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| **IS-IS** |

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| IS-IS is a link-state interior gateway protocol (IGP) which is described in ISO10589, **RFC** |

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| **1195**, **RFC 5308**. IS-IS runs the Dijkstra shortest-path first (SPF) algorithm to create a |

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| database of the network’s topology, and from that database to determine the best (that |

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| is, lowest cost) path to a destination. The intermediate systems (the name for routers) |

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| exchange topology information with their directly conencted neighbors. IS-IS runs |

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| directly on the data link layer (Layer 2). IS-IS addresses are called NETs and can be 8 to |

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| 20 bytes long, but are generally 10 bytes long. The tree database that is created with IS- |

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| IS is similar to the one that is created with OSPF in that the paths chosen should be |

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| similar. Comparisons to OSPF are inevitable and often are reasonable ones to make in |

regards to the way a network will respond with either IGP.

**General**

**Configuration**

**Mandatory Settings**

For IS-IS top operate correctly, one must do the equivalent of a Router ID in CLNS. This Router

ID is called the NET. This must be unique for each and every router that is operating in IS-IS. It

also must not be duplicated otherwise the same issues that occur within OSPF will occur within

IS-IS when it comes to said duplication.

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| **set protocols isis net <network-entity-title>** |

This commad sets network entity title (NET) provided in ISO format.

Here is an example NET value:

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| 49.0001.1921.6800.1002.00 |

The CLNS address consists of the following parts:

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|    | AFI - 49 The AFI value 49 is what IS-IS uses for private addressing.   |  | | --- | |  |   Area identifier: 0001 IS-IS area number (numberical area 1 )   |  | | --- | |  |  |  | | --- | |  |   System identifier: 1921.6800.1002 - for system idetifiers we recommend to use IP   |  | | --- | |  | |

address or MAC address of the router itself. The way to construct this is to keep all of

the zeroes of the router IP address, and then change the periods from being every

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|  | three numbers to every four numbers. The address that is listed here is 192.168.1.2 ,   |  | | --- | |  |   which if expanded will turn into 192.168.001.002 . Then all one has to do is move the   |  | | --- | |  |   dots to have four numbers instead of three. This gives us 1921.6800.1002 .   |  | | --- | |  |   NET selector: 00 Must always be 00. This setting indicates “this system” or “local   |  | | --- | |  | |

system.”

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| **set protocols isis interface <interface>** |

This command enables IS-IS on this interface, and allows for adjacency to occur. Note that the name of IS-IS instance must be the same as the one used to configure the IS-IS process.

**IS-IS Global Configuration**

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| **set protocols isis dynamic-hostname** |

This command enables support for dynamic hostname TLV. Dynamic hostname mapping determined as described in **RFC 2763**, Dynamic Hostname Exchange Mechanism for IS-IS.

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| **set protocols isis level <level-1|level-1-2|level-2>** |

This command defines the IS-IS router behavior:

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|  | **level-1** - Act as a station (Level 1) router only. |
|  | **level-1-2** - Act as a station (Level 1) router and area (Level 2) router. |
|  | **level-2-only** - Act as an area (Level 2) router only. |
| **set protocols isis lsp-mtu <size>** | |

This command configures the maximum size of generated LSPs, in bytes. The size range is 128 to 4352.

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| **set protocols isis metric-style <narrow|transition|wide>** |

This command sets old-style (ISO 10589) or new style packet formats:

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|  | **narrow** - Use old style of TLVs with narrow metric. |
|  | **transition** - Send and accept both styles of TLVs during transition. |
|  | **wide** - Use new style of TLVs to carry wider metric. |
| **set protocols isis purge-originator** | |

This command enables **RFC 6232** purge originator identification. Enable purge originator identification (POI) by adding the type, length and value (TLV) with the Intermediate System (IS) identification to the LSPs that do not contain POI information. If an IS generates a purge, VyOS adds this TLV with the system ID of the IS to the purge.

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| **set protocols isis set-attached-bit** |

This command sets ATT bit to 1 in Level1 LSPs. It is described in **RFC 3787**.

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| **set protocols isis set-overload-bit** |

This command sets overload bit to avoid any transit traffic through this router. It is described in **RFC 3787**.

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| **set protocols isis name default-information originate <ipv4|ipv6> level-1** |

This command will generate a default-route in L1 database.

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| **set protocols isis name default-information originate <ipv4|ipv6> level-2** |

This command will generate a default-route in L2 database.

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| **set protocols isis ldp-sync** |

This command will enable IGP-LDP synchronization globally for ISIS. This requires for LDP to be functional. This is described in **RFC 5443**. By default all interfaces operational in IS-IS are enabled for synchronization. Loopbacks are exempt.

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| **set protocols isis ldp-sync holddown <seconds>** |

This command will change the hold down value globally for IGP-LDP synchronization during convergence/interface flap events.

**Interface Configuration**

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| **set protocols isis interface <interface> circuit-type <level-1|level-1-2| level-2-only>** |

This command specifies circuit type for interface:

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|  | **level-1** - Level-1 only adjacencies are formed. |
|  | **level-1-2** - Level-1-2 adjacencies are formed |
|  | **level-2-only** - Level-2 only adjacencies are formed |
| **set protocols isis interface <interface> hello-interval <seconds>** | |

This command sets hello interval in seconds on a given interface. The range is 1 to 600.

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| **set protocols isis interface <interface> hello-multiplier <seconds>** |

This command sets multiplier for hello holding time on a given interface. The range is 2 to 100.

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| **set protocols isis interface <interface> hello-padding** |

This command configures padding on hello packets to accommodate asymmetrical maximum transfer units (MTUs) from different hosts as described in **RFC 3719**. This helps to prevent a premature adjacency Up state when one routing devices MTU does not meet the requirements to establish the adjacency.

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| **set protocols isis interface <interface> metric <metric>** |

This command set default metric for circuit.

The metric range is 1 to 16777215 (Max value depend if metric support narrow or wide value).

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| **set protocols isis interface <interface> network point-to-point** |

This command specifies network type to Point-to-Point. The default network type is broadcast.

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| **set protocols isis interface <interface> passive** |

This command configures the passive mode for this interface.

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| **set protocols isis interface <interface> password plaintext-password <text>** |

This command configures the authentication password for the interface.

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| **set protocols isis interface <interface> priority <number>** |

This command sets priority for the interface for DIS election. The priority range is 0 to 127.

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| **set protocols isis interface <interface> psnp-interval <number>** |

This command sets PSNP interval in seconds. The interval range is 0 to 127.

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| **set protocols isis interface <interface> no-three-way-handshake** |

This command disables Three-Way Handshake for P2P adjacencies which described in **RFC 5303**. Three-Way Handshake is enabled by default.

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| **set protocols isis interface <interface> ldp-sync disable** |

This command disables IGP-LDP sync for this specific interface.

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| **set protocols isis interface <interface> ldp-sync holddown <seconds>** |

This command will change the hold down value for IGP-LDP synchronization during convergence/interface flap events, but for this interface only.

**Route Redistribution**

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| **set protocols isis redistribute ipv4 <route source> level-1** |

This command redistributes routing information from the given route source into the ISIS database as Level-1. There are six modes available for route source: bgp, connected, kernel, ospf, rip, static.

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| **set protocols isis redistribute ipv4 <route source> level-2** |

This command redistributes routing information from the given route source into the ISIS database as Level-2. There are six modes available for route source: bgp, connected, kernel, ospf, rip, static.

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| **set protocols isis redistribute ipv4 <route source> <level-1|level-2> metric <number>** |

This command specifies metric for redistributed routes from the given route source. There are six modes available for route source: bgp, connected, kernel, ospf, rip, static. The metric range is 1 to 16777215.

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| **set protocols isis redistribute ipv4 <route source> <level-1|level-2> route-map <name>** |

This command allows to use route map to filter redistributed routes from the given route source. There are six modes available for route source: bgp, connected, kernel, ospf, rip, static.

**Timers**

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| **set protocols isis lsp-gen-interval <seconds>** |

This command sets minimum interval in seconds between regenerating same LSP. The interval range is 1 to 120.

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| **set protocols isis lsp-refresh-interval <seconds>** |

This command sets LSP refresh interval in seconds. IS-IS generates LSPs when the state of a link changes. However, to ensure that routing databases on all routers remain converged, LSPs in stable networks are generated on a regular basis even though there has been no change to the state of the links. The interval range is 1 to 65235. The default value is 900 seconds.

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| **set protocols isis max-lsp-lifetime <seconds>** |

This command sets LSP maximum LSP lifetime in seconds. The interval range is 350 to 65535.

LSPs remain in a database for 1200 seconds by default. If they are not refreshed by that time, they are deleted. You can change the LSP refresh interval or the LSP lifetime. The LSP refresh interval should be less than the LSP lifetime or else LSPs will time out before they are refreshed.

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| **set protocols isis spf-interval <seconds>** |

This command sets minimum interval between consecutive SPF calculations in seconds.The interval range is 1 to 120.

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| **set protocols isis spf-delay-ietf holddown <milliseconds> set protocols isis spf-delay-ietf init-delay <milliseconds> set protocols isis spf-delay-ietf long-delay <milliseconds> set protocols isis spf-delay-ietf short-delay <milliseconds> set protocols isis spf-delay-ietf time-to-learn <milliseconds>** |

This commands specifies the Finite State Machine (FSM) intended to control the timing of the execution of SPF calculations in response to IGP events. The process described in **RFC 8405**.

**Examples**

**Enable IS-IS**

**Node 1:**

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| --- |
| set interfaces loopback lo address '192.168.255.255/32' set interfaces ethernet eth1 address '192.0.2.1/24' |

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| --- |
| set protocols isis interface eth1  set protocols isis interface lo  set protocols isis net '49.0001.1921.6825.5255.00' |

**Node 2:**

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| --- |
| set interfaces ethernet eth1 address '192.0.2.2/24' |

|  |
| --- |
| set interfaces loopback lo address '192.168.255.254/32' set interfaces ethernet eth1 address '192.0.2.2/24' |

|  |
| --- |
| set protocols isis interface eth1  set protocols isis interface lo  set protocols isis net '49.0001.1921.6825.5254.00' |

This gives us the following neighborships, Level 1 and Level 2:

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| Node-1@vyos:~$ show isis neighbor  Area VyOS:  System Id Interface L State Holdtime SNPA vyos eth1 1 Up 28 0c87.6c09.0001 vyos eth1 2 Up 28 0c87.6c09.0001 |

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| --- |
| Node-2@vyos:~$ show isis neighbor  Area VyOS:  System Id Interface L State Holdtime SNPA vyos eth1 1 Up 29 0c33.0280.0001 vyos eth1 2 Up 28 0c33.0280.0001 |

Here’s the IP routes that are populated. Just the loopback:

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| --- |
| Node-1@vyos:~$ show ip route isis  Codes: K - kernel route, C - connected, S - static, R - RIP,  O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,  T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,  f - OpenFabric,  > - selected route, \* - FIB route, q - queued, r - rejected, b - backup t - trapped, o - offload failure |

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| I 192.0.2.0/24 [115/20] via 192.0.2.2, eth1 inactive, weight 1, 00:02:22 I>\* 192.168.255.254/32 [115/20] via 192.0.2.2, eth1, weight 1, 00:02:22 |

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| --- |
| Node-2@vyos:~$ show ip route isis  Codes: K - kernel route, C - connected, S - static, R - RIP,  O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,  T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,  f - OpenFabric,  > - selected route, \* - FIB route, q - queued, r - rejected, b - backup t - trapped, o - offload failure |

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| --- |
| I 192.0.2.0/24 [115/20] via 192.0.2.1, eth1 inactive, weight 1, 00:02:21 I>\* 192.168.255.255/32 [115/20] via 192.0.2.1, eth1, weight 1, 00:02:21 |

**Enable IS-IS and redistribute routes not natively in IS-IS**

**Node 1:**

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| --- |
| set interfaces dummy dum0 address '203.0.113.1/24' set interfaces ethernet eth1 address '192.0.2.1/24' |

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| --- |
| set policy prefix-list EXPORT-ISIS rule 10 action 'permit'  set policy prefix-list EXPORT-ISIS rule 10 prefix '203.0.113.0/24'  set policy route-map EXPORT-ISIS rule 10 action 'permit'  set policy route-map EXPORT-ISIS rule 10 match ip address prefix-list 'EXPORT-ISIS' |

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| --- |
| set protocols isis interface eth1  set protocols isis net '49.0001.1921.6800.1002.00'  set protocols isis redistribute ipv4 connected level-2 route-map 'EXPORT-ISIS' |

**Node 2:**

|  |
| --- |
| set interfaces ethernet eth1 address '192.0.2.2/24' |

|  |
| --- |
| set protocols isis interface eth1  set protocols isis net '49.0001.1921.6800.2002.00' |

Routes on Node 2:

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| --- |
| Node-2@r2:~$ show ip route isis  Codes: K - kernel route, C - connected, S - static, R - RIP,  O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,  T - Table, v - VNC, V - VNC-Direct, A - Babel, D - SHARP,  F - PBR, f - OpenFabric,  > - selected route, \* - FIB route, q - queued route, r - rejected route |

|  |
| --- |
| I 203.0.113.0/24 [115/10] via 192.0.2.1, eth1, 00:03:42 |

**Enable IS-IS and IGP-LDP synchronization**

**Node 1:**

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| --- |
| set interfaces loopback lo address 192.168.255.255/32 set interfaces ethernet eth0 address 192.0.2.1/24 |

|  |
| --- |
| set protocols isis interface eth0  set protocols isis interface lo passive  set protocols isis ldp-sync  set protocols isis net 49.0001.1921.6825.5255.00 |

|  |
| --- |
| set protocols mpls interface eth0  set protocols mpls ldp discovery transport-ipv4-address 192.168.255.255 set protocols mpls ldp interface lo  set protocols mpls ldp interface eth0  set protocols mpls ldp parameters transport-prefer-ipv4  set protocols mpls ldp router-id 192.168.255.255 |

This gives us IGP-LDP synchronization for all non-loopback interfaces with a holddown timer of zero seconds:

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| Node-1@vyos:~$ show isis mpls ldp-sync  eth0  LDP-IGP Synchronization enabled: yes  holddown timer in seconds: 0  State: Sync achieved |

**Enable IS-IS with Segment Routing (Experimental)**

**Node 1:**

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| --- |
| set interfaces loopback lo address '192.168.255.255/32' set interfaces ethernet eth1 address '192.0.2.1/24' |

|  |
| --- |
| set protocols isis interface eth1  set protocols isis interface lo  set protocols isis net '49.0001.1921.6825.5255.00'  set protocols isis segment-routing global-block high-label-value '599'  set protocols isis segment-routing global-block low-label-value '550'  set protocols isis segment-routing prefix 192.168.255.255/32 index value '1' set protocols isis segment-routing prefix 192.168.255.255/32 index explicit-null set protocols mpls interface 'eth1' |

**Node 2:**

|  |
| --- |
| set interfaces loopback lo address '192.168.255.254/32' set interfaces ethernet eth1 address '192.0.2.2/24' |

|  |
| --- |
| set protocols isis interface eth1  set protocols isis interface lo  set protocols isis net '49.0001.1921.6825.5254.00'  set protocols isis segment-routing global-block high-label-value '599'  set protocols isis segment-routing global-block low-label-value '550'  set protocols isis segment-routing prefix 192.168.255.254/32 index value '2' set protocols isis segment-routing prefix 192.168.255.254/32 index explicit-null set protocols mpls interface 'eth1' |

This gives us MPLS segment routing enabled and labels for far end loopbacks:

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| --- |
| Node-1@vyos:~$ show mpls table  Inbound Label Type Nexthop Outbound Label  ----------------------------------------------------------------------  552 SR (IS-IS) 192.0.2.2 IPv4 Explicit Null <-- Node-2 loopback learned on Node-1 15000 SR (IS-IS) 192.0.2.2 implicit-null  15001 SR (IS-IS) fe80::e87:6cff:fe09:1 implicit-null  15002 SR (IS-IS) 192.0.2.2 implicit-null  15003 SR (IS-IS) fe80::e87:6cff:fe09:1 implicit-null |

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| --- |
| Node-2@vyos:~$ show mpls table  Inbound Label Type Nexthop Outbound Label  ---------------------------------------------------------------------  551 SR (IS-IS) 192.0.2.1 IPv4 Explicit Null <-- Node-1 loopback learned on Node-2 15000 SR (IS-IS) 192.0.2.1 implicit-null  15001 SR (IS-IS) fe80::e33:2ff:fe80:1 implicit-null  15002 SR (IS-IS) 192.0.2.1 implicit-null  15003 SR (IS-IS) fe80::e33:2ff:fe80:1 implicit-null |

Here is the routing tables showing the MPLS segment routing label operations:

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| Node-1@vyos:~$ show ip route isis  Codes: K - kernel route, C - connected, S - static, R - RIP,  O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,  T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,  f - OpenFabric,  > - selected route, \* - FIB route, q - queued, r - rejected, b - backup t - trapped, o - offload failure |

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| --- |
| I 192.0.2.0/24 [115/20] via 192.0.2.2, eth1 inactive, weight 1, 00:07:48  I>\* 192.168.255.254/32 [115/20] via 192.0.2.2, eth1, label IPv4 Explicit Null, weight 1, 00:03:39 |

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| --- |
| Node-2@vyos:~$ show ip route isis  Codes: K - kernel route, C - connected, S - static, R - RIP,  O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,  T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,  f - OpenFabric,  > - selected route, \* - FIB route, q - queued, r - rejected, b - backup t - trapped, o - offload failure |

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| --- |
| I 192.0.2.0/24 [115/20] via 192.0.2.1, eth1 inactive, weight 1, 00:07:46  I>\* 192.168.255.255/32 [115/20] via 192.0.2.1, eth1, label IPv4 Explicit Null, weight 1, 00:03:43 |