RFC4862] completely specifies the host behavior when interpreting these flags

Hosts might confuse about…

- **Is there any dependency between the two mechanisms?**
  - E.g. Do I need to see M=1 to initiate DHCPv6? If there are no RAs at all, should I initiate DHCPv6 by myself?
- **Should I interpret these flags as advisory or prescriptive?**
  - E.g. when M flag set, MUST I initiate DHCPv6 or might be according to other factors?
  - Especially when flags are in transition
    - E.g. I'm already SLAAC-configured, should I still care about the M flag changed?
- **Relationship between "Address Configuring Method" and "Address Lifetime"**
  - When method changes, should I immediately release the addresses or just wait them expired
- **Is there any dependency between the flags?**
  - one flag is set or not, would behavior of other flags be impacted?

Testing

- We tested various operating system's handling of these flags:
  - Windows 7
  - Linux (Ubuntu 12.10)
  - Mac OS X (10.7)
  - iOS (6.1.3, iPod Touch4)
  - *Android (4.0.4, HTC Incredible S)

  *(*Android lacks support of DHCPv6 so far.)*

Important test results

A flag behaviors

- For SLAAC-configured hosts, when A changed from 1 to 0, Win7 deprecated SLAAC while Linux/MAC/iOS ignored the RA messages. (**"Address Configuring Method" vs "Address Lifetime"**)

M flag behaviors

- Linux/MAC only start DHCPv6 until receive RA with M=1 (**dependency between the two mechanisms**)
- SLAAC-configured hosts receiving RA with M=1, Win7 does DHCPv6, Linux/MAC don't (**advisory or prescriptive**)
- DHCPv6-configured hosts receiving RA with M=0, Win7 release DHCPv6 addresses, Linux/MAC doesn't (**"Address Configuring Method" vs "Address Lifetime"**)

O flag behaviors

- O is not independent with M. When M set, O is implicitly set as well (This is reasonable)
- Linux/MAC won't initiate stateless DHCPv6 when A flag is NOT set; Win7/iOS would (**dependency between the flags**)
- O=1, then M from 1 to 0 or vice versa, Win7 would switch to stateless DHCPv6 or statefull DHCPv6; Linux/MAC/iOS no action (**advisory or prescriptive**)

Operational Issues

- Given inconsistent host behavior, it is difficult for network managers to predict and control host addressing
- **In the case of renumbering**
  - Renumbering exercise may require transition from SLAAC to DHCP or vice versa. [RFC7010]
- **In the case of cold start**
  - "This make it difficult for a site network manager to configure systems in such a way that all hosts boot in a consistent way. " [RFC5887]
- **In the nominal cases**
  - network wants hosts to do DHCPv6-only configuration
  - the hosts have been SLAAC-configured, then the network need the hosts to do DHCPv6 simultaneously (e.g. for multihoming)
  - the network wants the hosts to do statelssDHCPV6-only; for example, the hosts are configured with self-generated addresses (e.g. ULA), and they also need to contact the DHCPv6 server for info-configuration

Question

- Do operators/administrators care about the problems?
- Adopted by v6ops as a Problem Statement?

Comments?

Thank you

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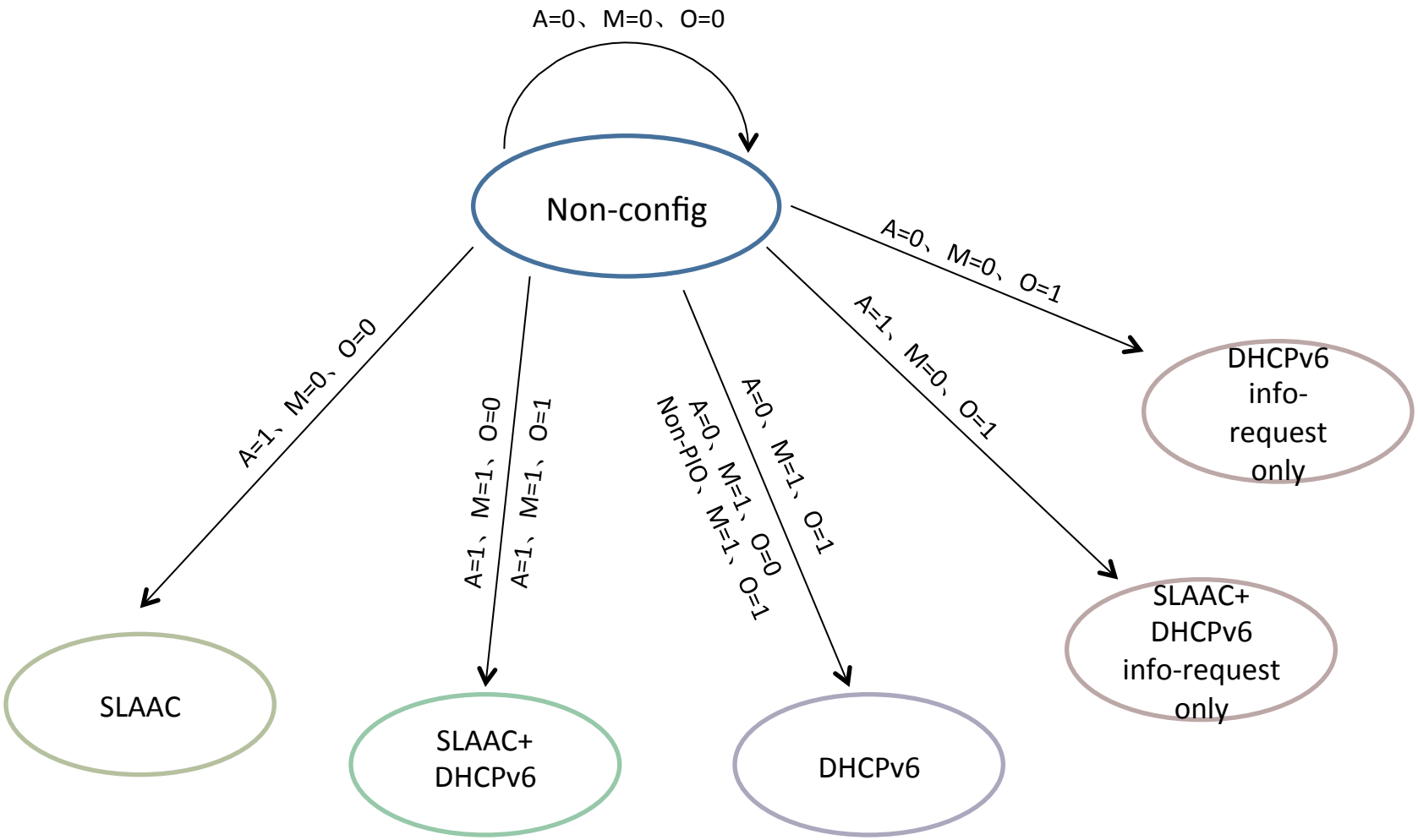
Backup Slides

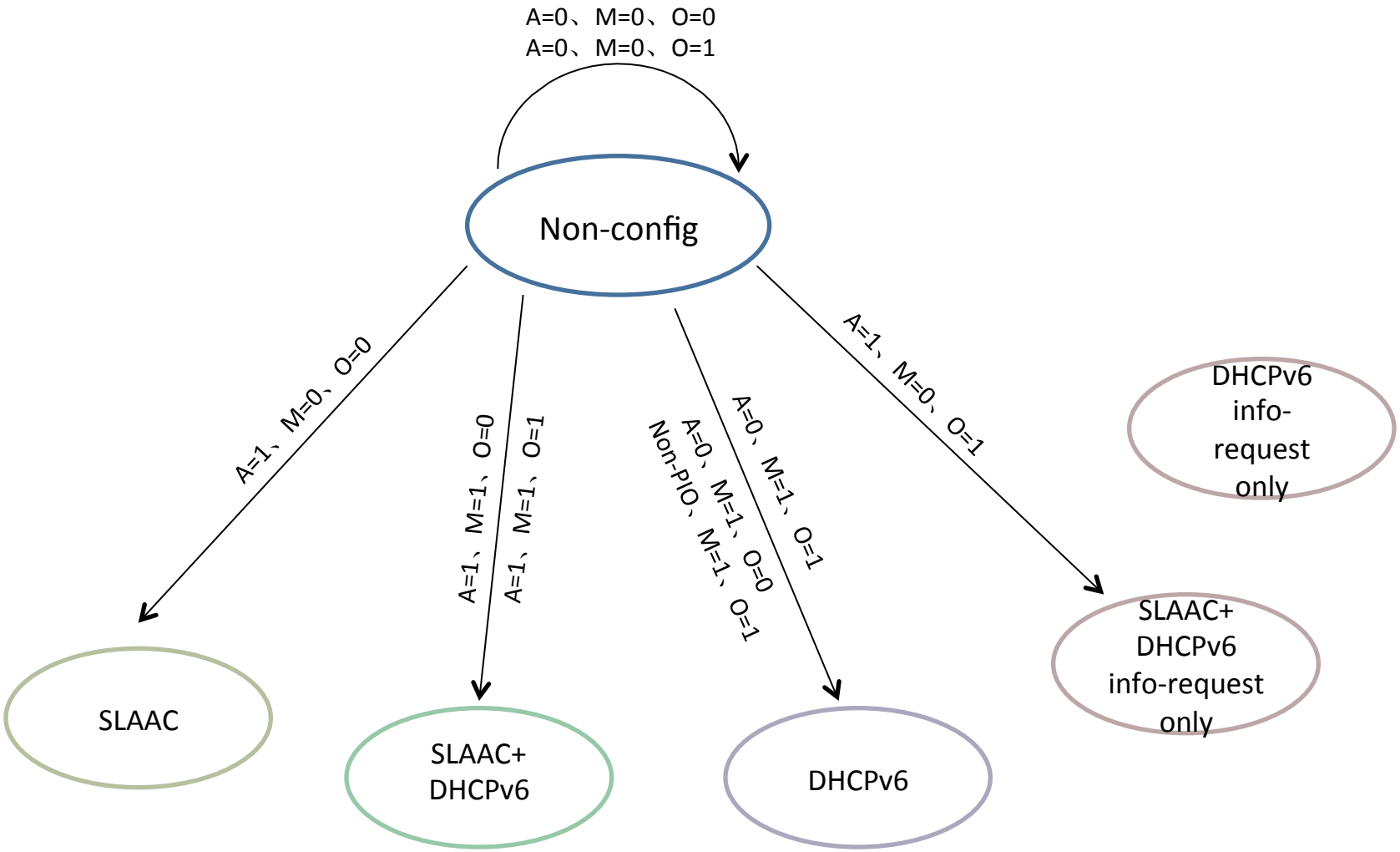
Test Case1: Initial behavior

- Host from non-configured to configured, we tested different A/M/O combinations in each OS platform. The configured states are enumerated as the following:
  - SLAAC only
  - SLAAC+Stateless DHCPv6 （info-request other-info than addresses）
  - SLAAC+Stateful DHCPv6 (address and other-info(if available) together)
  - Stateful DHCPv6 only (address and other-info(if available) together)
  - Stateless DHCPv6 only （only available in Windows 7）
- Follwoing slides illustrate state graphs of the OS platforms respectively

Windows 7/iOS (6.1.3)



Linux (Ubuntu 12.10) / Mac OS X (10.7)



Test Case1 Summary

- **A is interpreted as prescript in each OS**
- **M is interpreted as prescript in each OS at the initial state,** for controlling DHCPv6
- **A and M are independent**
- **A and O are not totally independent**. In Linux and Mac, A=1 is required for O=1 triggering DHCPv6 info-request; not applicable in Windows 7
- **M and O are not totally independent**. M=1 has priority than O=1 (when M=1 O=1， system will configure adderss and other-info together, rather than respectively)

Test Case2: SLAAC/DHCPv6 Switching

SLAAC only —> DHCPv6 only *(SLAAC-only host receiving RA with A=0 M=1)*

- Windows 7： abandon SLAAC, initiate DHCPv6, successfully switched
- Linux /Mac OS X/iOS： keep SLAAC, don't initiate DHCPv6 unless SLAAC is expired and no continuous RA

DHCPv6 only —> SLAAC only *(DHCPv6-only host receiving A=1 M=0)*

- Windows 7： config SLAAC, release DHCPv6，
- Linux： config SLAAC , keep DHCPv6 and keep renewing
- Mac OS X/iOS: config SLAAC, keep DHCPv6 and don't renew

Test Case3: Stateful/Stateless DHCPv6 Switching

Stateless—> Stateful (M changes from 0 to 1; keep A=O=1)

- Windows 7：initiates statefull DHCPv6，configures DHCPv6 address as well as re-configure other-info
- Linux/Mac OS X/iOS：no action

Stateful—> Stateless (M changes from 1 to 0; keep A=O=1)

- Windows 7： releases all DHCPv6 config including address and other-info，initiates statelss DHCPv6 information-request/reply
- Linux/Mac OS X/iOS：no action, renew when expired

END