IPv6-only IXPs are Coming?

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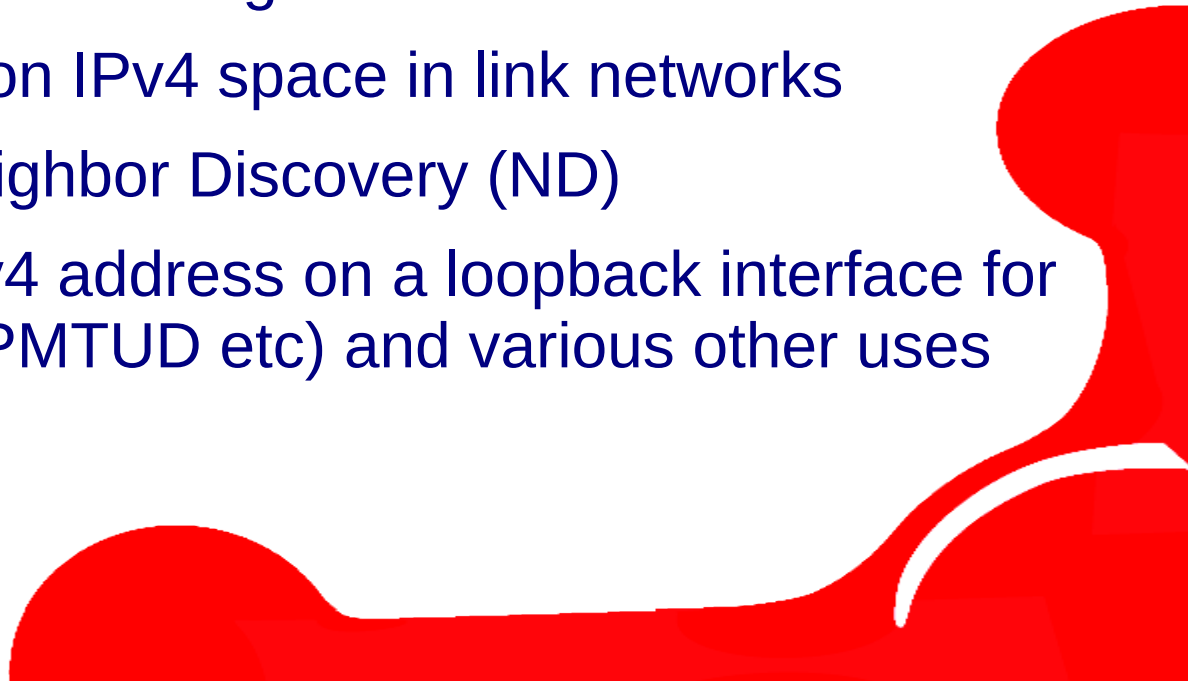
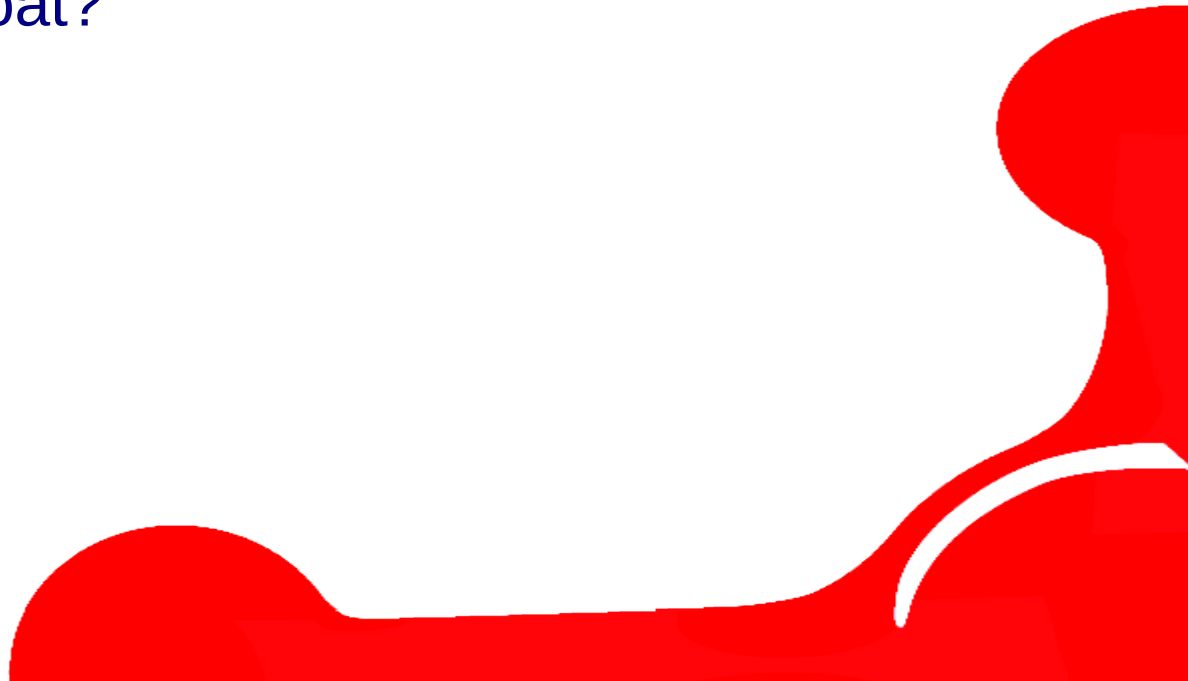
What's This All About?

- Making IPv4 last longer!
- RFC5549/8950 specifies a method for announcing IPv4 routes with IPv6 next-hop addresses using BGP
- Allows operators to save on IPv4 space in link networks
- ARP replaced by IPv6 Neighbor Discovery (ND)
- Routers still need **one** IPv4 address on a loopback interface for ICMP errors (traceroute, PMTUD etc) and various other uses



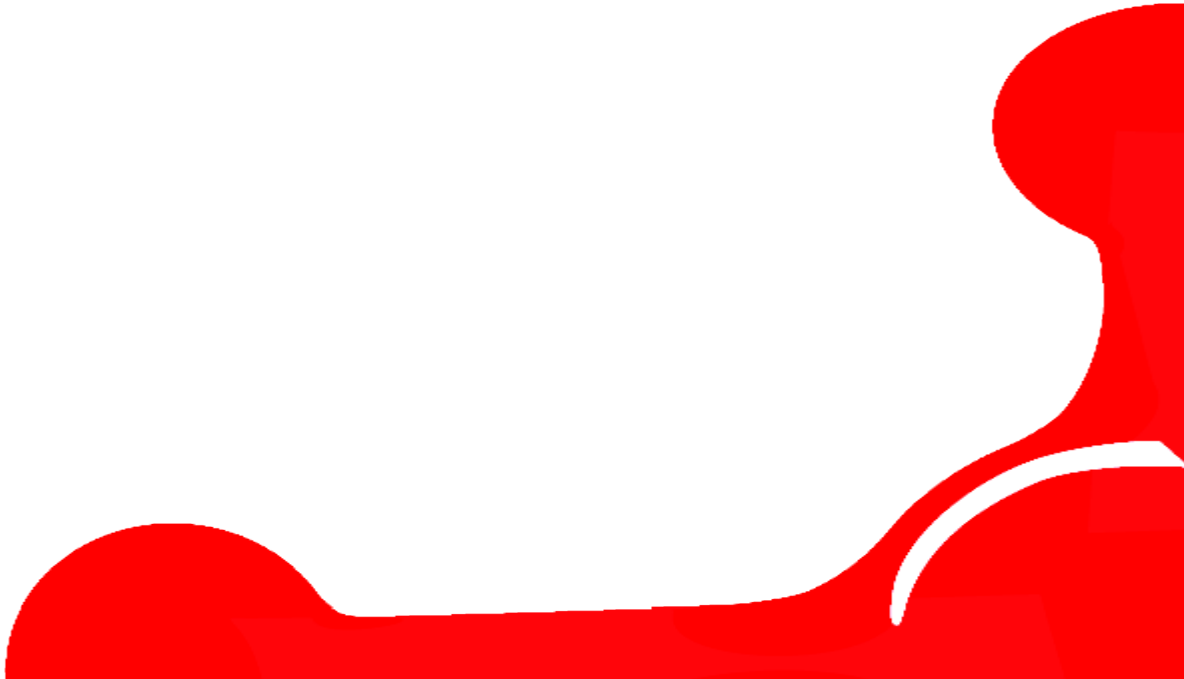
But IXPs? Why?

- IXPs already have IPv4 addresses
- RIPE even has a special address assignment policy for IXPs
- Why bother rocking the boat?



Renumbering an IXP Is Painful

- LINX renumbered from a /22 to a /21 on 2022-05-11
- Who here remembers that?



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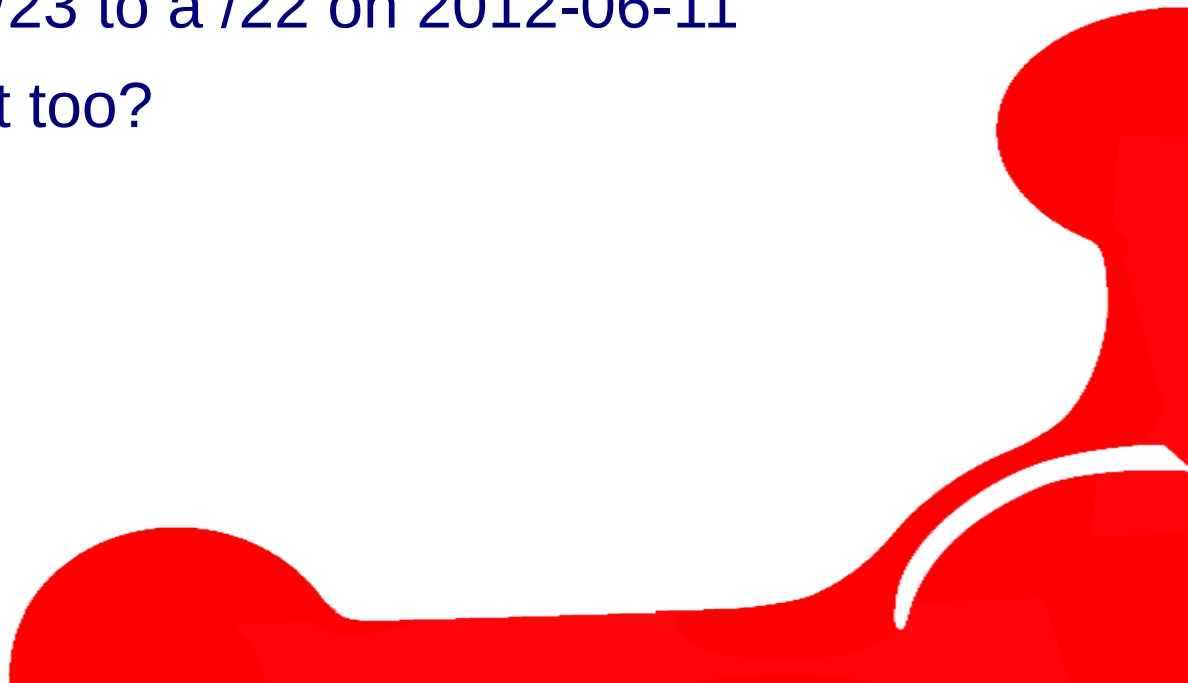

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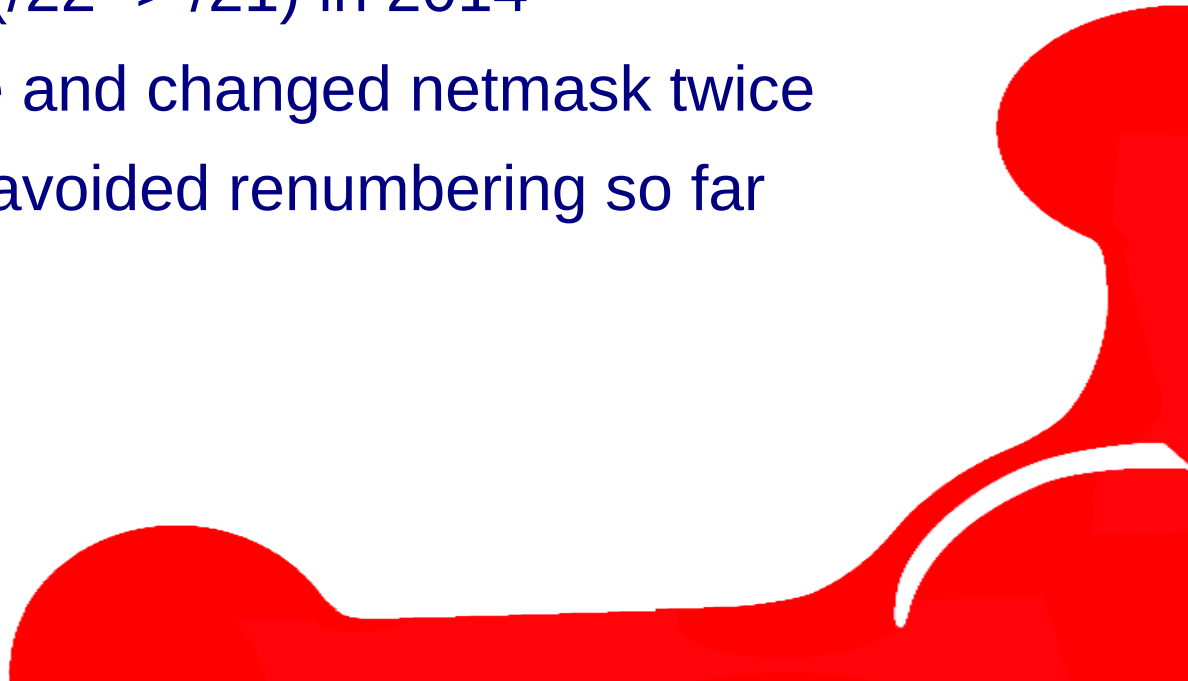
- Who here remembers that?
- LINX renumbered from a /23 to a /22 on 2012-06-11
- Who here remembers that too?
- LINX renumbered from a /24 to a /23 in 1997
- Thanks to Moyaze Shivji for the above dates

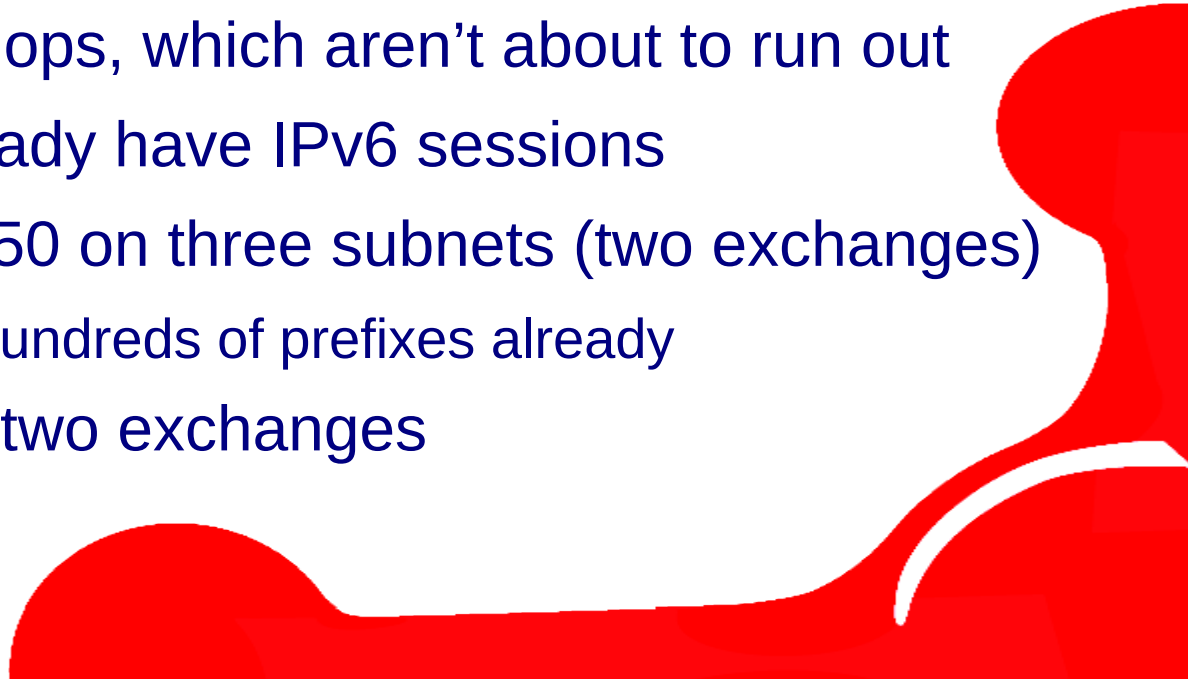
Renumbering an IXP Is Painful

- France-IX renumbering took almost two years 2019-2021
  - Thanks to Radu-Adrian Feurdean for dates
- AMS-IX last renumbered (/22 -> /21) in 2014
- DE-CIX renumbered once and changed netmask twice
- Netnod has miraculously avoided renumbering so far



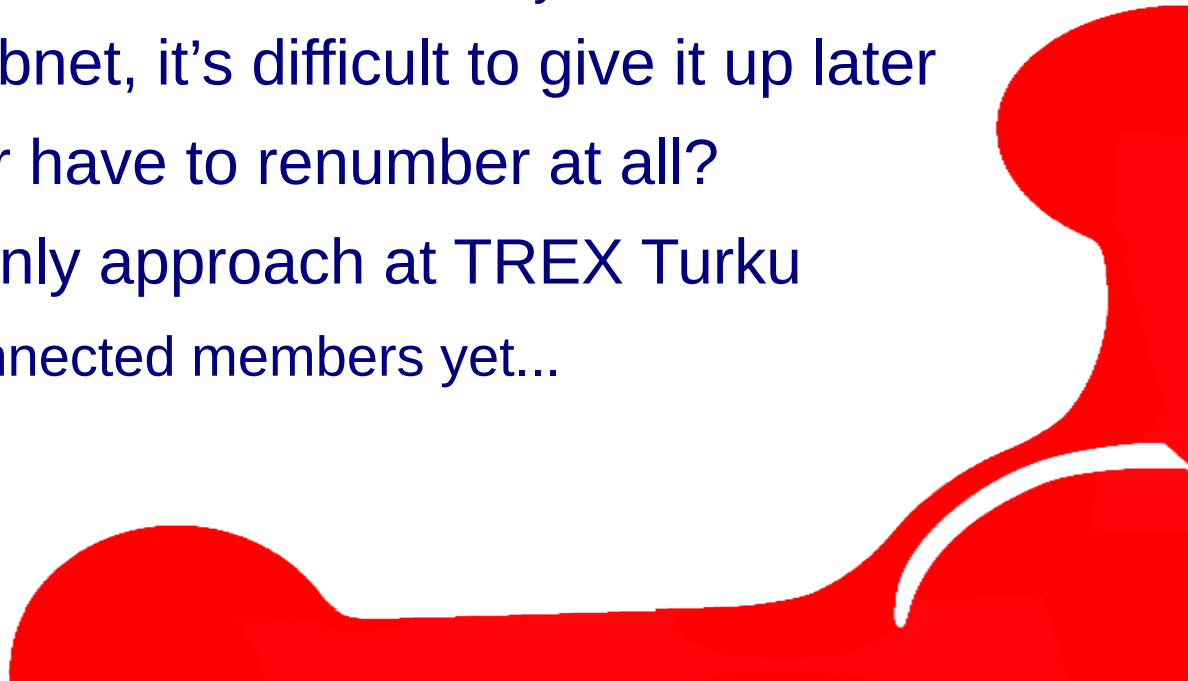
Alternative: One Final "Renumbering" Event

- When the peering subnet becomes full, think about whether you really want to go through the pain of renumbering again and again...
- ... or switch to IPv6 next-hops, which aren't about to run out
- All members typically already have IPv6 sessions
- NIX (cz) is testing RFC8950 on three subnets (two exchanges)
  - Dozens of sessions and hundreds of prefixes already
- TREX is also testing it on two exchanges



What About New IXPs?

- RIPE updated the IXP Address Space Assignment policy for IXPs:
  - Initial assignment is now /26
  - Multiple renumbering events needed even before you reach /24
- If we start with an IPv4 subnet, it’s difficult to give it up later
- So take a chance to never have to renumber at all?
- We are testing this IPv6-only approach at TREX Turku
  - A new IXP, not a lot of connected members yet...



RFC8950-ixp Working Group

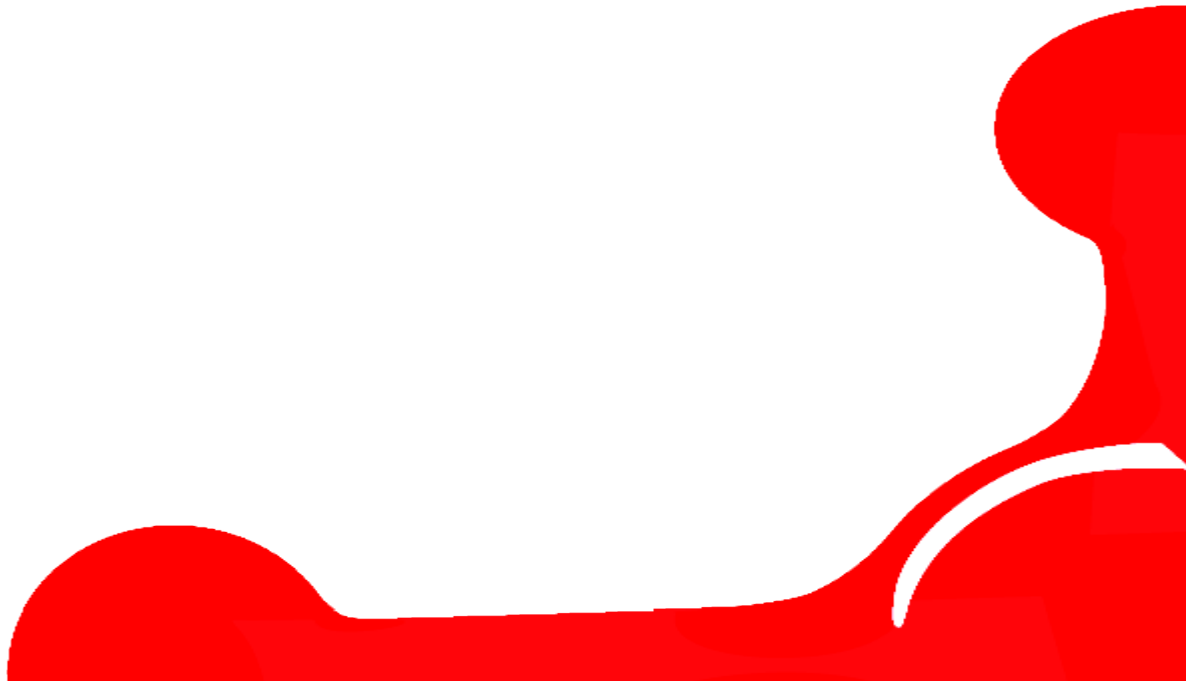
- Euro-IX started a working group to map out the challenges and to work on best practices for adopting RFC8950 at IXPs
  - Chairmen: André Grüneberg (BCIX) and Aleksi Suhonen (TREX)
  - Members from DE-CIX, LINX, NIX.CZ, nic.cz, NetDEF, ...
- https://github.com/euro-ix/rfc8950-ixp
  - Pull requests accepted...
- There’s also a mailing list and a mattermost chat channel

RFC8950 Challenges

- The original RFC5549 is from 2018
  - Initial implementations aimed mostly at MPLS VPN AFI/SAFIs
- Interoperability hadn’t been tested much before this
- ICMP Unreachables unpredictable on some platforms
- IBGP next-hop-self even more important now
- Since we began this work, a lot of platforms have matured

Thank you!

Questions?



Junos Config Example 1/2

```
[edit interfaces irb unit 7]
description EXCHANGE_Turku;
family inet {
    filter {
        input spoof-protect-trex;
    }
}
family inet6 {
    filter {
        input 6spoof-protect-trex;
    }
    address 2001:7f8:1d:7::72f8:1/64;
}
```

- The family inet section has to exist for the router to process IPv4 traffic
- But it doesn’t need an address.

Junos Config Example 2/2

```
[edit protocols bgp group peering-rfc8950]
type external;
export [ 6export_peering 4export_peering deny-all ];
import [ 4hygiene 6hygiene deny-tier1s 4import_peering 6import_peering deny-all ];
family inet {
    unicast {
        prefix-limit maximum 9999;
        extended-nexthop;
    }
}
family inet6 {
    unicast {
        prefix-limit maximum 999;
    }
}
```

Junos Show Route Example

```
axu@betty> show route 193.163.5.0 terse

inet.0: 975756 destinations, 1499988 routes (507404 active, 0 holddown, 728982 hidden)
+ = Active Route, - = Last Active, * = Both

A V Destination        P Prf   Metric 1   Metric 2  Next hop        AS path
* V 193.163.5.0/24     B 170        300             >2001:7f8:1d:7:0:3:289b:2 207003 I
  V                    B 170        300             >2001:7f8:1d:7:0:3:289b:1 207003 I
  V                    B 170        100             >195.140.192.47  207003 I
  V                    B 170         60           0 >195.140.192.13  6667 207003 I

axu@betty>
```