Testing Solutions

IP Network

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IPv6 Test Methodology

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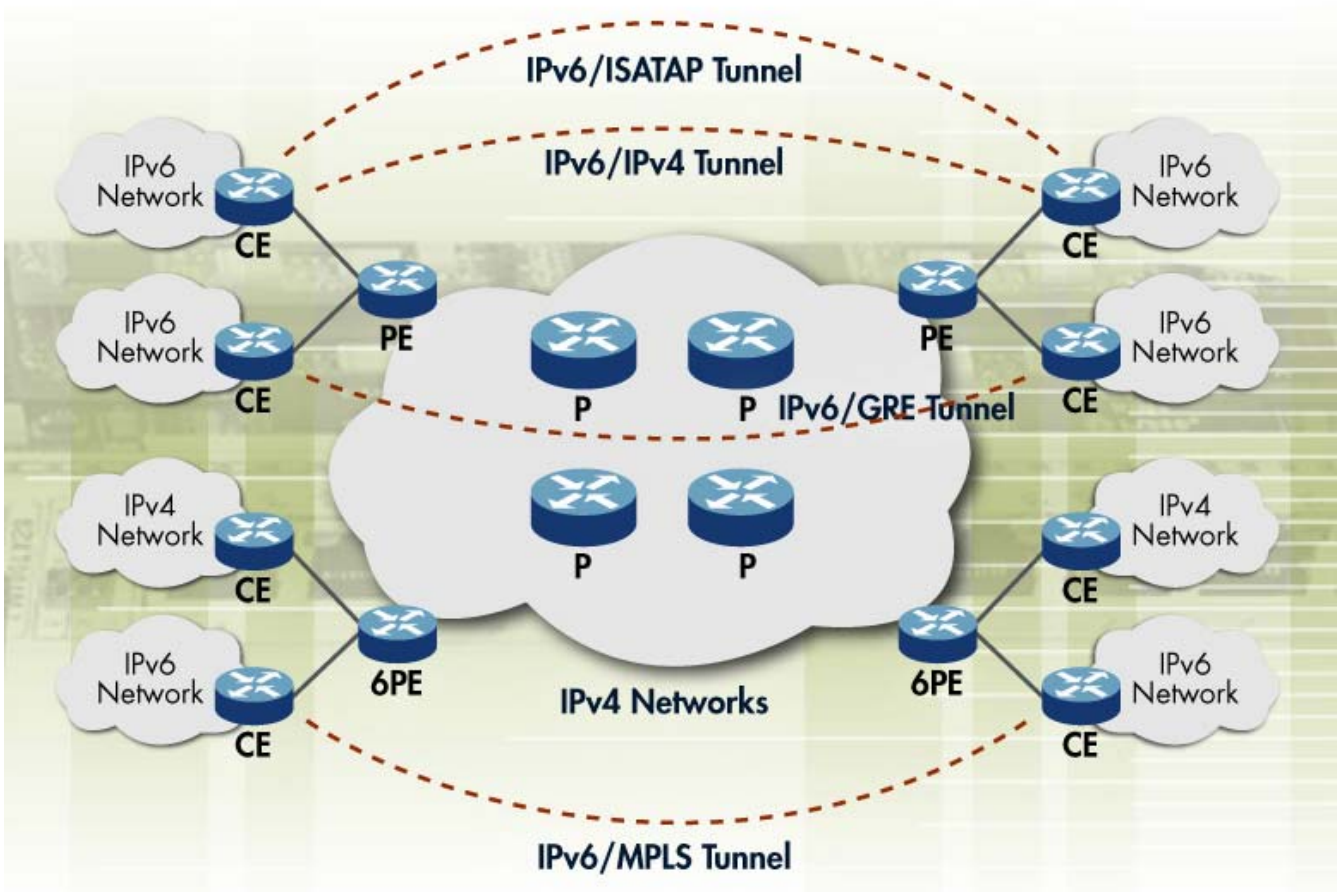
Agenda

- IPv4 to IPv6 Migration Strategy
- IPv6 Conformance Test
- IPv4/IPv6 Forwarding Functional & Performance Test
- IPv6/IPv4 Tunneling Test
- Routing Performance and Scalability Test
- MoonV6 Test Result
- Summary

IPv4 to IPv6 Migration Strategy

Integration and Coexistence with IPv4 Networks

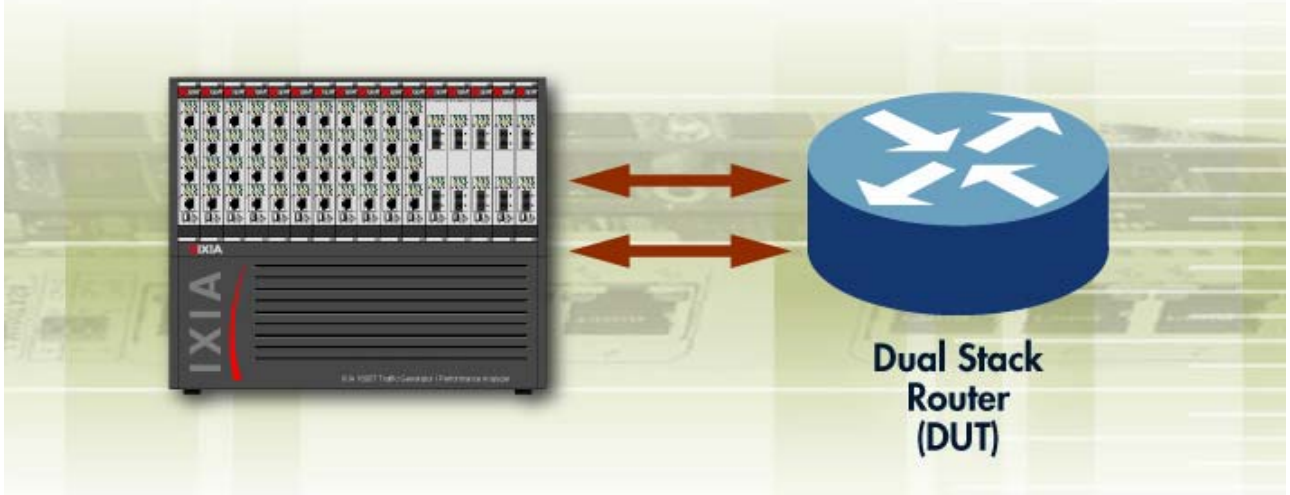
- **Tunneling**
- **Translation – SIIT, NAT-PT, BIS…**
- **Dual-stack Routers and Backbone**



Key Areas for Testing

- **Dual Stack Routers will be heavily used to support:**
  - IP4 and IPv6 Packets forwarding
  - Tunneling
  - Address and protocol translation
  - New routing protocols – OSPFv3, ISISv6, RIPng, BGP4+
- **It is critical to make sure the DS Router is able to:**
  - Forward IPv4/IPv6 packets (forwarding test)
  - Interoperate with other equipment (conformance test)
  - Comply with various IPv6 standards (conformance test)
  - Perform reliably well under heavy loading (performance test)

IPv6 Conformance Test



- **Carefully review IPv6 standards line by line to create a library of automated test cases – IPv6 Conformance Test Suite**
- **Thoroughly verify every single feature defined by RFC**
- **Conduct Conformance Test to assess of interoperability**
- **Find bugs during design cycle, not at customer site!!**
- **Provide baseline for regression test**
- **Help service providers and network operators identify interoperability issues**

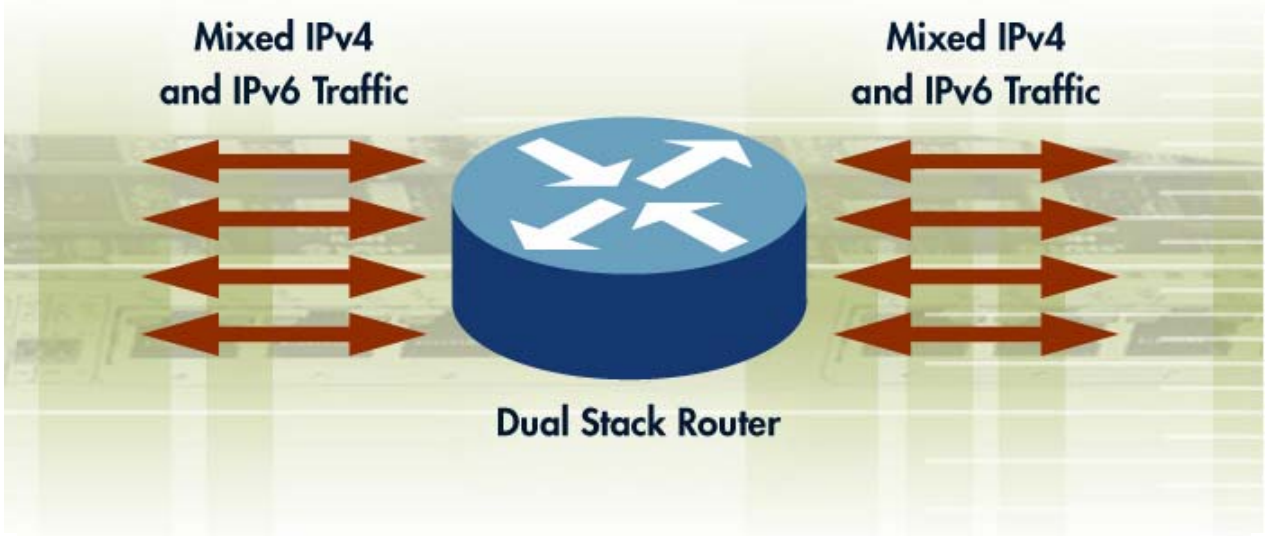
IPv6 Technology – Over 60 RFCs

RFC3056	Connection of IPv6 Domai
RFC3053	IPv6 Tunnel Broker
RFC3041	Privacy Extensions for Sta
RFC3019	IP Version 6 Management Discovery Protocol
RFC2928	Initial IPv6 Sub-TLA ID As
RFC2921	6BONE pTLA and pNLA F
RFC2894	Router Renumbering for IP
RFC2893	Transition Mechanisms for
RFC2874	DNS Extensions to Suppo
RFC2767	Dual Stack Hosts using the
RFC2766	Network Address Translati
RFC2765	Stateless IP/ICMP Transla
RFC2740	OSPF for IPv6
RFC2732	Format for Literal IPv6 Ad
RFC2711	IPv6 Router Alert Option
RFC2710	Multicast Listener Discove
RFC2675	IPv6 Jumbograms
RFC2590	Transmission of IPv6 Pack
RFC2553	Basic Socket Interface Ext
RFC2545	Use of BGP-4 Multiprotoc
RFC2529	Transmission of IPv6 over
RFC2526	Reserved IPv6 Subnet An
RFC2497	Transmission of IPv6 Pack
RFC2492	IPv6 over ATM Networks
RFC2491	IPv6 over Non-Broadcast
RFC2474	Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers
RFC2473	Generic Packet Tunneling in IPv6 Specification
RFC2472	IP Version 6 over PPP
RFC2471	IPv6 Testing Address Allocation
RFC2470	Transmission of IPv6 Packets over Token Ring Networks
RFC2467	Transmission of IPv6 Packets over FDDI Networks
RFC2466	Management Informa
RFC2465	Management Informa General Group
RFC2464	Transmission of IPv6
RFC2463	Internet Control Mess Version 6 (IPv6) Spec
RFC2462	IPv6 Stateless Addre
RFC2461	Neighbor Discovery f
RFC2460	Internet Protocol, Ver
RFC2454	IP Version 6 Manage
RFC2452	IP Version 6 Manage Protocol
RFC2450	Proposed TLA and N
RFC2428	FTP Extensions for IPv6 and NATs
RFC2406	IP Encapsulating Security Payload (ESP)
RFC2402	IP Authentication Header
RFC2401	Security Architecture for the Internet Protocol
RFC2375	IPv6 Multicast Address Assignments
RFC2374	An IPv6 Aggregatable Global Unicast Address Format
RFC2292	Advanced Sockets API for IPv6
RFC2185	Routing Aspects of IPv6 Transition
RFC2080	RIPng for IPv6
RFC2030	Simple Network Time Protocol (SNTP) Version 4 for IPv4, IPv6 and OSI
RFC1981	Path MTU Discovery for IP version 6
RFC1924	A Compact Representation of IPv6 Addresses
RFC1888	OSI NSAPs and IPv6
RFC1887	An Architecture for IPv6 Unicast Address Allocation
RFC1886	DNS Extensions to support IP version 6
RFC1884	IP Version 6 Addressing Architecture
RFC1881	IPv6 Address Allocation Management
RFC1810	Report on MD5 Performance
RFC1809	Using the Flow Label Field in IPv6

Sample IPv6 Test Suites

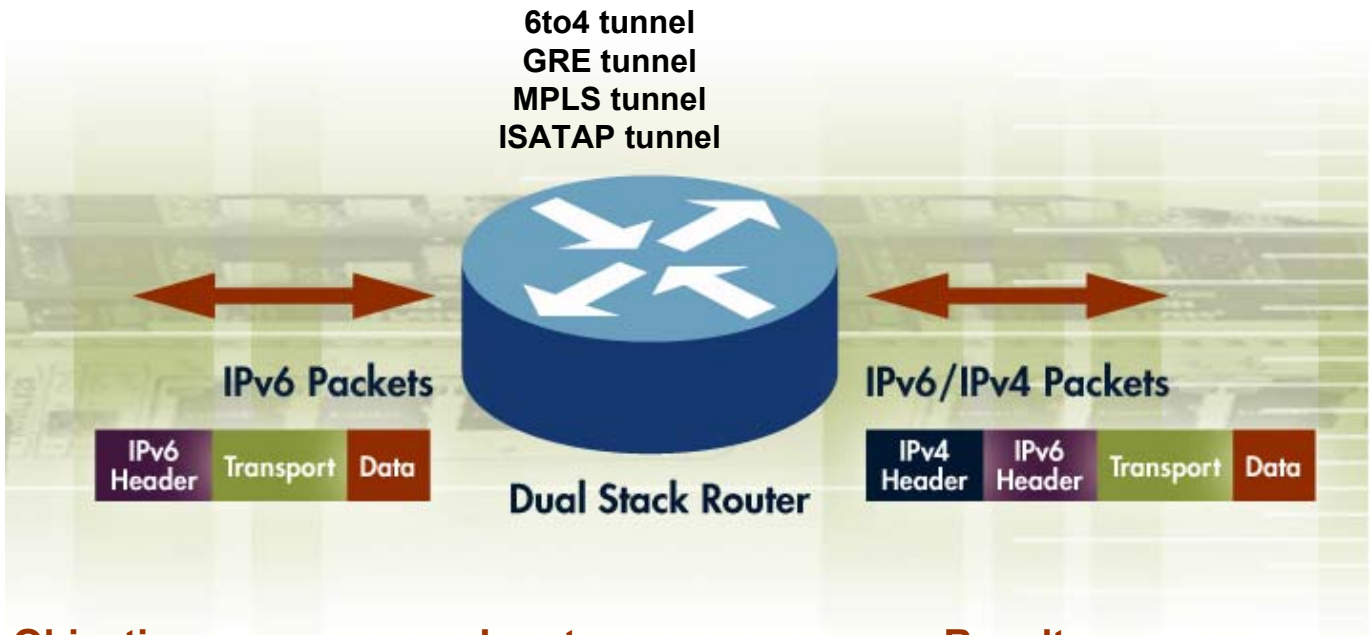
- **Important RFCs customers wish to test**
  - IPv6 (RFC 2460)
  - Transmission of IPv6 Packets over Ethernet Networks (RFC 2464)
  - IPv6 over PPP (RFC 2474)
  - ICMPv6 (RFC 2463)
  - Stateless Address Autoconfiguration (RFC 2462)
  - Path MTU Discovery (RFC 1981)
  - Neighbor Discovery Protocol (RFC 2461)
  - Multicast Listener Discovery (RFC 2710)
  - Tunneling (RFC 2529, RFC 2893, and RFC 3056)
  - We implemented the test suite with 572 test cases!!
- **IPv4 and Routing Test Suites(IPv6 & IPv4) are also available for testing DS routers**

Forwarding Functionality and Performance



	Objectives	Input	Results
Functionality	Verify the DUT can deliver IPv4 and IPv6 packets correctly	Packet header and payload Packet length Offered load	Header and payload integrity check Packet loss
Performance	Characterize the performance of DUT in simultaneous forwarding of IPv4 and IPv6 traffic	Packet length Offered load IPv6/IPv4 mixed ratio	Packet loss Throughput and latency

Tunneling Functionality



Objectives

Verify correct encapsulation and decapsulation between IPv6 and IPv4

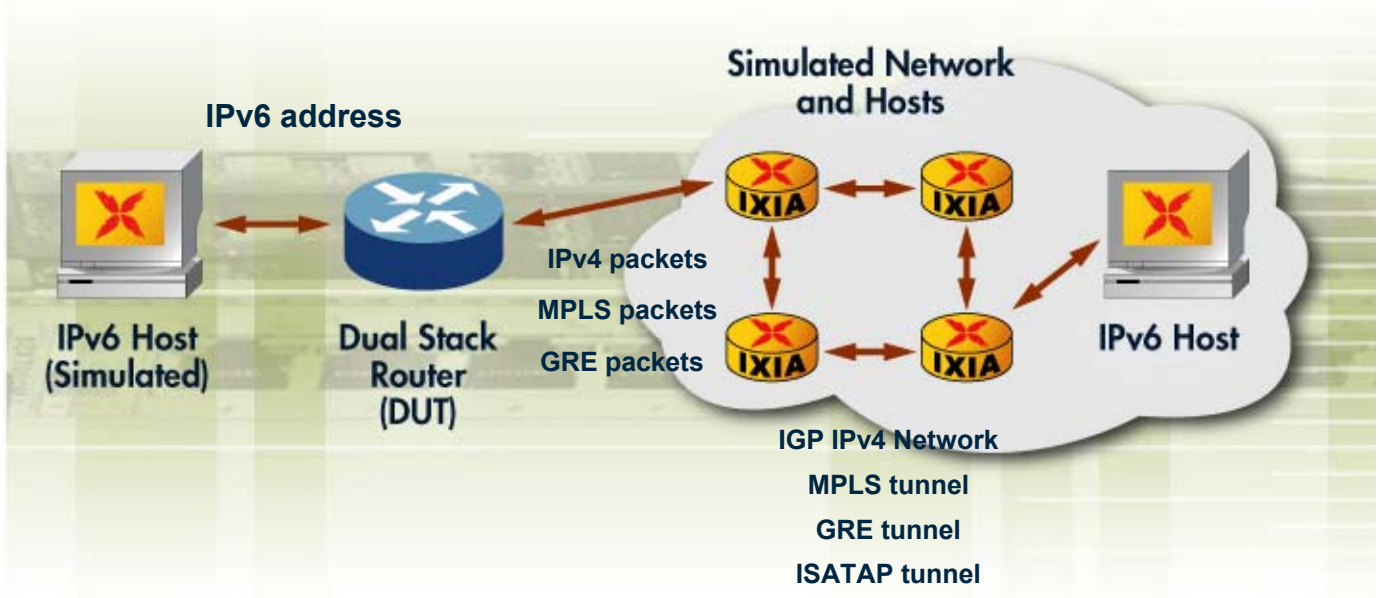
Input

Offered load
Packet length
Packet headers and payload
Address range

Results

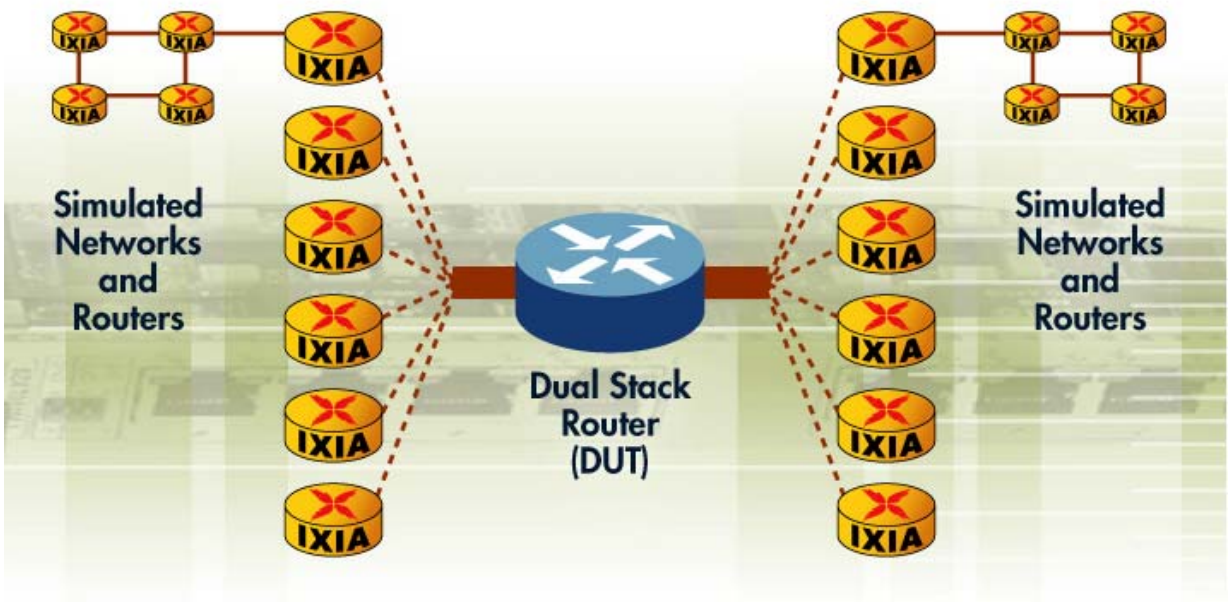
Header and payload integrity check
Packet loss
Address translation

Tunneling Performance



Objectives	Input	Results
Characterize performance in encapsulating and decapsulating IPv6 tunneled traffic	Offered load Packet size Address range	Packet loss Throughput Latency

Routing Performance and Scalability



Objectives

- Forwarding Information Base
- Routing Scalability
- Route Convergence
- Routing Stability

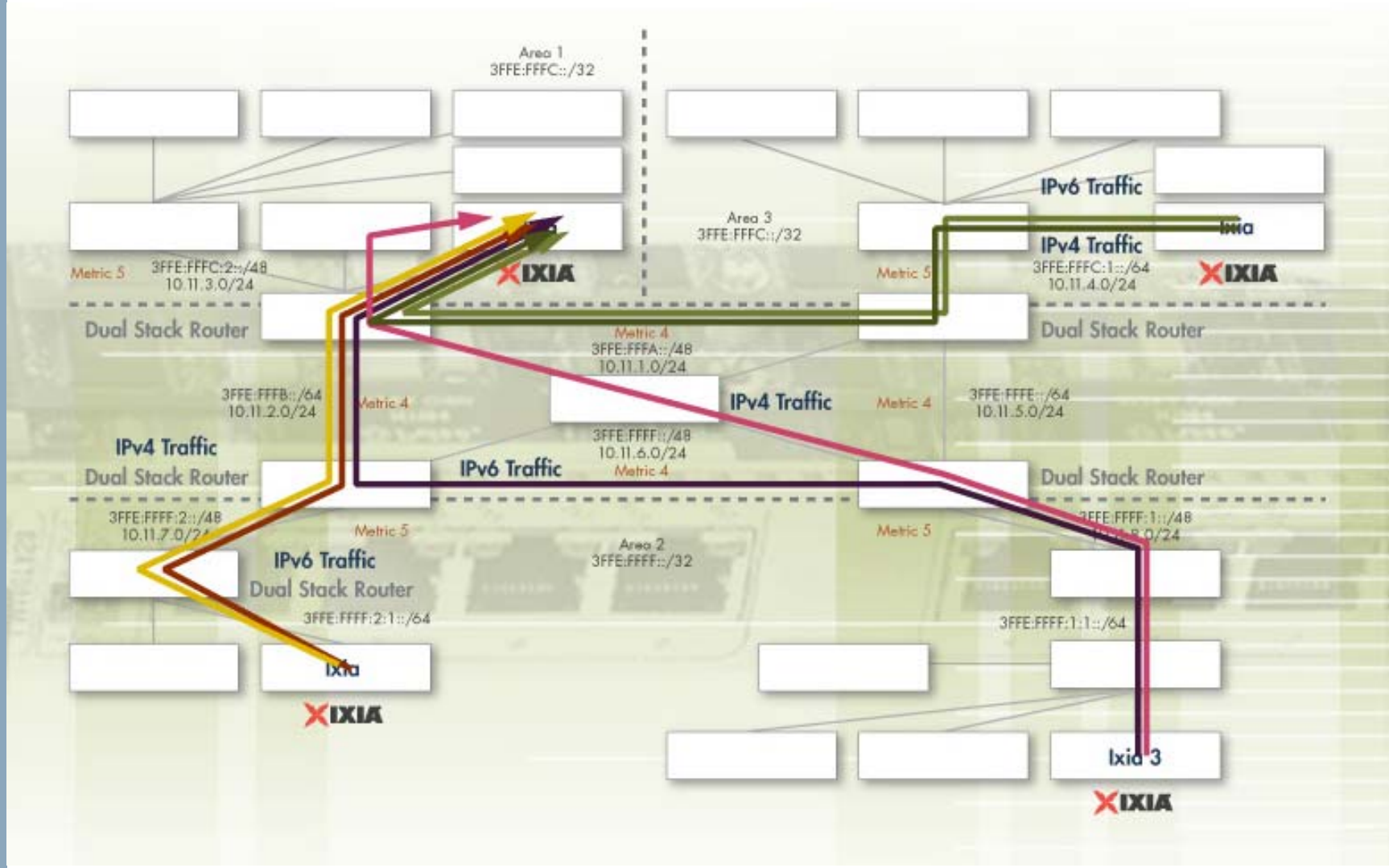
Input

- Size of simulated network
- Flapped routes, frequency
- Number of routes
- Number of LSAs/LSPs
- Offered load
- Packet size

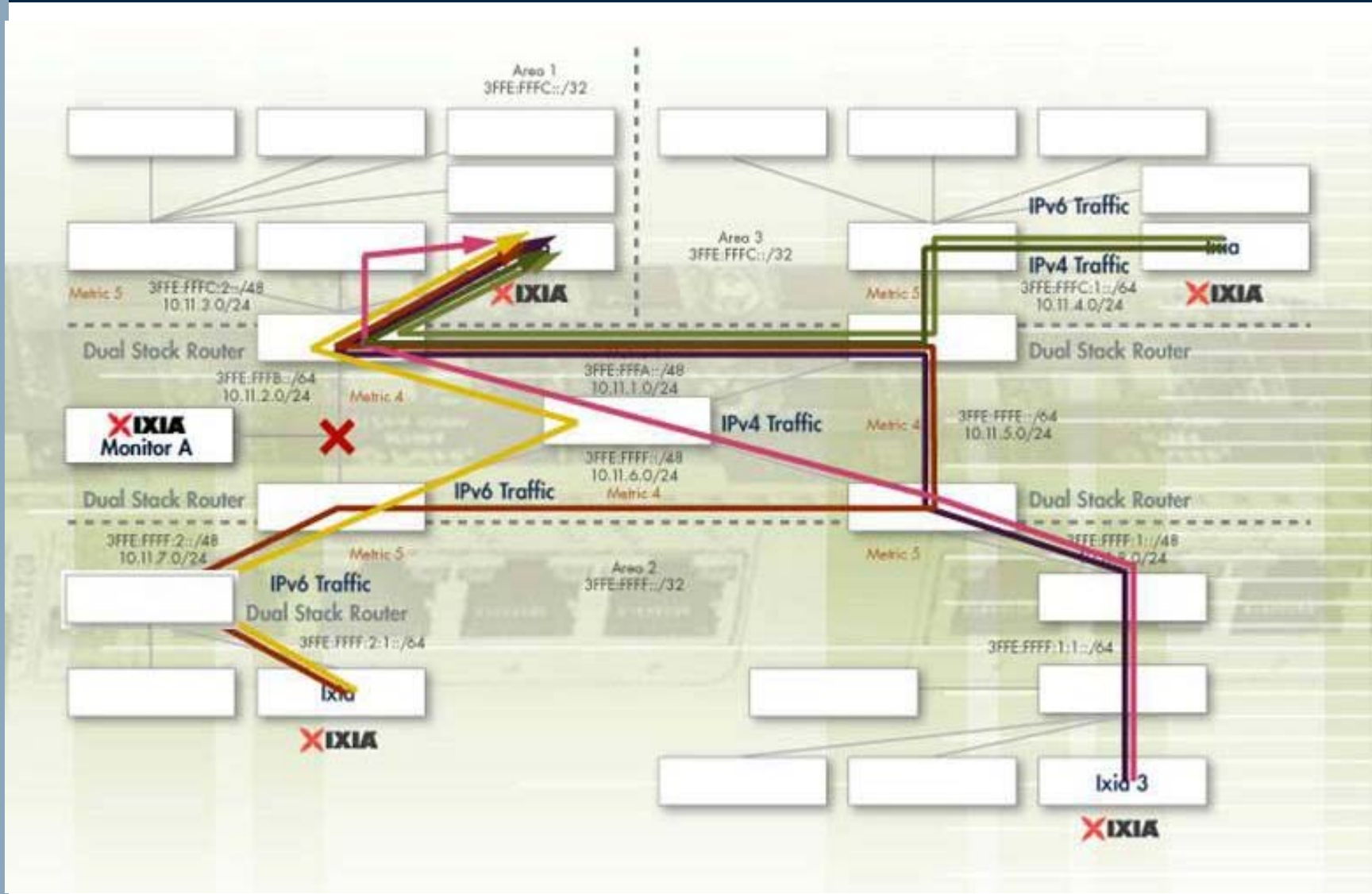
Results

- Packet loss

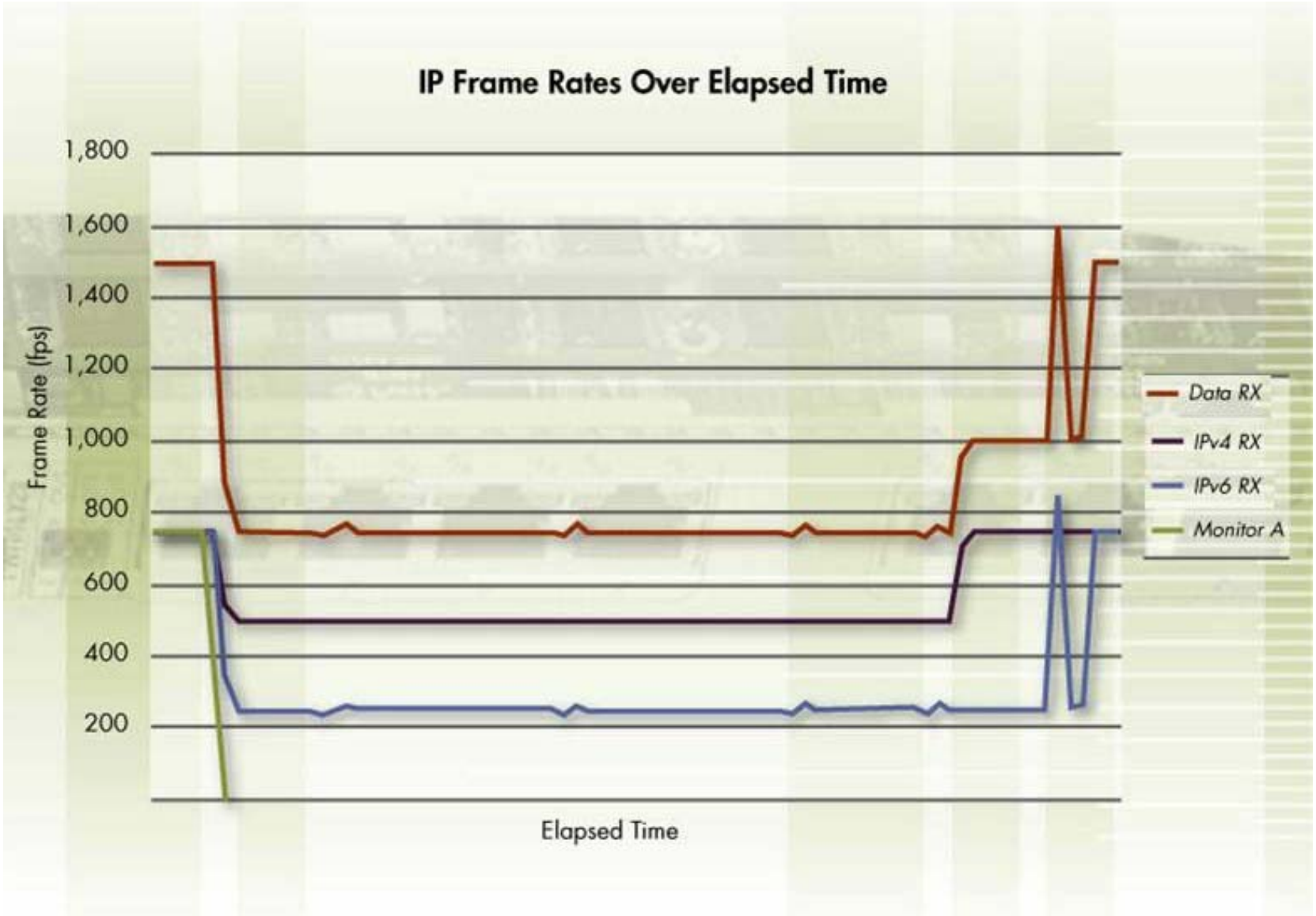
MoonV6 Test Configuration



MoonV6 Test Configuration – After Link Down



Test Result – Convergence



Summary

- **DS Routers will carry many new features:**
  - Tunneling
  - Translation
  - New Routing Protocols
- **Conformance test is critical to assess interoperability between vendor's IPv6 design**
- **Proper functional and performance tests are required to verify the new IPv6 data plane of DS Router**
- **The new routing protocols need to be characterized for performance and scalability**