Overview of IPv6 Transition Mechanisms

& their CPE requirements for Access Networks

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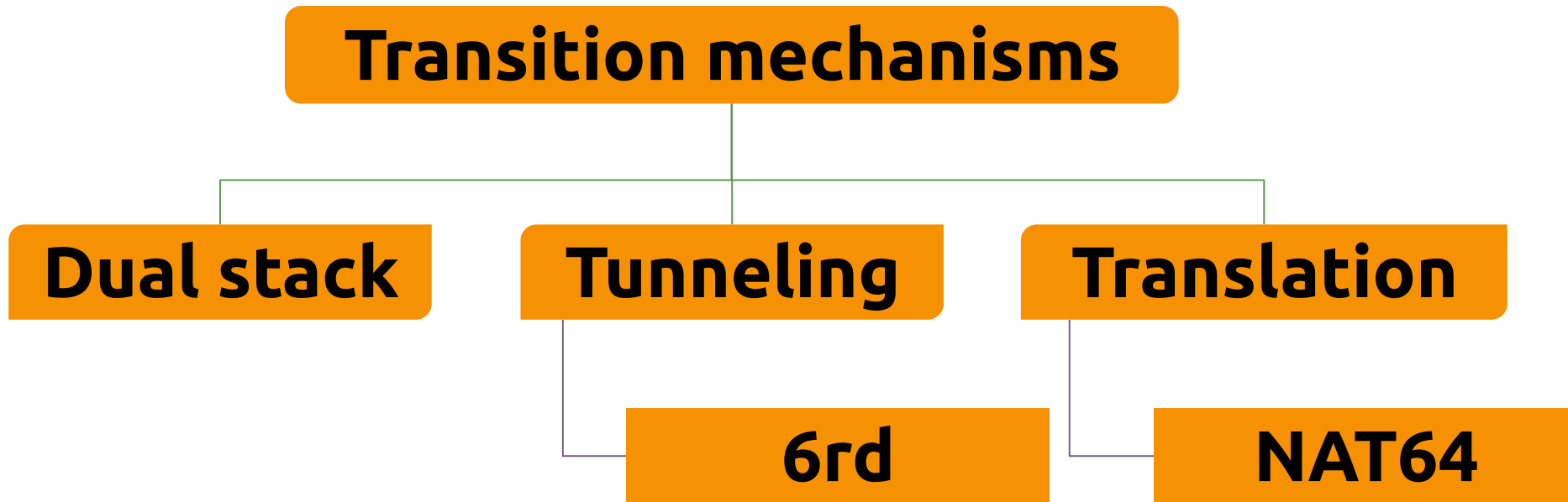
AfriNIC

Agenda

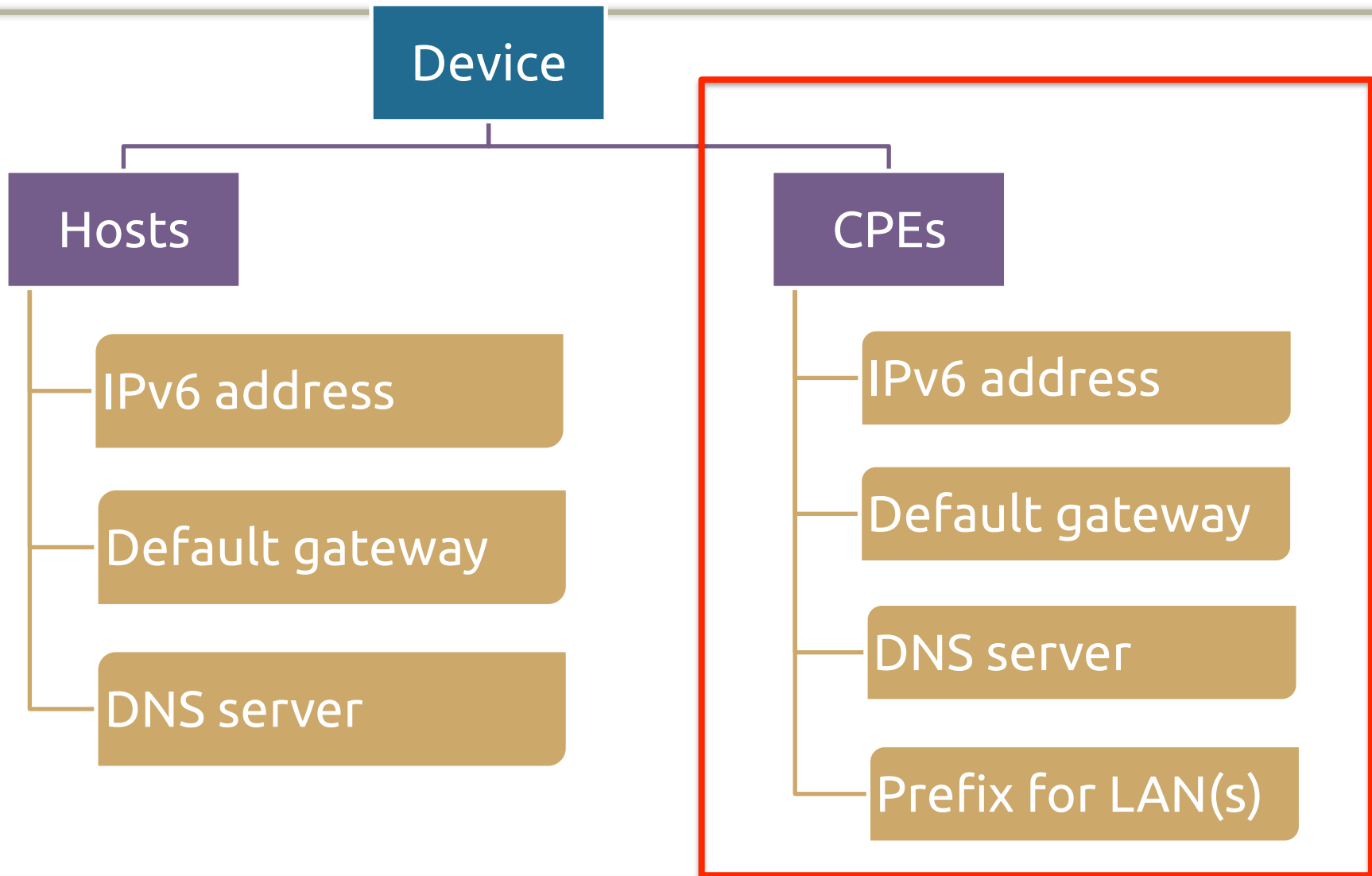**Transition Mechanisms**

FOR EACH transition mechanism DISCUSS

- Infrastructural elements
- Brief overview
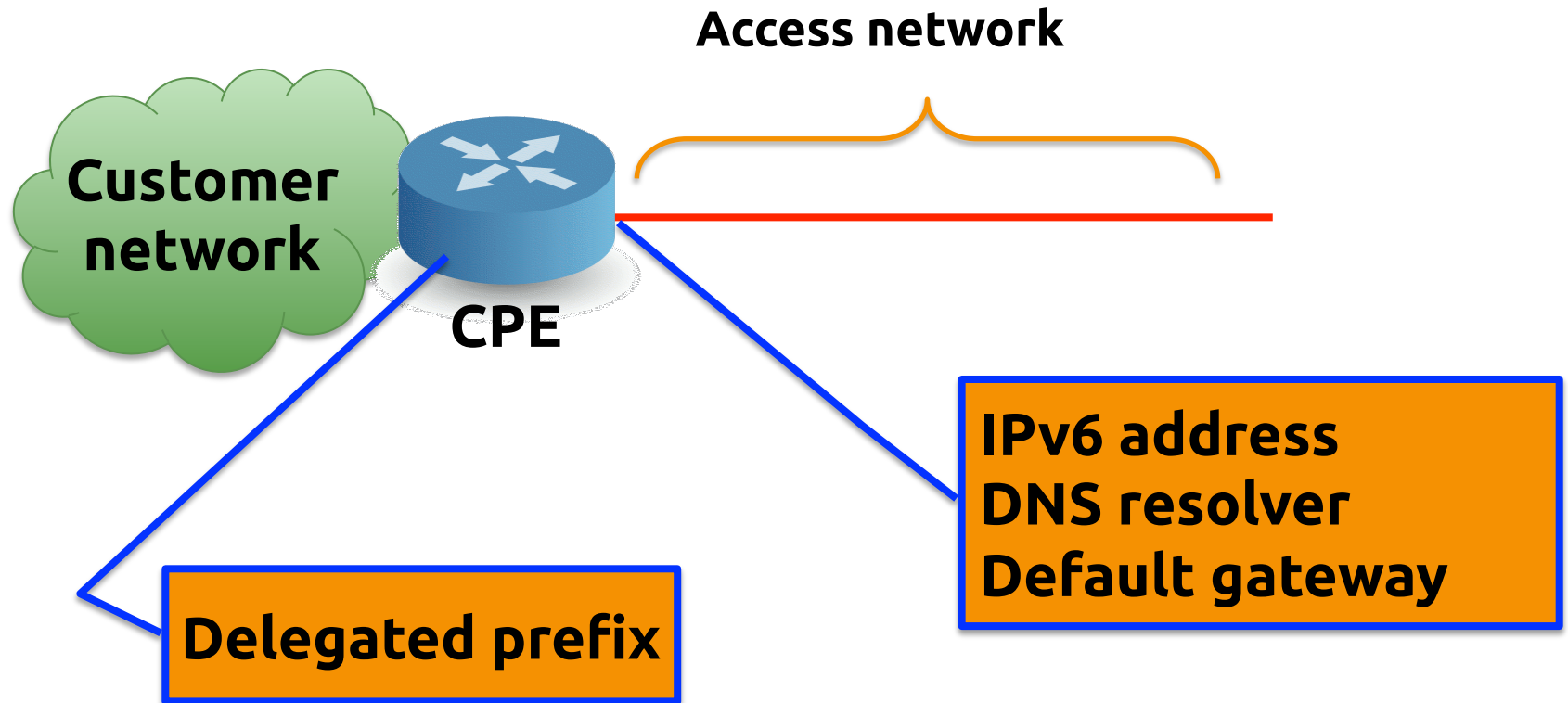- Where it is typically employed
- CPE requirements

NEXT

Transition mechanisms for access networks

Transition mechanisms

Dual stack

Tunneling

Translation

6rd

NAT64

IPv6 address provisioning requirements

IPv6 Address Provisioning

Device

Hosts
- IPv6 address
- Default gateway
- DNS server

CPEs
- IPv6 address
- Default gateway
- DNS server
- Prefix for LAN(s)

Critical CPE requirements

Options for automatic address provisioning

IPv6 Address Provisioning

	Address	Default Gateway	DNS server	Delegated Prefix
SLAAC	✔	✔	✖	
Stateful DHCPv6	✔	✖	✔	✔
Stateless DHCPv6	✖	✖	✔	✖
RDNSS	✖	✖	✔	✖

Overview of the Dual Stack

Dual Stack – Infrastructural elements

Access network

Customer network

CPE

PE

Provider core network
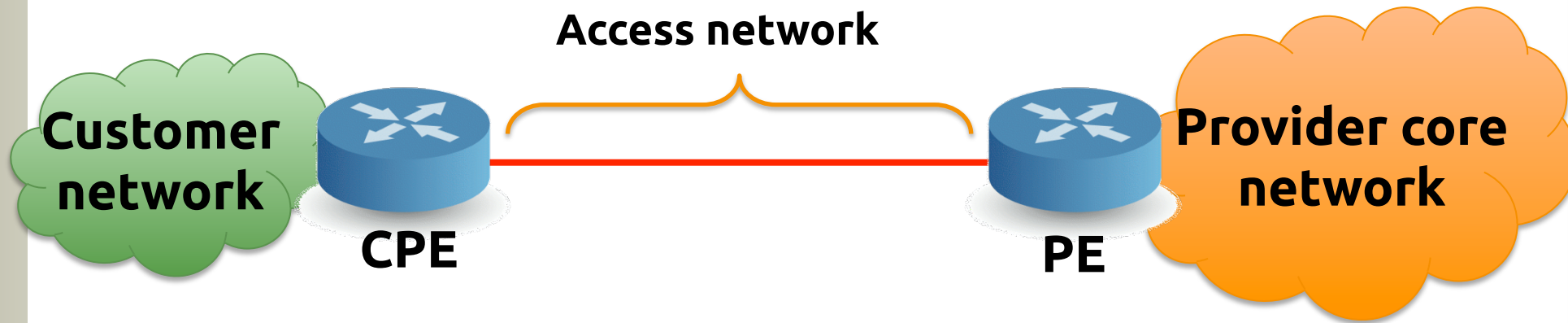
◆ IPv4 and IPv6 is enabled on all network elements

◆ Typically used when access network can easily support IPv6

Dual Stack – CPE requirements

Access network

Customer network

CPE

Delegated prefix

IPv4 address & mask
IPv6 address
DNS resolvers (v4 & v6)
IPv4 default gateway
IPv6 default gateway
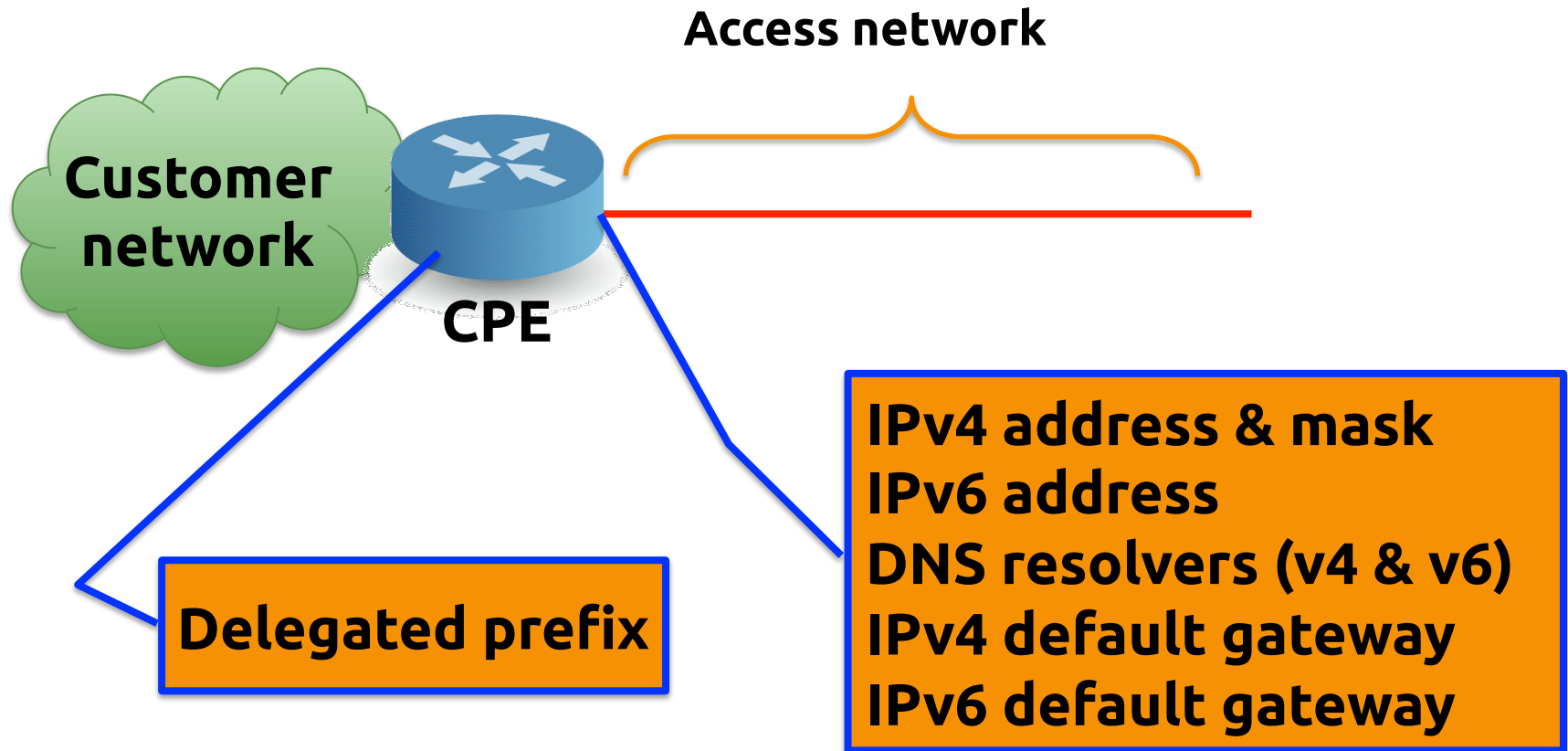
Some implications of running dual stack

Transition Mechanisms
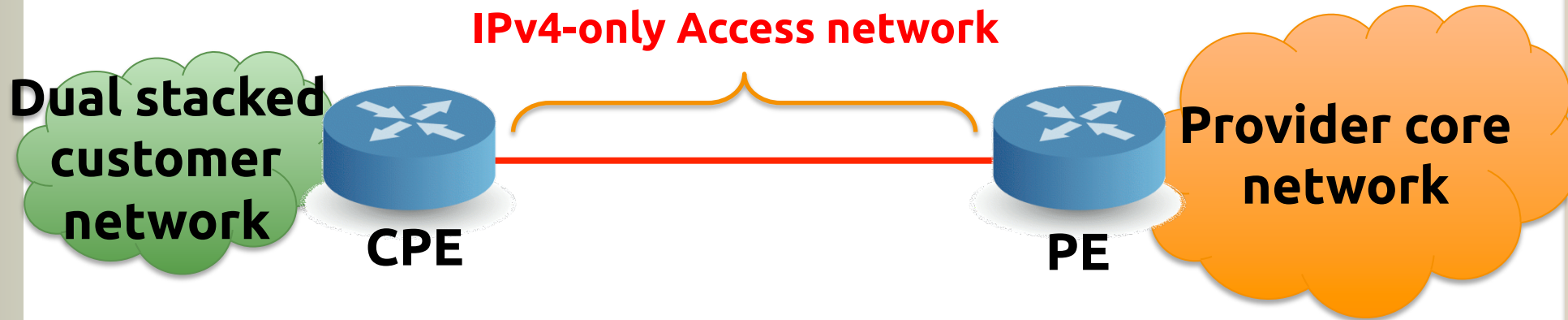
① Increased complexity in PE configuration

② Support staff must be trained to troubleshoot both protocols

Overview of 6rd

Tunneling– Infrastructural elements

IPv4-only Access network

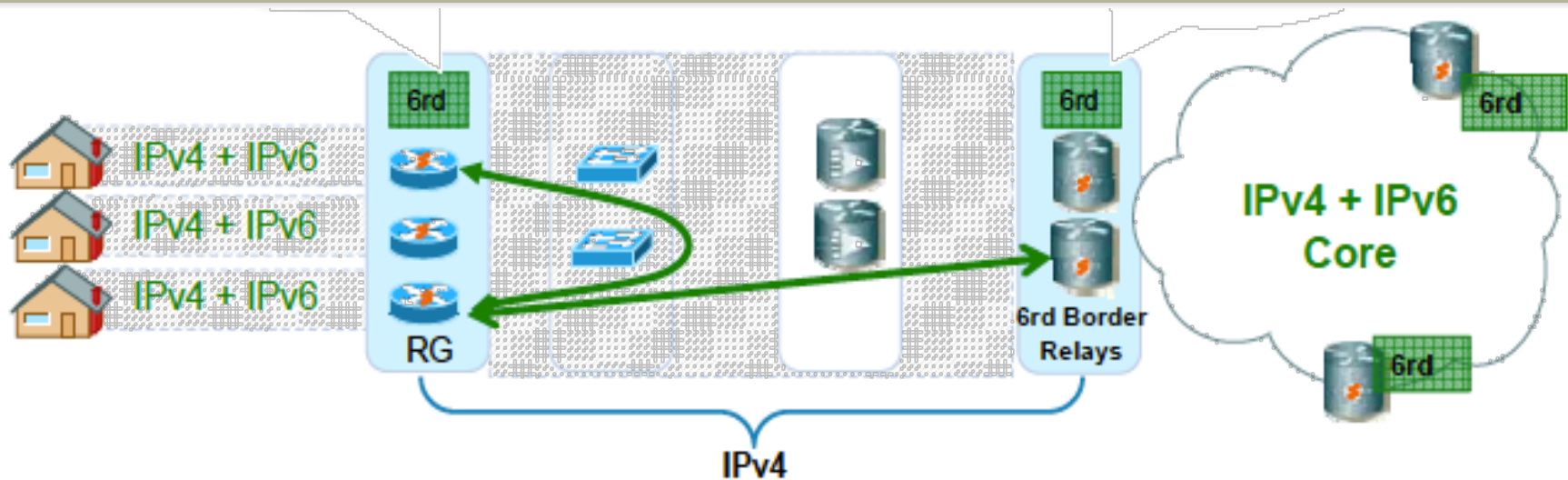**Dual stacked customer network**

CPE

Provider core network

PE

◆ IPv6 is carried within IPv4 packets across the access network

◆ Both the CPE and PE must be dual stack

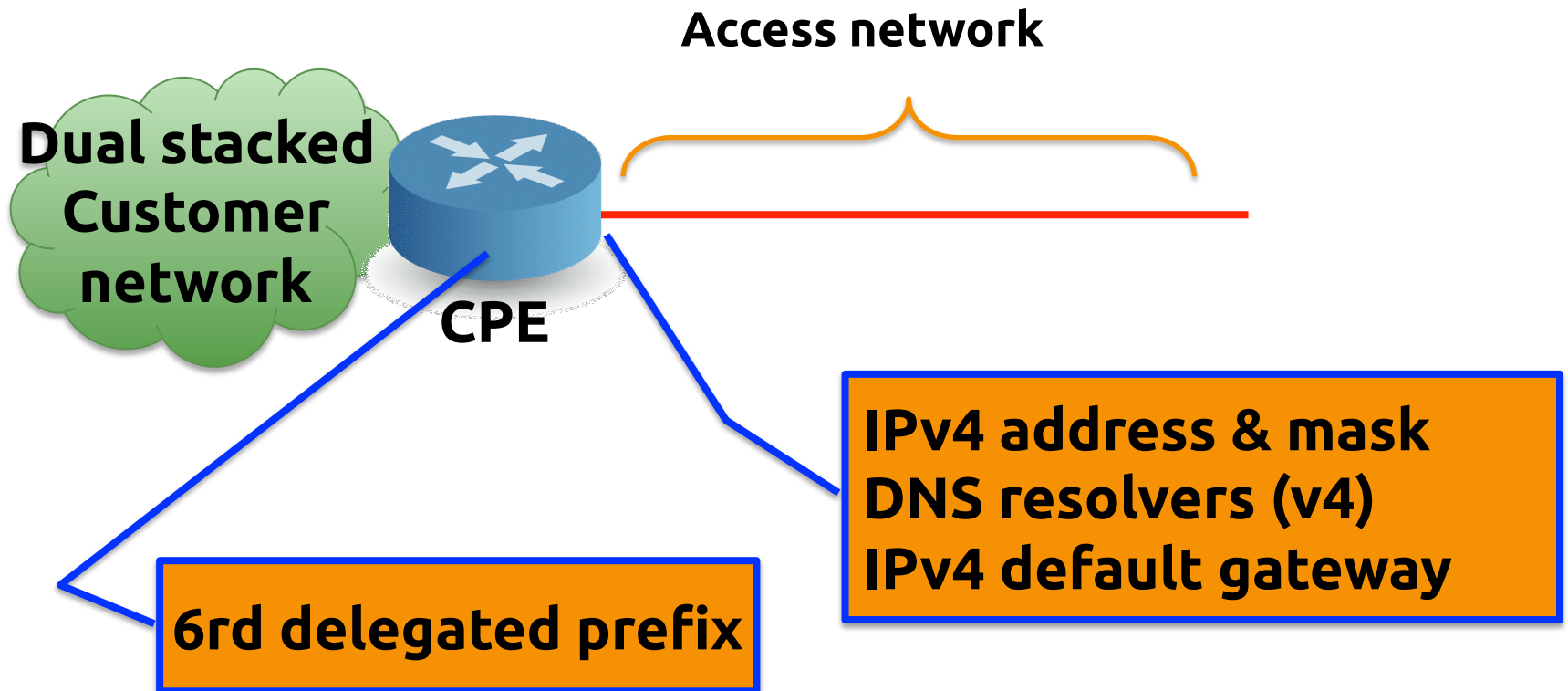◆ Use case: access network elements don't support IPv6

Types of tunnels

◆ Manual
- Requires manual configuration at both ends
- Not scalable for use in access networks

◆ Semi automatic, Tunnel Broker [RFC 3053]
- Remote end is auto-configured, other is manual
- Not scalable for use in access networks

◆ Automatic
- Tunnels are created on demand
- Examples: 6to4, 6rd, ISATAP
- 6rd is currently the most recommended tunnel mechanism

Overview of 6rd

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IPv4 + IPv6

IPv4 + IPv6

IPv4 + IPv6

6rd

RG

6rd

6rd Border Relays

IPv4

IPv4 + IPv6 Core

6rd

6rd

◆ 6rd = IPv6 Rapid Deployment (RFC 5969)

◆ Plug-n-play ease of 6to4 without the drawbacks

◆ Uses an ISP's v6 prefix rather than 2002::/16 thus limiting the operational domain to the ISP's network.
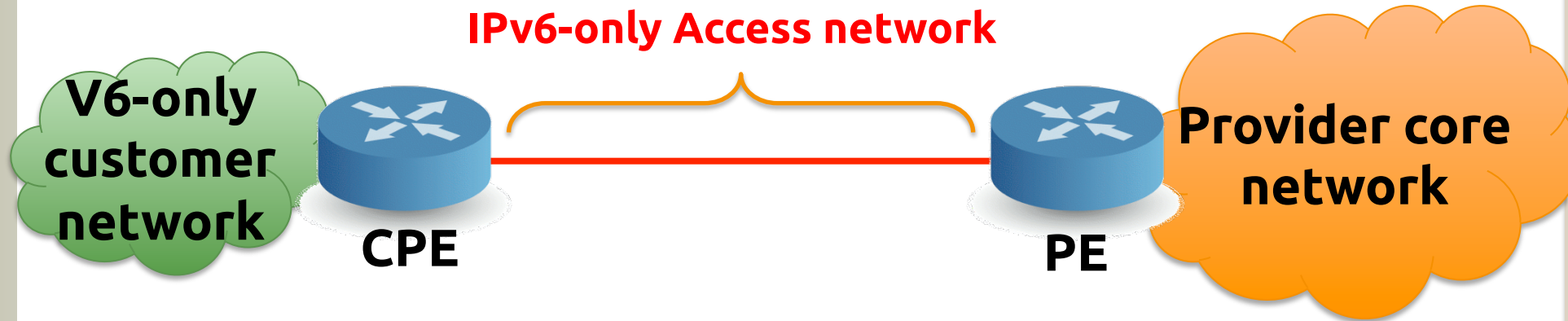
6rd – CPE requirements

Access network

Dual stacked
Customer
network

CPE

6rd delegated prefix

**IPv4 address & mask
DNS resolvers (v4)
IPv4 default gateway**

6rd delegated prefix is derived from the CPE WAN IPv4 address

Overview of NAT64

NAT64 – Infrastructural elements

IPv6-only Access network

V6-only customer network

CPE

Provider core network

PE
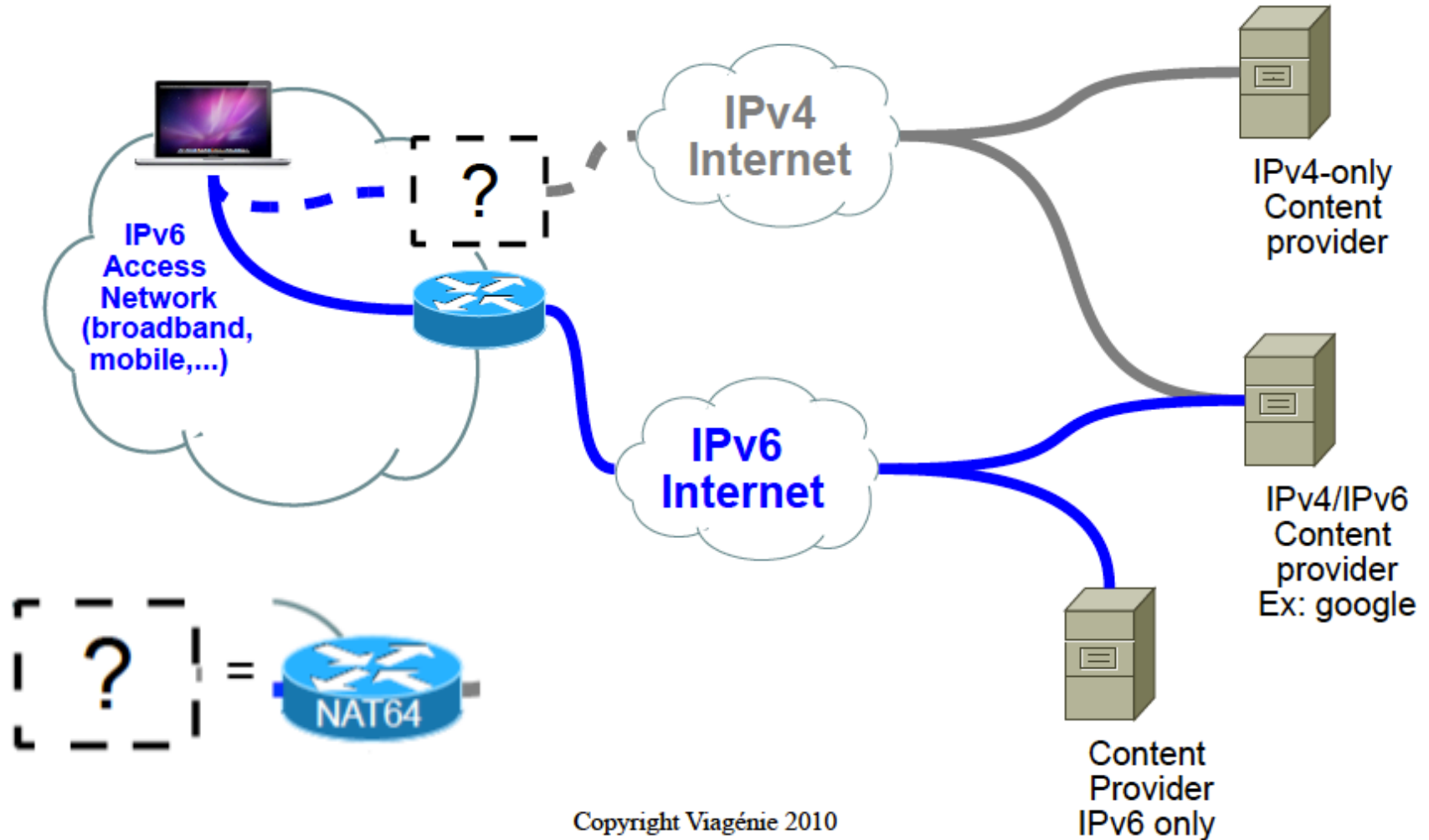
◆ Only mechanism where a v6-only host can talk to a v4 host
◆ Typical use case: greenfield IPv6 only networks
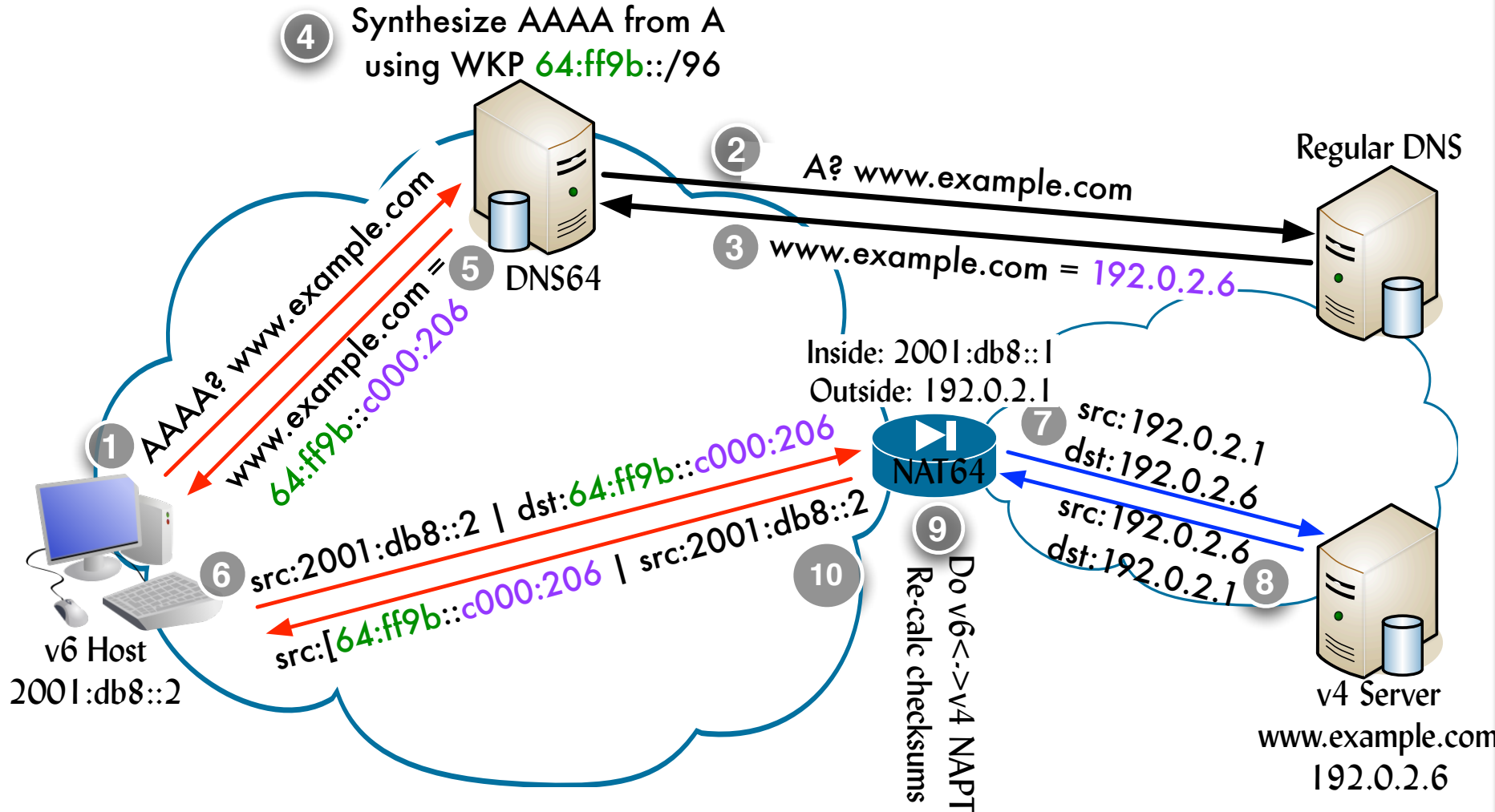
NAT64 & DNS64 – Use Case for Access Networks

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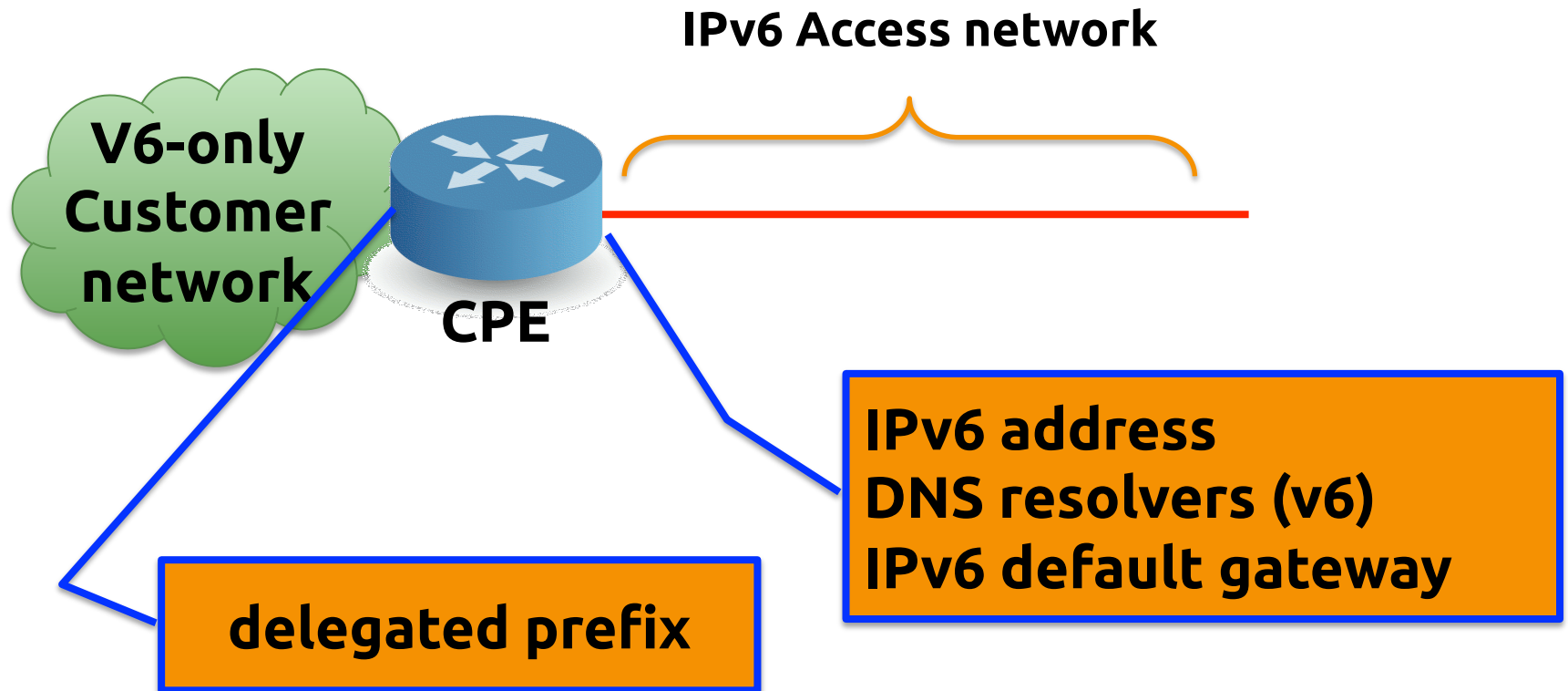
IPv4-IPv6 Translation: NAT64 & DNS64

◆ Only mechanism for getting v4 only speaking to v6 only

◆ Operates in two modes:

  ▪ Stateful - one to many v4 address mapping

  ▪ Stateless - one to one address mapping with only IP & ICMP header translation)

◆ Current Implementations

  ▪ Ecdysis (free and Open Source)

  ▪ MS Forefront UAG DirectAccess

  ▪ Cisco CGv6

NAT64 & DNS64 – How it Works

NAT64 – CPE requirements

IPv6 Access network

V6-only Customer network

CPE

delegated prefix

**IPv6 address
DNS resolvers (v6)
IPv6 default gateway**

The NAT64 functionality is typically at the providers edge

Thank U | Questions ?

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