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Chapter 8

Introduction to IPv6

- Expanded address space
- Globally unique IP addresses
- Fixed header length
- Improved option mechanism
- Address autoconfiguration
- Support for labeling traffic flows
- Security capabilities
- Maximum transmission unit (MTU) path discovery
- Site multihoming

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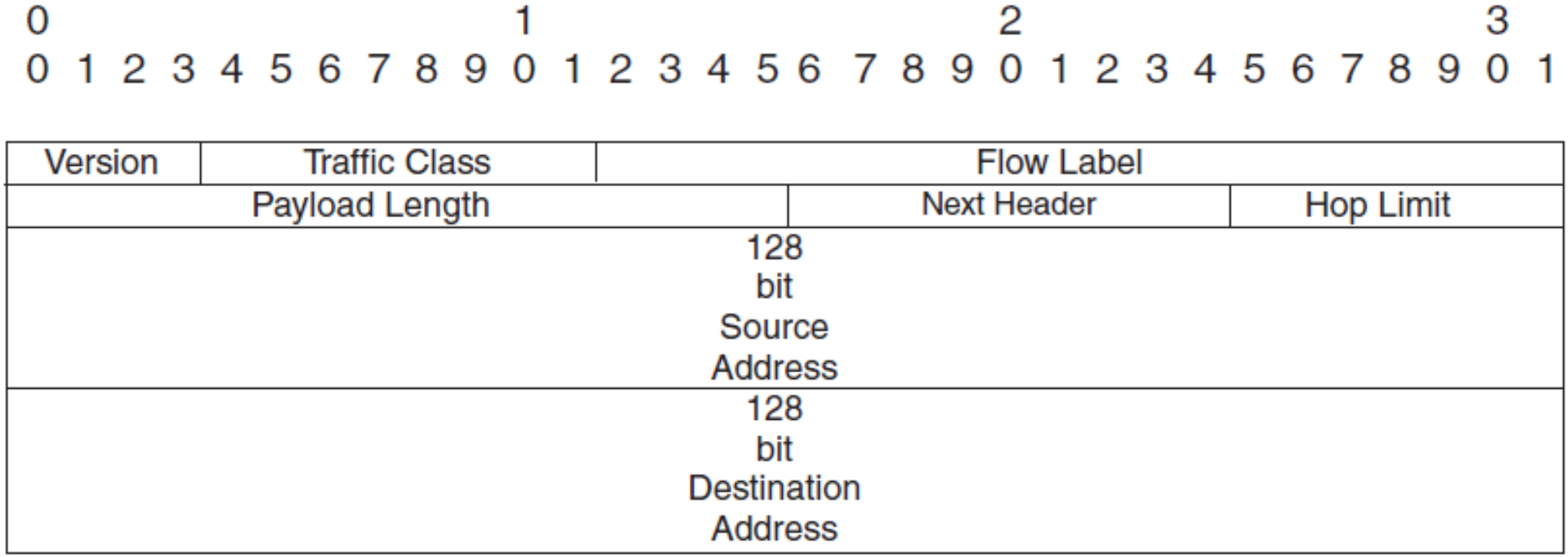
IPv6 Header



34 billion billion billion billion IPv6 addresses

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Chapter 8

IPv6 Address Representation

FE1A:42B9:001B:0000:0000:12D0:005B:06B0

FE1A:42B9:1B:0:0:12D0:5B:6B0

FE1A:42B9:1B::12D0:5B:6B0

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IPv6 Prefix Representation

2001:0000:0000:0ab0:0000:0000:0000:0000/60

2001:0000:0000:0ab0:0:0:0:0/60

2001:0000:0000:ab0::/60

2001:0:0:ab0::/60

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IPv6 Address Types

- **Unicast Address (one-to-one)**
  - **2000::/3-Global Unicast**
- **Anycast Address (one-to-nearest)**
- **Multicast Address (one-to-many)**
  - **FF00::/8-Multicast**
  - **FF01:0:0:0:0:0:0:1—Indicates all-nodes address for interface-local scope.**
  - **FF02:0:0:0:0:0:0:2—All-routers address for link-local.**

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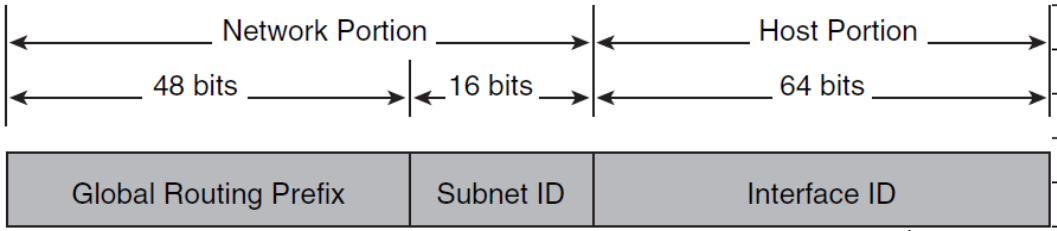
IPv6 Address Allocations



Binary Prefix	Hexadecimal/Prefix	Allocation
0000 0000	0000::/8	Unspecified, loopback, IPv4-compatible
0000 0001	0100::/8	Unassigned
0000 001	0200::/7	Unassigned
0000 010	0400::/7	Reserved for Internetwork Packet Exchange (IPX) allocation
0000 1	0800::/5	Unassigned
0001	1000::/4	Unassigned
001	2000::/3	Global unicast address
010	4000::/3	Unassigned
011	6000::/3	Unassigned
100	8000::/3	Reserved for geographic-based unicast addresses
	A000::/3	Unassigned
	C000::/3	Unassigned
	E000::/3	Unassigned
	F000::/5	Unassigned
	F800::/6	Unassigned
1111 110	FC00::/7	Unassigned
1111 1110 0	FE00::/9	Unassigned
1111 1110 10	FE80::/10	Link-local unicast addresses
1111 1110 11	FEC0::/10	Unassigned; was site-local unicast addresses (deprecated)
1111 1111	FF00::/8	Multicast addresses

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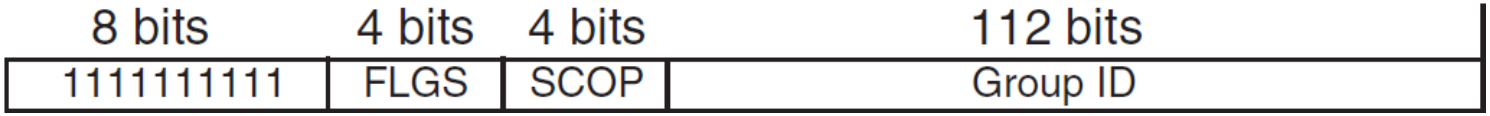
IPv6 Multicast



Multicast Address	Multicast Group
FF01::1	All nodes (node-local)
FF02::1	All nodes (link-local)
FF01::2	All routers (node-local)
FF02::2	All routers (link-local)
FF02::5	Open Shortest Path First version 3 (OSPFv3)
FF02::6	OSPFv3 designated routers
FF02::9	Routing Information Protocol (RIPng)
FF02::A	EIGRP routers
FF02::B	Mobile agents
FF02::C	DHCP servers/relay agents
FF02::D	All Protocol Independent Multicast (PIM) routers

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Chapter 8

ICMPv6

- Echo request
- Echo reply
- Destination unreachable
- Packet too big
- Time exceeded
- Parameter problem
- No route to destination
- Destination administratively prohibited
- Address unreachable
- Port unreachable

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Chapter 8

IPv6 Network Discovery (ND) Protocol

- Address autoconfiguration
- Duplicate address detection
- Prefix discovery
- Parameter discovery
- Address resolution
- Router discovery
- Next-hop determination
- Neighbor unreachability detection
- IPv6 ND
  - Router Advertisement
  - Router Solicitation
  - Neighbor Solicitation
  - Neighbor Advertisement
  - Redirect

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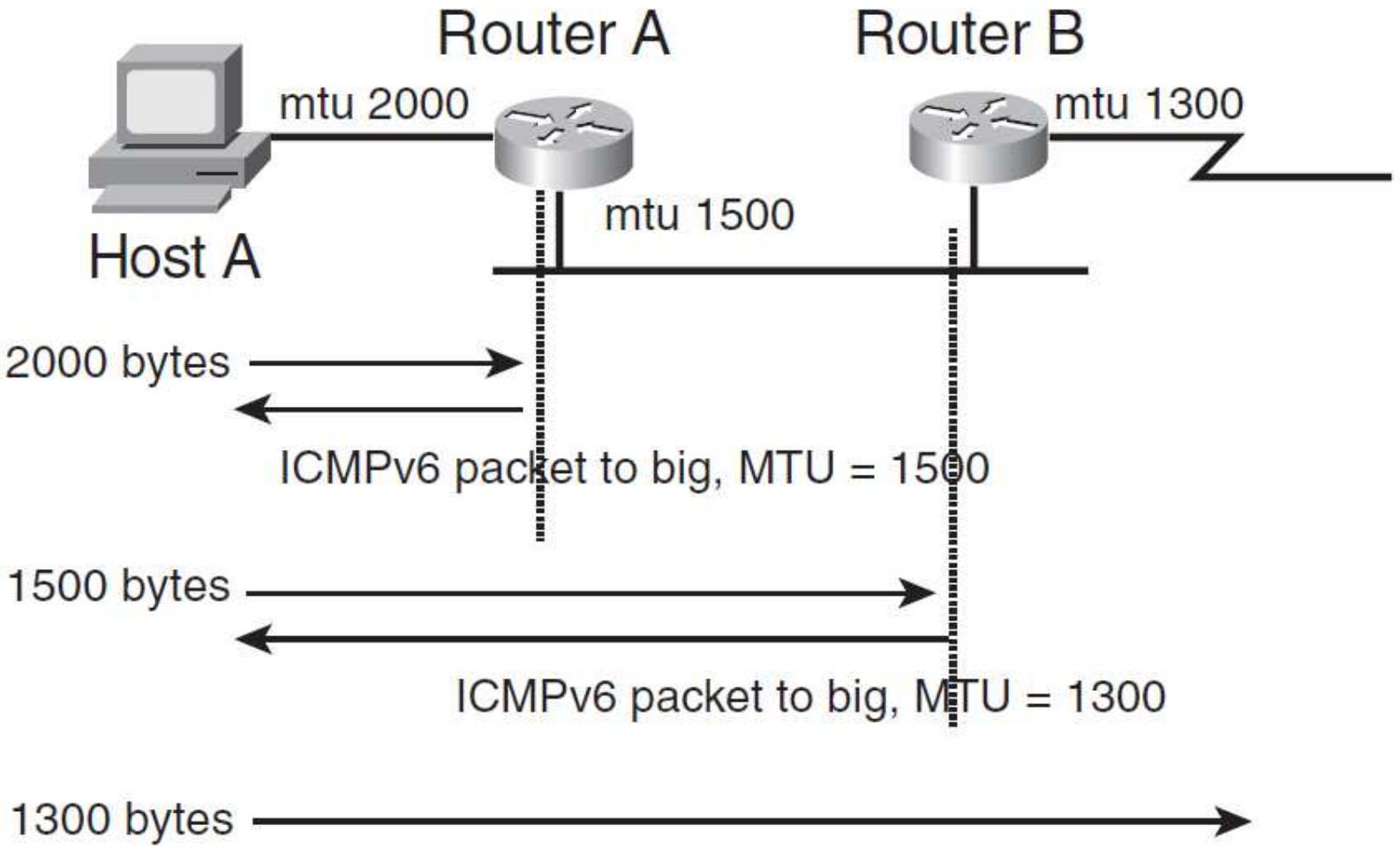
Path MTU Discovery



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IPv6 Routing Protocols

RIPng for IPv6

EIGRP for IPv6

OSPFv3 for IPv6

IS-IS for IPv6

BGP4 Multiprotocol Extensions for IPv6

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Chapter 8

IPv4 to IPv6 Transition Strategies

- **IPv6 over dedicated WAN links**
- **IPv6 over IPv4 tunnels**
- **IPv6 using dual-stack backbones**
- **Protocol translation**

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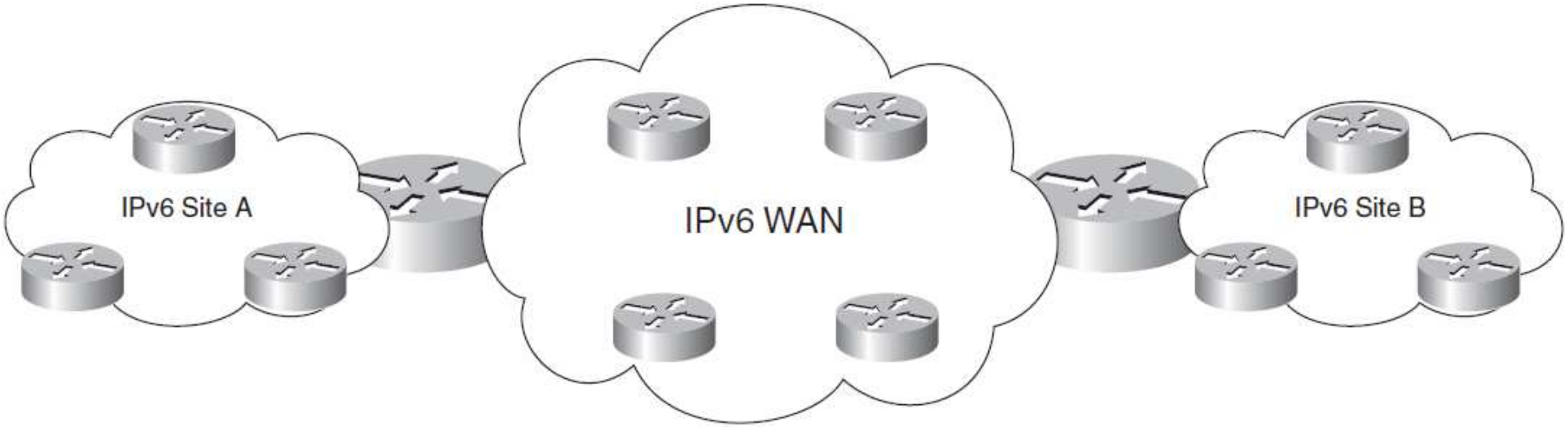
IPv6 over Dedicated WAN Links



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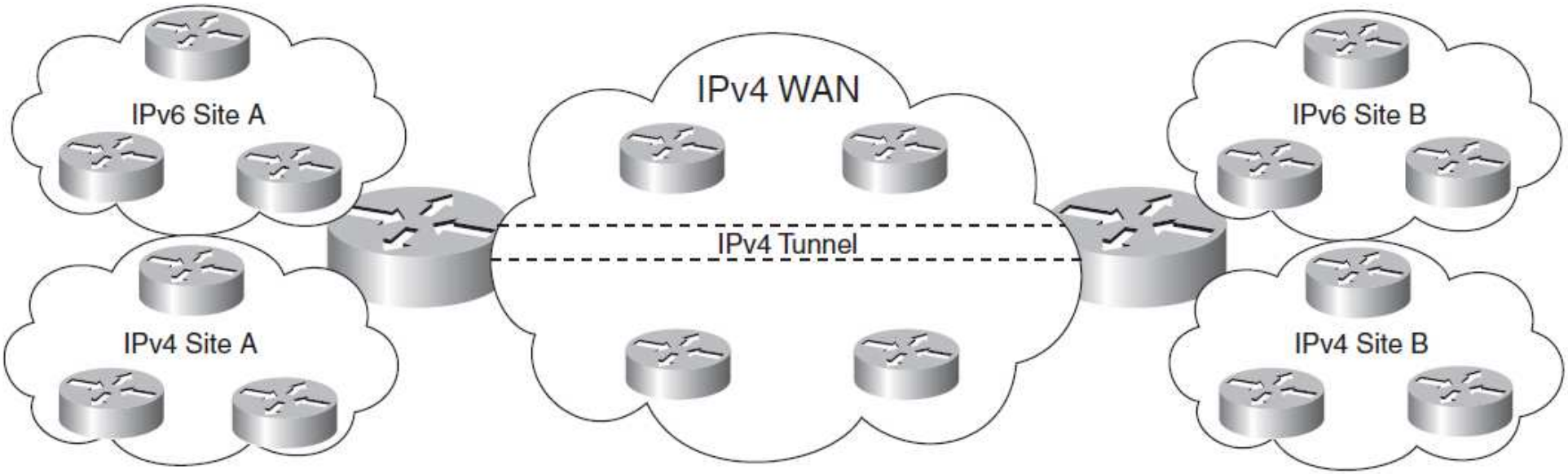
IPv6 over IPv4 Tunnels



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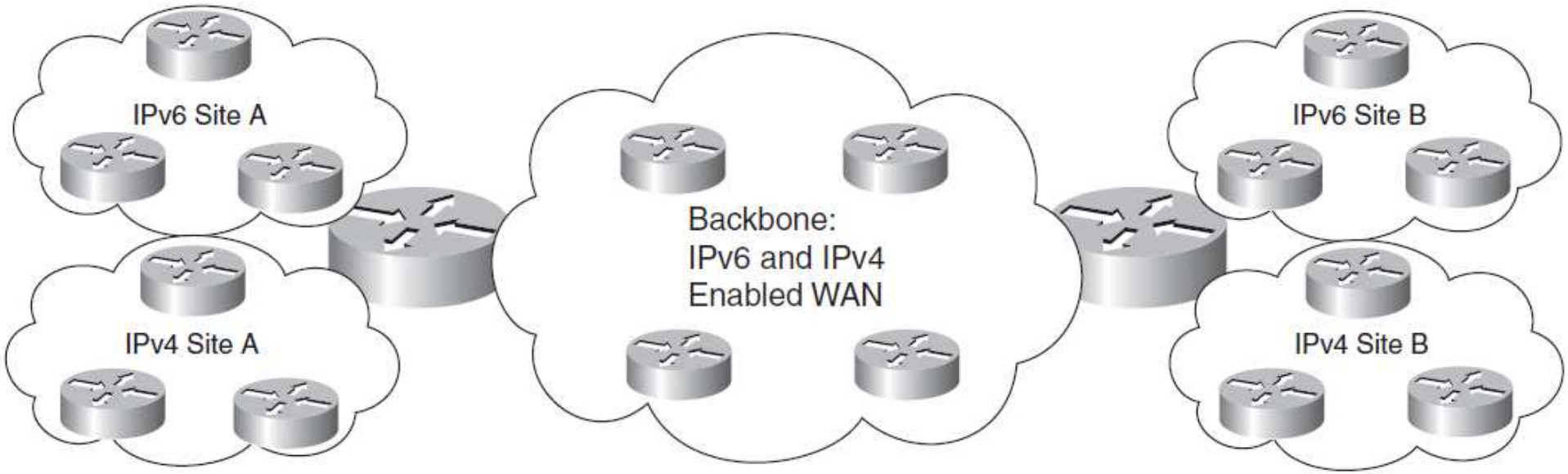
Dual-Stack Backbones



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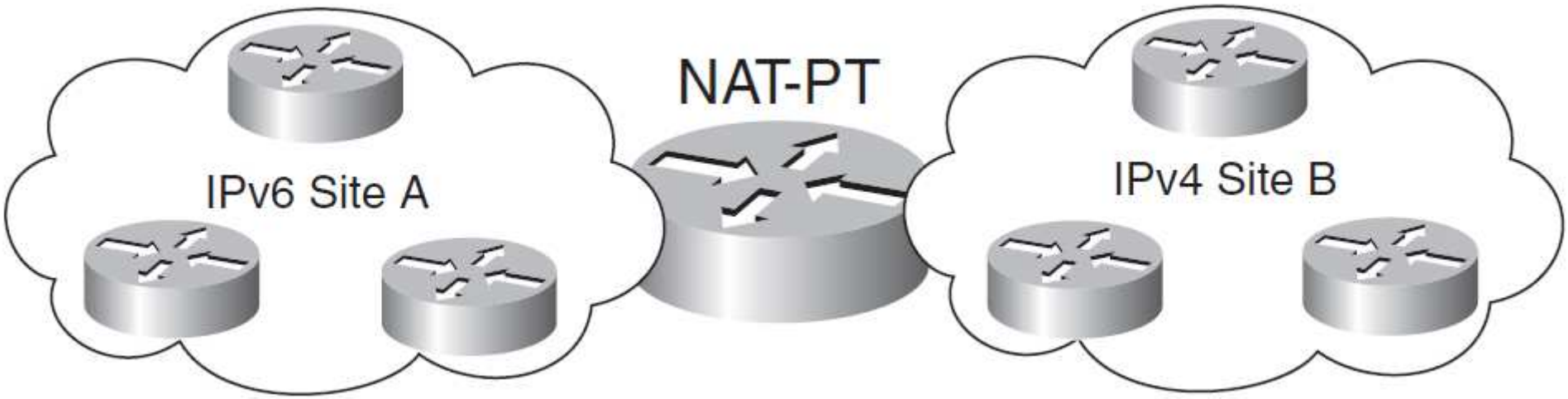
Protocol Translation Mechanisms



Chapter 8

IPv6 Summary

Characteristic	IPv6	IPv4
Address length	128 bits	32 bits
Address representation	Hexadecimal	Dotted-decimal
Header length	Fixed (40 bytes)	Variable
Upper-layer protocols	Next header field	Protocol type field
Link address resolution	ND	ARP
Address configuration	Stateless autoconfiguration or stateful DHCP	Stateful DHCP
DNS (name-to-address resolution)	A6 records	A records
Interior routing protocols	EIGRPv6, OSPFv3, RIPng, IS-IS for IPv6	EIGRP, OSPFv2, RIPv2, IS-IS
Classification and marking	Traffic class and flow label fields, Differentiated Services Code Point (DSCP)	IP precedence bits, type-of-service field, DSCP
Private addresses	Site-local addresses	RFC 1918 private address space
Fragmentation	Sending host only	Sending host and intermediate routers
Loopback address	0:0:0:0:0:0:0:1	127.0.0.1
Address types	Unicast, anycast, multicast	Unicast, multicast, broadcast

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