An Analysis of Network Convergence Time Between IPv4 Routing Protocols; RIP, EIGRP, OSPF, and their IPv6 Equivalents.

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Abstract

As IPv4 is nearing the end of its ability to meet the needs of the growing network community, IPv6 has been selected as the protocol which will meet the demands of future network growth.

Every new technology brings about a period of uncertainty as businesses, operators, and users transition from the previous technology to the new, and only through research, experimentation and implementation can this uncertainty be removed.

The purpose of this project is to determine if there is a difference in the time required to restore user communications after a link failure has occurred. The IPv4 versions of RIP, EIGRP and OSPF will be evaluated against their IPv6 equivalents.

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List of Abbreviations

AfriNIC - African Network Information Centre

APNIC – Asia Pacific Network Information Centre

ARIN – American Registry for Internet Numbers

CIDR – Classless Inter-domain Routing

DUAL – Diffusing Update Algorithm

DR – Designated Router

EIGRP – Enhanced Interior Gateway Routing Protocol

FHRP – First Hop Redundancy Protocol

IANA – Internet Assigned Numbers Authority

IP – Internet Protocol

IPSec – IP Security

ISP – Internet Service Provider

LACNIC – Latin America and Caribbean Network Information Centre

LSA – Link State Advertisement

MTU – Maximum Transmission Unit

NAT – Network Address Translation

NDP – Neighbor Discovery Protocol

OSPF – Open Shortest Path First

PAT- Port Address Translation

PDM – Protocol Dependent Module

QoS – Quality of Service

RIP – Routing Information Protocol

RIPE NCC – Réseaux IP Européens Network Coordination Centre

RIPng – Routing Information Protocol Next Generation

RIR – Regional Internet Registry

RTE – Route Table Entry

RTP – Reliable Transport Protocol

TLV – Type Length Value

UPnP – Universal Plug and Play

Introduction

In January of 1980, the original standard for IPv4 was released as RFC760. It was later updated in September, 1981 in RFC 791 [1]. This was an inconspicuous beginning for IP, the protocol which would become fundamental to global communication, business enterprise, and consumer lifestyle.

IPv4 was originally developed for ARPANET [2], and has evolved over the last 30 years. It is now becoming what is known as the "*Internet of things*" or the "*Internet of Everything*", a concept which entails connecting people, computers, mobile devices, vehicles, appliances and more. [1]

IPv4 has been modified and its functionality extended with technologies such as Network Address Translation (NAT) and Classless Inter-domain Routing (CIDR), however, IPv4 has a number of limitations which need to be addressed if the "*Internet of things*" is to fully meet its potential. The most significant of these limitations is the fact that IPv4 is running out of available addresses for new devices. [2]

February 3, 2011 marked the beginning of the end of IPv4 as IANA allocated the last 5 of the /8 IPv4 address ranges to the five Regional Internet Registries; ARIN, RIPE NCC, APNIC, LACNIC, and AfriNIC. [2] As of January 18, 2014 each of the RIRs documented reserves of IPv4 /8 address ranges are as follows;

RIR	Projected exhaustion date	Current Remaining /8s
APNIC	April 19, 2011	0.8107
RIPE NCC	September 14, 2012	0.8493
LACNIC	January 10, 2015	1.3017
ARIN	February 13, 2015	1.4053
AfriNIC	January 23, 2022	3.3487

Table 1 RIR IPv4 Address Exhaustion

Note: "Exhaustion is defined here as the time when the pool of available addresses in each RIR reaches the threshold of no more general use allocations of IPv4 addresses"

Source http://www.potaroo.net/tools/ipv4/index.html

The exhaustion of the IPv4 address space was recognized as a problem in the early 1990s and the development of the next generation of IP, now known as IPv6, began. IPv6 was developed to address the limitations of IPv4 such as limited addressing space, low support for security and limited Quality of Service (QoS) support. [3].

The migration to IPv6 has been undergoing for some time; however the migration officially began on June 6, 2012, a day known as "World IPv6 Launch" day. This day saw major ISP's, manufacturers for business and consumer products, as well as major content providers permanently enable IPv6. [4]

Any new technology is going to introduce new questions and uncertainty as a migration from old to new occurs. Questions such as: what content is available for IPv6? What will this do to my applications? How does this affect my server or network performance? What happens to my IPv4 network? What are the benefits to my company? [4] [5]. The purpose of this project is to determine if there is difference in the time required to restore user communications via an alternative path, after a link failure has occurred, as compared between the IPv4 routing protocols Routing Information protocol (RIP), Enhanced Interior Gateway Routing Protocol (EIGRP), and Open Shortest Path First (OSPF) and their IPv6 equivalents. A transition implementation of OSPF in a dual stack configuration will also be examined.

Network Convergence

"The process of bringing all route tables to a state of consistency is called convergence. The time it takes to share information across a network and for all routers to calculate the best paths is the convergence time." [6] The ability of routers to detect a network event such as a link failure, propagate the event to all affected routers, process the event and then make a forwarding decision based upon the new information is critical to network convergence and the continued flow of information [7] [8]. Many studies have been conducted to address the issues that IPv4 and IPv6 routing protocols present. These issues include such topics as protocol convergence time, router forwarding decision time, and the effects of network events such as link failure, delay or traffic fluctuations. The following section will provide a brief synopsis of the related work as it applies to network convergence and draw together observations to provide further framework for this project.

The papers [9] [10] [11] [12] [13] [14] [15] [16], all examine the IPv4 implementations of RIP, EIGRP and OSPF, and discuss the convergence time of the protocols in their specific scenarios, which may include, different topologies, different layer 1&2 technologies, as well as different network sizes. All but one of the papers performed their tests using a version of OPNET, whereas Dwyer and Jasani [9] performed a physical network build. The results from the convergence tests from these projects are varied, as would be expected from the different scenarios that each were investigating. EIGRP had convergence times from a low of 1.3 ms to a high of 43 s; OSPF ranged from 542 ms to 52 s; and RIP ranged from 18 s to 50 s. These do provide a general idea of a performance

range for the IPv4 routing protocols, across a variety of situations, unfortunately none of these experiments examined IPv6.

The papers [17] [18] [19] [20] [8], examine implementations of EIGRP and OSPF in both the IPv4 environment and the IPv6 environment. OPNET and other network simulators were the most common tools for examining network implementations. RIP was not examined in any of these projects, even though it has a viable IPv6 implementation. Conclusions regarding the convergence time of the IPv6 routing protocols is pure guesswork as insufficient information regarding this process was available, as only two of the reports examined the concept. Haihong and Xiaoling determined in their experiment that the OSPF convergence time was about 59 s for both IPv4 and IPv6. [20] The Cisco presentation, "Which Routing Protocol", showed differences between the OSPF IPv4 and IPv6 implementation convergence times however they had tuned the IPv4 routing protocols timers [8], so this will have decreased the convergence time for IPv4, while no equivalent tuning was performed on the IPv6 routing protocols.

Network and routing protocol convergence is a complex issue with many different factors which can affect a network. No one research paper, project, or experiment will be able to address all of the issues that the conversion from IPv4 to IPv6 presents. Further areas of study that will contribute to the body of knowledge for IPv6 network convergence include:

- The effect of network topologies such as rings, meshes, and hub & spokes.
- The scale of the network in question and the number of entries in a route table.
- Resource utilization, memory, CPU, bandwidth, and routing protocol traffic are all protocol dependent, and will affect the performance of IPv6. [15]
- Memory architecture – determining if 64 or 128 bit architectures provide significant improvements to how routers handle the 128 bit addresses of IPv6.
- EIGRP has two very distinct behaviours, towards network convergence, if a feasible successor is present or if it must rely upon DUAL queries.
- The effects of other optimizations such as protocol timers, or load balancing features such as variance and FHRP must be studied.
- The effects of delay, traffic fluctuations and bandwidth limitations must be examined and understood. [21]
- Data such as web traffic and email traffic have very different characteristics from voice over IP traffic, which is different again from video traffic. [12]
- IPv4 and IPv6 will be coexisting on the network together for some time, and numerous transition technologies such as dual stack, tunneling and NAT-PT, have been developed to assist in the migration from IPv4 to IPv6. [22]

- OSPF and EIGRP both rely upon a hello protocol to maintain neighbor adjacencies, and the time to detect a link failure is a critical part of the network convergence process. BFD (Bidirectional Forwarding Detection) is proposed as a solution to the short comings of hello protocols. [7]
- Address families – both EIGRP and OSPF are in the process of implementing address families which will allow one process (OSPFv3 or EIGRPv6) to handle both IPv4 and IPv6 addresses, as opposed to running separate processes for IPv4 and IPv6 addresses. [23] [24]

IPv4 is the core protocol of today's Internet and data communication networks; any changes to it are going to introduce a cascade effect on all of the interconnected technologies. The list of future areas of study is vast and hence only a small number of potential topics were presented in this list.

A Comparison of Internet Protocol IV and VI

IPv6 was never intended to revolutionize the internetworking world, but instead it was designed to improve on the functions of IPv4, and to provide newer capabilities. [22] IPv6 was designed to improve on a number of the limitations of IPv4; limitations such as address space, connectivity issues, security and quality of service, as well as route table scalability, and header inefficiency.

Address Space - IPv4 supports a maximum of 2^{32} or approximately 4.3 billion addresses. Many of these addresses were unavailable due to the design of IPv4. Addresses above 224.0.0.0 were either multicast addresses or reserved for experimental purposes. An entire /8 address range (~16.8 million addresses) was reserved for loopback address functionality. IPv6 solves the address exhaustion problem by providing an address space of 2^{128} addresses or ~ $3.4*10^{38}$ addresses. To put this into perspective, if we assume a world population of seven billion people, two /64 IPv6 network addresses will provide the equivalent address space of the entire IPv4 internet to each and every single individual on the planet, with enough reserve space for another billion people.

Connectivity Concerns - NAT/PAT in combination with RFC 1916 private addresses was one of the most successful methodologies which helped delay the exhaustion of the IPv4 address space. [1] NAT was even presented as a security solution which obscured internal address from the external world. (The merits of the concept of NAT as a security implementation are beyond the scope of this work) However NAT introduced a number of connectivity issues that complicated peer to peer connections, and interfered with host to host security options such as IPSec operating in either tunnel or transport mode. These connections would either not work at all or would have to employ some form of NAT

bypass such as static mappings or uPnP. Devices which were tasked with NAT responsibility could also become overwhelmed, leading to a network bottleneck causing congestion and delay. [25] In the early days of the Internet, connections were mostly client-server with users being consumers of information, rather than contributors. [25] The 2000s brought a paradigm shift to the way people accessed and used the Internet. Mobile devices such as smart phones and tablets with always-on wireless or cellular connections have become the norm, allowing people to have 24-7 access to the Internet. This level of access has led to the development of websites such as Youtube and Facebook; blogs and content sharing peer to peer applications such as Bittorrent; all enabling the shift from pure consumer to content contributors requiring global IP connectivity. [1] Ultimately, while NAT did extend the usable life of IPv4 it was not a perfect solution, and its implementation restricted the concept that Internet hosts be globally reachable. [26] IPv6 addresses the issue of connectivity by providing sufficient globally unique address space that NAT is no longer required to be implemented, which will enable the Internet to support the future growth of new applications and services.

Security - With the continued increase of online criminal activity, spying by supposedly friendly governments (reference any search on recent NSA activities), human mistakes, such as the loss of the personal information of 620 000 patients, as reported in the Edmonton Journal by Mariam Ibrahim and Keith Gerein on January 22, 2014, information security is a major concern for people, business and governments. IPSec, a network layer authentication, integrity and encryption technology, was developed after IPv4 was deployed and support of IPSec within IPv4 was not required. IPv6 requires the support of IPSec on any IPv6 enabled device, and this consistency allows IPSec to be considered as an end to end security option for IPv6 [26]

Quality of Service - Application data, Voice over IP and Video over IP all have different requirements and the ability to support and prioritize different types of traffic is available in IPv4 with the Type of Service field, and the Traffic Class field in IPv6. When comparing the headers of IPv4 and IPv6, the flow label field (as defined in RFC 6437) is the only completely new field added to the IPv6 header. This field is used to expand upon the quality of services capabilities of IPv6 by giving routers the ability to mark traffic as belonging to a specific flow, and to handle flows rather than packets, which can lead to more efficient processing and special flow handling. [1]

Route Table Scalability - IPv4 was initially designed to use a classful addressing scheme with the classes A, B, and C being available for network assignment. Little, if any planning was given to the assignment of IPv4 address space and this led to the inability for ISP's to properly aggregate addresses. [1] [25] This process was found to be flawed when the explosive growth of the Internet increased the number BGP routes significantly as shown in Figure 1 from a few thousand in 1994 to over 450 000 by 2013 [3]. CIDR was developed to address this situation but the number of BGP routes continues to

increase as ISP's and businesses are either unwilling or unable to properly aggregate their address space. IPv6 has the ability to deploy a more scalable address plan, reduce the number of Internet routes and corresponding resources required to maintain these routes, as the address assignment process is just beginning, and the issues with the lack of aggregation are well known. [25]

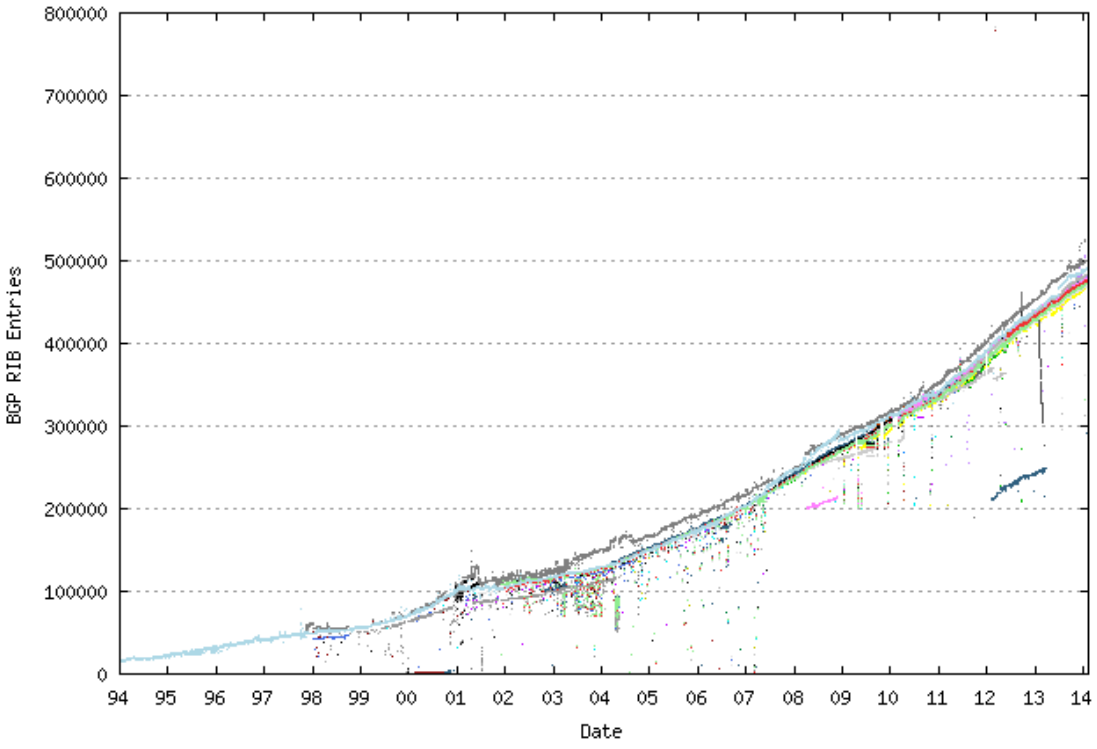


Figure 1 Growth of the BGP Table 1994 to Present

Source http://bgp.potaroo.net/ - January 25, 2014

Protocol Header – The IPv6 header was designed, with fields being removed, renamed, or reordered to address the inefficiencies within the IPv4 header. The minimum size of the IPv4 header is 20 bytes with 8 bytes being used for IPv4 addresses (40% of the header) while the size of the IPv6 header is 40 bytes with 32 bytes being used for IPv6 addresses (80% of the header). Addresses of 128 bits may not be processed as efficiently by 32 and 64 bit processors as a 32 bit IPv4 address; however the streamlined design allows for new IPv6 functionality (flow labels) plus faster header processing as functions that were seldom utilized, were removed from the header and implemented as IPv6 extension headers or removed completely such as header checksum calculations. [3] [26] While this project is not specifically examining the IPv6 packet, it will help determine if IPv6 routing processes are delayed in comparison to IPv4.

The following figure is a comparison of the IPv4 and IPv6 headers.

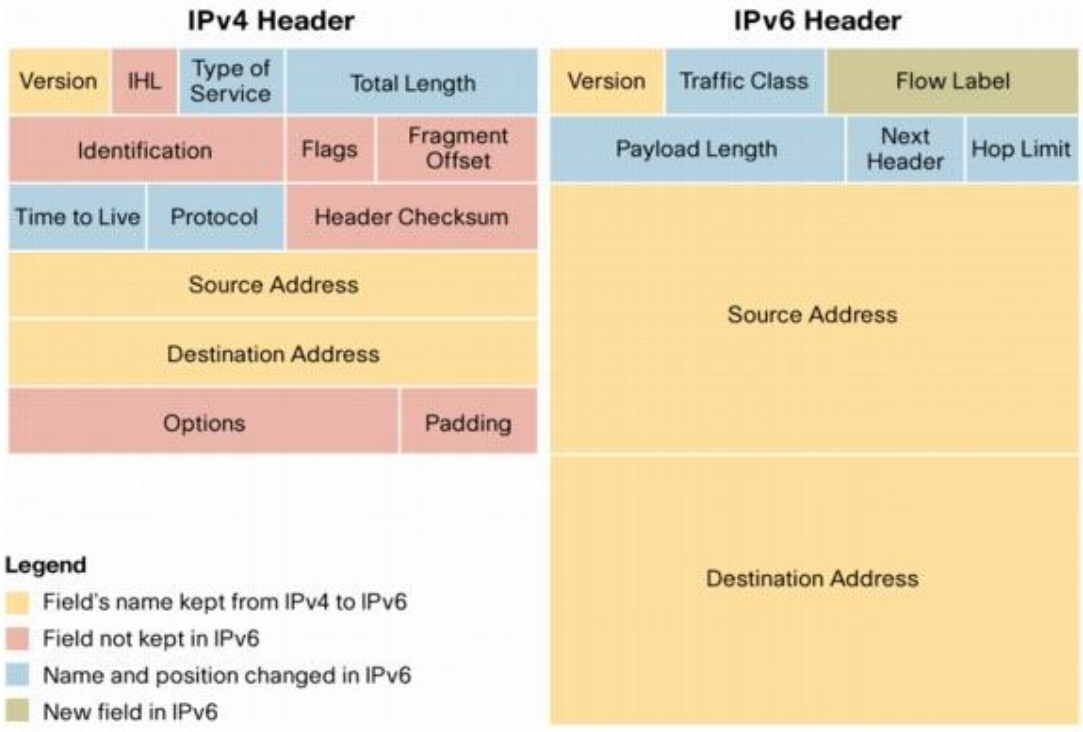


Figure 2 IPv4 and IPv6 Header Comparison

Source:
http://www.cisco.com/en/US/technologies/tk648/tk872/technologies_white_paper0900aecd8054d37d.html

Accessed: January 27, 2014

Other differences between IPv4 and IPv6

- IPv6 Fragmentation only occurs at the host, IPv6 routers use MTU path discovery to inform the host of the maximum transmission size. [1]
- Minimum MTU for IPv4 is 576 bytes, and is 1280 bytes in IPv6. [1]
- IPv6 replaces ARP with Neighbor Discovery Protocol [3]
- Broadcast addresses are replaced with link local multicasts. [27]
- IPv4 loopback 127.0.0.0 /8 IPv6 loopback ::1/128
- IPv6 nodes (hosts and routers), will have multiple addresses, the link local address, one or more unicast addresses, and possibly anycast addresses. [25]

ICMPV4 and ICMPv6

Internet Control Message Protocol is an integral part of IPv4 and IPv6 and any implementation of IP must support ICMP. [28] [29] ICMP messages are used for error reporting, node availability, and for network related diagnostics. ICMP was chosen to simulate the user data portion of this project for the following reasons:

- Well known protocol that is implemented in both IPv4 and IPv6.
- Connectionless, so will continue to send traffic even if the remote node is unavailable.
- Built in error reporting functionality with ICMP error messages.
- Built in node detection capability with ICMP informational messages.
- In their work Govindan and Paxson determined that ICMP is very accurate for delay based measurement, as ICMP generation time on nodes is negligible. [21]
- Echo requests and echo replies can simulate bidirectional communication, and the time to restoration of bidirectional communication is the key metric for this project.

The basic header for ICMPv4 and v6 are the same 4 byte size, as shown in figures 3 and 4

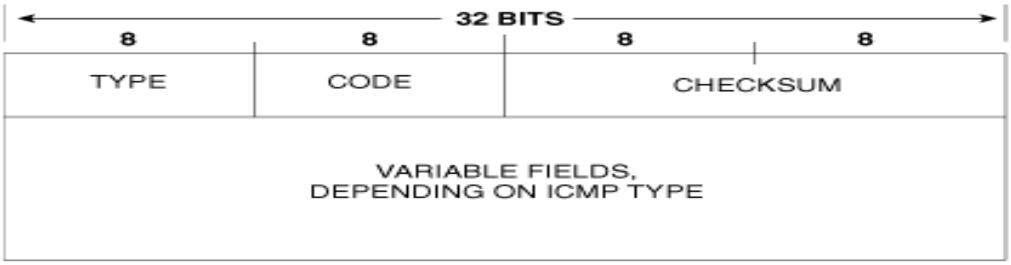


Figure 3 ICMPv4 Header [6]

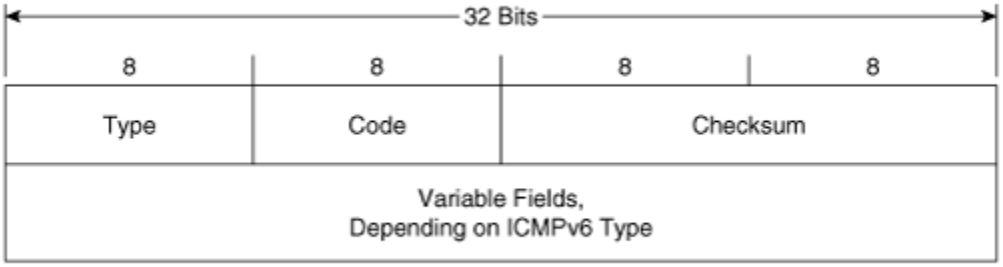


Figure 4 ICMPv6 Header [6]

The messages Echo request and Echo reply are the ICMP informational messages which form the basis for simulating bidirectional user communications within this project. The ICMP message format for Echo request is as follows;

ICMP	IPv4	Ipv6
TYPE	8	128
CODE	0	0
Identifier field size	2 bytes	2 bytes
Sequence field size	2 bytes	2 bytes
Data (amount of data sent)	32 bytes	32 bytes
ICMP datagram size	40 bytes	40 bytes

Table 2 ICMP Echo Request Comparison IPv4/IPv6

Note the amount of data was determined by examining packets in Wireshark.

Echo Reply

ICMP	IPv4	Ipv6
TYPE (2 bytes)	0	129
CODE (2 bytes)	0	0
Identifier field size	2 bytes	2 bytes
Sequence field size	2 bytes	2 bytes
Data (amount of data sent)	32 bytes	32 bytes
ICMP datagram size	40 bytes	40 bytes

Table 3 ICMP Echo Reply Comparison IPv4/IPv6

The amount of data generated in the test environment by ICMP Echo request and reply messages was 40 bytes for both IPv4 and IPv6 as verified in Wireshark. This consistency is ideal as it removes variations in ICMP message length as a factor which may affect the test network scenario.

RIPv2 and RIPng

The following section will provide a description of the similarities and differences between RIPv2 and RIPng. It will not go into the operational details of RIP, except to highlight factors which may affect the convergence time of the two protocols. RIP, as specified in RFC 2453 is a distance-vector algorithm based upon the work of Bellman-Ford [30]. RIPng (RFC 2080) is a modification of RIPv2 to operate in an IPv6 environment, and the two protocols share many similarities but are not compatible with each other. Both protocols use the same timers, metrics, shortest path calculation, and loop prevention mechanisms to maintain network connectivity. [30] [31] [6] UDP is used as the transport layer protocol to carry the RIP messages; port 520 is used by RIP and port 521 is used by RIPng.

The major difference between the two protocols is found within the RIP message format and the maximum size of the RIP messages. A RIPv2 update can contain 25 route table entries (RTE's) with a maximum size (including UDP header) of 512 bytes. RIPng messages are limited only based upon the MTU of the link that the update is being sent on. [6]

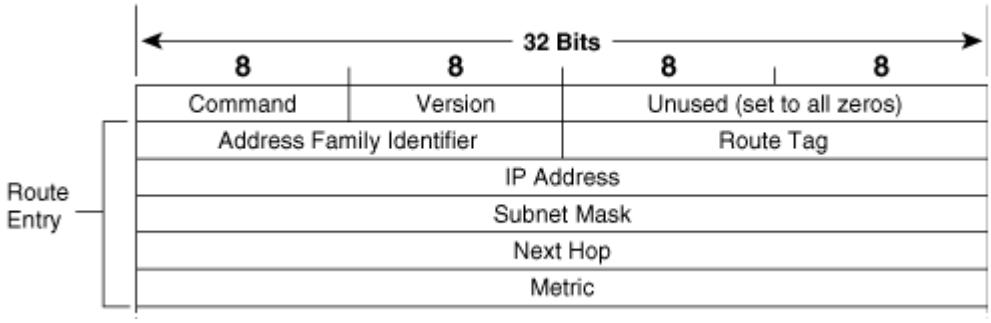


Figure 5 RIPv2 Message Format [6]

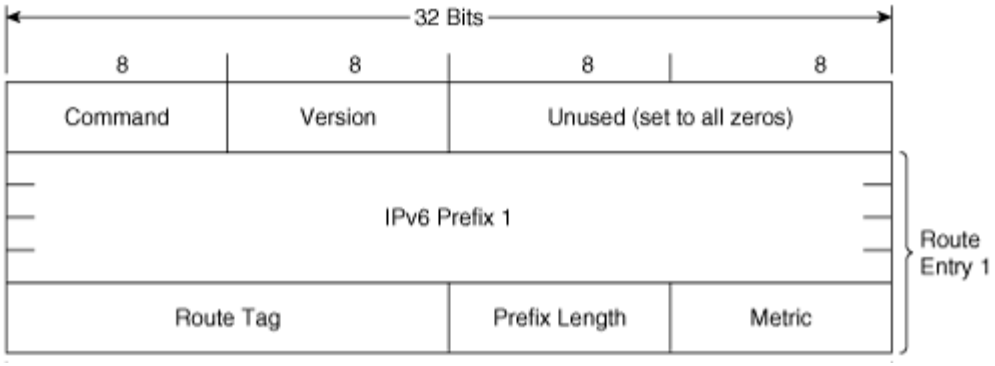


Figure 6 RIPng Message Format [6]

The RIPng message was optimized by removing the address family identifier, changing the subnet mask field (4 bytes) to the prefix length field (1 byte), and reducing the size of the metric field to 1 byte. The most important change to the RIPng RTE however comes from the removal of the next hop field. In RIP v2 each RTE contains the next hop address, if this convention was maintained in RIPng, each RTE would need to contain an additional 16 bytes per entry to accommodate the size of the IPv6 next hop address. If the RIP message was carrying 20 RTE, the RIPng message would be 320 bytes larger in size. To address this, a special RTE was created to act as the next hop field. A RTE with a metric field of 0xFF is used to indicate a next hop RTE, with the IPv6 prefix being the next hop address. All RTE's following this next hop RTE will use this prefix as their next hop, until either another next hop RTE is encountered or the end of the message is reached. [31] The changes to the message format allow the RIPng messages to carry the required information, with the RTE's being exactly the same size (20 bytes). The only additional size is added to the RIPng message by the next hop RTE.

As observed in the Wireshark capture from the test network;

Note the size includes 4 bytes for the Command, Version and 2 unused fields, plus 20 bytes for each RTE.

RIP v2 RTE's	RIPv2	RIPng RTE's	RIPng
2	44 bytes	1	24 bytes
8	164 bytes	9	184 bytes

Table 4 RIP Message Size Comparison

The changes made to RIP were designed to limit the effect of the increased prefix address size and as shown, this goal was accomplished primarily through the removal of the next hop address field. This change ensures that RIPng messages generate comparable traffic to RIPv2 and RIPng should demonstrate similar convergence behaviours as RIPv2, with only the IPv6 header increasing the packet size.

EIGRPv4 and EIGRPv6

EIGRP is a Cisco proprietary protocol; however Cisco has recently made the decision to make the protocol available to other vendors, and it is currently in draft form with the IETF. This change may make the protocol more widely available, and understanding EIGRP behaviour continues to be an important skill of a network manager. This section will examine the similarities and differences between the IPv4 implementation (EIGRPv4) and the IPv6 version (EIGRPv6), as to which changes may affect the convergence of an IPv6 network as compared to an IPv4 network. EIGRP was designed as modular software, with a core functionality which is common to all modules, and a protocol dependent module which allows EIGRP to support the network layer protocols IPX, Appletalk, IPv4, and now IPv6. [32]

The protocol dependent modules (PDM) allow the core functionality of EIGRP to be maintained, and there are many similarities between the two protocols. These similarities include the Diffusing Update Algorithm (DUAL) which is responsible for path determination and ensuring loop free connectivity, the Reliable Transport Protocol (RTP) remains the layer 4 protocol responsible for guaranteed delivery of packets. The same basic packets types (Hello, Acknowledgments, Updates, Queries, and Replies), timers and tables (neighbor, topology, and routing tables), and metrics are maintained. [8] [33] Despite the similarities the different PDM's are not compatible with each other.

EIGRPv6 was developed to support IPv6 and required three new TLVs which carry EIGRPv6 specific information to be implemented. The three new TLVs include; request type, internal type, and exterior type, only the internal type TLV is used by the EIGRPv6 routers for this project. [33]

With all of the similarities that have been identified the difference between the protocols can be found by examining the EIGRP message types. All EIGRP messages (v4 and v6) include the following header, with a fixed length of 20 bytes. The TLV's are variable in length and carry specific information required by the type of EIGRP message (Hello, query, update…)

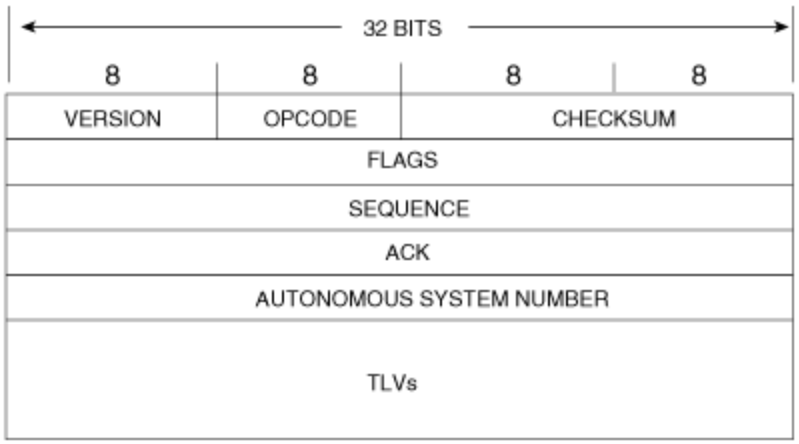


Figure 7 EIGRP RTP Header [6]

Type	Length
Next Hop Forwarding Address	
Metric Section	
Subnet Mask Bit Count	Address (variable length) ((Bit_Count - 1) / 8) + 1

Figure 8 EIGRP Internal Route TLV [34]

The internal route TLV is used by EIGRP queries to propagate route prefix information between routers, and the amount of data carried will increase with the number of network prefixes being updated. The most significant size factor between the two protocols is found in the Query/Update message fields for next hop address, and destination prefix. The EIGRPv6 next hop address is always 16 bytes, and is included with every TLV entry, as compared to the EIGRPv4 next hop address which is always only 4 bytes. The destination prefix is a variable size for both versions of the protocol, but is also carried in every route TLV.

The following table was compiled by examining the EIGRP messages captured on the test network, and is a partial summary of the EIGRP message size (including 20 byte EIGRP header), as such it must be noted that every network will have different characteristics.

EIGRP Message	EIGRP v4	EIGRP v6
Hello Message size	40 bytes	40 bytes
Query/update 1 prefix	48 bytes	66 bytes
Query/update 2 prefixes	77 bytes	119 bytes
Next hop address field size	4 bytes	16 bytes
Destination prefix field size	3 bytes	9 bytes

Table 5 EIGRP Message Size Comparison

Many of the internal operations (DUAL) are consistent between the two versions of EIGRP; it is within the specific messages and TLVs that a size difference is observed between the two protocols. This size increase is in addition to the increase found between the IPv4 and the IPv6 header, and the effect of this difference will be examined within the experimental portion of this project.

OSPFv2 and OSPFv3

OSPF as specified in RFC 2328, was developed as a link state routing protocol to support IPv4 networks. RFC 5340 specifies the changes and modifications to OSPFv2 to support IPv6, and this new protocol is known as OSPFv3. [35] In addition to supporting IPv6, another major goal of RFC 5340 was to ensure that OSPFv3 could be run on any network layer protocol, and was not directly linked to IPv6. [32] To achieve these two goals a number of modifications were made to OSPF, although many processes remain the same between the two protocols.

The basic operational mechanisms of OSPF remain the same, SPF calculations are still based on Dijkstras algorithm; and the basic message types (Hello, DBD, Advertisements, Requests and Updates) remain although some changes have taken place in message format. [33] Designated Routers, ABRs and ASBRs are still required for correct operation of OSPF; metrics and default timers have not been changed. Despite the goal of protocol independence, OSPFv3 as specified in RFC 5340 cannot support IPv4 networks. Further work on this process can be found in RFC 5838, which is developing the address family capabilities for OSPF, which will allow OSPFv3 to support both IPv4 and IPv6 networks.

The following is a summary of the changes made to OSPF to support IPv6:

- Removal of specific addressing requirements – IPv6 addresses were removed from Router and Network LSA's, and these now carry only topology information. [35] [33]
- OPSFv3 processes run per-link, "a medium over which nodes can communicate at the link layer" [35], as an IPv6 interface can have multiple prefixes.
- Three separate flooding scopes have been implemented; Link-local, Area and Autonomous system. [35]
- Multiple instances of OSPFv3 can run per link. [25]
- Changes were made to the OSPF header; two new LSAs were introduced (Link-LSA, and Intra-Area-Prefix-LSA); Type 3 LSAs (network summary) were renamed Inter-Area-Prefix-LSA; and Type 4 LSAs (ASBR-summary) were renamed Inter-Area-Router-LSAs. Specific details regarding the OSPF message formats and LSAs will be discussed further in this project. [35]
- Unknown LSA types are now forwarded based on an option as opposed to dropping the LSA as in OSPFv2. [35]
- OSPF authentication was removed, in favour of using IPSec as implemented in the IPv6 header. [36]

The two new LSAs introduced to OSPF directly support the larger address requirement of IPv6. The Link-LSA is used to provide all prefixes associated with a link between OSPF neighbors, and this information is used for next hop calculations. This LSA is also used to provide option information to other OSPFv3 routers. [32] The Intra-area-prefix LSA carries IPv6 network prefixes to all OSPFv3 routers within the area. These two new LSAs are IPv6 specific and were introduced as part of the goal to make the basic processes of OSPFv3 protocol independent, by removing the address prefix information from the Router and Network LSAs. [35]

The next two figures highlight the difference between the OSPFv2 and OSPFv3 headers, which are included in every OSPF packet. The OSPFv2 header is 24 bytes in length while the OSPFv3 header has been reduced in size to 16 bytes by the removal of the authentication fields. The instance field is a new field which is designed to allow a link to have multiple instances of OSPFv3 operating on it.

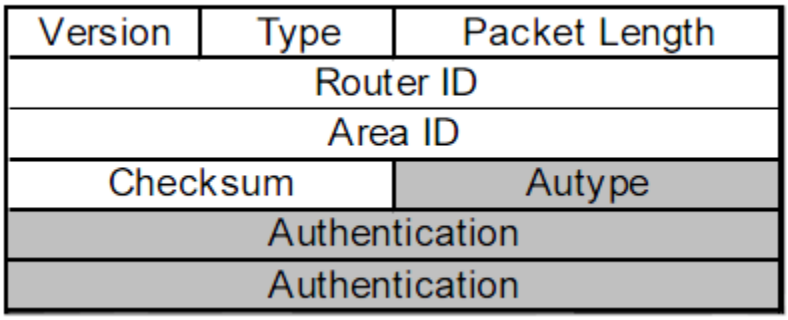


Figure 9 - OSPFv2 Header [36]

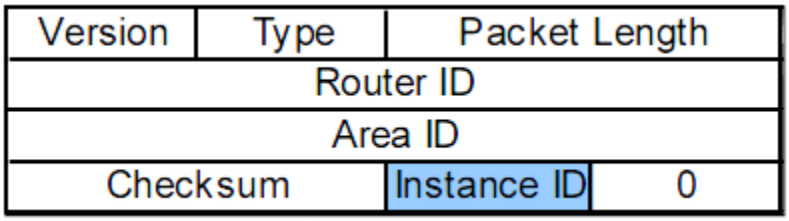


Figure 10 - OSPFv3 Header [36]

The Link State Update message (LSU) is used to inform the OSPF network of a change to a link, and is a critical component of the OSPF convergence process. Each LSU can carry a number of LSAs, with each LSA having a header and then LSA specific fields.

The LSAs observed on the test network were Router LSAs which are used to describe all of the links available on a router. The following figures examine the differences between the OSPFv2 LSAs and the OSPFv3 LSAs.

LS age	Options	LS Type
Link State ID		
Advertising Router		
LS Sequence Number		
LS Checksum	Length	

Figure 11 - OSPFv2 LSA Header [36]

LS age	LS Type
Link State ID	
Advertising Router	
LS Sequence Number	
LS Checksum	Length

Figure 12 - OSPFv3 LSA Header [36]

The LSA header for both versions of OSPF is 20 bytes, with the only change being the movement of the options field into the LSA specific portion of the message. It is by examining the router LSA that a major difference can be observed between the two protocols.

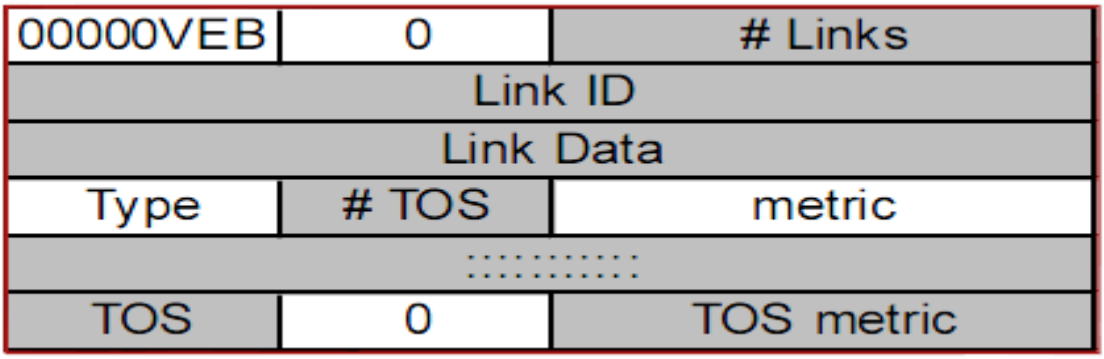


Figure 13 - OSPFv2 Router LSA [36]

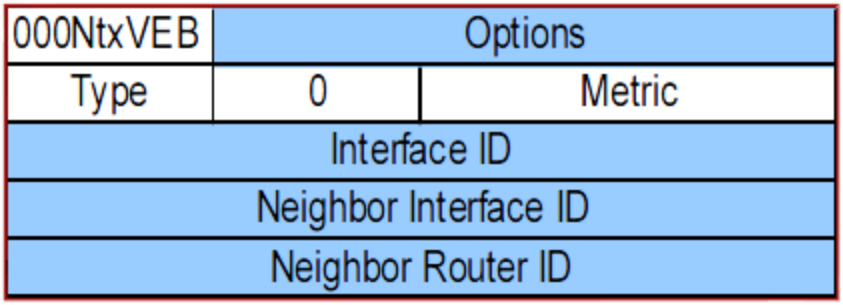


Figure 14 - OSPFv3 Router LSA [36]

The router LSA for OSPFv2 as shown in Figure 13 includes information about all connected links for a router, and includes fields (indicated by ::::) which contain IPv4 network information for all connected networks. The LSA for OSPFv3 contains no information regarding connected IPv6 networks only topology information and this results in the OSPFv3 router LSA being smaller in size. The difference in message size between versions will only increase as the number of connected networks increases. The results from the current project show that the OSPFv3 router LSA (44 bytes) is ~85% the size of the OSPFv2 router LSA (52 bytes). In their work Haihong and Xiaoling determined that the router LSA for OSPFv3 was 83% the size of the OSPFv2 router LSA. [20] The next table was compiled by examining the OSPF traffic on the test network, and details the size of the OSPF messages between the two protocols. The OSPF header size is included in the total (24 bytes v2 and 16 bytes v3), and it is the difference in OSPF header size which accounts for the size difference between the Hello and Acknowledgment messages.

OSPF Message	OSPFv2	OSPFv3
Hello packet	52 bytes	44 bytes
Link State Update (1 – Link State Advertisement)	76 bytes	60 bytes
Link State Acknowledgement	44 bytes	36 bytes

Table 6 OSPF Message Size Comparison

The changes made to the OSPFv3 LSA allow the link state update messages to be smaller and more efficient than their OSPFv2 equivalents; with only one link advertisement the OSPFv2 LSU is 96 bytes including the IPv4 header (20 bytes), whereas the OSPFv3 LSU is 100 bytes with the IPv6 header (40 bytes). Given the similarities in convergence activities and message sizes, both versions of OSPF should demonstrate similar convergence times on the test network. Haihong and Xiaoling determined in an OPNET simulation that there was virtually no convergence time difference between the two versions of OSPF [20]. This project will use a network build to further examine the network convergence of the two versions of OSPF.

IPv6 Transition – Dual Stack

The world will transition to IPv6; when it will happen is a matter that each and every organization will have to address as part of their strategic plan. There is no deadline yet for when IPv4 will be turned off and the world will only be running IPv6. Organizations must address many issues such as legacy hardware and software requirements, the evolution of new equipment, and the issues that change inevitably introduces. Business continuity must be maintained during this transition period and therefore IPv4 and IPv6 will coexist on networks for many years to come. [1]

As companies will be migrating at different rates, the individual transition to IPv6 must be as independent as possible. To accommodate the variable migration strategies the IETF has provided options which include dual stack configurations, tunneling, and protocol translation tools to ensure network connectivity is maintained. [22] Dual stack configurations require devices to support both IPv4 and IPv6 protocols simultaneously, and the device will use either protocol as required. Tunneling allows IPv6 packets to be transported across an IPv4 network by encapsulating the IPv6 traffic within an IPv4 packet; there are a number of tunneling options available to meet network requirements. Neither of these approaches allows an IPv4-only device to exchange information with an IPv6-only host. To accomplish this task NAT64, which performs protocol translation between IPv4 and IPv6 devices, must be implemented. [1] A discussion and examination of tunneling and NAT64 is beyond the scope of this project.

Dual stack configurations are a natural extension of this project's test environment as dual stacks require running an IPv4 routing protocol and an IPv6 routing simultaneously on the network. A dual stack network, configured with OSPFv2 and OSPFv3 will require additional memory and processor resources to accommodate both protocols running simultaneously. This includes two sets of neighbour, topology and routing tables; as well SPF calculations will be performed twice, once for each protocol. Network traffic will also be increased as both IPv4 and IPv6 packets utilize the same network links. The final stage of this project will examine the effects of implementing a dual stack network and the time taken to restore communications. These results will then be compared against the previously examined standalone configurations of OSPF.

Test Procedure

To examine the behaviour of the routing protocol and determine the time required to restore bidirectional communication, this project will use ICMP Echo Request and Reply messages to simulate communications. The network will be configured with the protocol under examination and the routers will be allowed to converge. Network convergence and the primary data path between the source and destination PC will be verified via the use of **trace route** and **show ip route** commands, which will be discussed later. Communication will be established by initiating a continuous **PING** from the source PC to the destination PC and a network tap connected to a laptop running Wireshark will be used to capture the packet flow. A network event will be introduced by disconnecting a link at the point indicated on the network diagram, and this will begin the start of the error period. For the purpose of this project the error period will be defined as follows:

> Error period is the difference in time between the first unanswered Echo Request and the next received Echo Reply message.

The first received Echo Reply after the network error will verify that the network has converged and bidirectional communication has been restored. The test procedure will be completed three times for each protocol and an average of the error period for each protocol will be calculated. The error period average will be used to determine if there is a difference in the time taken to restore communication between an IPv4 and its IPv6 equivalent.

The initial project proposal was to use ICMP Destination Unreachable messages to indicate the start of the error period; however this was changed to the first unanswered Echo Request for the following reasons.

- Upon examining the captured data, it was determined that the response time between the Echo Request and Echo reply on the test network before the error was introduced was 1 ms, whereas the Destination Unreachable message was often not received more than 1 s after the initial unanswered Echo Request message. The use of the first unanswered Echo Request message provides a much more accurate indication as to when the actual error was introduced.
- As well, an unexpected behaviour was observed in ICMP in that for EIGRPv6, and OSPFv3 Destination Unreachable messages were not generated by the routers as they were in IPv4. The reasons for this behaviour are beyond the current scope of this project.

Two methods were used to verify the primary path through the network before the error was introduced; **trace route** and the router command **show ip route**. Trace route uses ICMP messages to determine the path a packet has taken through the network and Figure 15 displays the path before the network error is introduced. This may be compared against the network diagram in the following section to verify that packets are following the primary path through R1 to R2 to R3 to R4 to the destination host.

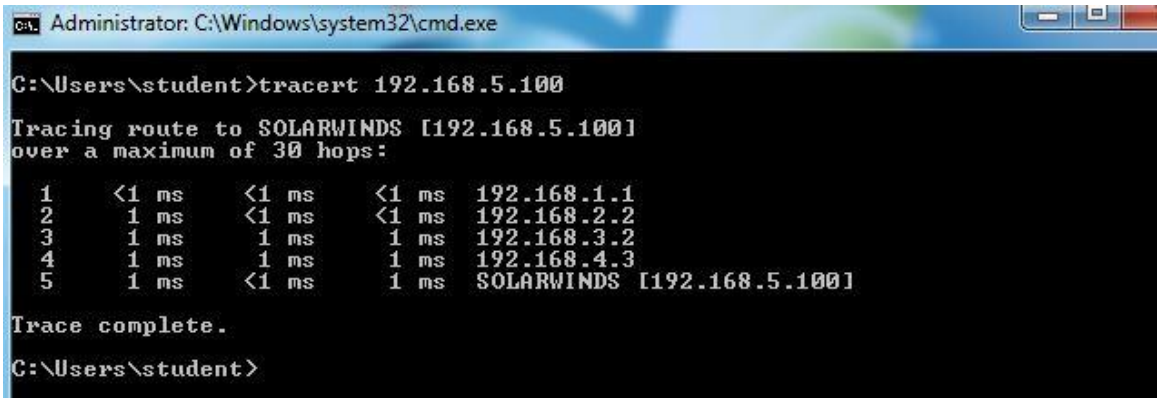
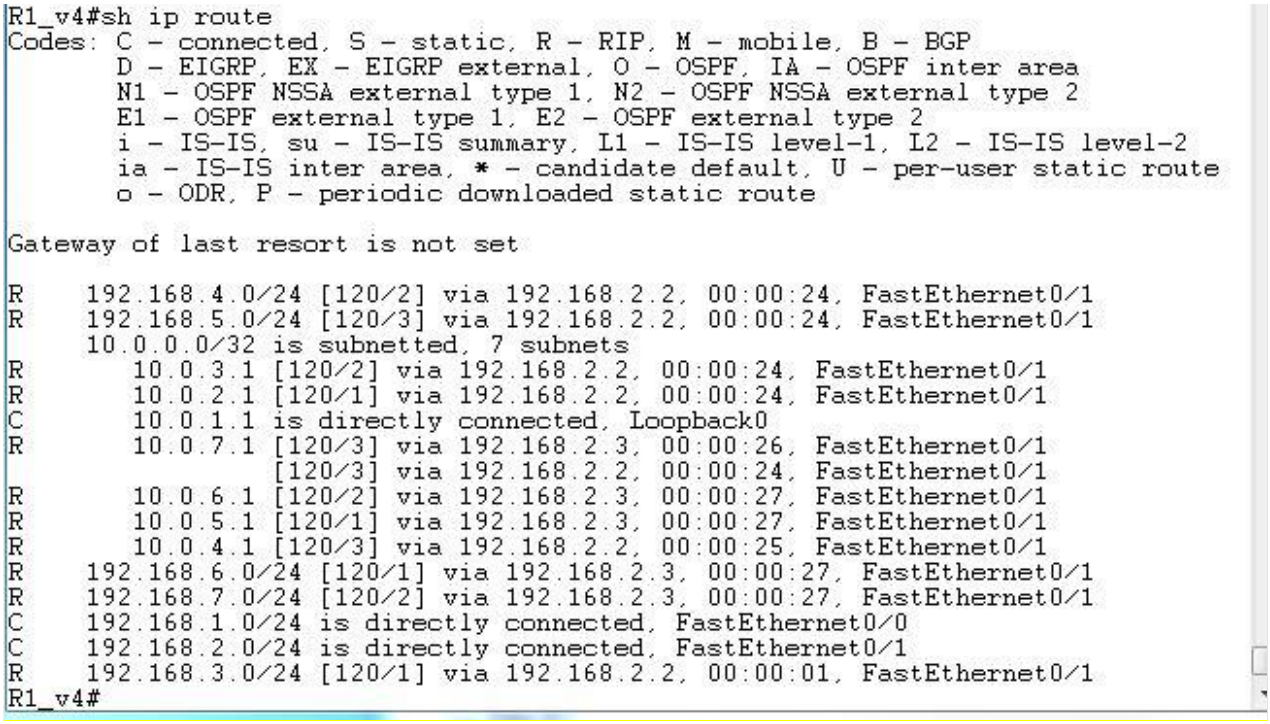


Figure 15 Trace Route Output before Network Error

Show ip route is the Cisco command to display the routing table which is used by the router in making its forwarding decisions. Figure 16 displays the output of the **show ip route** command for RIP router 1. Examining the RIP routing table it can be determined that R1_v4 will forward packets to the destination network (192.168.5.0) via the next hop address of 192.168.2.2 (R2). As well it can be determined that R1_v4 has two available paths to the network 10.0.7.1 through the next hop addresses of 192.168.2.2 (R2) and 192.168.2.3 (R5 – the secondary path).



```
R1_v4#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    192.168.4.0/24 [120/2] via 192.168.2.2, 00:00:24, FastEthernet0/1
R    192.168.5.0/24 [120/3] via 192.168.2.2, 00:00:24, FastEthernet0/1
     10.0.0.0/32 is subnetted, 7 subnets
R       10.0.3.1 [120/2] via 192.168.2.2, 00:00:24, FastEthernet0/1
R       10.0.2.1 [120/1] via 192.168.2.2, 00:00:24, FastEthernet0/1
C       10.0.1.1 is directly connected, Loopback0
R       10.0.7.1 [120/3] via 192.168.2.3, 00:00:26, FastEthernet0/1
                 [120/3] via 192.168.2.2, 00:00:24, FastEthernet0/1
R       10.0.6.1 [120/2] via 192.168.2.3, 00:00:27, FastEthernet0/1
R       10.0.5.1 [120/1] via 192.168.2.3, 00:00:27, FastEthernet0/1
R       10.0.4.1 [120/3] via 192.168.2.2, 00:00:25, FastEthernet0/1
R    192.168.6.0/24 [120/1] via 192.168.2.3, 00:00:27, FastEthernet0/1
R    192.168.7.0/24 [120/2] via 192.168.2.3, 00:00:27, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet0/1
R    192.168.3.0/24 [120/1] via 192.168.2.2, 00:00:01, FastEthernet0/1
R1_v4#
```

Figure 16 - RIP Route Table before Network Error

After the network error is introduced, and bidirectional communication has been restored between the two hosts, the output of the **tracert** command displays the communications path as following the secondary path of R1–R5- R6-R7-R4. This is shown in Figure 17.

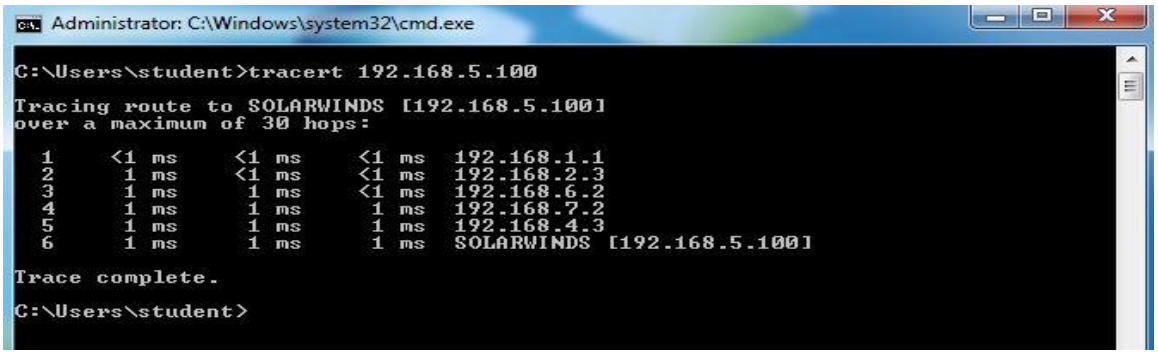


Figure 17 Trace Route Output after Network Error

```
R1_v4#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    192.168.4.0/24 [120/3] via 192.168.2.3, 00:00:05, FastEthernet0/1
R    192.168.5.0/24 [120/4] via 192.168.2.3, 00:00:05, FastEthernet0/1
     10.0.0.0/32 is subnetted, 7 subnets
R       10.0.3.1 [120/2] via 192.168.2.2, 00:00:12, FastEthernet0/1
R       10.0.2.1 [120/1] via 192.168.2.2, 00:00:12, FastEthernet0/1
C       10.0.1.1 is directly connected, Loopback0
R       10.0.7.1 [120/3] via 192.168.2.3, 00:00:05, FastEthernet0/1
R       10.0.6.1 [120/2] via 192.168.2.3, 00:00:05, FastEthernet0/1
R       10.0.5.1 [120/1] via 192.168.2.3, 00:00:06, FastEthernet0/1
R       10.0.4.1 [120/4] via 192.168.2.3, 00:00:06, FastEthernet0/1
R    192.168.6.0/24 [120/1] via 192.168.2.3, 00:00:06, FastEthernet0/1
R    192.168.7.0/24 [120/2] via 192.168.2.3, 00:00:06, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet0/1
R    192.168.3.0/24 [120/1] via 192.168.2.2, 00:00:14, FastEthernet0/1
R1_v4#
```

Figure 18 RIP Route Table after Network Error

The RIP route table displayed in Figure 18 now shows the path to 192.168.5.0 with a next hop address of 192.168.2.3 (R5), and the path to 10.0.7.1 has only one path available through R5. Appendix A contains the route tables for the other protocols being examined.

Network Diagrams

For the purposes of this project the primary data path for communications between the source and destination PC's is R1-R2-R3-R4. The secondary path which is only used after the network error is introduced is R1-R5-R6-R7-R4. This is shown in Figure 19.

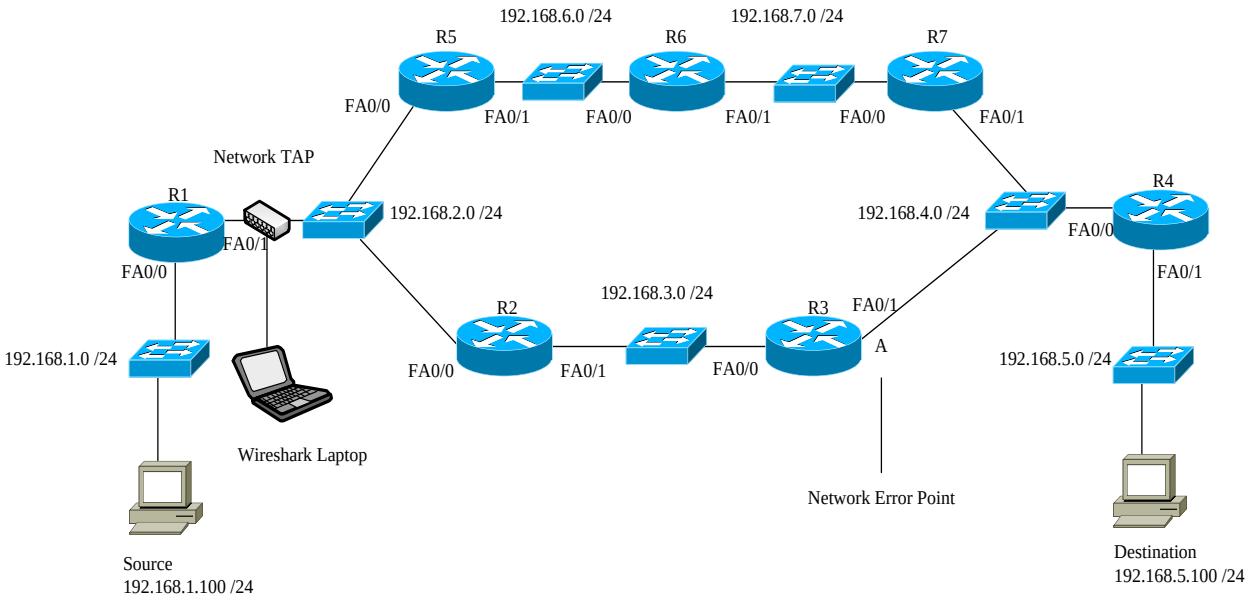


Figure 19 IPv4 Network

Table 7 lists the IPv4 addressing scheme used in the test network

Router	Interface	IPv4 Address	Loop Back Address
R1	FA0/0	192.168.1.1	10.0.1.1
	FA0/1	192.168.2.1	
R2	FA0/0	192.168.2.2	10.0.2.1
	FA0/1	192.168.3.1	
R3	FA0/0	192.168.3.2	10.0.3.1
	FA0/1	192.168.4.1	
R4	FA0/0	192.168.4.3	10.0.4.1
	FA0/1	192.168.5.1	
R5	FA0/0	192.168.2.3	10.0.5.1
	FA0/1	192.168.6.1	
R6	FA0/0	192.168.6.2	10.0.6.1
	FA0/1	192.168.7.1	
R7	FA0/0	192.168.7.2	10.0.7.1
	FA0/1	192.168.4.2	

Table 7 IPv4 Addressing Scheme

Figure 20 shows the network diagram for the IPv6 test network.

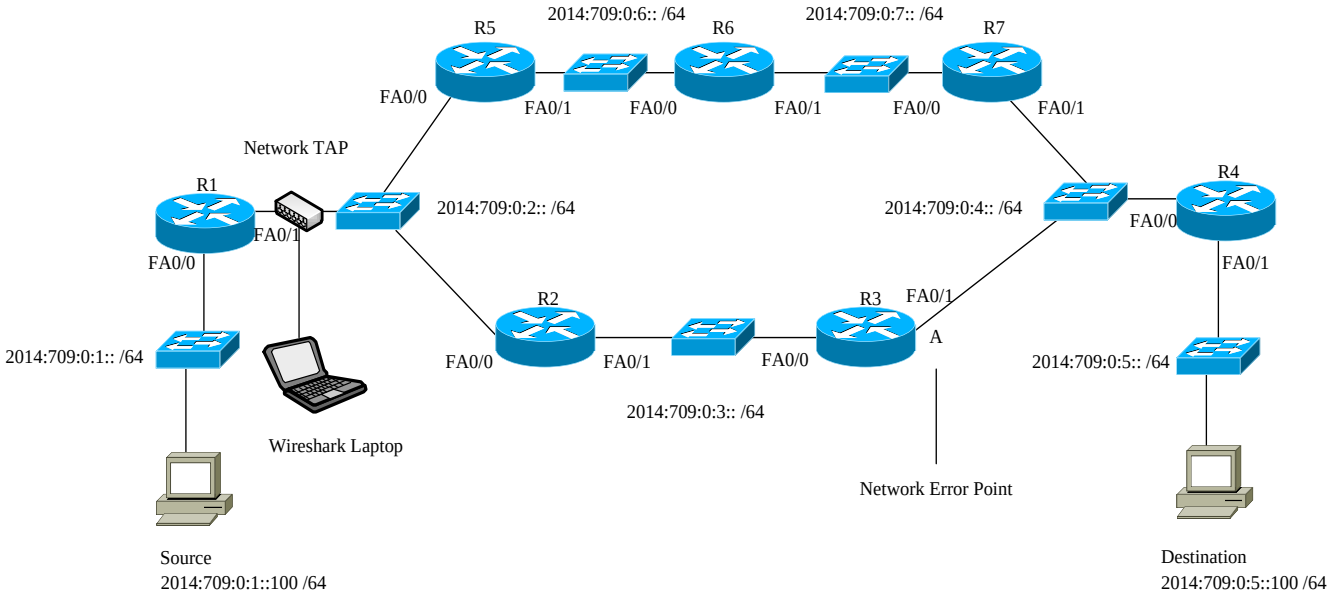


Figure 20 IPv6 Network

Table 8 shows the IPv6 address plan used in the test network.

Router	Interface	IPv6 Address	Link Local Address	Loop Back Address
R1	FA0/0	2014:709:0:1::1	FE80::1	2014:709:0:A1::1
	FA0/1	2014:709:0:2::1	FE80::1	
R2	FA0/0	2014:709:0:2::2	FE80::2	2014:709:0:A2::1
	FA0/1	2014:709:0:3::1	FE80::2	
R3	FA0/0	2014:709:0:3::2	FE80::3	2014:709:0:A3::1
	FA0/1	2014:709:0:4::1	FE80::3	
R4	FA0/0	2014:709:0:4::3	FE80::4	2014:709:0:A4::1
	FA0/1	2014:709:0:5::1	FE80::4	
R5	FA0/0	2014:709:0:2::3	FE80::5	2014:709:0:A5::1
	FA0/1	2014:709:0:6::1	FE80::5	
R6	FA0/0	2014:709:0:6::2	FE80::6	2014:709:0:A6::1
	FA0/1	2014:709:0:7::1	FE80::6	
R7	FA0/0	2014:709:0:7::2	FE80::7	2014:709:0:A7::1
	FA0/1	2014:709:0:4::2	FE80::7	

Table 8 IPv6 Addressing Scheme

Figure 21 shows the network diagram for the IPv4/IPv6 dual stack network.

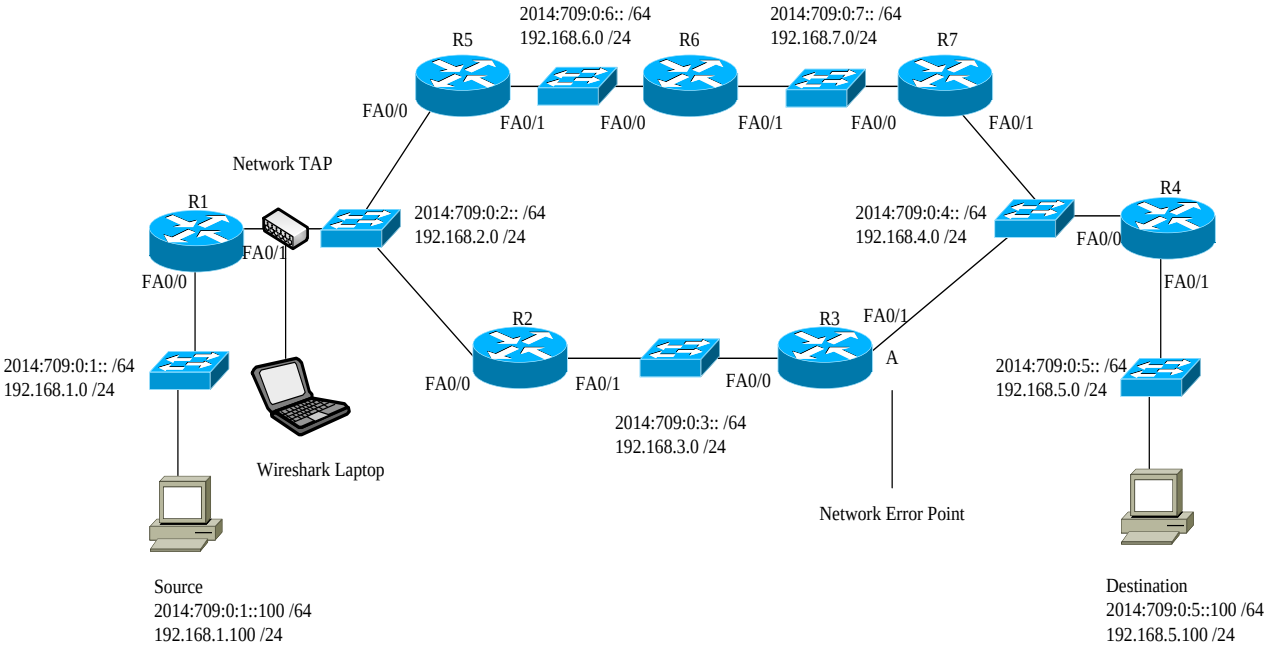


Figure 21 IP Dual Stack Network

Table 9 shows the addressing scheme used in the dual stack test network.

Router	Interface	IPv6 Address	Link Local Address	IPv4 Address	Loop Back Address
R1	FA0/0	2014:709:0:1::1	FE80::1	192.168.1.1	2014:709:0:A1::1
	FA0/1	2014:709:0:2::1	FE80::1	192.168.2.1	
R2	FA0/0	2014:709:0:2::2	FE80::2	192.168.2.2	2014:709:0:A2::1
	FA0/1	2014:709:0:3::1	FE80::2	192.168.3.1	
R3	FA0/0	2014:709:0:3::2	FE80::3	192.168.3.2	2014:709:0:A3::1
	FA0/1	2014:709:0:4::1	FE80::3	192.168.4.1	
R4	FA0/0	2014:709:0:4::3	FE80::4	192.168.4.3	2014:709:0:A4::1
	FA0/1	2014:709:0:5::1	FE80::4	192.168.5.1	
R5	FA0/0	2014:709:0:2::3	FE80::5	192.168.2.3	2014:709:0:A5::1
	FA0/1	2014:709:0:6::1	FE80::5	192.168.6.1	
R6	FA0/0	2014:709:0:6::2	FE80::6	192.168.6.2	2014:709:0:A6::1
	FA0/1	2014:709:0:7::1	FE80::6	192.168.7.1	
R7	FA0/0	2014:709:0:7::2	FE80::7	192.168.7.2	2014:709:0:A7::1
	FA0/1	2014:709:0:4::2	FE80::7	192.168.4.2	

Table 9 IPv4/IPv6 Dual Stack Addressing Scheme

Router Configuration

This section will provide the R1 configuration for OSPFv2, OSPFv3 and the OSPF dual stack configuration. All routers were Cisco 2811 routers running IOS C2800NM-Adventerprisek9-m, 12.4(22)T4 code. The remaining router configurations can be found in Appendix B.

OSPFv2

```
hostname R1_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.1.1 255.255.255.255
interface FastEthernet0/0
ip address 192.168.1.1 255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.2.1 255.255.255.0
no shut
router ospf 709
network 10.0.1.1 0.0.0.0 area 0
network 192.168.1.0 0.0.0.255 area 0
network 192.168.2.0 0.0.0.255 area 0
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

OSPFv3

```
hostname R1_v6
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address 2014:709:0:A1::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ipv6 address 2014:709:0:1::1/64
ipv6 address FE80::1 Link-local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ipv6 address 2014:709:0:2::1/64
ipv6 address FE80::1 Link-local
ipv6 ospf 709 area 0
no shut
ipv6 router ospf 709
router-id 10.0.1.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

OSPF Dual Stack

```
hostname R1_dualstack
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ip address 10.0.1.1 255.255.255.255
ipv6 address 2014:709:0:A1::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ip address 192.168.1.1 255.255.255.0
ipv6 address 2014:709:0:1::1/64
ipv6 address FE80::1 Link-local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ip address 192.168.2.1 255.255.255.0
ipv6 address 2014:709:0:2::1/64
ipv6 address FE80::1 Link-local
ipv6 ospf 709 area 0
no shut
router ospf 709
network 10.0.1.1 0.0.0.0 area 0
network 192.168.1.0 0.0.0.255 area 0
network 192.168.2.0 0.0.0.255 area 0
ipv6 router ospf 709
router-id 10.0.1.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

Packet Capture and Analysis

A laptop running Wireshark was connected to a network TAP to capture packet transmissions. The location of the laptop in the test network is shown in Figure 19. This section will use an EIGRP capture as a sample to demonstrate how the captured data was analyzed and interpreted in determining the length of the protocol error period. Appendix C contains screen captures of the other Wireshark captures.

Packet colouring rules as shown in Figure 22 were implemented to highlight the specific type of packet as well as illustrate the direction of communication.

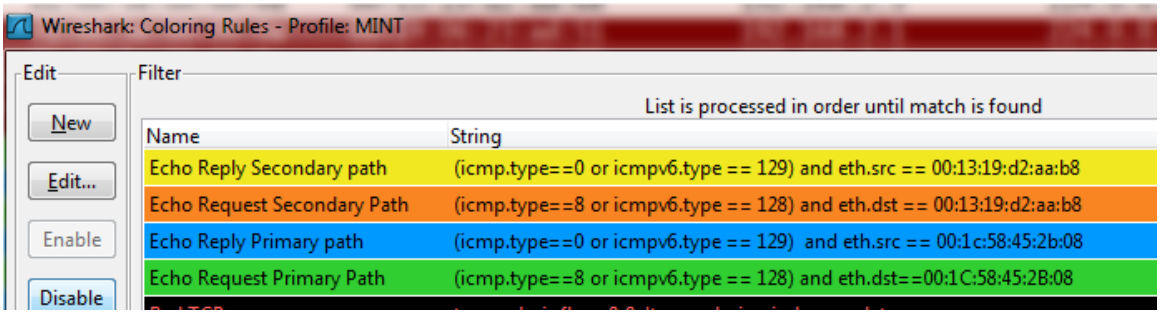


Figure 22 Custom Colour Rules

- Green is used to indicate an Echo Request being forwarded from R1 to R2 along the primary path.
- Blue is used to indicate an Echo Reply being forwarded from R2 to R1 along the primary path.
- Orange is used to indicate an Echo Request being forward from R1 to R5 along the secondary path.
- Yellow is used to indicate an Echo Reply being forwarded from R5 to R1 along the secondary path.

To assist in the analysis a display filter was used to show only the packets associated with the routing protocol under examination, as well as ICMP packets. Figure 23 displays Echo request and reply messages being sent along the primary path, as well as an EIGRP Hello message, that is highlighted in red.

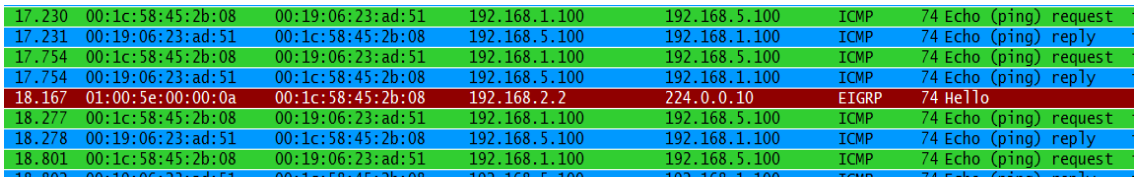


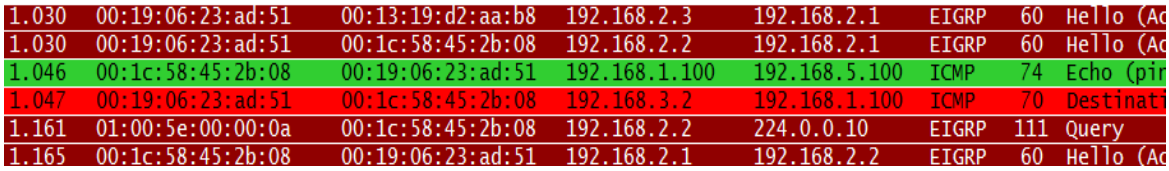
Figure 23 ICMP Communications before Network Error

Information of relevance to the project; it can be noted that ICMP Echo Request messages are sent out approximately every 500 ms, however this may change during the error period of the project based upon the behaviour of the ICMP test software and network hardware to between 1 and 4 seconds. This adds a margin of uncertainty as the exact moment that the network error is introduced cannot be determined nor can the specific time network convergence has completed. The error can be determined to have occurred within the ~500 ms window between when the last Echo Reply message was received and the first unanswered Echo Request message was sent. Network errors are inherently unpredictable and the detection and propagation of these events, as previously noted is an ongoing area of research. As such network convergence time is also inherently uncertain, however for this project network convergence can be said to have occurred between the last unanswered Echo request and the first answered Echo request, which Wireshark shows may be as large as 4 seconds. For the purposes of this project differences in ICMP behaviour and timings are acknowledged as a factor, but the uncertainty is common to the entire projects test scenarios; any differences less than 4 seconds may be partially attributed to ICMP behaviour.

23.515	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74	Echo (ping)
24.037	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74	Echo (ping)
24.038	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74	Echo (ping)
24.319	01:00:5e:00:00:0a	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.10	EIGRP	74	Hello
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74	Echo (ping)
0.947	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	111	Query
0.950	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.2.1	192.168.2.2	EIGRP	60	Hello (Ack)
0.955	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	82	Update

Figure 24 Network Error Event

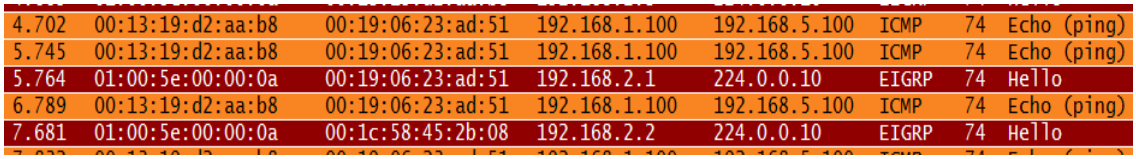
Figure 24 highlights the detection and beginning of the Error period. Using the reference time capabilities of Wireshark, the first unanswered ping is set as the time reference (0.000). At 0.947s after the reference an EIGRP Query message is received. This EIGRP message indicates that a network change has occurred and the routers have begun looking for alternative routes.



1.030	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.2.3	192.168.2.1	EIGRP	60	Hello (Ac
1.030	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.2.2	192.168.2.1	EIGRP	60	Hello (Ac
1.046	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74	Echo (pir
1.047	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70	Destinati
1.161	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	111	Query
1.165	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.2.1	192.168.2.2	EIGRP	60	Hello (Ac

Figure 25 Network Convergence Ongoing

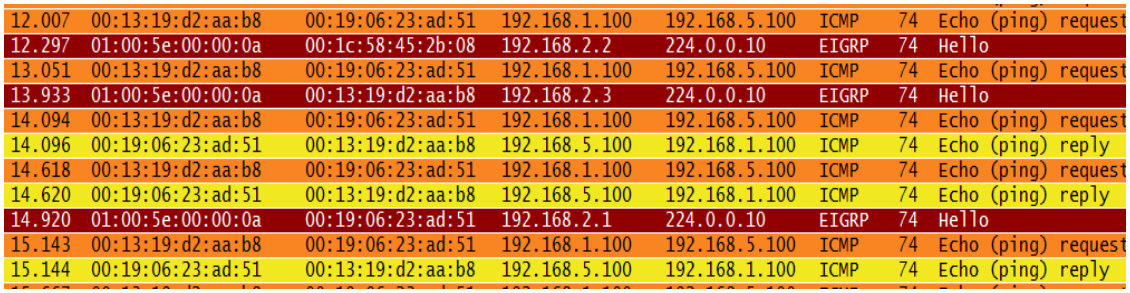
Figure 25 shows that R1 has still not yet determined an alternative path to the destination network and continues to forward packets through R2 to reach the destination. As well it can be noted as further justification not to use the ICMP error message as the starting point of the error period, the light red packet is the first ICMP destination unreachable message received. This message was received 1.047 seconds after the first unanswered Echo Request which was used to start the error period.



4.702	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74	Echo (ping)
5.745	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74	Echo (ping)
5.764	01:00:5e:00:00:0a	00:19:06:23:ad:51	192.168.2.1	224.0.0.10	EIGRP	74	Hello
6.789	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74	Echo (ping)
7.681	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	74	Hello

Figure 26 R1 Forwarding along Secondary Path

Figure 26 shows that R1 has updated its routing table and is now forwarding packets to R5 using the secondary path to reach the destination network. ICMP Echo reply messages are still not yet being received, as network convergence has not yet occurred.



12.007	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74	Echo (ping) request
12.297	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	74	Hello
13.051	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74	Echo (ping) request
13.933	01:00:5e:00:00:0a	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.10	EIGRP	74	Hello
14.094	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74	Echo (ping) request
14.096	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74	Echo (ping) reply
14.618	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74	Echo (ping) request
14.620	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74	Echo (ping) reply
14.920	01:00:5e:00:00:0a	00:19:06:23:ad:51	192.168.2.1	224.0.0.10	EIGRP	74	Hello
15.143	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74	Echo (ping) request
15.144	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74	Echo (ping) reply

Figure 27 Bidirectional Communication Restored

Figure 27 provides the first successful Echo request and Reply message pair since the start of the error period, indicating that bidirectional communication has been restored and that the error period lasted 14.096 seconds.

The previous procedure was followed to determine the error period for each protocol. The summary of the results are included in the next section.

Summary of Results

Table 10 shows the error period results for each tested routing protocol.

Protocol	Test 1	Test 2	Test 3	Average
RIPv2	184.502 s	189.545 s	180.634 s	184.894 s
EIGRPv4	14.096 s	12.008 s	11.489 s	12.531 s
OSPFv2	8.355 s	8.354 s	8.367 s	8.359 s
RIPng	187.357 s	178.879 s	191.421 s	185.886 s
EIGRPv6	13.274 s	13.349 s	14.254 s	13.626 s
OSPFv3	6.989 s	7.063 s	6.850 s	6.967 s

Table 10 Summary of Results

Table 11 shows the error period results of the IPv4/IPv6 dual stack test scenario.

OSPF Dual Stack	Test1	Test 2	Test 3	Average
OSPFv2	8.631 s	8.403 s	8.364 s	8.466 s
OSPFv3	7.176 s	7.106 s	7.331 s	7.204 s

Table 11 OSPF Dual Stack Summary

Note for the dual stack environment – the first unanswered Echo Request message is used to start the Error period for both protocols, regardless of whether or not it was an IPv4 or IPv6 Echo Request. The end of the error period is indicated by the first successful Echo reply message for each specific protocol.

Table 12 presents the difference in error periods between the IPv4 and IPv6 protocols (IPv6 time – IPv4 time) of the averaged results from Table 10.

Protocol	IPv4	IPv6	Difference
RIP	184.894 s	185.886 s	0.992 s
EIGRP	12.531 s	13.626 s	1.095 s
OSPF	8.359 s	6.967 s	-1.392 s

Table 12 Difference between Protocols

Table 13 presents the difference (Standalone – Dual Stack) in averaged error periods between the standalone OSPF implementation from Table 8 and the dual stack OSPF configuration from Table 11.

Protocol	Standalone	Dual Stack	Difference
OSPFv2	8.359 s	8.466 s	-0.107 s
OSPFv3	6.967 s	7.204 s	-0.237 s

Table 13 Dual Stack Comparison

Conclusion

Despite the major changes to the IP header, and the creation of new protocols to support IPv6, this project has shown that the time required to restore bidirectional communication between hosts is, on average, within 2 seconds for the IPv4 and IPv6 versions of the protocols RIP, EIGRP and OSPF. This time period is within the 4 seconds of uncertainty that ICMP introduced. As such the IPv4 and IPv6 versions of the routing protocols can be said to have similar convergence times.

Each routing protocol experienced only minor changes to core functionality with changes primarily supporting the larger address size of IPv6 network prefixes. Timers, algorithms, and other processes were kept largely the same between each version of a protocol. The message format for RIPng underwent significant modification to limit the effects of the IPv6 prefix size, whereas EIGRP simply accepts the larger message sizes between the two versions, and did not try and improve the efficiency of the EIGRP message process. OSPFv3 underwent the most significant changes, with message formats, and LSU's being significantly altered to support IPv6, and was the only IPv6 protocol to average better times than its IPv4 counterpart.

OSPFv3's move to become a protocol independent of the network layer by removing IPv6 prefixes from portions of the OSPF process is a very significant change. As the network scale increases OSPF may demonstrate increasing convergence time differences between the two protocols as OSPFv2 must carry more information within its messages.

EIGRPv6 with its opposite approach of simply accepting the larger IPv6 prefix sizes may also experience significant differences in convergence time as the network scale increases.

Configuring routers in a Dual Stack environment demonstrated only minor differences (~250 ms) in the time to restore network connectivity as compared to a standalone implementation and this may partially be accounted for by the behaviour of ICMP.

Further experimentation should be performed on a larger scale network with a more predictable packet generation process.

“IPv6 is an evolutionary not a revolutionary step and this is very clear in the case of routing which saw minor changes even through most of the routing protocols were completely rebuilt” – Ciprian Popoviciu [8].

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Appendix A Route Tables – R1

RIPv2 route table before network error.

```
R1_v4#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    192.168.4.0/24 [120/2] via 192.168.2.2, 00:00:24, FastEthernet0/1
R    192.168.5.0/24 [120/3] via 192.168.2.2, 00:00:24, FastEthernet0/1
     10.0.0.0/32 is subnetted, 7 subnets
R       10.0.3.1 [120/2] via 192.168.2.2, 00:00:24, FastEthernet0/1
R       10.0.2.1 [120/1] via 192.168.2.2, 00:00:24, FastEthernet0/1
C       10.0.1.1 is directly connected, Loopback0
R       10.0.7.1 [120/3] via 192.168.2.3, 00:00:26, FastEthernet0/1
                 [120/3] via 192.168.2.2, 00:00:24, FastEthernet0/1
R       10.0.6.1 [120/2] via 192.168.2.3, 00:00:27, FastEthernet0/1
R       10.0.5.1 [120/1] via 192.168.2.3, 00:00:27, FastEthernet0/1
R       10.0.4.1 [120/3] via 192.168.2.2, 00:00:25, FastEthernet0/1
R    192.168.6.0/24 [120/1] via 192.168.2.3, 00:00:27, FastEthernet0/1
R    192.168.7.0/24 [120/2] via 192.168.2.3, 00:00:27, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet0/1
R    192.168.3.0/24 [120/1] via 192.168.2.2, 00:00:01, FastEthernet0/1
R1_v4#
```

RIPv2 route table after network error.

```
R1_v4#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    192.168.4.0/24 [120/3] via 192.168.2.3, 00:00:05, FastEthernet0/1
R    192.168.5.0/24 [120/4] via 192.168.2.3, 00:00:05, FastEthernet0/1
     10.0.0.0/32 is subnetted, 7 subnets
R       10.0.3.1 [120/2] via 192.168.2.2, 00:00:12, FastEthernet0/1
R       10.0.2.1 [120/1] via 192.168.2.2, 00:00:12, FastEthernet0/1
C       10.0.1.1 is directly connected, Loopback0
R       10.0.7.1 [120/3] via 192.168.2.3, 00:00:05, FastEthernet0/1
R       10.0.6.1 [120/2] via 192.168.2.3, 00:00:05, FastEthernet0/1
R       10.0.5.1 [120/1] via 192.168.2.3, 00:00:06, FastEthernet0/1
R       10.0.4.1 [120/4] via 192.168.2.3, 00:00:06, FastEthernet0/1
R    192.168.6.0/24 [120/1] via 192.168.2.3, 00:00:06, FastEthernet0/1
R    192.168.7.0/24 [120/2] via 192.168.2.3, 00:00:06, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet0/1
R    192.168.3.0/24 [120/1] via 192.168.2.2, 00:00:14, FastEthernet0/1
R1_v4#
```

EIGRPv4 route table before network error.

```
R1_v4#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

D    192.168.4.0/24 [90/33280] via 192.168.2.2, 00:12:17, FastEthernet0/1
D    192.168.5.0/24 [90/35840] via 192.168.2.2, 00:11:27, FastEthernet0/1
     10.0.0.0/32 is subnetted, 7 subnets
D       10.0.3.1 [90/158720] via 192.168.2.2, 00:12:17, FastEthernet0/1
D       10.0.2.1 [90/156160] via 192.168.2.2, 00:12:45, FastEthernet0/1
C       10.0.1.1 is directly connected, Loopback0
D       10.0.7.1 [90/161280] via 192.168.2.3, 00:09:50, FastEthernet0/1
                 [90/161280] via 192.168.2.2, 00:09:50, FastEthernet0/1
D       10.0.6.1 [90/158720] via 192.168.2.3, 00:10:09, FastEthernet0/1
D       10.0.5.1 [90/156160] via 192.168.2.3, 00:10:36, FastEthernet0/1
D       10.0.4.1 [90/161280] via 192.168.2.2, 00:11:29, FastEthernet0/1
D    192.168.6.0/24 [90/30720] via 192.168.2.3, 00:10:36, FastEthernet0/1
D    192.168.7.0/24 [90/33280] via 192.168.2.3, 00:10:09, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet0/1
D    192.168.3.0/24 [90/30720] via 192.168.2.2, 00:12:47, FastEthernet0/1
R1_v4#
```

EIGRPv4 route table after network error.

```
R1_v4#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

D    192.168.4.0/24 [90/35840] via 192.168.2.3, 00:02:29, FastEthernet0/1
D    192.168.5.0/24 [90/38400] via 192.168.2.3, 00:02:29, FastEthernet0/1
     10.0.0.0/32 is subnetted, 7 subnets
D       10.0.3.1 [90/158720] via 192.168.2.2, 00:20:40, FastEthernet0/1
D       10.0.2.1 [90/156160] via 192.168.2.2, 00:21:08, FastEthernet0/1
C       10.0.1.1 is directly connected, Loopback0
D       10.0.7.1 [90/161280] via 192.168.2.3, 00:02:29, FastEthernet0/1
D       10.0.6.1 [90/158720] via 192.168.2.3, 00:18:31, FastEthernet0/1
D       10.0.5.1 [90/156160] via 192.168.2.3, 00:18:59, FastEthernet0/1
D       10.0.4.1 [90/163840] via 192.168.2.3, 00:02:30, FastEthernet0/1
D    192.168.6.0/24 [90/30720] via 192.168.2.3, 00:18:59, FastEthernet0/1
D    192.168.7.0/24 [90/33280] via 192.168.2.3, 00:18:32, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet0/1
D    192.168.3.0/24 [90/30720] via 192.168.2.2, 00:21:11, FastEthernet0/1
R1_v4#
```

OSPFv2 route table before network error.

```
R1_v4#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

O    192.168.4.0/24 [110/3] via 192.168.2.2, 00:01:03, FastEthernet0/1
O    192.168.5.0/24 [110/4] via 192.168.2.2, 00:01:03, FastEthernet0/1
     10.0.0.0/32 is subnetted, 7 subnets
O       10.0.3.1 [110/3] via 192.168.2.2, 00:07:20, FastEthernet0/1
O       10.0.2.1 [110/2] via 192.168.2.2, 00:08:00, FastEthernet0/1
C       10.0.1.1 is directly connected, Loopback0
O       10.0.7.1 [110/4] via 192.168.2.3, 00:04:23, FastEthernet0/1
                 [110/4] via 192.168.2.2, 00:01:03, FastEthernet0/1
O       10.0.6.1 [110/3] via 192.168.2.3, 00:04:34, FastEthernet0/1
O       10.0.5.1 [110/2] via 192.168.2.3, 00:05:10, FastEthernet0/1
O       10.0.4.1 [110/4] via 192.168.2.2, 00:01:04, FastEthernet0/1
O    192.168.6.0/24 [110/2] via 192.168.2.3, 00:05:10, FastEthernet0/1
O    192.168.7.0/24 [110/3] via 192.168.2.3, 00:04:34, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet0/1
O    192.168.3.0/24 [110/2] via 192.168.2.2, 00:08:10, FastEthernet0/1
R1_v4#
```

OSPFv2 route table after network error.

```
R1_v4#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

O    192.168.4.0/24 [110/4] via 192.168.2.3, 00:04:12, FastEthernet0/1
O    192.168.5.0/24 [110/5] via 192.168.2.3, 00:04:12, FastEthernet0/1
     10.0.0.0/32 is subnetted, 7 subnets
O       10.0.3.1 [110/3] via 192.168.2.2, 00:15:56, FastEthernet0/1
O       10.0.2.1 [110/2] via 192.168.2.2, 00:16:36, FastEthernet0/1
C       10.0.1.1 is directly connected, Loopback0
O       10.0.7.1 [110/4] via 192.168.2.3, 00:12:58, FastEthernet0/1
O       10.0.6.1 [110/3] via 192.168.2.3, 00:13:08, FastEthernet0/1
O       10.0.5.1 [110/2] via 192.168.2.3, 00:13:46, FastEthernet0/1
O       10.0.4.1 [110/5] via 192.168.2.3, 00:04:13, FastEthernet0/1
O    192.168.6.0/24 [110/2] via 192.168.2.3, 00:13:46, FastEthernet0/1
O    192.168.7.0/24 [110/3] via 192.168.2.3, 00:13:10, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet0/1
O    192.168.3.0/24 [110/2] via 192.168.2.2, 00:16:38, FastEthernet0/1
R1_v4#
```

RIPng route table before network error.

```
IPv6 Routing Table - Default - 17 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, M - MIPv6, R - RIP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
C   2014:709:0:1::/64 [0/0]
     via FastEthernet0/0, directly connected
L   2014:709:0:1::1/128 [0/0]
     via FastEthernet0/0, receive
C   2014:709:0:2::/64 [0/0]
     via FastEthernet0/1, directly connected
L   2014:709:0:2::1/128 [0/0]
     via FastEthernet0/1, receive
R   2014:709:0:3::/64 [120/2]
     via FE80::2, FastEthernet0/1
R   2014:709:0:4::/64 [120/3]
     via FE80::2, FastEthernet0/1
R   2014:709:0:5::/64 [120/4]
     via FE80::2, FastEthernet0/1
R   2014:709:0:6::/64 [120/2]
     via FE80::5, FastEthernet0/1
R   2014:709:0:7::/64 [120/3]
     via FE80::5, FastEthernet0/1
LC  2014:709:0:A1::1/128 [0/0]
     via Loopback0, receive
R   2014:709:0:A2::1/128 [120/2]
     via FE80::2, FastEthernet0/1
R   2014:709:0:A3::1/128 [120/3]
     via FE80::2, FastEthernet0/1
R   2014:709:0:A4::1/128 [120/4]
     via FE80::2, FastEthernet0/1
R   2014:709:0:A5::1/128 [120/2]
     via FE80::5, FastEthernet0/1
R   2014:709:0:A6::1/128 [120/3]
     via FE80::5, FastEthernet0/1
R   2014:709:0:A7::1/128 [120/4]
     via FE80::5, FastEthernet0/1
     via FE80::2, FastEthernet0/1
L   FF00::/8 [0/0]
     via Null0, receive
R1_v6#
```

RIPng route table after network error.

```
R1_v6#sh ipv6 route
IPv6 Routing Table - Default - 17 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, M - MIPv6, R - RIP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
C   2014:709:0:1::/64 [0/0]
     via FastEthernet0/0, directly connected
L   2014:709:0:1::1/128 [0/0]
     via FastEthernet0/0, receive
C   2014:709:0:2::/64 [0/0]
     via FastEthernet0/1, directly connected
L   2014:709:0:2::1/128 [0/0]
     via FastEthernet0/1, receive
R   2014:709:0:3::/64 [120/2]
     via FE80::2, FastEthernet0/1
R   2014:709:0:4::/64 [120/4]
     via FE80::5, FastEthernet0/1
R   2014:709:0:5::/64 [120/5]
     via FE80::5, FastEthernet0/1
R   2014:709:0:6::/64 [120/2]
     via FE80::5, FastEthernet0/1
R   2014:709:0:7::/64 [120/3]
     via FE80::5, FastEthernet0/1
LC  2014:709:0:A1::1/128 [0/0]
     via Loopback0, receive
R   2014:709:0:A2::1/128 [120/2]
     via FE80::2, FastEthernet0/1
R   2014:709:0:A3::1/128 [120/3]
     via FE80::2, FastEthernet0/1
R   2014:709:0:A4::1/128 [120/5]
     via FE80::5, FastEthernet0/1
R   2014:709:0:A5::1/128 [120/2]
     via FE80::5, FastEthernet0/1
R   2014:709:0:A6::1/128 [120/3]
     via FE80::5, FastEthernet0/1
R   2014:709:0:A7::1/128 [120/4]
     via FE80::5, FastEthernet0/1
L   FF00::/8 [0/0]
     via Null0, receive
R1_v6#
```

EIGRPv6 route table before network error.

```
R1_v6#sh ipv6 route
IPv6 Routing Table - Default - 17 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, M - MIPv6, R - RIP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
C   2014:709:0:1::/64 [0/0]
     via FastEthernet0/0, directly connected
L   2014:709:0:1::1/128 [0/0]
     via FastEthernet0/0, receive
C   2014:709:0:2::/64 [0/0]
     via FastEthernet0/1, directly connected
L   2014:709:0:2::1/128 [0/0]
     via FastEthernet0/1, receive
D   2014:709:0:3::/64 [90/30720]
     via FE80::2, FastEthernet0/1
D   2014:709:0:4::/64 [90/33280]
     via FE80::2, FastEthernet0/1
D   2014:709:0:5::/64 [90/35840]
     via FE80::2, FastEthernet0/1
D   2014:709:0:6::/64 [90/30720]
     via FE80::5, FastEthernet0/1
D   2014:709:0:7::/64 [90/33280]
     via FE80::5, FastEthernet0/1
LC  2014:709:0:A1::1/128 [0/0]
     via Loopback0, receive
D   2014:709:0:A2::1/128 [90/156160]
     via FE80::2, FastEthernet0/1
D   2014:709:0:A3::1/128 [90/158720]
     via FE80::2, FastEthernet0/1
D   2014:709:0:A4::1/128 [90/161280]
     via FE80::2, FastEthernet0/1
D   2014:709:0:A5::1/128 [90/156160]
     via FE80::5, FastEthernet0/1
D   2014:709:0:A6::1/128 [90/158720]
     via FE80::5, FastEthernet0/1
D   2014:709:0:A7::1/128 [90/161280]
     via FE80::2, FastEthernet0/1
     via FE80::5, FastEthernet0/1
L   FF00::/8 [0/0]
     via Null0, receive
R1_v6#
```

EIGRPv6 route table after network error.

```
R1_v6#sh ipv6 route
IPv6 Routing Table - Default - 17 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, M - MIPv6, R - RIP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
C   2014:709:0:1::/64 [0/0]
     via FastEthernet0/0, directly connected
L   2014:709:0:1::1/128 [0/0]
     via FastEthernet0/0, receive
C   2014:709:0:2::/64 [0/0]
     via FastEthernet0/1, directly connected
L   2014:709:0:2::1/128 [0/0]
     via FastEthernet0/1, receive
D   2014:709:0:3::/64 [90/30720]
     via FE80::2, FastEthernet0/1
D   2014:709:0:4::/64 [90/35840]
     via FE80::5, FastEthernet0/1
D   2014:709:0:5::/64 [90/38400]
     via FE80::5, FastEthernet0/1
D   2014:709:0:6::/64 [90/30720]
     via FE80::5, FastEthernet0/1
D   2014:709:0:7::/64 [90/33280]
     via FE80::5, FastEthernet0/1
LC  2014:709:0:A1::1/128 [0/0]
     via Loopback0, receive
D   2014:709:0:A2::1/128 [90/156160]
     via FE80::2, FastEthernet0/1
D   2014:709:0:A3::1/128 [90/158720]
     via FE80::2, FastEthernet0/1
D   2014:709:0:A4::1/128 [90/163840]
     via FE80::5, FastEthernet0/1
D   2014:709:0:A5::1/128 [90/156160]
     via FE80::5, FastEthernet0/1
D   2014:709:0:A6::1/128 [90/158720]
     via FE80::5, FastEthernet0/1
D   2014:709:0:A7::1/128 [90/161280]
     via FE80::5, FastEthernet0/1
L   FF00::/8 [0/0]
     via Null0, receive
R1_v6#
```

OSPFv3 route table before network error.

```
R1_v6#sh ipv6 route
IPv6 Routing Table - Default - 17 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, M - MIPv6, R - RIP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
C   2014:709:0:1::/64 [0/0]
     via FastEthernet0/0, directly connected
L   2014:709:0:1::1/128 [0/0]
     via FastEthernet0/0, receive
C   2014:709:0:2::/64 [0/0]
     via FastEthernet0/1, directly connected
L   2014:709:0:2::1/128 [0/0]
     via FastEthernet0/1, receive
O   2014:709:0:3::/64 [110/2]
     via FE80::2, FastEthernet0/1
O   2014:709:0:4::/64 [110/3]
     via FE80::2, FastEthernet0/1
O   2014:709:0:5::/64 [110/4]
     via FE80::2, FastEthernet0/1
O   2014:709:0:6::/64 [110/2]
     via FE80::5, FastEthernet0/1
O   2014:709:0:7::/64 [110/3]
     via FE80::5, FastEthernet0/1
LC  2014:709:0:A1::1/128 [0/0]
     via Loopback0, receive
O   2014:709:0:A2::1/128 [110/1]
     via FE80::2, FastEthernet0/1
O   2014:709:0:A3::1/128 [110/2]
     via FE80::2, FastEthernet0/1
O   2014:709:0:A4::1/128 [110/3]
     via FE80::2, FastEthernet0/1
O   2014:709:0:A5::1/128 [110/1]
     via FE80::5, FastEthernet0/1
O   2014:709:0:A6::1/128 [110/2]
     via FE80::5, FastEthernet0/1
O   2014:709:0:A7::1/128 [110/3]
     via FE80::5, FastEthernet0/1
     via FE80::2, FastEthernet0/1
L   FF00::/8 [0/0]
     via Null0, receive
R1_v6#
```

OSPFv3 route table after network error

```
R1_v6#sh ipv6 route
IPv6 Routing Table - Default - 17 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, M - MIPv6, R - RIP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
C   2014:709:0:1::/64 [0/0]
     via FastEthernet0/0, directly connected
L   2014:709:0:1::1/128 [0/0]
     via FastEthernet0/0, receive
C   2014:709:0:2::/64 [0/0]
     via FastEthernet0/1, directly connected
L   2014:709:0:2::1/128 [0/0]
     via FastEthernet0/1, receive
O   2014:709:0:3::/64 [110/2]
     via FE80::2, FastEthernet0/1
O   2014:709:0:4::/64 [110/4]
     via FE80::5, FastEthernet0/1
O   2014:709:0:5::/64 [110/5]
     via FE80::5, FastEthernet0/1
O   2014:709:0:6::/64 [110/2]
     via FE80::5, FastEthernet0/1
O   2014:709:0:7::/64 [110/3]
     via FE80::5, FastEthernet0/1
LC  2014:709:0:A1::1/128 [0/0]
     via Loopback0, receive
O   2014:709:0:A2::1/128 [110/1]
     via FE80::2, FastEthernet0/1
O   2014:709:0:A3::1/128 [110/2]
     via FE80::2, FastEthernet0/1
O   2014:709:0:A4::1/128 [110/4]
     via FE80::5, FastEthernet0/1
O   2014:709:0:A5::1/128 [110/1]
     via FE80::5, FastEthernet0/1
O   2014:709:0:A6::1/128 [110/2]
     via FE80::5, FastEthernet0/1
O   2014:709:0:A7::1/128 [110/3]
     via FE80::5, FastEthernet0/1
L   FF00::/8 [0/0]
     via Null0, receive
R1_v6#
```

OSPF Dual Stack route tables before network error

```
R1_dualstack#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

O    192.168.4.0/24 [110/3] via 192.168.2.2, 00:10:49, FastEthernet0/1
O    192.168.5.0/24 [110/4] via 192.168.2.2, 00:10:09, FastEthernet0/1
     10.0.0.0/32 is subnetted, 7 subnets
O       10.0.3.1 [110/3] via 192.168.2.2, 00:10:59, FastEthernet0/1
O       10.0.2.1 [110/2] via 192.168.2.2, 00:11:38, FastEthernet0/1
C       10.0.1.1 is directly connected, Loopback0
O       10.0.7.1 [110/4] via 192.168.2.3, 00:13:04, FastEthernet0/1
                 [110/4] via 192.168.2.2, 00:10:49, FastEthernet0/1
O       10.0.6.1 [110/3] via 192.168.2.3, 00:13:05, FastEthernet0/1
O       10.0.5.1 [110/2] via 192.168.2.3, 00:13:05, FastEthernet0/1
O       10.0.4.1 [110/4] via 192.168.2.2, 00:10:10, FastEthernet0/1
O    192.168.6.0/24 [110/2] via 192.168.2.3, 00:13:05, FastEthernet0/1
O    192.168.7.0/24 [110/3] via 192.168.2.3, 00:13:05, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet0/1
O    192.168.3.0/24 [110/2] via 192.168.2.2, 00:11:40, FastEthernet0/1
R1_dualstack#
```

```
R1_dualstack#sh ipv6 route
IPv6 Routing Table - Default - 17 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, M - MIPv6, R - RIP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
C   2014:709:0:1::/64 [0/0]
     via FastEthernet0/0, directly connected
L   2014:709:0:1::1/128 [0/0]
     via FastEthernet0/0, receive
C   2014:709:0:2::/64 [0/0]
     via FastEthernet0/1, directly connected
L   2014:709:0:2::1/128 [0/0]
     via FastEthernet0/1, receive
O   2014:709:0:3::/64 [110/2]
     via FE80::2, FastEthernet0/1
O   2014:709:0:4::/64 [110/3]
     via FE80::2, FastEthernet0/1
O   2014:709:0:5::/64 [110/4]
     via FE80::2, FastEthernet0/1
O   2014:709:0:6::/64 [110/2]
     via FE80::5, FastEthernet0/1
O   2014:709:0:7::/64 [110/3]
     via FE80::5, FastEthernet0/1
LC  2014:709:0:A1::1/128 [0/0]
     via Loopback0, receive
O   2014:709:0:A2::1/128 [110/1]
     via FE80::2, FastEthernet0/1
O   2014:709:0:A3::1/128 [110/2]
     via FE80::2, FastEthernet0/1
O   2014:709:0:A4::1/128 [110/3]
     via FE80::2, FastEthernet0/1
O   2014:709:0:A5::1/128 [110/1]
     via FE80::5, FastEthernet0/1
O   2014:709:0:A6::1/128 [110/2]
     via FE80::5, FastEthernet0/1
O   2014:709:0:A7::1/128 [110/3]
     via FE80::5, FastEthernet0/1
     via FE80::2, FastEthernet0/1
L   FF00::/8 [0/0]
     via Null0, receive
R1_dualstack#
```

OSPF dual stack route tables after network error.

```
R1_dualstack#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

O    192.168.4.0/24 [110/4] via 192.168.2.3, 00:01:15, FastEthernet0/1
O    192.168.5.0/24 [110/5] via 192.168.2.3, 00:01:15, FastEthernet0/1
     10.0.0.0/32 is subnetted, 7 subnets
O       10.0.3.1 [110/3] via 192.168.2.2, 00:15:27, FastEthernet0/1
O       10.0.2.1 [110/2] via 192.168.2.2, 00:16:06, FastEthernet0/1
C       10.0.1.1 is directly connected, Loopback0
O       10.0.7.1 [110/4] via 192.168.2.3, 00:17:32, FastEthernet0/1
O       10.0.6.1 [110/3] via 192.168.2.3, 00:17:32, FastEthernet0/1
O       10.0.5.1 [110/2] via 192.168.2.3, 00:17:34, FastEthernet0/1
O       10.0.4.1 [110/5] via 192.168.2.3, 00:01:16, FastEthernet0/1
O    192.168.6.0/24 [110/2] via 192.168.2.3, 00:17:34, FastEthernet0/1
O    192.168.7.0/24 [110/3] via 192.168.2.3, 00:17:34, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet0/1
O    192.168.3.0/24 [110/2] via 192.168.2.2, 00:16:08, FastEthernet0/1
R1_dualstack#

R1_dualstack#sh ipv6 route
IPv6 Routing Table - Default - 17 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, M - MIPv6, R - RIP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
C   2014:709:0:1::/64 [0/0]
     via FastEthernet0/0, directly connected
L   2014:709:0:1::1/128 [0/0]
     via FastEthernet0/0, receive
C   2014:709:0:2::/64 [0/0]
     via FastEthernet0/1, directly connected
L   2014:709:0:2::1/128 [0/0]
     via FastEthernet0/1, receive
O   2014:709:0:3::/64 [110/2]
     via FE80::2, FastEthernet0/1
O   2014:709:0:4::/64 [110/4]
     via FE80::5, FastEthernet0/1
O   2014:709:0:5::/64 [110/5]
     via FE80::5, FastEthernet0/1
O   2014:709:0:6::/64 [110/2]
     via FE80::5, FastEthernet0/1
O   2014:709:0:7::/64 [110/3]
     via FE80::5, FastEthernet0/1
LC  2014:709:0:A1::1/128 [0/0]
     via Loopback0, receive
O   2014:709:0:A2::1/128 [110/1]
     via FE80::2, FastEthernet0/1
O   2014:709:0:A3::1/128 [110/2]
     via FE80::2, FastEthernet0/1
O   2014:709:0:A4::1/128 [110/4]
     via FE80::5, FastEthernet0/1
O   2014:709:0:A5::1/128 [110/1]
     via FE80::5, FastEthernet0/1
O   2014:709:0:A6::1/128 [110/2]
     via FE80::5, FastEthernet0/1
O   2014:709:0:A7::1/128 [110/3]
     via FE80::5, FastEthernet0/1
L   FF00::/8 [0/0]
     via Null0, receive
R1_dualstack#
```

Appendix B – All Router Configuration Files

Configs have been compressed for column space, and as such a command may span multiple lines (ip address command…).

RIPv2

```
hostname R1_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.1.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.1.1
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.2.1
255.255.255.0
no shut
router rip
version 2
network 10.0.0.0
network 192.168.1.0
network 192.168.2.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R2_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.2.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.2.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.3.1
255.255.255.0
no shut
router rip
version 2
network 10.0.0.0
network 192.168.2.0
network 192.168.3.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R3_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.3.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.3.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.4.1
255.255.255.0
no shut
router rip
version 2
network 10.0.0.0
network 192.168.3.0
network 192.168.4.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R4_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.4.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.4.3
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.5.1
255.255.255.0
no shut
router rip
version 2
network 10.0.0.0
network 192.168.4.0
network 192.168.5.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R5_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.5.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.2.3
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.6.1
255.255.255.0
no shut
router rip
version 2
network 10.0.0.0
network 192.168.2.0
network 192.168.6.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R6_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.6.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.6.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.7.1
255.255.255.0
no shut
router rip
version 2
network 10.0.0.0
network 192.168.6.0
network 192.168.7.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

hostname R7_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.7.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.7.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.4.2
255.255.255.0
no shut
router rip
version 2
network 10.0.0.0
network 192.168.4.0
network 192.168.7.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end

EIGRPv4

hostname R1_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.1.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.1.1
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.2.1
255.255.255.0
no shut
router eigrp 709
network 10.0.0.0
network 192.168.1.0
network 192.168.2.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end

hostname R2_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.2.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.2.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.3.1
255.255.255.0
no shut
router eigrp 709
network 10.0.0.0
network 192.168.2.0
network 192.168.3.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end

```
hostname R3_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.3.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.3.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.4.1
255.255.255.0
no shut
router eigrp 709
network 10.0.0.0
network 192.168.3.0
network 192.168.4.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R4_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.4.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.4.3
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.5.1
255.255.255.0
no shut
router eigrp 709
network 10.0.0.0
network 192.168.4.0
network 192.168.5.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R5_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.5.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.2.3
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.6.1
255.255.255.0
no shut
router eigrp 709
network 10.0.0.0
network 192.168.2.0
network 192.168.6.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R6_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.6.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.6.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.7.1
255.255.255.0
no shut
router eigrp 709
network 10.0.0.0
network 192.168.6.0
network 192.168.7.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R7_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.7.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.7.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.4.2
255.255.255.0
no shut
router eigrp 709
network 10.0.0.0
network 192.168.4.0
network 192.168.7.0
no auto-summary
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

OSPFv2

```
hostname R1_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.1.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.1.1
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.2.1
255.255.255.0
no shut
router ospf 709
network 10.0.1.1 0.0.0.0
area 0
network 192.168.1.0
0.0.0.255 area 0
network 192.168.2.0
0.0.0.255 area 0
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R2_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.2.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.2.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.3.1
255.255.255.0
no shut
router ospf 709
network 10.0.2.1 0.0.0.0
area 0
network 192.168.2.0
0.0.0.255 area 0
network 192.168.3.0
0.0.0.255 area 0
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R3_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.3.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.3.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.4.1
255.255.255.0
no shut
router ospf 709
network 10.0.3.1 0.0.0.0
area 0
network 192.168.3.0
0.0.0.255 area 0
network 192.168.4.0
0.0.0.255 area 0
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R4_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.4.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.4.3
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.5.1
255.255.255.0
no shut
router ospf 709
network 10.0.4.1 0.0.0.0
area 0
network 192.168.4.0
0.0.0.255 area 0
network 192.168.5.0
0.0.0.255 area 0
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R5_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.5.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.2.3
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.6.1
255.255.255.0
no shut
router ospf 709
network 10.0.5.1 0.0.0.0
area 0
network 192.168.2.0
0.0.0.255 area 0
network 192.168.6.0
0.0.0.255 area 0
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R6_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.6.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.6.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.7.1
255.255.255.0
no shut
router ospf 709
network 10.0.6.1 0.0.0.0
area 0
network 192.168.6.0
0.0.0.255 area 0
network 192.168.7.0
0.0.0.255 area 0
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R7_v4
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
no ip domain lookup
enable secret mint
interface Loopback0
ip address 10.0.7.1
255.255.255.255
interface FastEthernet0/0
ip address 192.168.7.2
255.255.255.0
no shut
interface FastEthernet0/1
ip address 192.168.4.2
255.255.255.0
no shut
router ospf 709
network 10.0.7.1 0.0.0.0
area 0
network 192.168.4.0
0.0.0.255 area 0
network 192.168.7.0
0.0.0.255 area 0
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

RIPng

```
hostname R1_v6
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
 ipv6 address 2014:709:0:A1::1/128
 ipv6 rip MINT enable
interface FastEthernet0/0
 ipv6 address 2014:709:0:1::1/64
 ipv6 address FE80::1 Link-local
 ipv6 rip MINT enable
 no shut
interface FastEthernet0/1
 ipv6 address 2014:709:0:2::1/64
 ipv6 address FE80::1 Link-local
 ipv6 rip MINT enable
 no shut
line con 0
 logging synchronous
 exec-timeout 0 0
line vty 0 4
 password mint709
 login
end
```

```
hostname R2_v6
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
 ipv6 address 2014:709:0:A2::1/128
 ipv6 rip MINT enable
interface FastEthernet0/0
 ipv6 address 2014:709:0:2::2/64
 ipv6 address FE80::2 Link-local
 ipv6 rip MINT enable
 no shut
interface FastEthernet0/1
 ipv6 address 2014:709:0:3::1/64
 ipv6 address FE80::2 Link-local
 ipv6 rip MINT enable
 no shut
line con 0
 logging synchronous
 exec-timeout 0 0
line vty 0 4
 password mint709
 login
end
```

```
hostname R3_v6
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
 ipv6 address 2014:709:0:A3::1/128
 ipv6 rip MINT enable
interface FastEthernet0/0
 ipv6 address 2014:709:0:3::2/64
 ipv6 address FE80::3 Link-local
 ipv6 rip MINT enable
 no shut
interface FastEthernet0/1
 ipv6 address 2014:709:0:4::1/64
 ipv6 address FE80::3 Link-local
 ipv6 rip MINT enable
 no shut
line con 0
 logging synchronous
 exec-timeout 0 0
line vty 0 4
 password mint709
 login
end
```

```
hostname R4_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A4::1/128
ipv6 rip MINT enable
interface FastEthernet0/0
ipv6 address
2014:709:0:4::3/64
ipv6 address FE80::4 Link-
local
ipv6 rip MINT enable
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:5::1/64
ipv6 address FE80::4 Link-
local
ipv6 rip MINT enable
no shut
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R5_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A5::1/128
ipv6 rip MINT enable
interface FastEthernet0/0
ipv6 address
2014:709:0:2::3/64
ipv6 address FE80::5 Link-
local
ipv6 rip MINT enable
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:6::1/64
ipv6 address FE80::5 Link-
local
ipv6 rip MINT enable
no shut
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R6_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A6::1/128
ipv6 rip MINT enable
interface FastEthernet0/0
ipv6 address
2014:709:0:6::2/64
ipv6 address FE80::6 Link-
local
ipv6 rip MINT enable
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:7::1/64
ipv6 address FE80::6 Link-
local
ipv6 rip MINT enable
no shut
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R7_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A7::1/128
ipv6 rip MINT enable
interface FastEthernet0/0
ipv6 address
2014:709:0:7::2/64
ipv6 address FE80::7 Link-
local
ipv6 rip MINT enable
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:4::2/64
ipv6 address FE80::7 Link-
local
ipv6 rip MINT enable
no shut
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

EIGRP v6

```
hostname R1_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A1::1/128
ipv6 eigrp 709
interface FastEthernet0/0
ipv6 address
2014:709:0:1::1/64
ipv6 address FE80::1 Link-
local
ipv6 eigrp 709
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:2::1/64
ipv6 address FE80::1 Link-
local
ipv6 eigrp 709
no shut
ipv6 router eigrp 709
no shutdown
router-id 10.0.1.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R2_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A2::1/128
ipv6 eigrp 709
interface FastEthernet0/0
ipv6 address
2014:709:0:2::2/64
ipv6 address FE80::2 Link-
local
ipv6 eigrp 709
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:3::1/64
ipv6 address FE80::2 Link-
local
ipv6 eigrp 709
no shut
ipv6 router eigrp 709
no shutdown
router-id 10.0.2.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R3_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A3::1/128
ipv6 eigrp 709
interface FastEthernet0/0
ipv6 address
2014:709:0:3::2/64
ipv6 address FE80::3 Link-
local
ipv6 eigrp 709
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:4::1/64
ipv6 address FE80::3 Link-
local
ipv6 eigrp 709
no shut
ipv6 router eigrp 709
no shutdown
router-id 10.0.3.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R4_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A4::1/128
ipv6 eigrp 709
interface FastEthernet0/0
ipv6 address
2014:709:0:4::3/64
ipv6 address FE80::4 Link-
local
ipv6 eigrp 709
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:5::1/64
ipv6 address FE80::4 Link-
local
ipv6 eigrp 709
no shut
ipv6 router eigrp 709
no shutdown
router-id 10.0.4.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R5_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A5::1/128
ipv6 eigrp 709
interface FastEthernet0/0
ipv6 address
2014:709:0:2::3/64
ipv6 address FE80::5 Link-
local
ipv6 eigrp 709
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:6::1/64
ipv6 address FE80::5 Link-
local
ipv6 eigrp 709
no shut
ipv6 router eigrp 709
no shutdown
router-id 10.0.5.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R6_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A6::1/128
ipv6 eigrp 709
interface FastEthernet0/0
ipv6 address
2014:709:0:6::2/64
ipv6 address FE80::6 Link-
local
ipv6 eigrp 709
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:7::1/64
ipv6 address FE80::6 Link-
local
ipv6 eigrp 709
no shut
ipv6 router eigrp 709
no shutdown
router-id 10.0.6.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R7_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A7::1/128
ipv6 eigrp 709
interface FastEthernet0/0
ipv6 address
2014:709:0:7::2/64
ipv6 address FE80::7 Link-
local
ipv6 eigrp 709
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:4::2/64
ipv6 address FE80::7 Link-
local
ipv6 eigrp 709
no shut
ipv6 router eigrp 709
no shutdown
router-id 10.0.7.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

OSPFv3

```
hostname R1_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A1::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ipv6 address
2014:709:0:1::1/64
ipv6 address FE80::1 Link-
local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:2::1/64
ipv6 address FE80::1 Link-
local
ipv6 ospf 709 area 0
no shut
ipv6 router ospf 709
router-id 10.0.1.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R2_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A2::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ipv6 address
2014:709:0:2::2/64
ipv6 address FE80::2 Link-
local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:3::1/64
ipv6 address FE80::2 Link-
local
ipv6 ospf 709 area 0
no shut
ipv6 router ospf 709
router-id 10.0.2.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R3_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A3::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ipv6 address
2014:709:0:3::2/64
ipv6 address FE80::3 Link-
local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:4::1/64
ipv6 address FE80::3 Link-
local
ipv6 ospf 709 area 0
no shut
ipv6 router ospf 709
router-id 10.0.3.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R4_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A4::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ipv6 address
2014:709:0:4::3/64
ipv6 address FE80::4 Link-
local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:5::1/64
ipv6 address FE80::4 Link-
local
ipv6 ospf 709 area 0
no shut
ipv6 router ospf 709
router-id 10.0.4.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R5_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A5::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ipv6 address
2014:709:0:2::3/64
ipv6 address FE80::5 Link-
local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:6::1/64
ipv6 address FE80::5 Link-
local
ipv6 ospf 709 area 0
no shut
ipv6 router ospf 709
router-id 10.0.5.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R6_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A6::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ipv6 address
2014:709:0:6::2/64
ipv6 address FE80::6 Link-
local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:7::1/64
ipv6 address FE80::6 Link-
local
ipv6 ospf 709 area 0
no shut
ipv6 router ospf 709
router-id 10.0.6.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R7_v6
ipv6 host R1_v6
2014:709:0:A1::1
ipv6 host R2_v6
2014:709:0:A2::1
ipv6 host R3_v6
2014:709:0:A3::1
ipv6 host R4_v6
2014:709:0:A4::1
ipv6 host R5_v6
2014:709:0:A5::1
ipv6 host R6_v6
2014:709:0:A6::1
ipv6 host R7_v6
2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ipv6 address
2014:709:0:A7::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ipv6 address
2014:709:0:7::2/64
ipv6 address FE80::7 Link-
local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ipv6 address
2014:709:0:4::2/64
ipv6 address FE80::7 Link-
local
ipv6 ospf 709 area 0
no shut
ipv6 router ospf 709
router-id 10.0.7.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

OSPF Dual Stack

```
hostname R1_dualstack
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ip address 10.0.1.1 255.255.255.255
ipv6 address 2014:709:0:A1::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ip address 192.168.1.1 255.255.255.0
ipv6 address 2014:709:0:1::1/64
ipv6 address FE80::1 Link-local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ip address 192.168.2.1 255.255.255.0
ipv6 address 2014:709:0:2::1/64
ipv6 address FE80::1 Link-local
ipv6 ospf 709 area 0
no shut
router ospf 709
network 10.0.1.1 0.0.0.0 area 0
network 192.168.1.0 0.0.0.255 area 0
network 192.168.2.0 0.0.0.255 area 0
ipv6 router ospf 709
router-id 10.0.1.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R2_dualstack
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ip address 10.0.2.1 255.255.255.255
ipv6 address 2014:709:0:A2::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ip address 192.168.2.2 255.255.255.0
ipv6 address 2014:709:0:2::2/64
ipv6 address FE80::2 Link-local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ip address 192.168.3.1 255.255.255.0
ipv6 address 2014:709:0:3::1/64
ipv6 address FE80::2 Link-local
ipv6 ospf 709 area 0
no shut
router ospf 709
network 10.0.2.1 0.0.0.0 area 0
network 192.168.2.0 0.0.0.255 area 0
network 192.168.3.0 0.0.0.255 area 0
ipv6 router ospf 709
router-id 10.0.2.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R3_dualstack
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ip address 10.0.3.1 255.255.255.255
ipv6 address 2014:709:0:A3::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ip address 192.168.3.2 255.255.255.0
ipv6 address 2014:709:0:3::2/64
ipv6 address FE80::3 Link-local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ip address 192.168.4.1 255.255.255.0
ipv6 address 2014:709:0:4::1/64
ipv6 address FE80::3 Link-local
ipv6 ospf 709 area 0
no shut
router ospf 709
network 10.0.3.1 0.0.0.0 area 0
network 192.168.3.0 0.0.0.255 area 0
network 192.168.4.0 0.0.0.255 area 0
ipv6 router ospf 709
router-id 10.0.3.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R4_dualstack
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ip address 10.0.4.1 255.255.255.255
ipv6 address 2014:709:0:A4::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ip address 192.168.4.3 255.255.255.0
ipv6 address 2014:709:0:4::3/64
ipv6 address FE80::4 Link-local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ip address 192.168.5.1 255.255.255.0
ipv6 address 2014:709:0:5::1/64
ipv6 address FE80::4 Link-local
ipv6 ospf 709 area 0
no shut
router ospf 709
network 10.0.4.1 0.0.0.0 area 0
network 192.168.4.0 0.0.0.255 area 0
network 192.168.5.0 0.0.0.255 area 0
ipv6 router ospf 709
router-id 10.0.4.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R5_dualstack
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ip address 10.0.5.1 255.255.255.255
ipv6 address 2014:709:0:A5::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ip address 192.168.2.3 255.255.255.0
ipv6 address 2014:709:0:2::3/64
ipv6 address FE80::5 Link-local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ip address 192.168.6.1 255.255.255.0
ipv6 address 2014:709:0:6::1/64
ipv6 address FE80::5 Link-local
ipv6 ospf 709 area 0
no shut
router ospf 709
network 10.0.5.1 0.0.0.0 area 0
network 192.168.2.0 0.0.0.255 area 0
network 192.168.6.0 0.0.0.255 area 0
ipv6 router ospf 709
router-id 10.0.5.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

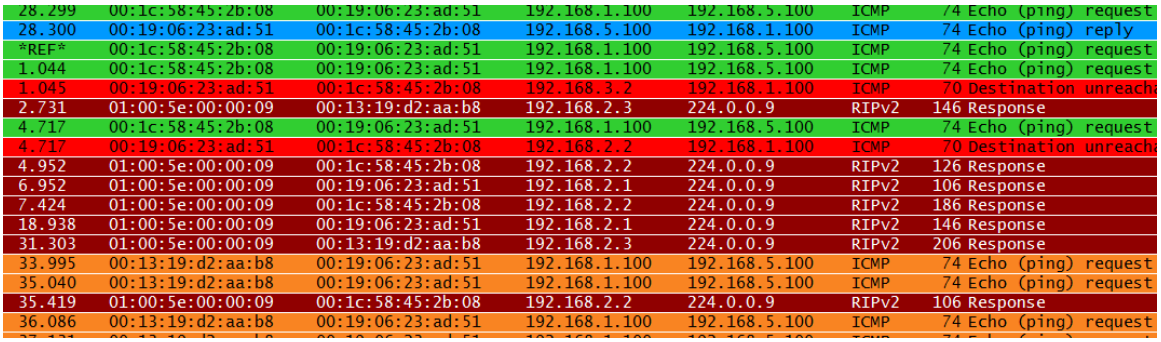
```
hostname R6_dualstack
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ip address 10.0.6.1 255.255.255.255
ipv6 address 2014:709:0:A6::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ip address 192.168.6.2 255.255.255.0
ipv6 address 2014:709:0:6::2/64
ipv6 address FE80::6 Link-local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ip address 192.168.7.1 255.255.255.0
ipv6 address 2014:709:0:7::1/64
ipv6 address FE80::6 Link-local
ipv6 ospf 709 area 0
no shut
router ospf 709
network 10.0.6.1 0.0.0.0 area 0
network 192.168.6.0 0.0.0.255 area 0
network 192.168.7.0 0.0.0.255 area 0
ipv6 router ospf 709
router-id 10.0.6.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

```
hostname R7_dualstack
ip host R1_v4 10.0.1.1
ip host R2_v4 10.0.2.1
ip host R3_v4 10.0.3.1
ip host R4_v4 10.0.4.1
ip host R5_v4 10.0.5.1
ip host R6_v4 10.0.6.1
ip host R7_v4 10.0.7.1
ipv6 host R1_v6 2014:709:0:A1::1
ipv6 host R2_v6 2014:709:0:A2::1
ipv6 host R3_v6 2014:709:0:A3::1
ipv6 host R4_v6 2014:709:0:A4::1
ipv6 host R5_v6 2014:709:0:A5::1
ipv6 host R6_v6 2014:709:0:A6::1
ipv6 host R7_v6 2014:709:0:A7::1
no ip domain lookup
ipv6 unicast-routing
ipv6 cef
enable secret mint
interface Loopback0
ip address 10.0.7.1 255.255.255.255
ipv6 address 2014:709:0:A7::1/128
ipv6 ospf 709 area 0
interface FastEthernet0/0
ip address 192.168.7.2 255.255.255.0
ipv6 address 2014:709:0:7::2/64
ipv6 address FE80::7 Link-local
ipv6 ospf 709 area 0
no shut
interface FastEthernet0/1
ip address 192.168.4.2 255.255.255.0
ipv6 address 2014:709:0:4::2/64
ipv6 address FE80::7 Link-local
ipv6 ospf 709 area 0
no shut
router ospf 709
network 10.0.7.1 0.0.0.0 area 0
network 192.168.4.0 0.0.0.255 area 0
network 192.168.7.0 0.0.0.255 area 0
ipv6 router ospf 709
router-id 10.0.7.1
line con 0
logging synchronous
exec-timeout 0 0
line vty 0 4
password mint709
login
end
```

Appendix C – Wireshark Captures

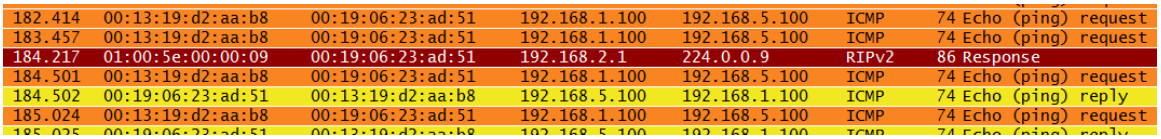
Display filters have been utilized to filter out unnecessary packets

RIPv2 Test 1



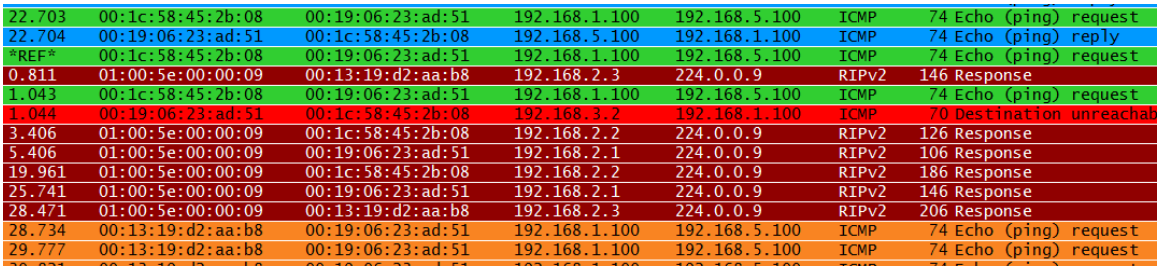
28.299	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
28.300	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.044	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.045	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destination unreach
2.731	01:00:5e:00:00:09	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.9	RIPv2	146 Response
4.717	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
4.717	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.2.2	192.168.1.100	ICMP	70 Destination unreach
4.952	01:00:5e:00:00:09	00:1c:58:45:2b:08	192.168.2.2	224.0.0.9	RIPv2	126 Response
6.952	01:00:5e:00:00:09	00:19:06:23:ad:51	192.168.2.1	224.0.0.9	RIPv2	106 Response
7.424	01:00:5e:00:00:09	00:1c:58:45:2b:08	192.168.2.2	224.0.0.9	RIPv2	186 Response
18.938	01:00:5e:00:00:09	00:19:06:23:ad:51	192.168.2.1	224.0.0.9	RIPv2	146 Response
31.303	01:00:5e:00:00:09	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.9	RIPv2	206 Response
33.995	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
35.040	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
35.419	01:00:5e:00:00:09	00:1c:58:45:2b:08	192.168.2.2	224.0.0.9	RIPv2	106 Response
36.086	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request

Packets excluded - multiple unanswered Echo Requests



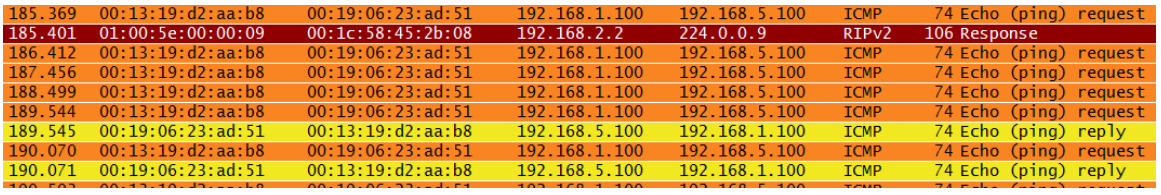
182.414	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
183.457	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
184.217	01:00:5e:00:00:09	00:19:06:23:ad:51	192.168.2.1	224.0.0.9	RIPv2	86 Response
184.501	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
184.502	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
185.024	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request

RIPv2 Test 2



22.703	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
22.704	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
0.811	01:00:5e:00:00:09	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.9	RIPv2	146 Response
1.043	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.044	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destination unreachab
3.406	01:00:5e:00:00:09	00:1c:58:45:2b:08	192.168.2.2	224.0.0.9	RIPv2	126 Response
5.406	01:00:5e:00:00:09	00:19:06:23:ad:51	192.168.2.1	224.0.0.9	RIPv2	106 Response
19.961	01:00:5e:00:00:09	00:1c:58:45:2b:08	192.168.2.2	224.0.0.9	RIPv2	186 Response
25.741	01:00:5e:00:00:09	00:19:06:23:ad:51	192.168.2.1	224.0.0.9	RIPv2	146 Response
28.471	01:00:5e:00:00:09	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.9	RIPv2	206 Response
28.734	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
29.777	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request

Packets excluded - multiple unanswered Echo Requests



185.369	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
185.401	01:00:5e:00:00:09	00:1c:58:45:2b:08	192.168.2.2	224.0.0.9	RIPv2	106 Response
186.412	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
187.456	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
188.499	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
189.544	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
189.545	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
190.070	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
190.071	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply

RIPv2 Test 3

62.636	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
62.637	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.043	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.044	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destination unreacha
2.750	01:00:5e:00:00:09	00:19:06:23:ad:51	192.168.2.1	224.0.0.9	RIPv2	86 Response
4.698	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
4.699	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.2.2	192.168.1.100	ICMP	70 Destination unreacha
4.724	01:00:5e:00:00:09	00:1c:58:45:2b:08	192.168.2.2	224.0.0.9	RIPv2	126 Response
5.940	01:00:5e:00:00:09	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.9	RIPv2	206 Response
8.353	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request

Packets excluded - multiple unanswered Echo Requests

178.546	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
179.589	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
180.633	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
180.634	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
181.157	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
181.158	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
181.681	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request

EIGRPv4 Test 1

24.037	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
24.038	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
0.947	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	111 Query
0.955	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	82 Update
0.965	01:00:5e:00:00:0a	00:19:06:23:ad:51	192.168.2.1	224.0.0.10	EIGRP	82 Query
0.977	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.2.1	192.168.2.2	EIGRP	83 Reply
0.978	01:00:5e:00:00:0a	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.10	EIGRP	82 Update
0.990	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.2.3	192.168.2.1	EIGRP	82 Reply
0.995	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.2.2	192.168.2.1	EIGRP	82 Reply
0.999	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	83 Update
1.006	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.2.2	192.168.2.1	EIGRP	83 Update
1.017	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.2.1	192.168.2.2	EIGRP	82 Reply
1.025	01:00:5e:00:00:0a	00:19:06:23:ad:51	192.168.2.1	224.0.0.10	EIGRP	82 Update
1.046	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.047	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destination unreachab
1.161	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	111 Query
1.171	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	82 Update
1.178	01:00:5e:00:00:0a	00:19:06:23:ad:51	192.168.2.1	224.0.0.10	EIGRP	111 Query
1.190	01:00:5e:00:00:0a	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.10	EIGRP	111 Update
1.202	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.2.3	192.168.2.1	EIGRP	111 Reply
1.203	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.2.2	192.168.2.1	EIGRP	111 Reply
1.225	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.2.1	192.168.2.2	EIGRP	111 Reply
1.238	01:00:5e:00:00:0a	00:19:06:23:ad:51	192.168.2.1	224.0.0.10	EIGRP	111 Update
1.243	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	111 Update
4.702	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
5.745	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
6.789	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
7.832	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
8.876	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
9.920	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
10.964	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
12.007	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
13.051	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
14.094	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
14.096	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
14.618	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
14.620	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply

EIGRPv4 Test 2

22.426	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
22.427	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.017	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	111 Query
1.027	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	82 Update
1.038	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.2.1	192.168.2.2	EIGRP	111 Reply
1.043	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.044	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destination unreachal
1.050	01:00:5e:00:00:0a	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.10	EIGRP	82 Update
1.058	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	111 Update
1.066	01:00:5e:00:00:0a	00:19:06:23:ad:51	192.168.2.1	224.0.0.10	EIGRP	82 Update
1.230	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	111 Query
1.250	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.2.1	192.168.2.2	EIGRP	111 Reply
1.266	01:00:5e:00:00:0a	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.10	EIGRP	111 Update
1.275	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	111 Update
1.286	01:00:5e:00:00:0a	00:19:06:23:ad:51	192.168.2.1	224.0.0.10	EIGRP	111 Update
4.700	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
5.744	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
6.788	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
7.832	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
8.876	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
9.920	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
10.964	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
12.007	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
12.008	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
12.531	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
12.532	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply

EIGRPv4 Test 3

22.241	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
22.242	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
0.939	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	168 Query
0.948	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	82 Update
0.962	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.2.1	192.168.2.2	EIGRP	168 Reply
0.975	01:00:5e:00:00:0a	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.10	EIGRP	139 Update
0.985	01:00:5e:00:00:0a	00:1c:58:45:2b:08	192.168.2.2	224.0.0.10	EIGRP	168 Update
0.994	01:00:5e:00:00:0a	00:19:06:23:ad:51	192.168.2.1	224.0.0.10	EIGRP	139 Update
1.043	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
2.087	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
3.131	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
4.174	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
5.219	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
6.262	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
7.306	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
8.350	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
9.396	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
10.444	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
11.488	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
11.489	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
12.011	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
12.012	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply

OSPFv2 Test 1

24.569	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
24.570	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
0.949	01:00:5e:00:00:05	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.5	OSPF	98 Hello Packet
1.043	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.044	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destination unreachab
1.092	01:00:5e:00:00:05	00:1c:58:45:2b:08	192.168.2.2	224.0.0.5	OSPF	110 LS Update
3.460	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	98 Hello Packet
3.592	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	78 LS Acknowledge
3.593	01:00:5e:00:00:06	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.6	OSPF	78 LS Acknowledge
4.385	01:00:5e:00:00:05	00:1c:58:45:2b:08	192.168.2.2	224.0.0.5	OSPF	98 Hello Packet
4.699	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
4.700	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destination unreachab
8.354	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
8.355	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
8.878	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
8.879	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply

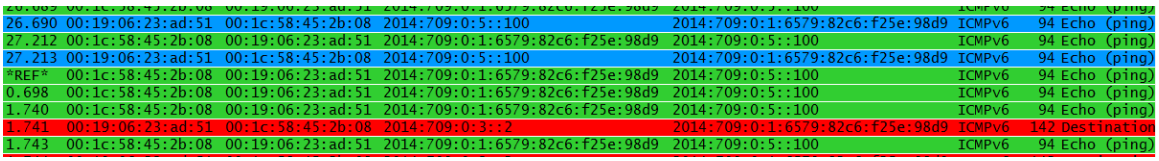
OSPFv2 Test 2

20.016	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
20.017	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
0.972	01:00:5e:00:00:05	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.5	OSPF	98 Hello Packet
0.986	01:00:5e:00:00:05	00:1c:58:45:2b:08	192.168.2.2	224.0.0.5	OSPF	110 LS Update
1.044	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.045	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destination unreacha
3.485	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	78 LS Acknowledge
3.488	01:00:5e:00:00:06	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.6	OSPF	78 LS Acknowledge
4.698	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
4.699	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destination unreacha
6.285	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	98 Hello Packet
7.044	01:00:5e:00:00:05	00:1c:58:45:2b:08	192.168.2.2	224.0.0.5	OSPF	98 Hello Packet
8.353	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
8.354	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
8.876	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
8.878	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply

OSPFv2 Test 3

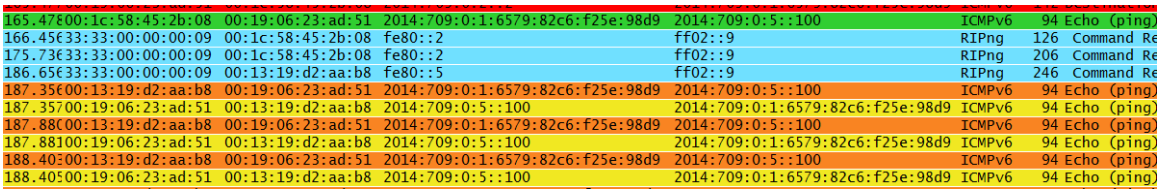
23.665	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
23.666	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.043	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
1.044	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destination unreachab
1.120	01:00:5e:00:00:05	00:1c:58:45:2b:08	192.168.2.2	224.0.0.5	OSPF	110 LS Update
3.619	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	78 LS Acknowledge
3.622	01:00:5e:00:00:06	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.6	OSPF	78 LS Acknowledge
3.998	01:00:5e:00:00:05	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.5	OSPF	98 Hello Packet
4.710	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
4.712	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destination unreachab
4.807	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	98 Hello Packet
5.828	01:00:5e:00:00:05	00:1c:58:45:2b:08	192.168.2.2	224.0.0.5	OSPF	98 Hello Packet
8.365	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
8.367	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply
8.889	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (ping) request
8.890	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (ping) reply

RIPng Test 1



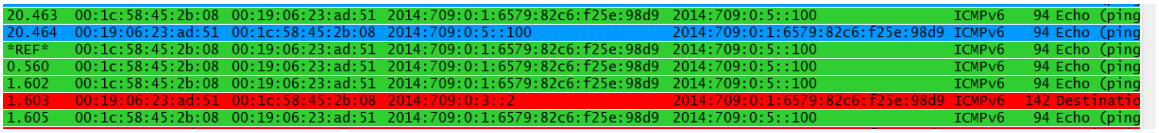
26.690	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo (ping)
27.212	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping)
27.213	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo (ping)
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping)
0.698	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping)
1.740	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping)
1.741	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:3::2	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	142 Destination
1.743	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping)

Packets excluded - multiple unanswered Echo Requests



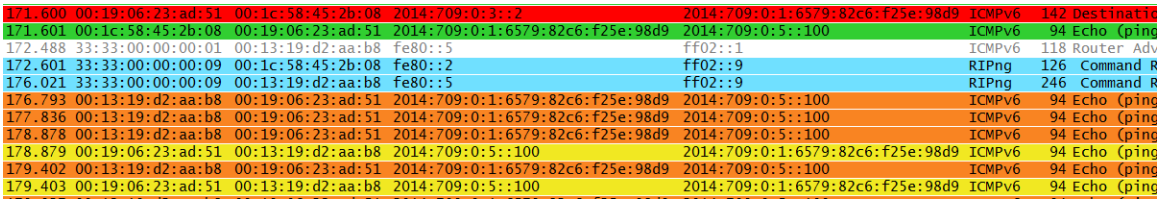
165.47	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping)
166.45	33:33:00:00:00:09	00:1c:58:45:2b:08	fe80::2	ff02::9	RIPng	126 Command Re
175.73	33:33:00:00:00:09	00:1c:58:45:2b:08	fe80::2	ff02::9	RIPng	206 Command Re
186.65	33:33:00:00:00:09	00:13:19:d2:aa:b8	fe80::5	ff02::9	RIPng	246 Command Re
187.35	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping)
187.357	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo (ping)
187.88	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping)
187.881	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo (ping)
188.40	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping)
188.405	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo (ping)

RIPng Test 2



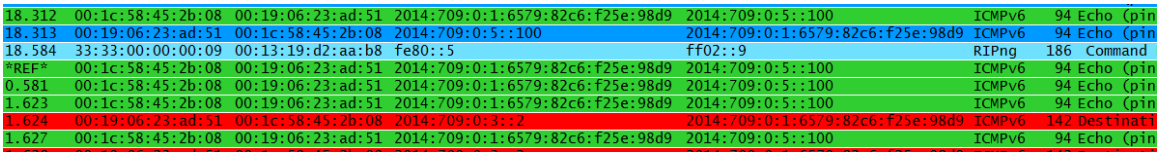
20.463	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
20.464	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo (ping
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
0.560	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
1.602	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
1.603	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:3::2	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	142 Destinatio
1.605	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping

Packets excluded - multiple unanswered Echo Requests



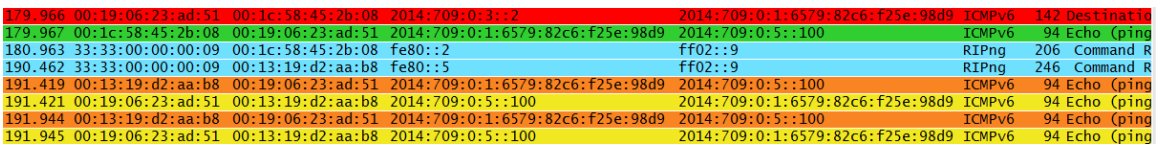
171.600	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:3::2	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	142 Destinatio
171.601	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
172.488	33:33:00:00:00:01	00:13:19:d2:aa:b8	fe80::5	ff02::1	ICMPv6	118 Router Adv
172.601	33:33:00:00:00:09	00:1c:58:45:2b:08	fe80::2	ff02::9	RIPng	126 Command R
176.021	33:33:00:00:00:09	00:13:19:d2:aa:b8	fe80::5	ff02::9	RIPng	246 Command R
176.793	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
177.836	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
178.878	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
178.879	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo (ping
179.402	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
179.403	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo (ping

RIPng Test 3



18.312	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (pin
18.313	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo (pin
18.584	33:33:00:00:00:09	00:13:19:d2:aa:b8	fe80::5	ff02::9	RIPng	186 Command
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (pin
0.581	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (pin
1.623	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (pin
1.624	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:3::2	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	142 Destinati
1.627	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (pin

Packets excluded - multiple unanswered Echo Requests



179.966	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:3::2	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	142 Destinatio
179.967	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
180.963	33:33:00:00:00:09	00:1c:58:45:2b:08	fe80::2	ff02::9	RIPng	206 Command R
190.462	33:33:00:00:00:09	00:13:19:d2:aa:b8	fe80::5	ff02::9	RIPng	246 Command R
191.419	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
191.421	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo (ping
191.944	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo (ping
191.945	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo (ping

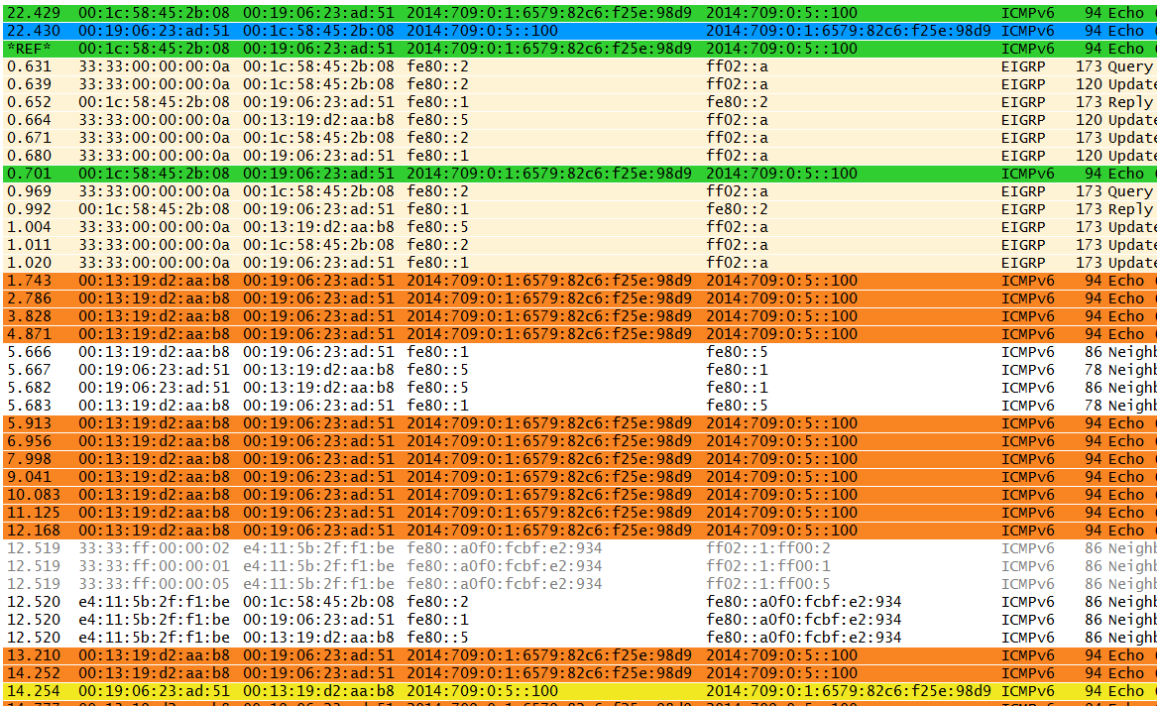
EIGRPv6 Test 1

17.687	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
17.688	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
0.764	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
0.776	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	272 Query
0.784	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	120 Updat
0.793	33:33:00:00:00:0a	00:19:06:23:ad:51	fe80::1	ff02::a	EIGRP	120 Query
0.805	00:1c:58:45:2b:08	00:19:06:23:ad:51	fe80::1	fe80::2	EIGRP	226 Reply
0.806	33:33:00:00:00:0a	00:13:19:d2:aa:b8	fe80::5	ff02::a	EIGRP	219 Updat
0.813	33:33:00:00:00:0a	00:19:06:23:ad:51	fe80::1	ff02::a	EIGRP	173 Updat
0.818	00:19:06:23:ad:51	00:13:19:d2:aa:b8	fe80::5	fe80::1	EIGRP	120 Reply
0.824	00:19:06:23:ad:51	00:1c:58:45:2b:08	fe80::2	fe80::1	EIGRP	120 Reply
0.832	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	226 Updat
0.845	00:1c:58:45:2b:08	00:19:06:23:ad:51	fe80::1	fe80::2	EIGRP	120 Reply
0.850	33:33:00:00:00:0a	00:19:06:23:ad:51	fe80::1	ff02::a	EIGRP	120 Updat
1.807	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
2.850	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
3.892	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
3.912	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	120 Updat
4.934	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
5.800	00:19:06:23:ad:51	00:13:19:d2:aa:b8	fe80::5	fe80::1	ICMPv6	86 Neigh
5.801	00:13:19:d2:aa:b8	00:19:06:23:ad:51	fe80::1	fe80::5	ICMPv6	78 Neigh
5.808	00:13:19:d2:aa:b8	00:19:06:23:ad:51	fe80::1	fe80::5	ICMPv6	86 Neigh
5.808	00:19:06:23:ad:51	00:13:19:d2:aa:b8	fe80::5	fe80::1	ICMPv6	78 Neigh
5.976	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
7.019	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
8.061	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
9.104	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
10.146	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
11.188	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
12.231	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
13.273	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
13.274	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo
13.552	33:33:00:00:00:01	00:19:06:23:ad:51	fe80::1	ff02::1	ICMPv6	118 Route
13.797	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo

EIGRPv6 Test 2

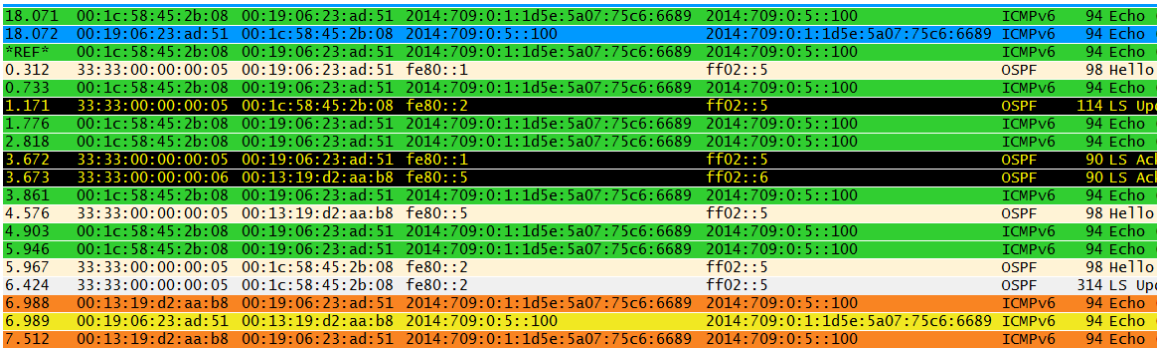
20.398	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
20.398	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
0.839	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
0.939	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	272 Query
0.944	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	120 Updat
0.958	00:1c:58:45:2b:08	00:19:06:23:ad:51	fe80::1	fe80::2	EIGRP	272 Reply
0.969	33:33:00:00:00:0a	00:13:19:d2:aa:b8	fe80::5	ff02::a	EIGRP	219 Updat
0.980	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	272 Updat
0.986	33:33:00:00:00:0a	00:19:06:23:ad:51	fe80::1	ff02::a	EIGRP	219 Updat
1.883	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
2.924	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
3.967	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
5.009	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
5.973	00:13:19:d2:aa:b8	00:19:06:23:ad:51	fe80::1	fe80::5	ICMPv6	86 Neigh
5.973	00:19:06:23:ad:51	00:13:19:d2:aa:b8	fe80::5	fe80::1	ICMPv6	78 Neigh
5.988	00:19:06:23:ad:51	00:13:19:d2:aa:b8	fe80::5	fe80::1	ICMPv6	86 Neigh
5.989	00:13:19:d2:aa:b8	00:19:06:23:ad:51	fe80::1	fe80::5	ICMPv6	78 Neigh
6.051	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
7.094	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
8.021	33:33:00:00:00:01	00:19:06:23:ad:51	fe80::1	ff02::1	ICMPv6	118 Route
8.136	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
9.030	33:33:ff:00:00:02	e4:11:5b:2f:f1:be	fe80::a0f0:fcbf:e2:934	ff02::1:ff00:2	ICMPv6	86 Neigh
9.030	33:33:ff:00:00:01	e4:11:5b:2f:f1:be	fe80::a0f0:fcbf:e2:934	ff02::1:ff00:1	ICMPv6	86 Neigh
9.030	33:33:ff:00:00:05	e4:11:5b:2f:f1:be	fe80::a0f0:fcbf:e2:934	ff02::1:ff00:5	ICMPv6	86 Neigh
9.031	e4:11:5b:2f:f1:be	00:19:06:23:ad:51	fe80::1	fe80::a0f0:fcbf:e2:934	ICMPv6	86 Neigh
9.031	e4:11:5b:2f:f1:be	00:1c:58:45:2b:08	fe80::2	fe80::a0f0:fcbf:e2:934	ICMPv6	86 Neigh
9.031	e4:11:5b:2f:f1:be	00:13:19:d2:aa:b8	fe80::5	fe80::a0f0:fcbf:e2:934	ICMPv6	86 Neigh
9.179	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
10.221	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
11.263	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
12.306	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
13.348	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
13.349	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo
13.872	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
13.873	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo

EIGRPv6 Test 3



22.429	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
22.430	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
0.631	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	173 Query
0.639	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	120 Update
0.652	00:1c:58:45:2b:08	00:19:06:23:ad:51	fe80::1	fe80::2	EIGRP	173 Reply
0.664	33:33:00:00:00:0a	00:13:19:d2:aa:b8	fe80::5	ff02::a	EIGRP	120 Update
0.671	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	173 Update
0.680	33:33:00:00:00:0a	00:19:06:23:ad:51	fe80::1	ff02::a	EIGRP	120 Update
0.701	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
0.969	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	173 Query
0.992	00:1c:58:45:2b:08	00:19:06:23:ad:51	fe80::1	fe80::2	EIGRP	173 Reply
1.004	33:33:00:00:00:0a	00:13:19:d2:aa:b8	fe80::5	ff02::a	EIGRP	173 Update
1.011	33:33:00:00:00:0a	00:1c:58:45:2b:08	fe80::2	ff02::a	EIGRP	173 Update
1.020	33:33:00:00:00:0a	00:19:06:23:ad:51	fe80::1	ff02::a	EIGRP	173 Update
1.743	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
2.786	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
3.828	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
4.871	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
5.666	00:13:19:d2:aa:b8	00:19:06:23:ad:51	fe80::1	fe80::5	ICMPv6	86 Neighb
5.667	00:19:06:23:ad:51	00:13:19:d2:aa:b8	fe80::5	fe80::1	ICMPv6	78 Neighb
5.682	00:19:06:23:ad:51	00:13:19:d2:aa:b8	fe80::5	fe80::1	ICMPv6	86 Neighb
5.683	00:13:19:d2:aa:b8	00:19:06:23:ad:51	fe80::1	fe80::5	ICMPv6	78 Neighb
5.913	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
6.956	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
7.998	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
9.041	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
10.083	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
11.125	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
12.168	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
12.519	33:33:ff:00:00:02	e4:11:5b:2f:f1:be	fe80::a0f0:fcbf:e2:934	ff02::1:ff00:2	ICMPv6	86 Neighb
12.519	33:33:ff:00:00:01	e4:11:5b:2f:f1:be	fe80::a0f0:fcbf:e2:934	ff02::1:ff00:1	ICMPv6	86 Neighb
12.519	33:33:ff:00:00:05	e4:11:5b:2f:f1:be	fe80::a0f0:fcbf:e2:934	ff02::1:ff00:5	ICMPv6	86 Neighb
12.520	e4:11:5b:2f:f1:be	00:1c:58:45:2b:08	fe80::2	fe80::a0f0:fcbf:e2:934	ICMPv6	86 Neighb
12.520	e4:11:5b:2f:f1:be	00:19:06:23:ad:51	fe80::1	fe80::a0f0:fcbf:e2:934	ICMPv6	86 Neighb
12.520	e4:11:5b:2f:f1:be	00:13:19:d2:aa:b8	fe80::5	fe80::a0f0:fcbf:e2:934	ICMPv6	86 Neighb
13.210	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
14.252	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:6579:82c6:f25e:98d9	2014:709:0:5::100	ICMPv6	94 Echo
14.254	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:6579:82c6:f25e:98d9	ICMPv6	94 Echo

OSPFv3 Test 1



18.071	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
18.072	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
0.312	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	98 Hello
0.733	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
1.171	33:33:00:00:00:05	00:1c:58:45:2b:08	fe80::2	ff02::5	OSPF	114 LS Upd
1.776	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
2.818	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
3.672	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	90 LS Ack
3.673	33:33:00:00:00:06	00:13:19:d2:aa:b8	fe80::5	ff02::6	OSPF	90 LS Ack
3.861	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
4.576	33:33:00:00:00:05	00:13:19:d2:aa:b8	fe80::5	ff02::5	OSPF	98 Hello
4.903	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
5.946	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
5.967	33:33:00:00:00:05	00:1c:58:45:2b:08	fe80::2	ff02::5	OSPF	98 Hello
6.424	33:33:00:00:00:05	00:1c:58:45:2b:08	fe80::2	ff02::5	OSPF	314 LS Upd
6.988	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
6.989	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo
7.512	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo

OSPFv3 Test 2

16.067	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
16.068	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
0.807	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
1.163	33:33:00:00:00:05	00:1c:58:45:2b:08	fe80::2	ff02::5	OSPF	114 LS Up
1.849	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
2.892	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
3.663	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	90 LS Ac
3.664	33:33:00:00:00:06	00:13:19:d2:aa:b8	fe80::5	ff02::6	OSPF	90 LS Ac
3.840	33:33:00:00:00:05	00:13:19:d2:aa:b8	fe80::5	ff02::5	OSPF	98 Hello
3.934	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
4.977	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
5.227	33:33:00:00:00:05	00:1c:58:45:2b:08	fe80::2	ff02::5	OSPF	98 Hello
6.019	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
6.138	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	98 Hello
7.062	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
7.063	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo
7.585	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo

OSPFv3 Test 3

17.834	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
17.835	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
0.594	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
1.049	33:33:00:00:00:05	00:1c:58:45:2b:08	fe80::2	ff02::5	OSPF	114 LS Up
1.269	33:33:00:00:00:05	00:13:19:d2:aa:b8	fe80::5	ff02::5	OSPF	98 Hello
1.637	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
1.763	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	98 Hello
2.679	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
3.547	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	90 LS Ac
3.549	33:33:00:00:00:06	00:13:19:d2:aa:b8	fe80::5	ff02::6	OSPF	90 LS Ac
3.722	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
4.763	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
5.537	33:33:00:00:00:05	00:1c:58:45:2b:08	fe80::2	ff02::5	OSPF	98 Hello
5.806	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
6.848	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
6.850	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo

OSPF Dual Stack Test 1

21.739	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo
21.740	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
0.253	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo
0.920	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
1.282	01:00:5e:00:00:06	00:1c:58:45:2b:08	192.168.2.2	224.0.0.6	OSPF	110 LS Up
1.284	01:00:5e:00:00:05	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.5	OSPF	110 LS Up
1.298	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo
1.299	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Dest
1.361	33:33:00:00:00:06	00:1c:58:45:2b:08	fe80::2	ff02::6	OSPF	114 LS Up
1.394	33:33:00:00:00:05	00:13:19:d2:aa:b8	fe80::5	ff02::5	OSPF	114 LS Up
1.963	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
3.005	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
3.591	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	98 Hello
3.659	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	98 Hello
3.784	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	78 LS Ac
3.828	33:33:00:00:00:05	00:1c:58:45:2b:08	fe80::2	ff02::5	OSPF	98 Hello
3.892	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	90 LS Ac
4.048	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
4.764	01:00:5e:00:00:05	00:1c:58:45:2b:08	192.168.2.2	224.0.0.5	OSPF	98 Hello
4.969	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo
4.970	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Dest
5.090	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
6.132	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
6.668	33:33:00:00:00:01	00:1c:58:45:2b:08	fe80::2	ff02::1	ICMPv6	118 Route
7.175	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
7.176	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo
7.699	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
7.700	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo
7.862	33:33:00:00:00:05	00:13:19:d2:aa:b8	fe80::5	ff02::5	OSPF	98 Hello
8.166	01:00:5e:00:00:05	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.5	OSPF	98 Hello
8.223	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo
8.224	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo
8.629	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo
8.631	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo
8.747	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo

OSPF Dual Stack Test 2

26.157	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (pin
26.158	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (pin
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (pin
0.037	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (pin
0.484	01:00:5e:00:00:05	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.5	OSPF	98 Hello Pac
0.851	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (pin
1.082	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (pin
1.083	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destinati
1.099	01:00:5e:00:00:06	00:1c:58:45:2b:08	192.168.2.2	224.0.0.6	OSPF	110 LS Update
1.101	01:00:5e:00:00:05	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.5	OSPF	110 LS Update
1.175	33:33:00:00:00:06	00:1c:58:45:2b:08	fe80::2	ff02::6	OSPF	114 LS Update
1.212	33:33:00:00:00:05	00:13:19:d2:aa:b8	fe80::5	ff02::5	OSPF	114 LS Update
1.893	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (pin
2.935	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (pin
2.980	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	98 Hello Pac
3.601	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	78 LS Acknow
3.713	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	90 LS Acknow
3.978	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (pin
4.741	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (pin
4.742	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destinati
5.020	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (pin
5.409	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	98 Hello Pac
5.951	01:00:5e:00:00:05	00:1c:58:45:2b:08	192.168.2.2	224.0.0.5	OSPF	98 Hello Pac
6.063	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (pin
7.105	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (pin
7.106	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo (pin
7.596	33:33:00:00:00:05	00:13:19:d2:aa:b8	fe80::5	ff02::5	OSPF	98 Hello Pac
7.629	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (pin
7.630	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo (pin
8.153	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (pin
8.154	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo (pin
8.383	33:33:00:00:00:05	00:1c:58:45:2b:08	fe80::2	ff02::5	OSPF	98 Hello Pac
8.401	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (pin
8.403	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (pin

OSPF Dual Stack Test 3

16.841	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (p
17.224	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p
17.225	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo (p
17.366	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (p
17.367	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.5.100	192.168.1.100	ICMP	74 Echo (p
17.394	33:33:00:00:00:05	00:13:19:d2:aa:b8	fe80::5	ff02::5	OSPF	98 Hello Pa
17.748	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p
17.749	00:19:06:23:ad:51	00:1c:58:45:2b:08	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo (p
REF	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (p
0.381	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p
1.044	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (p
1.045	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destina
1.075	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p
1.454	01:00:5e:00:00:06	00:1c:58:45:2b:08	192.168.2.2	224.0.0.6	OSPF	110 LS Upda
1.456	01:00:5e:00:00:05	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.5	OSPF	110 LS Upda
1.530	33:33:00:00:00:06	00:1c:58:45:2b:08	fe80::2	ff02::6	OSPF	114 LS Upda
1.563	33:33:00:00:00:05	00:13:19:d2:aa:b8	fe80::5	ff02::5	OSPF	114 LS Upda
2.118	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p
3.160	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p
3.347	01:00:5e:00:00:05	00:13:19:d2:aa:b8	192.168.2.3	224.0.0.5	OSPF	98 Hello Pa
3.954	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	78 LS Ackn
4.062	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	90 LS Ackn
4.203	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p
4.666	01:00:5e:00:00:05	00:1c:58:45:2b:08	192.168.2.2	224.0.0.5	OSPF	98 Hello Pa
4.704	00:1c:58:45:2b:08	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (p
4.705	00:19:06:23:ad:51	00:1c:58:45:2b:08	192.168.3.2	192.168.1.100	ICMP	70 Destina
4.726	33:33:00:00:00:05	00:1c:58:45:2b:08	fe80::2	ff02::5	OSPF	98 Hello Pa
5.245	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p
6.287	00:1c:58:45:2b:08	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p
6.905	33:33:00:00:00:05	00:19:06:23:ad:51	fe80::1	ff02::5	OSPF	98 Hello Pa
7.330	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p
7.331	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo (p
7.814	01:00:5e:00:00:05	00:19:06:23:ad:51	192.168.2.1	224.0.0.5	OSPF	98 Hello Pa
7.854	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p
7.855	00:19:06:23:ad:51	00:13:19:d2:aa:b8	2014:709:0:5::100	2014:709:0:1:1d5e:5a07:75c6:6689	ICMPv6	94 Echo (p
8.363	00:13:19:d2:aa:b8	00:19:06:23:ad:51	192.168.1.100	192.168.5.100	ICMP	74 Echo (p
8.364	00:19:06:23:ad:51	00:13:19:d2:aa:b8	192.168.5.100	192.168.1.100	ICMP	74 Echo (p
8.377	00:13:19:d2:aa:b8	00:19:06:23:ad:51	2014:709:0:1:1d5e:5a07:75c6:6689	2014:709:0:5::100	ICMPv6	94 Echo (p