

# ND Prefix

## Robustness Improvements

draft-vv-6man-nd-prefix-robustness-01

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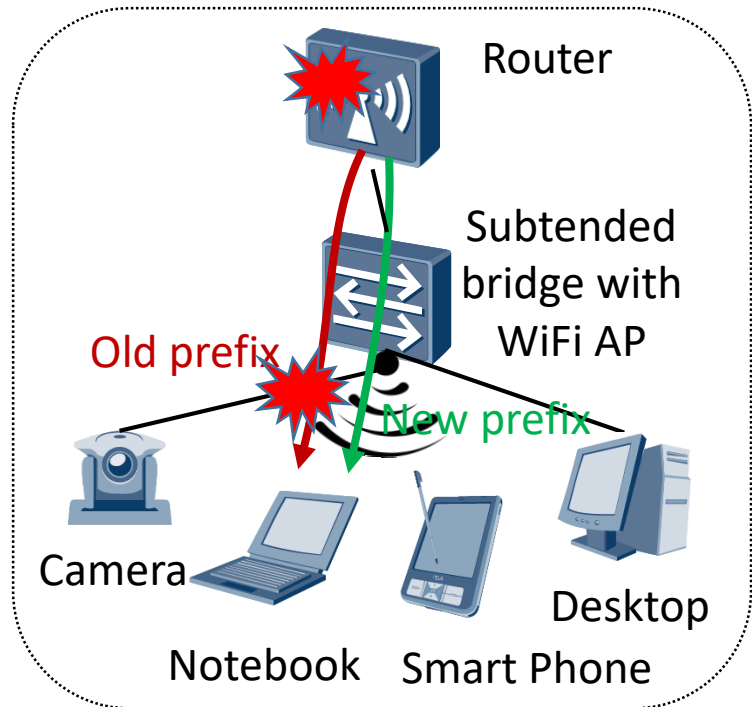
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# Background

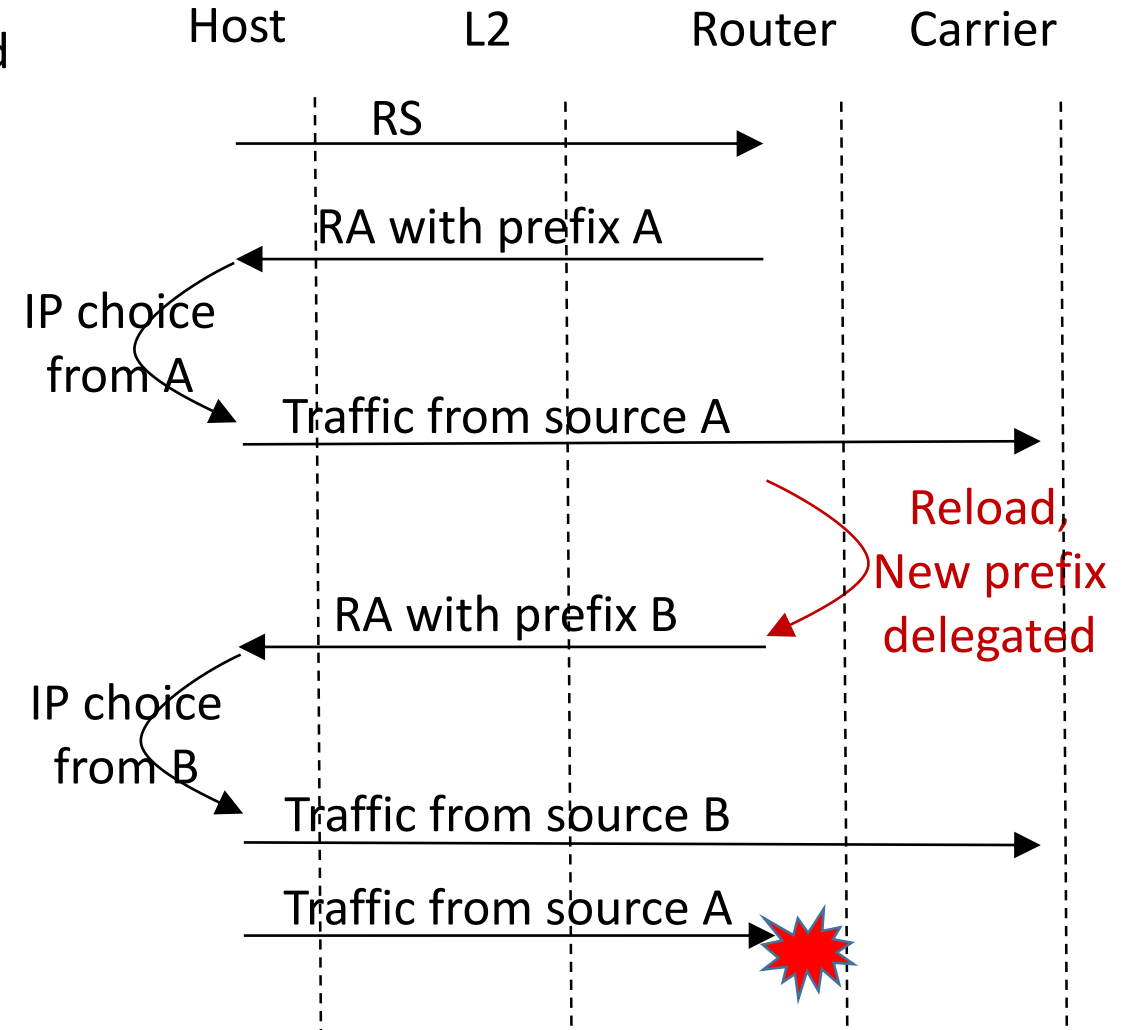
- This draft looks at those cases that may lead to network prefixes invalidity
- Specific focus is on the multihoming multi-prefix scenario, other cases are analyzed for the sake of completeness
- The target is to develop a root cause analysis and propose a solution.

# The Problem Statement – Router Reload (in an environment with Provider-Aggregatable addresses)

1. Non-graceful reload
2. Graceful reload, but the prefix is not deprecated
3. Abrupt hardware replacement

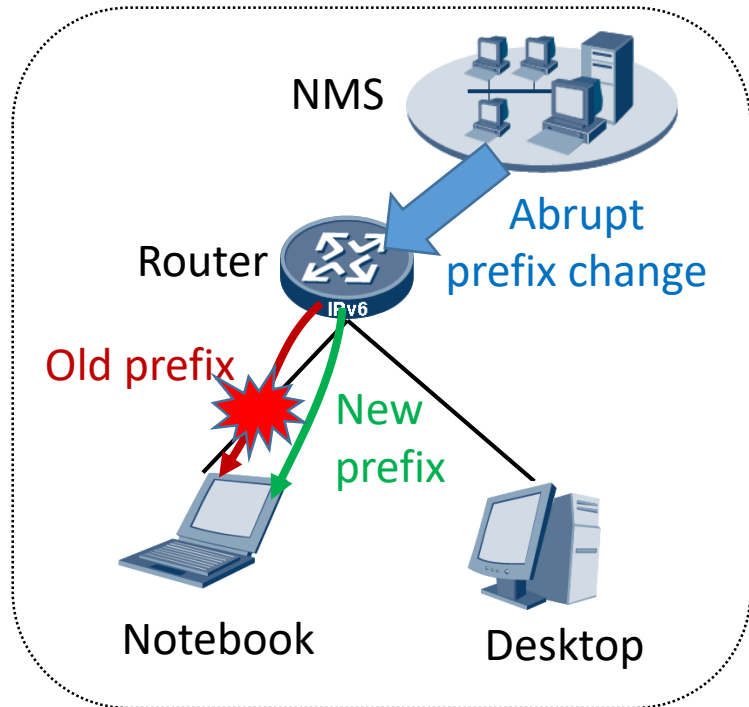


- Carrier could give a new prefix
- Hosts do not see router's power recycle – could continue to use the old prefix



# The Problem Statement - Non-graceful Configuration Change (in any environment)

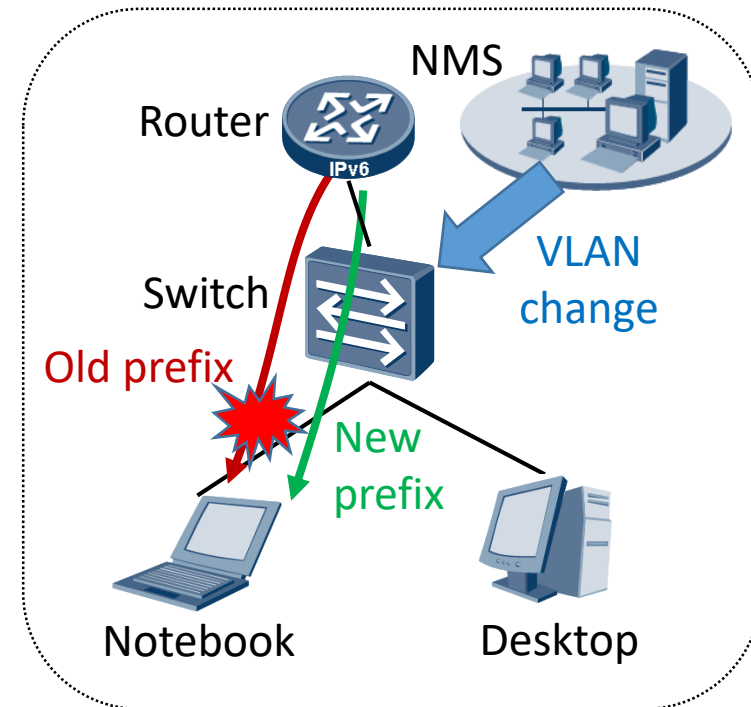
## 4a. Abrupt prefix change on the router



- Hosts do not receive prefix deprecation - old prefix could be used
- New prefix announced

New Prefix adoption would happen automatically in the SLAAC environment, DHCP adoption depends on the host. Both cases make it possible to use Old Prefix.

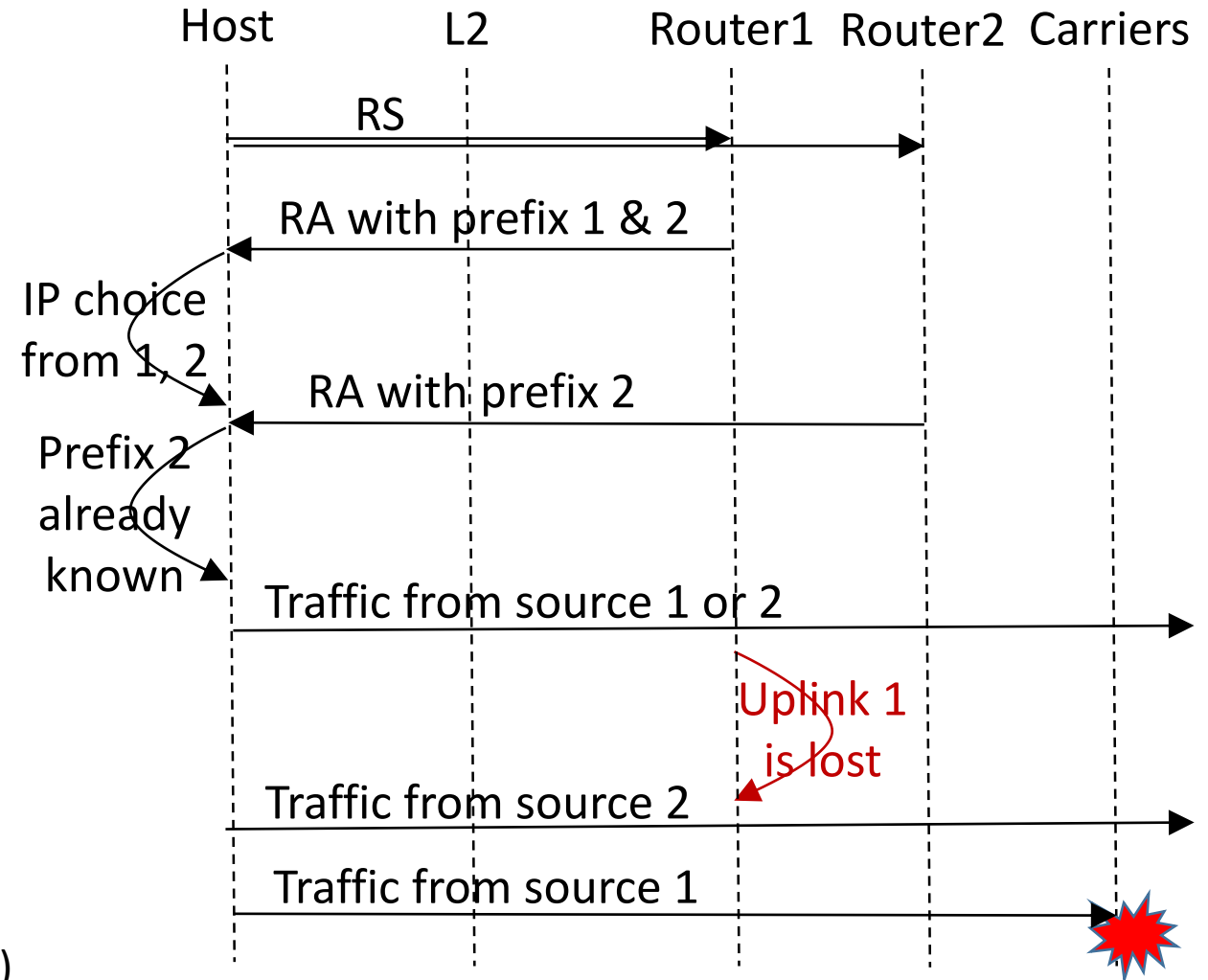
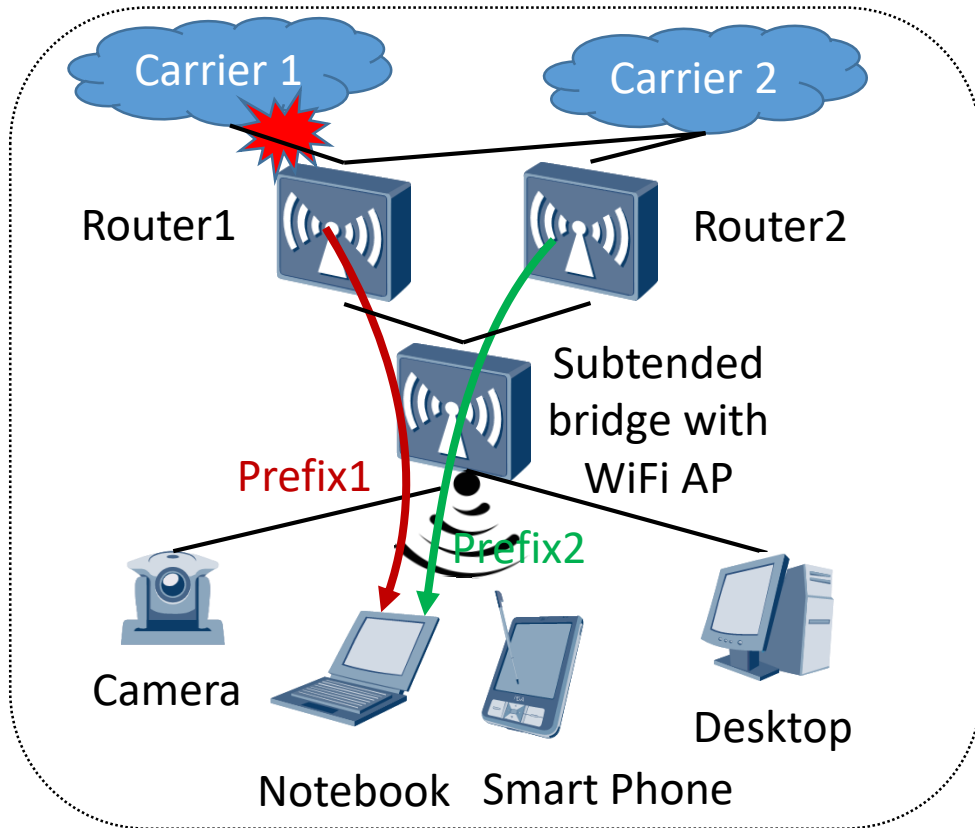
## 4b. VLAN change on the switch



- Hosts do not receive prefix deprecation – the old prefix could be used
- New prefix (from different VLAN) announced

# The Problem Statement – Multi-homing Multi-prefix environment

5. Site connectivity if the uplink is lost, but the prefix is not deprecated automatically



- Prefix1 and Default Router status was not deprecated because Router1 has connectivity to Carrier2 (RFC 7084)
- Hosts could use Prefix1, traffic would go to Carrier2

**Result: traffic dropped by RPF check** (for days in SLAAC or hours in DHCP)

Not discussed in RFC 8978

# Solutions dependency on standard corrections

Solutions	
5.1	MHMP support
5.2	Provider lost in MHMP
5.3	Abrupt configuration change
5.4	Planned router outage
5.5	Abrupt router outage
5.6	Abrupt hardware replacement
5.7	Routers' LLA change

Nothing common  
with draft-ietf-6man-slaac-renum

	Standard modifications	Correction to
6.1	Prefer the default router that advertises prefix used for source address chosen	sec 6.3.6 of ND
6.2	Deprecate PIOs if prefix source is lost (with optional dampening)	sec 4.2 of SLAAC
6.3	Mandatory deprecation of changed prefixes	sec 4.1 of SLAAC
6.4	Mandatory deprecation on shutdown	sec 6.2.5 of ND
6.5	Requirement for prefixes storage in non-volatile memory	sec 5.7 of SLAAC
6.6	Synchronization flag in RA (all information is in this RA)	sec 4.2, 6.2.3, 6.3.4 of ND
6.7	Do not deprecate default routers, deprecate PIOs	G-4/5 of RFC 7084 (CPE req)
6.8	Clean associated prefixes too when router expired and discarded	sec 6.3.6 of ND
6.9	Clean orphaned prefixes at the default router list	sec 6.3.6 of ND

# Next Steps

- We'd like to receive comments from the community
- Any review (even co-authoring) is welcome

Thank you

# Backup slides

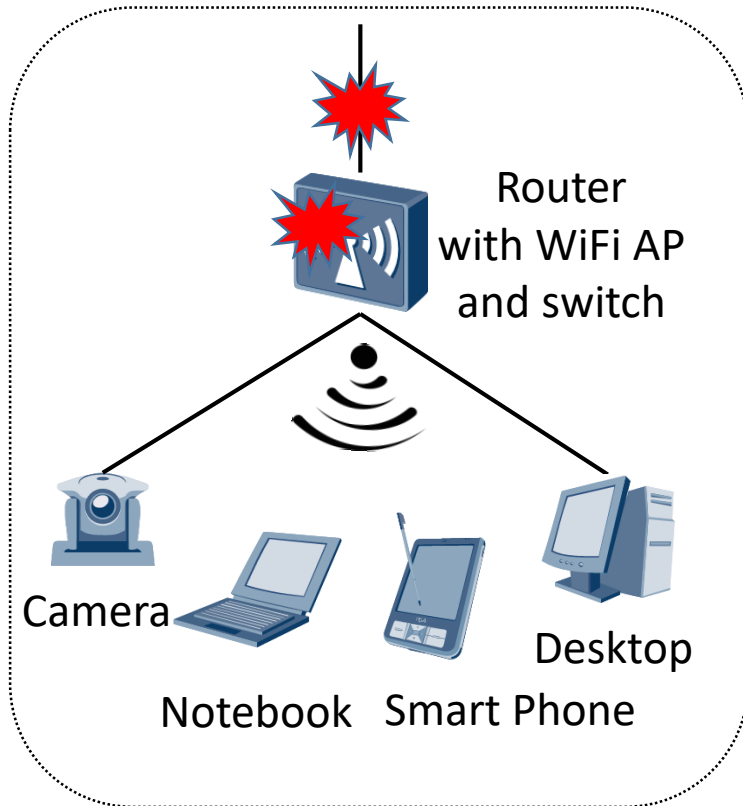


# ND topologies

## Architecture I:

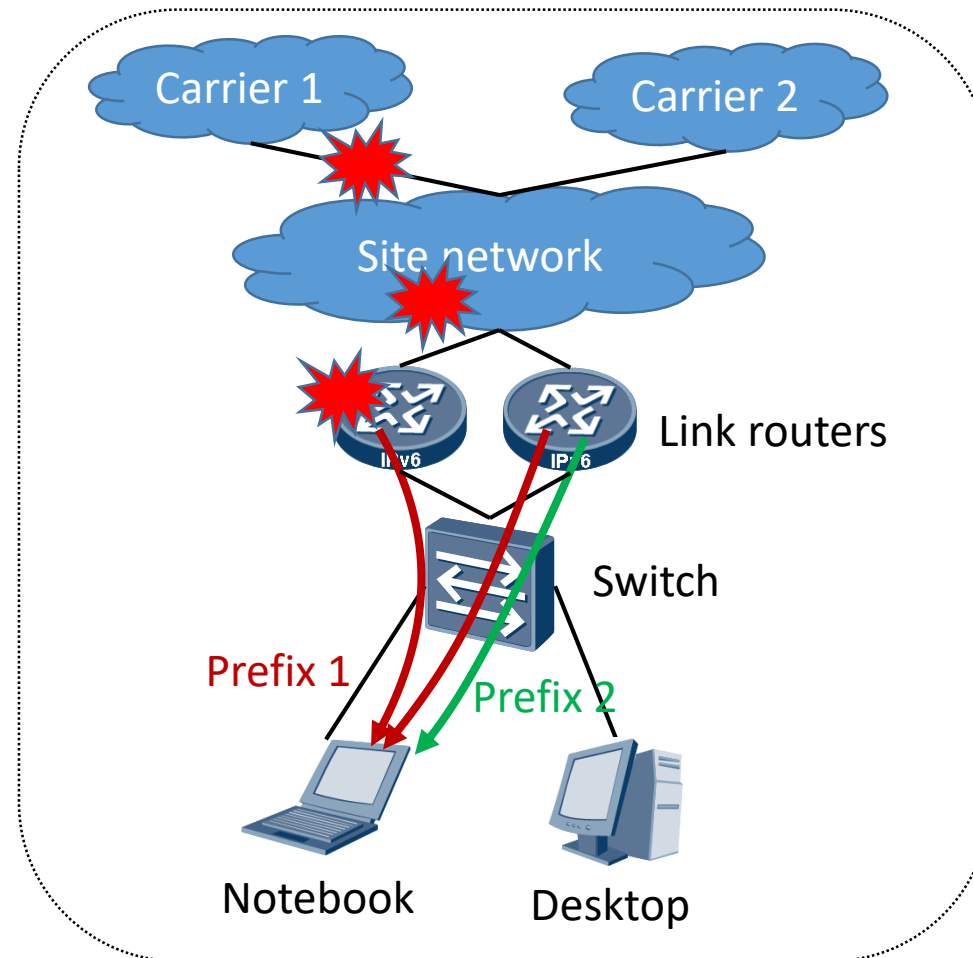
L2 and L3 devices are merged

- Sharing the fate for power, reboot



Architecture II: L2 and L3 devices are separate

- Multi-homing multi-prefix subnet is possible
- It is out of the scope of 1<sup>st</sup> hop how routers learn prefixes from upstream – any combination of prefixes could be announced from any router with the possibility to change at any time

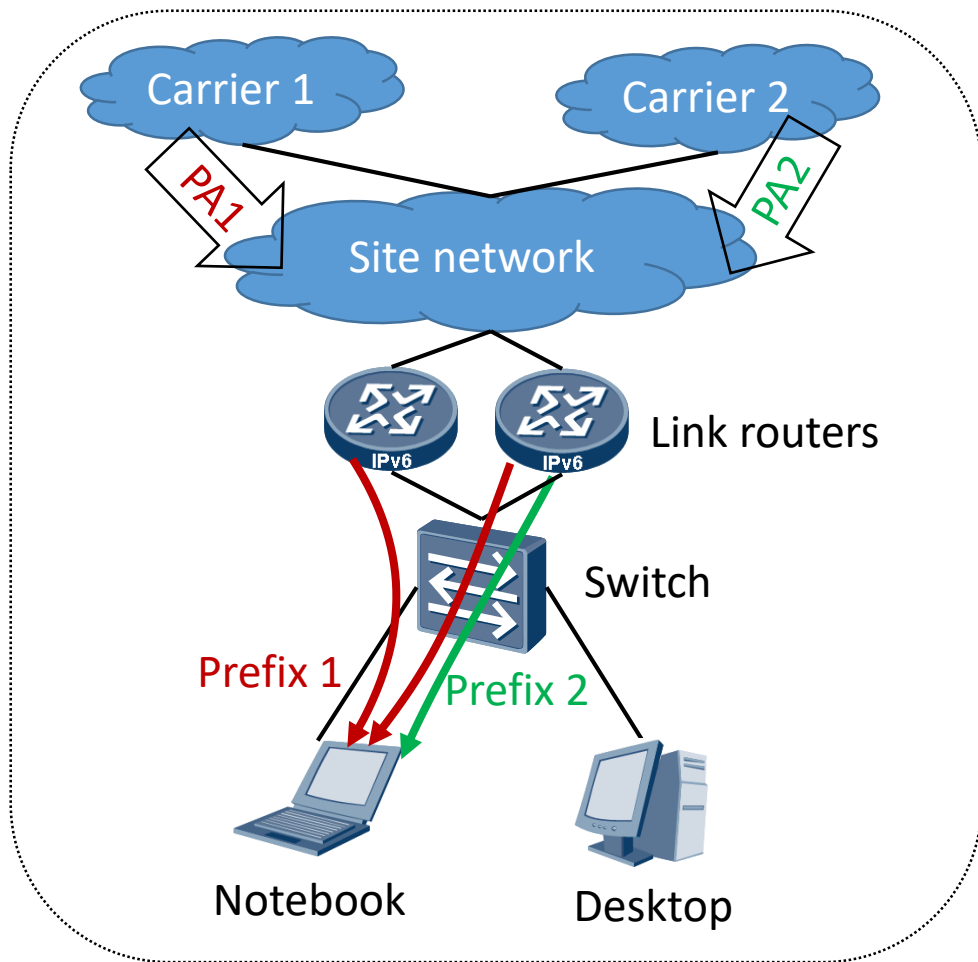


# Protection Scenarios (assumed to be the full list)

1. Proper prefix usage for Multi-Homing Multi-Prefix environment.  
Hosts should be capable of choosing in a coordinated way  
(1) a source address (from proper PA prefix) and (2) a next hop:
  - a) In a normal situation: all providers and prefixes are available
  - b) In a faulty situation: one provider is not reachable, but some hosts and links on the routed path to this provider may still be reachable
  - c) In the case when the administrator abruptly replaces prefix
2. Prefix deprecation for the case of router outage that:
  - a) Planned for this interface  
(reboot, shutdown, or ceasing to be a router)
  - b) Abrupt (power outage, software, or hardware bug)
  - c) Abrupt (power outage, hardware fault) with hardware replacement
3. Prefix deprecation for the case of link layer address change of the router

Bigger scope compare to RFC 8978 – MHMP is included

# Multi-Homing Multi-Prefix: Challenge in Stable Environment



Reminders:

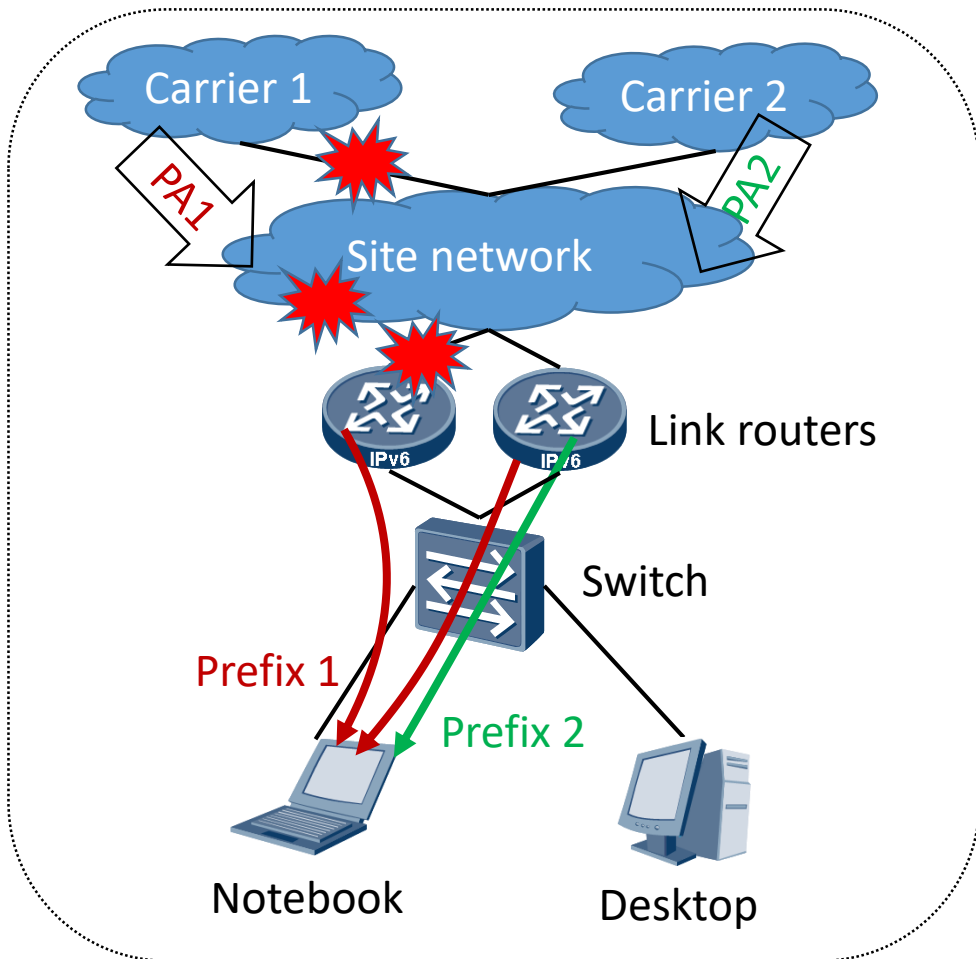
1. Any combination of PA prefixes could be announced from any router on the link. Router not announcing particular prefix may not have connectivity to respective Carrier.
2. It is assumed (by RFC 6724) in the majority of implementations that next hop is chosen first by default.

The problem for hosts: To coordinate the choice of next hop with source address to get connectivity.

Solutions:

1. The case “equal value prefixes” is resolved by RFC 6724: Default SASA (Source Address Selection Algorithm).
- 2a. The case “non-equal value prefixes” is partially resolved by: SASA (RFC 6724) with policy downloaded by DHCP (RFC 7078) + (should be coordinated) Route Preferences (RFC 4191)
- 2b. It is possible to resolve the case of “non-equal value prefixes” by only SASA (RFC 6724) with policy downloaded by DHCP (RFC 7078), If routers would be excluded from next hop selection for the cases when respective routers do not announce already chosen source IP address. **Modification to ND (RFC 4861) is proposed.**

# Multi-Homing Multi-Prefix: Path to Delegated Provider is Lost



The same assumptions are as on the previous slide.

But the additional event is assumed: the path to 1 prefix is lost.

The problem for the router: Inform hosts.

The problem for hosts (the same): To coordinate the choice of next hop with source address to get connectivity.

Proposed solutions:

1. Withdraw prefixes, not default router status.

**Modifications are proposed to:**

(1) CPE requirements (RFC 7084),

(2) SLAAC (RFC 4862)

2. Join CPE requirements (RFC 7084) and HomeNet

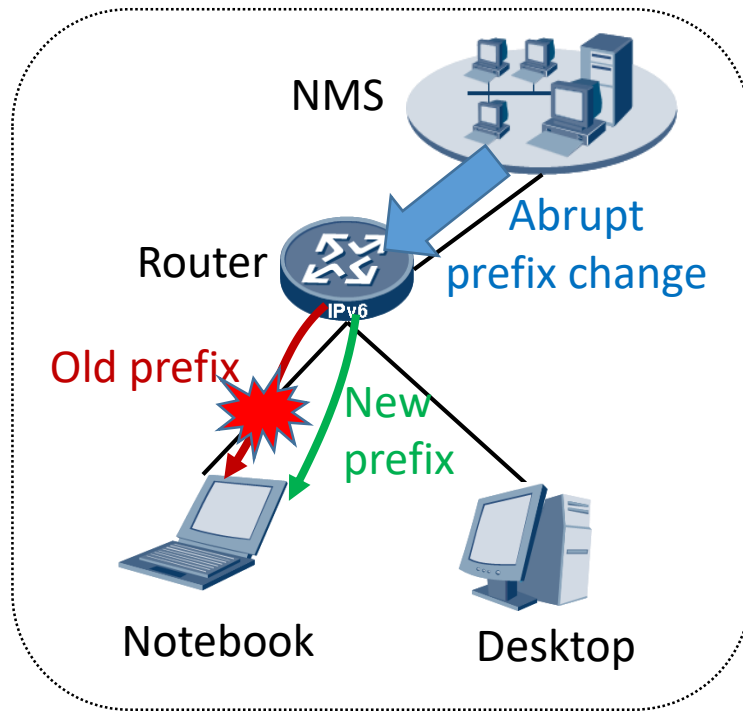
Architecture (RFC 7368) to use ULA for stability, security, and long outage protection. ULA could be the only address space available for a fully disconnected site.

3. Use a dampening mechanism to suppress oscillating prefix delegation uplinks.

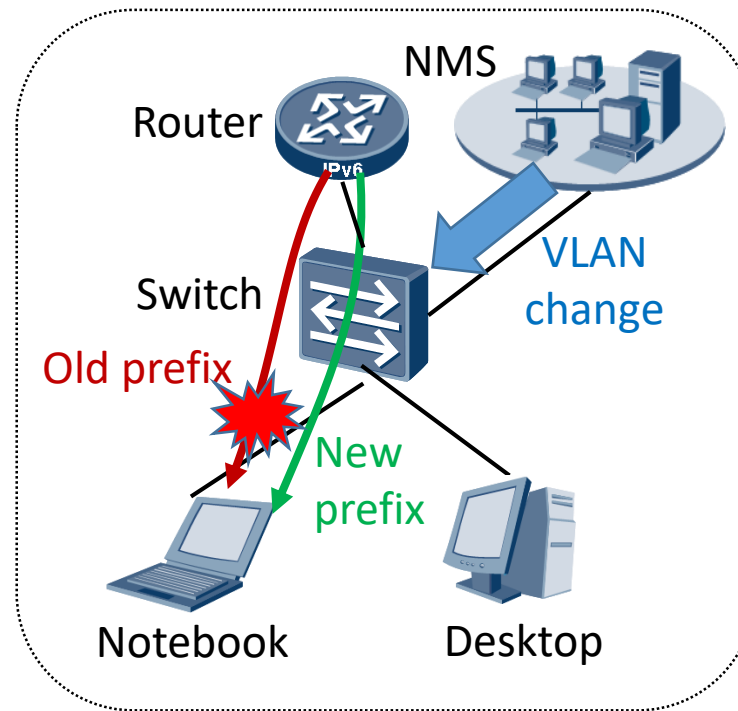
**Modification to SLAAC (RFC 4862) is proposed.**

# Non-graceful configuration change

On the router



On the L2 (switch) link



The problem statement: the host would use the wrong IP if moved to a different link (subnet) without any warning.

Proposed solutions:

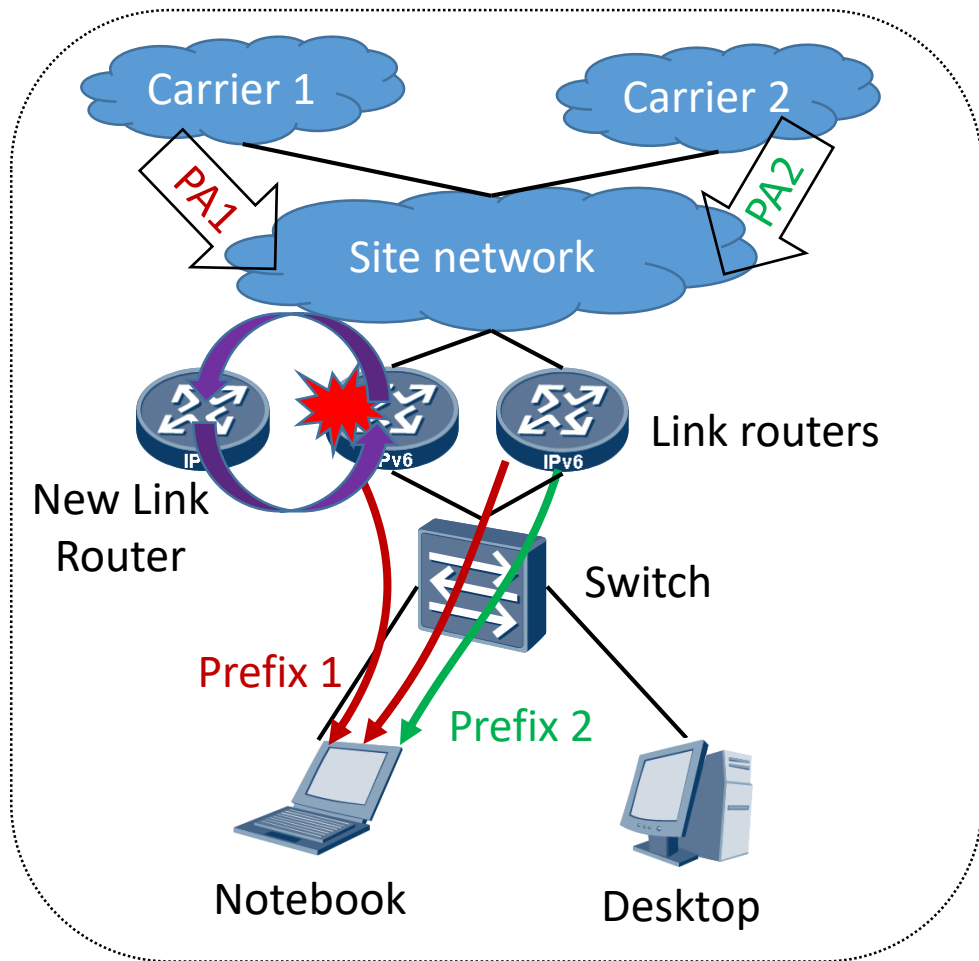
1. Short term: additional check to make sure that prefix would be deprecated.

**Modification to SLAAC (RFC 4862) is proposed**

2. Long term: states synchronization between hosts and router.

**Modification to ND (RFC 4861) is proposed**

# Router Outage



The problem statement:

The router could use a different prefix for links after reload.  
The router could be identified as the different one if it was physically replaced.

Proposed solutions for planned outage:

additional check to make sure that prefix would be deprecated.

**Modification to ND (RFC 4861) is proposed**

Proposed solutions for abrupt outage:

1. Short term: prefix storage in non-volatile memory

**Modifications are proposed to:**

**(1) CPE requirements (RFC 7084, (2) SLAAC (RFC 4862)**

2. Long term: states synchronization between hosts and router.

**Modification to ND (RFC 4861) is proposed**

3. Faster detection of the stale router

**Modification to ND (RFC 4861) is proposed**

4. Clean orphaned prefixes at the default router list

**Modification to ND (RFC 4861) is proposed**