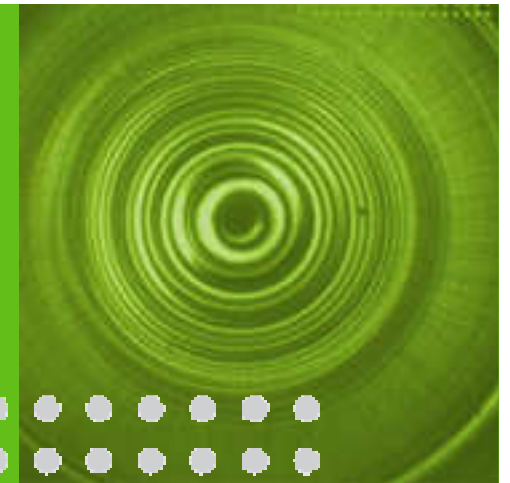


# Multiple NSP Architecture for IPv6

## New Requirements for WT-124i3



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## Agenda

1. Review of IPv6 Multiple NSP Architecture (at Florence)
2. Requirements for WT-124i3
3. Sequence example

# 1

## Review of IPv6 Multiple NSP Architecture (at Florence)

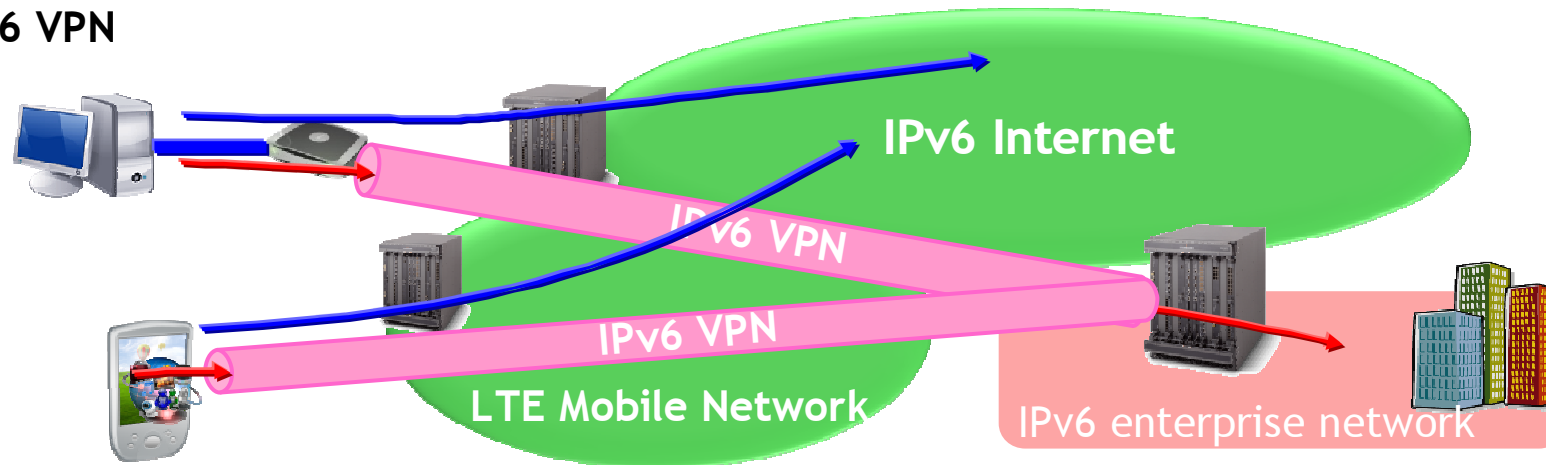


# Use cases

## - Multi-xSP Service on Broadband

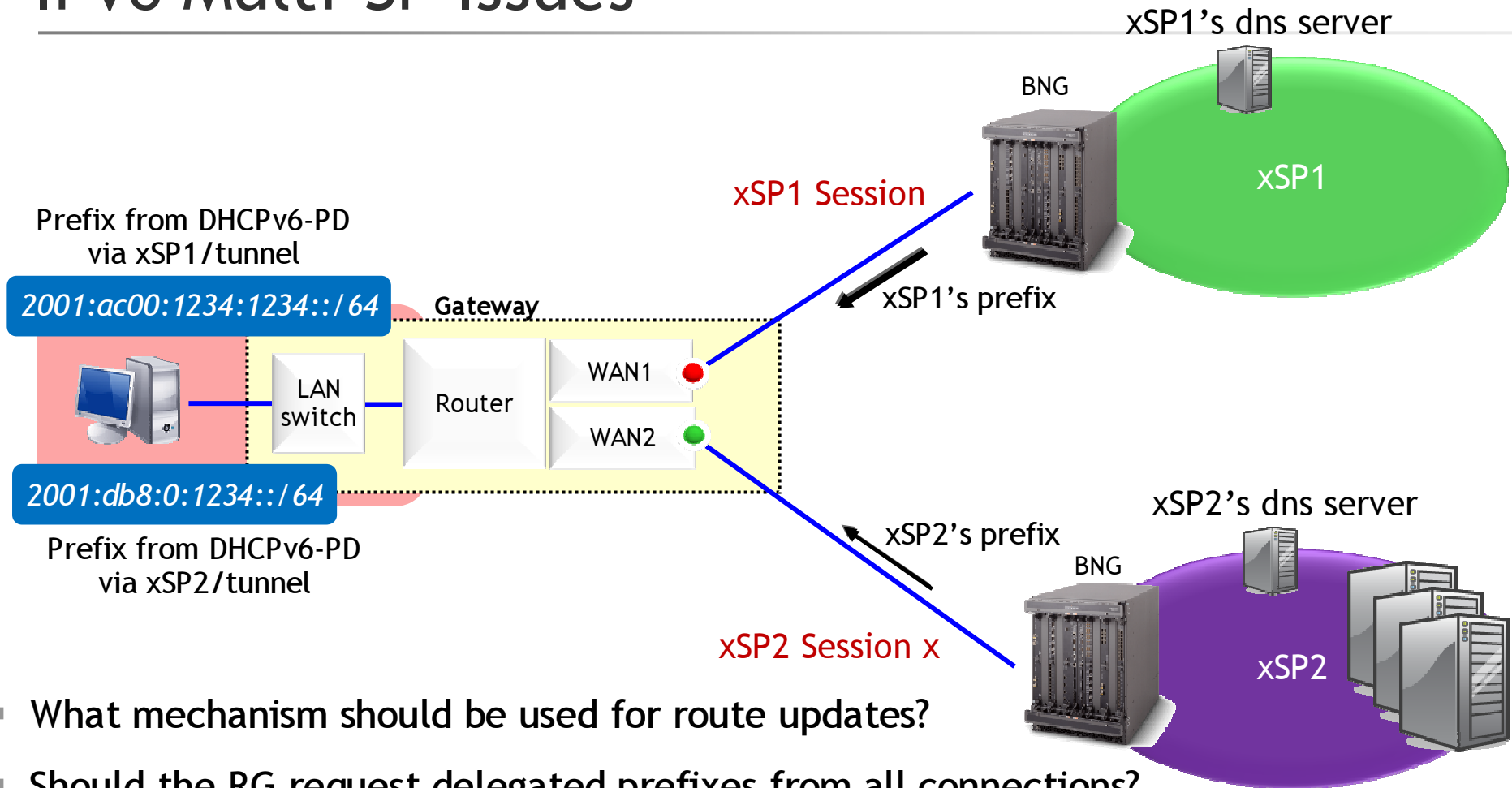


## - IPv6 VPN



Multi-Uplink situation will happen in many use case scenarios.

# IPv6 Multi-SP Issues



- What mechanism should be used for route updates?
- Should the RG request delegated prefixes from all connections?
- How should DNS servers be configured?
- What about host source address selection?

# Simultaneous Internet and ASP Access

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## The challenge becomes:

- “How do I provide IPv6 multi-SP Access to a single device?”

## The Issues we need to solve:

- How can we implement source address selection policy?
- How can we implement route selection policy?
- How can we implement DNS selection policy?

**We should have policy-based solution to enable per-subscriber and centralized management capability.**

# Related I-Ds and work at IETF

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- Source address selection policy
  - [draft-fujisaki-dhc-addr-select-opt-09](#) Mar 3, 2010  
*Distributing Address Selection Policy using DHCPv6*  
*T. Fujisaki, A. Matsumoto NTT, R. Hiromi Intec Netcore*
- Route selection policy
  - [draft-dec-dhcpv6-route-option-03](#) Mar 8, 2010  
*DHCPv6 Route Option*  
*W. Dec, R. Johnson Cisco Systems*
- DNS selection policy
  - [draft-savolainen-mif-dns-server-selection-02](#) Feb 26, 2010
  - *DNS Server Selection on Multi-Homed Hosts*  
*T. Savolainen Nokia*
- IPv6 Multi-NSP solution draft including above I-Ds
  - [draft-troan-ipv6-multihoming-without-ipv6nat-00](#)
  - *IPv6 Multi-homing without Network Address Translation*
  - *O. Troan, D. Wing Cisco Systems, D. Miles Alcatel-lucent, S. Matsushima SOFTBANK TELECOM, T. Okimoto NTT*

# 2 Requirements for WT-124i3



# Existing TR-124 Requirements

IPv6	IPv6 WAN Connection
WAN.IPv6.10	The device <b>MUST</b> support receipt of route information per RFC 4191. If the device only has one WAN connection, it does not need to place this information in its routing table, but it does need to save it (for possible sending on the LAN interface).
WAN.IPv6.11	If route information is provided (RFC 4191) and the device has multiple WAN connections, it <b>MUST</b> place the route information in its routing table.
WAN.IPv6.15	The device <b>SHOULD</b> be able to request the following DHCPv6 options: SNTP_SERVERS (RFC 4075), Domain Search List (RFC 3646), and Client FQDN (RFC 4704).
DHCPv6S	IPv6 WAN Connection
LAN.DHCPV6S.4	The device <b>SHOULD</b> be configurable to support rules as to which host devices will be assigned addresses through DHCPv6. That is, it should be possible for a service provider to place their own host devices in the premises and have the RG only support DHCPv6 address assignment to those devices. Note that this does not require use of the RA "M" flag, as the service provider host devices can be configured to always use DHCPv6 for address assignment. The DUID may help to identify host devices.

# Existing TR-124 Requirements

DNS6	Naming Services (IPv6)
LAN.DNSv6.4	The device <b>MUST</b> be able to query for A and AAAA records using either IPv4 or IPv6 transport to DNS recursive name servers in the WAN.
LAN.DNSv6.5	The device <b>SHOULD</b> use a DNS recursive name server obtained through DHCPv6 option (23 - OPTION_DNS_SERVERS) to query for AAAA records to the WAN, as its first choice.
LAN.DNS.3	<p>When the device learns DNS name server addresses from multiple WAN connections, the device <b>MUST</b> query a server on each connection simultaneously and provide the requesting LAN client with the first returned positive result from these DNS servers. A negative response will not be transmitted to a LAN device until all WAN DNS servers have either timed out or returned a negative response to a common query.</p> <p>Service providers may choose not to provide DNS name server addresses on certain connections in a multiple connection configuration.</p>

# New Requirements for WT-124i3

WANIPv6	WAN IPv6
WAN.IPv6.XX	<i>If route information is provided (<b>draft-dec-dhcpv6-route-option</b>) and the device has multiple WAN connections, it <b>MUST</b> place the route information in its routing table.</i>
WAN.IPv6.15	<i>The device <b>SHOULD</b> be able to request the following DHCPv6 options: SNTP_SERVERS (RFC 4075), Route information (<b>draft-dec-dhcpv6-route-option</b>), DNS selection policy (<b>draft-savolainen-mif-dns-server-selection</b>), and address selection policy-table (<b>draft-fujisaki-dhc-addr-select-opt</b>)</i>


# New Requirements for WT-124i3

LAN.DHCPv6S	LAN DHCPv6 Server
LAN.DHCPv6S.x	<i>The device SHOULD support the automatic generation of address selection policy-table options (OPTION_DASP) for hosts which include OPTION_DASP in the DHCPv6 REQUEST. If used, the policy-table MUST ensure prefixes advertised from each WAN link are assigned a unique label</i>
LAN.DHCPv6S.x	<i>If policy-table options (OPTION_DASP) is requested in a DHCPv6 REQUEST, the device SHOULD advertise an address from each ASP prefix.</i>
NAT6	NAT66
LAN.NAT6.x	<i>The device SHOULD support stateless Network Address Translation as described in draft-mrw-behave-nat66-xx. <b>NOTE: draft-mrw will be updated to mitigate /48 prefix size restriction.</b></i>
LAN.NAT6.x	<i>Whenever traffic is sent to a more-specific ASP prefix (has a Route Information Option) AND the source address falls outside said prefix, NAT66 MUST be performed.</i>

# New Requirements for WT-124i3

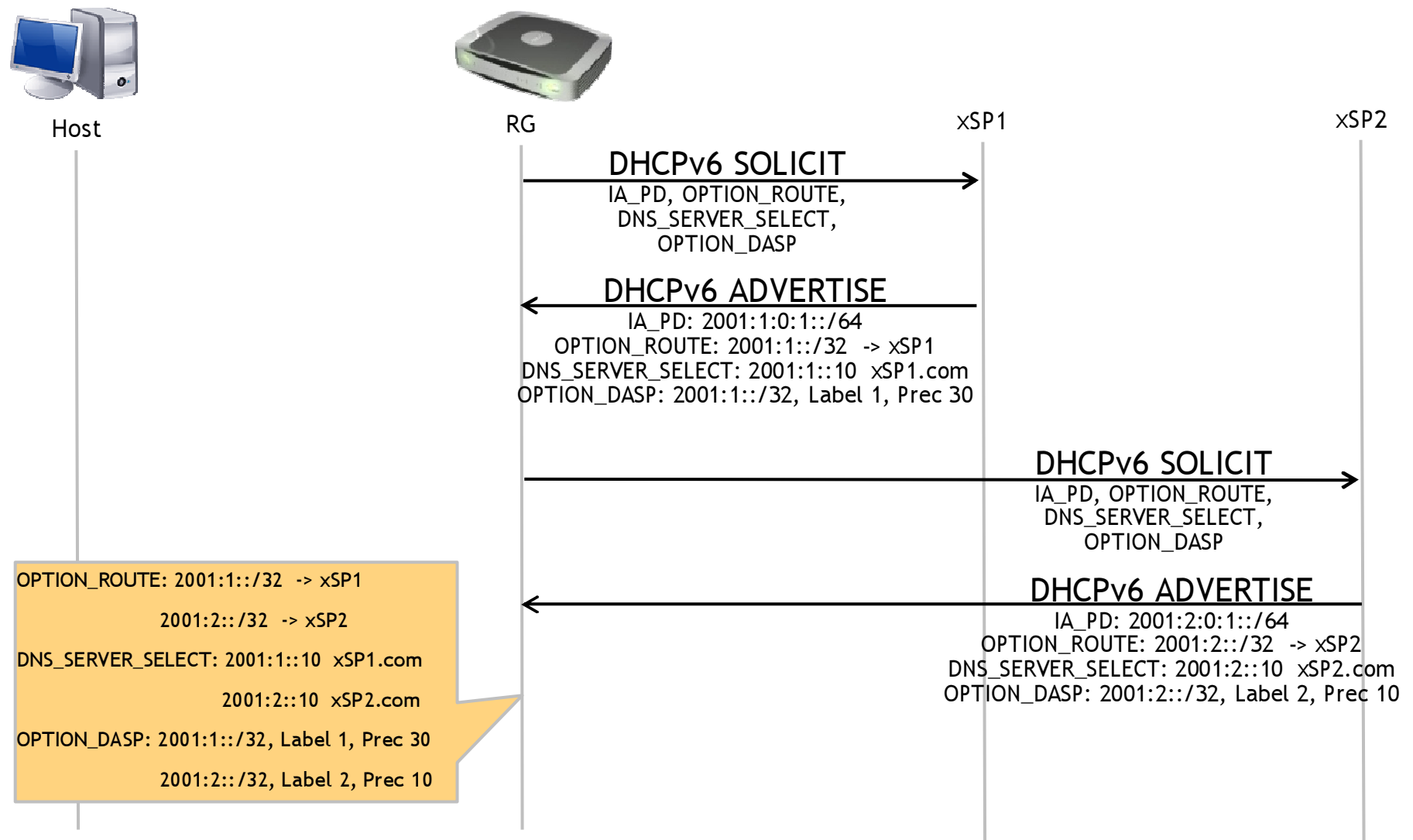
DNS6	Naming Services (IPv6)
LAN.DNS.3	<i>When the device is proxying DNS queries for LAN devices and it learns DNS name server addresses from multiple WAN connections, the device also MUST make recursive query to the DNS name server specified with DNS selection policy which is obtained through DHCP stated in [WAN.IPv6.15:DNS selection policy].</i>

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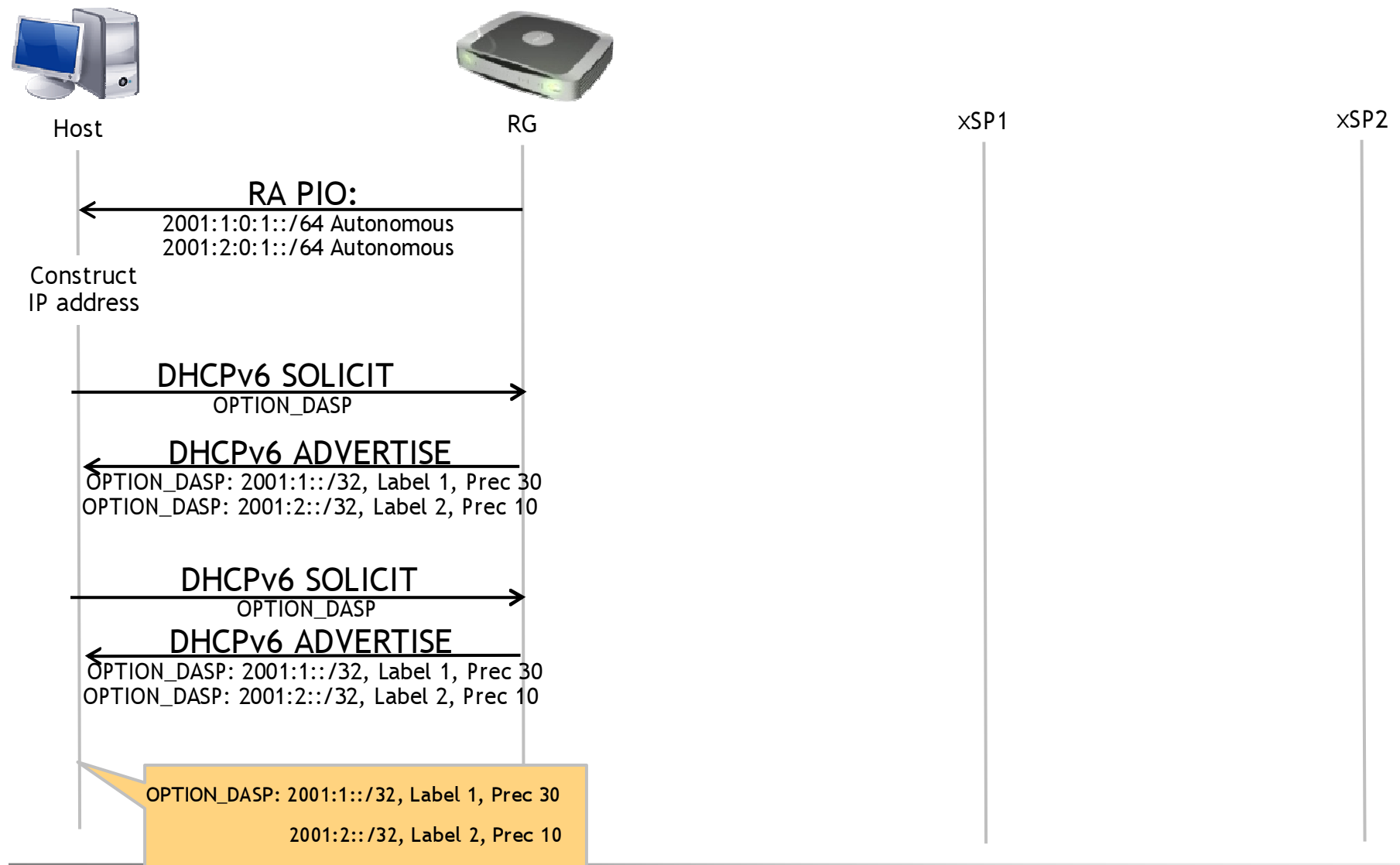


# 3 Sequence example

# Source address selection/Route information/DNS selection distribution RG/Host Behaviour

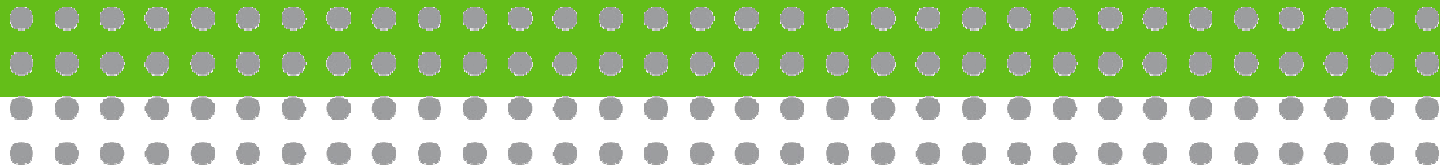


# Source address selection/Route information/DNS selection distribution RG/Host Behaviour





Thank You



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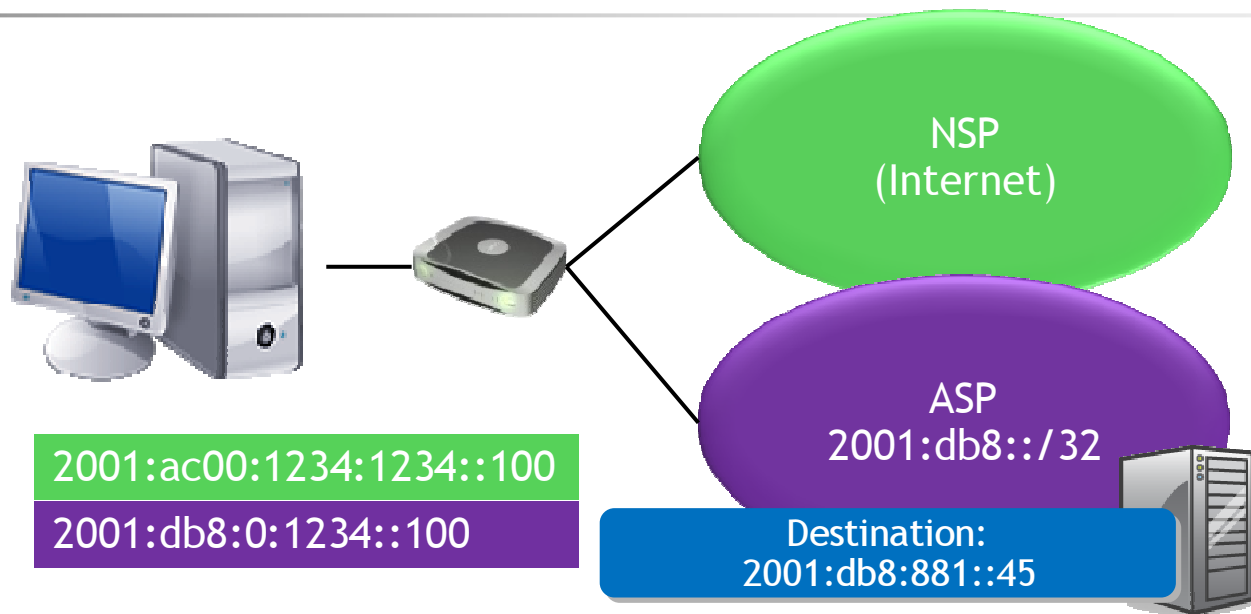
BackUp

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# Example use of policy table

For *source* address selection

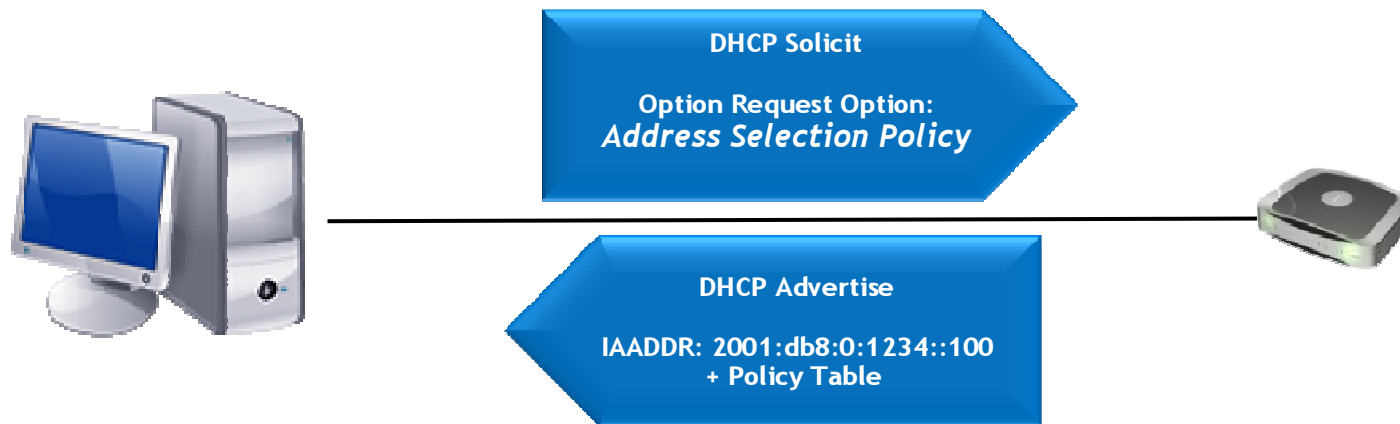
Prefix	Prec	Label
::1/128	50	0
::/0	40	1
2001:ac00:1234:1234::/64	40	1
2002::/16	30	2
::/96	20	3
::ffff:0:0/96	10	4
2001::/32	5	5
2001:db8::/32	1	10
2001:db8:0:1234::/64	1	10



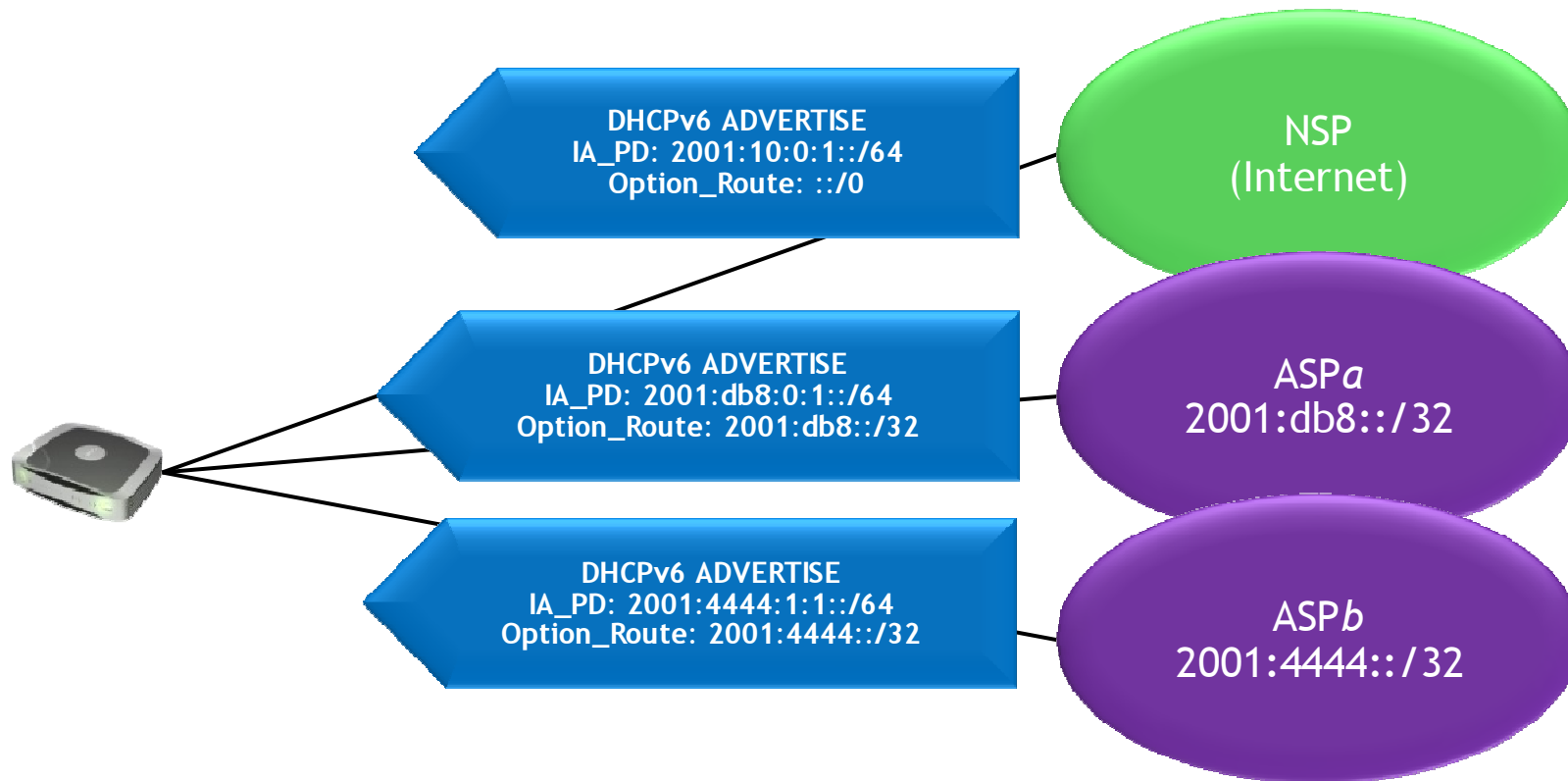
Source	Source Label	Destination	Destination Label
2001:ac00:1234:1234::100	1	2001:db8:881::45	10
2001:db8:0:1234::100	10	2001:db8:881::45	10

# Conclusion: Source address selection policy

- Can be configured automatically by combining the RG routing table and a table of delegated prefixes: explicit policy table
- A mechanism to pass information to the client is required:  
“*draft-fujisaki-dhc-addr-select-opt*” is one of the possible solution
- Only hosts which request the Address Selection Policy will be assigned an IPv6 address from the ASP networks and provided the policy



# DHCPv6 - Route Option Example

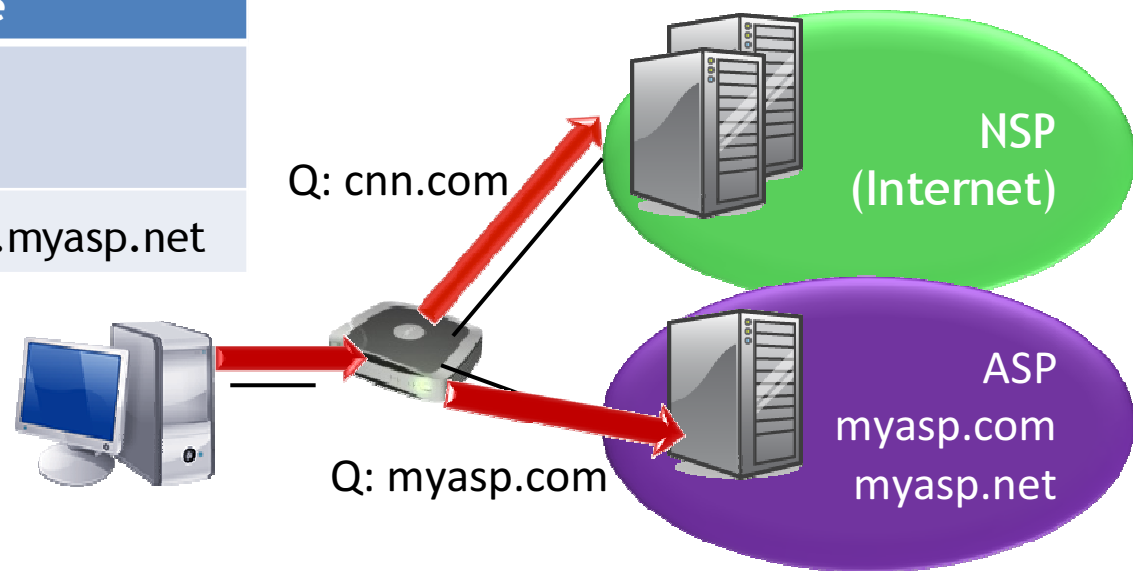


Prefix	Next-hop
::/0 (default)	NSP
2001:db8::/32	ASPa
2001:4444::/32	ASPb

# DNS selection requirements

- “A user can resolve a FQDN from the qualified ASP’s DNS server(s).”
  - Domain Name can be used to represent “qualification”.
  - An ASP can have multiple DNS servers and Domain Name.
  - For NSP’s case , an ASP can be qualified for ANY domains.

DNS Server	Domain Name
2001:db8:1::53 fd00:1:1:1:1::53	[ANY]
2001:db8:2::53	.myasp.com, .myasp.net



# DNS selection possible solutions

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## 1) Distribute Domain Name to DNS Server mapping information

- By DHCP or RA.
- “*draft-savolainen-mif-dns-server-selection*” shows the solution.

DNS Server	Domain Name
2001:db8:1::53 fd00:1:1:1:1::53	[ANY]
2001:db8:2::53	.myasp.com, .myasp.net

## 2) Send DNS queries to every possible DNS servers:

- Clear drawbacks are extra-load on DNS servers.
- Also when multiple replies are returned, it's hard to tell which answer is qualified.

# Legacy Host Support



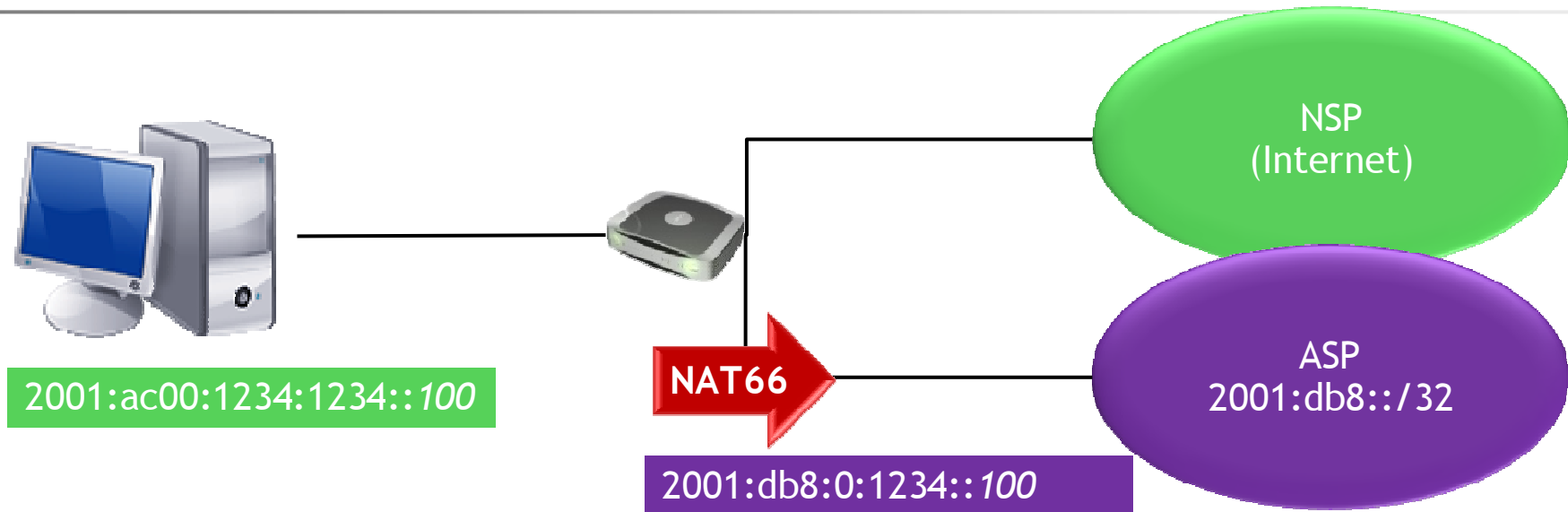
# DHCPv6 without Address Selection Policy

- We should not give multiple addresses to hosts which cannot support address selection policy, if a request is sent we discard the Solicit (per RFC)
- DNS and routing are provided by the RG, so legacy hosts can access ASP services via NAT66



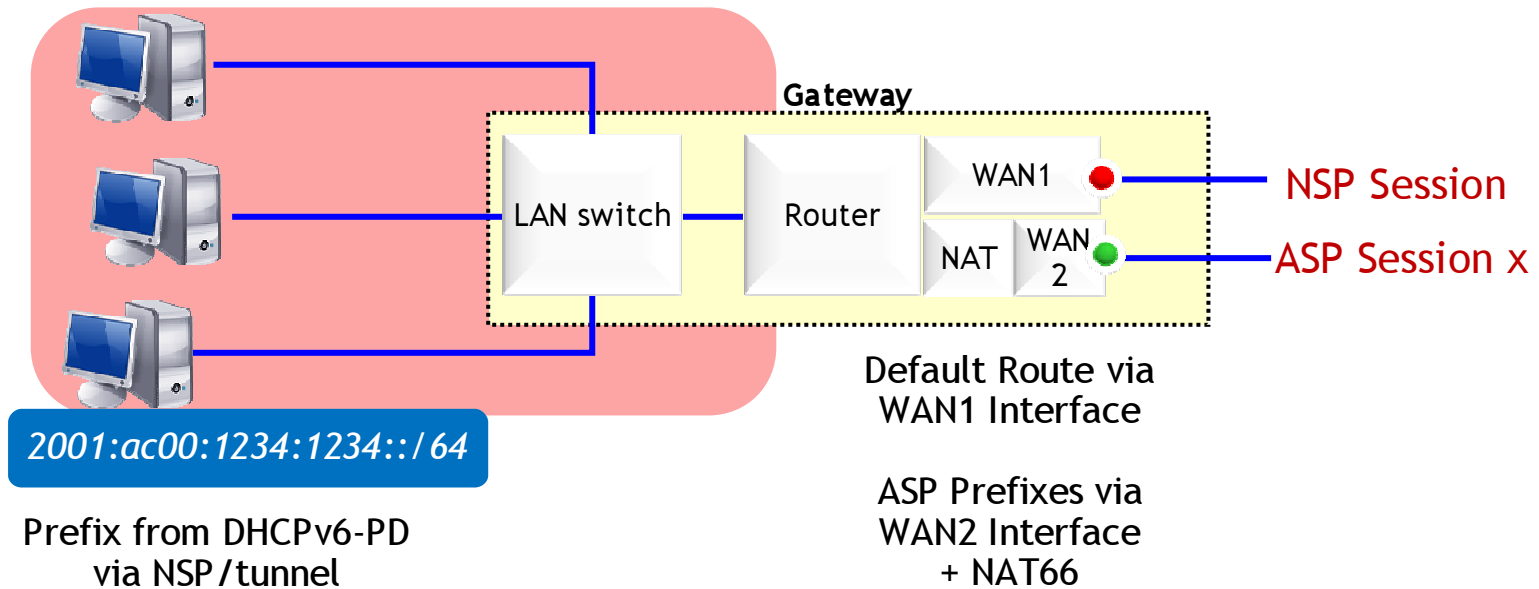
# Hosts without policy table

For ASP access



- **Stateless** 1:1 NAT66  
`2001:ac00:1234:1234:w:x:y:z <-> 2001:db8:0:1234:w:x:y:z`
- NAT66 should be the option of last resort for hosts which don't support policy.

## Gateway Routing Table



Prefix	Next-hop
::/0 (default)	WAN1
2001:db8::/32	WAN2 (NAT)