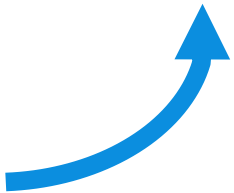
SRv6 Update - UK IPv6 Council

Clarence Filsfils
Cisco Fellow – cf@cisco.com

Simplicity Always Prevails

Furthermore with more scale and functionality



SRv6 Eco-System

At record speed

- 7 large-scale commercial deployments
  - Softbank, Iliad, China Telecom, LINE corporation, China Unicom, CERNET2 and Uganda MTN.
- 18 HW linerate implementations
  - Cisco Systems, Huawei
  - Broadcom, Barefoot, Marvell, Intel
  - SmartNic
  - Multiple Interop Reports
- 9 open-source platforms/ Applications
  - Linux, FD.io VPP, P4, Wireshark, tcpdump, iptables, nftables, snort

Cisco Supports SoftBank on First Segment Routing IPv6 Deployment in Prep for 5G

Link to PR - https://newsroom.cisco.com/press-release-content?type=webcontent&articleId=1969030

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Iliad is set to
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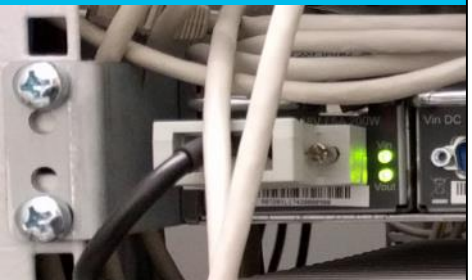
https://newsroom.cisco.com/press-release



Tue 10-Dec-19 10:34

SP

Sébastien Parisot <sparisot@free-mobile.fr>

Re: [spring] SPRING SRv6 Deployment Status draft

To 松嶋聡; Zafar Ali (zali)

Cc SPRING WG List

We removed extra line breaks from this message.

Hi Satoru, Zafar,

I would like to provide an update to SRv6 deployment in Iliad's nationwide network in Italy.

As of the end of 2019, the SRv6 network consists of:
- 1000 Cisco NCS 5500 routers
- 1800 Iliad's Nodeboxes
- The network services 4.5 million mobile subscribers (as of Q3 2019)
- The network is carrying 300 Gbps of commercial traffic at peak hours
- It is expected to grow to more than 4000 Nodeboxes in 2020.

The following SRv6 features have been deployed:
- A Segment Routing Header based data plane
- End (PSP), End.X (PSP), End.DT4, T.Encaps.Red, T.Insert.Red functions
- BGP VPN SRv6 extensions
- ISIS SRv6 extensions
- SRH-based Topology Independent (TI-LFA) Fast Reroute mechanisms
- Support for ping and traceroute

Can you please update the SRv6 deployment draft accordingly?

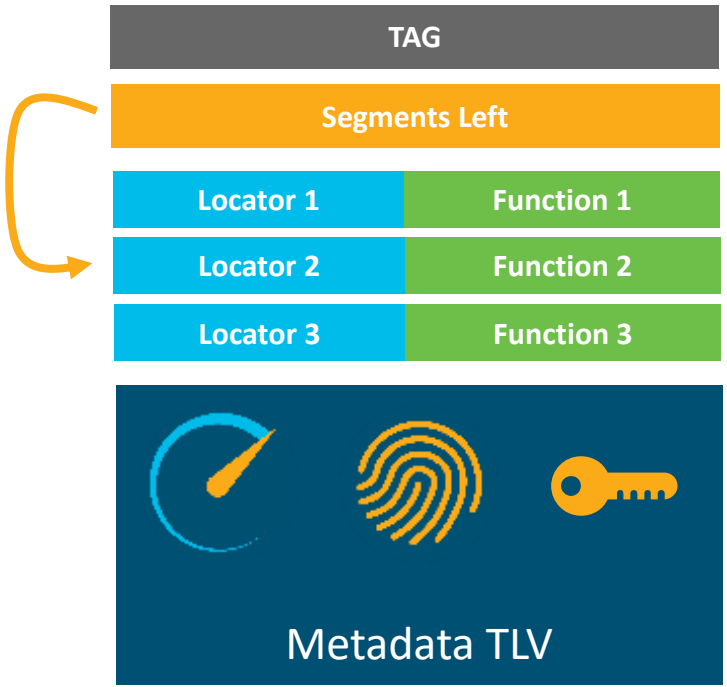
Thanks,
Sébastien

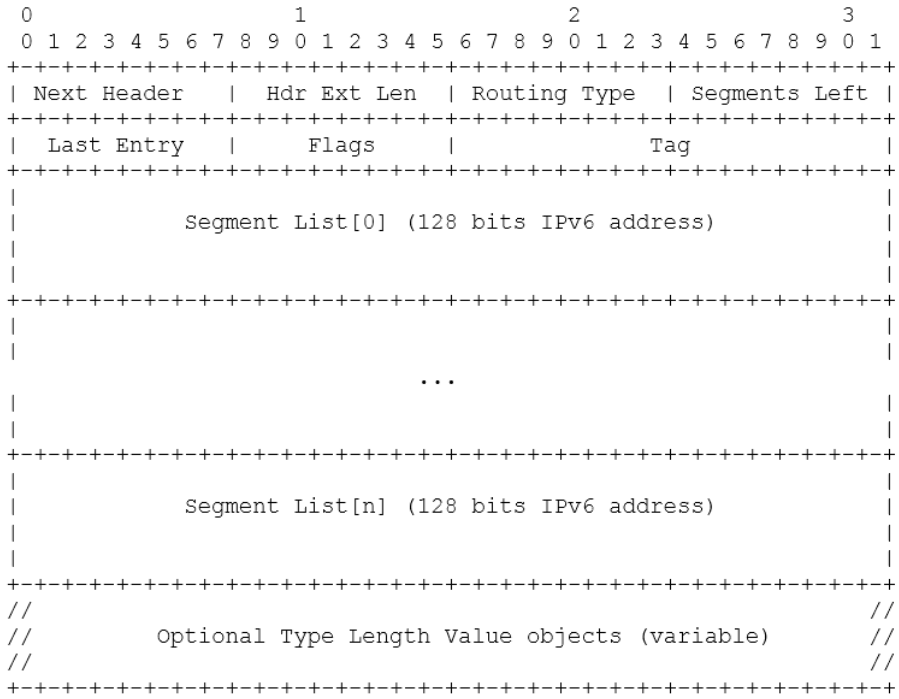
ad

co

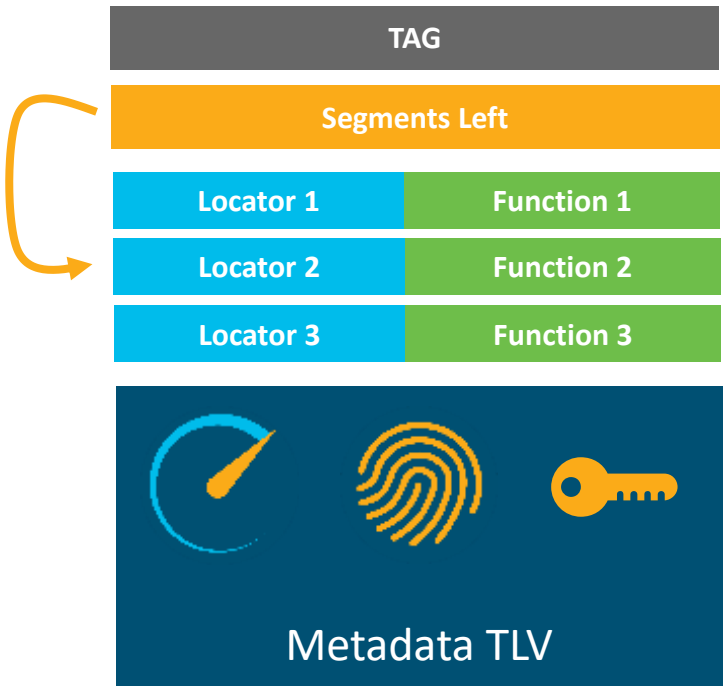
SRv6 - Reminder

SRv6 Header





SRv6 for anything

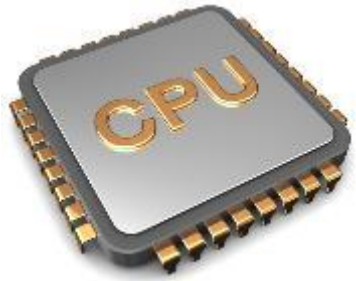


Optimized for HW processing

e.g. Underlay & Tenant use-cases

Optimized for SW processing

e.g. NFV, Container, Micro-Service



IETF

texelart © 123RF.com

SR Architecture

- RFC 8402 – Proposed Standard
  - Defines SR-MPLS with MPLS dataplane and Label SID’s
  - Defines SRv6 with SRH and SRv6 SID’s

SRv6

- RFC Proposed Standard
  - SRv6 DataPlane: SRH and SRv6 SID
- Last-Call
  - Network Programming (END, END.X, END.DX/DT, T.Encaps)
  - Control Plane (ISIS, BGP-LS)
  - Policy
  - OAM
- One IETF away to Last-Call
  - BGP

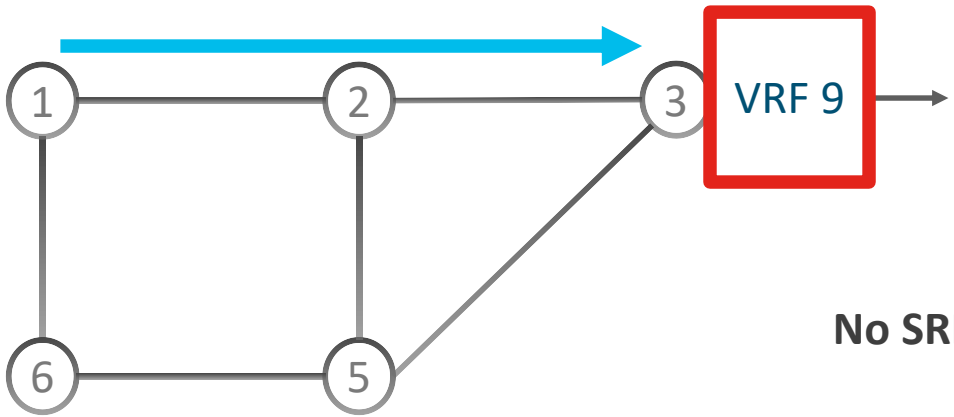
SRv6 Deployed Use-Cases

LIU MING © 123RF.com

VPN over Best-Effort 5G Slice

Network Program: B:3:V(9)

B*: locator block is associated with *ISIS base algo (Low Cost, Best Effort)

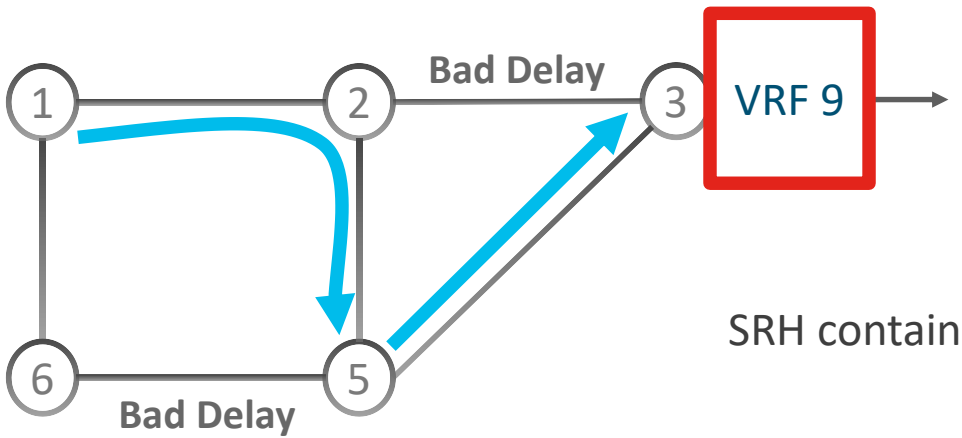


No SRH!

VPN with Low-Delay 5G Slice – SR-TE option

Network Program: B:2:C5 then B:3:V(9)

B: locator block is associated with ISIS base algo (Low Cost)

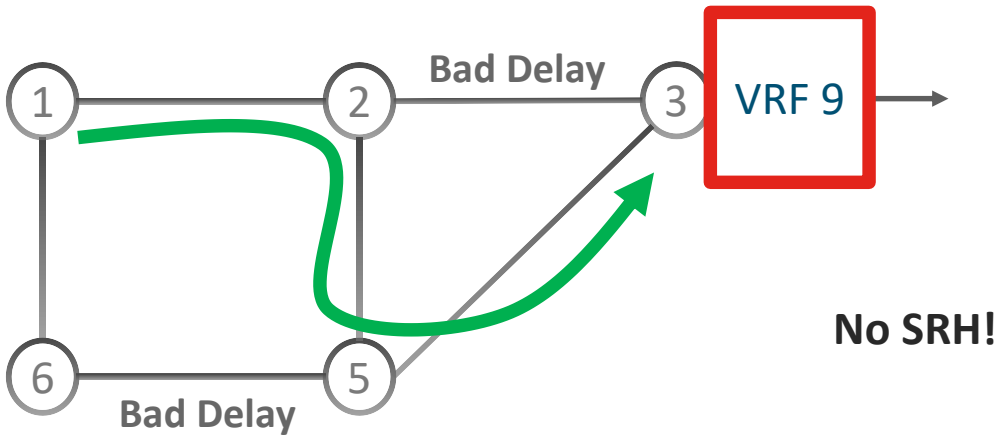


SRH contains 1 single SID

VPN with Low-Delay 5G Slice – Flex-algo option

Network Program: D:3:V(9)

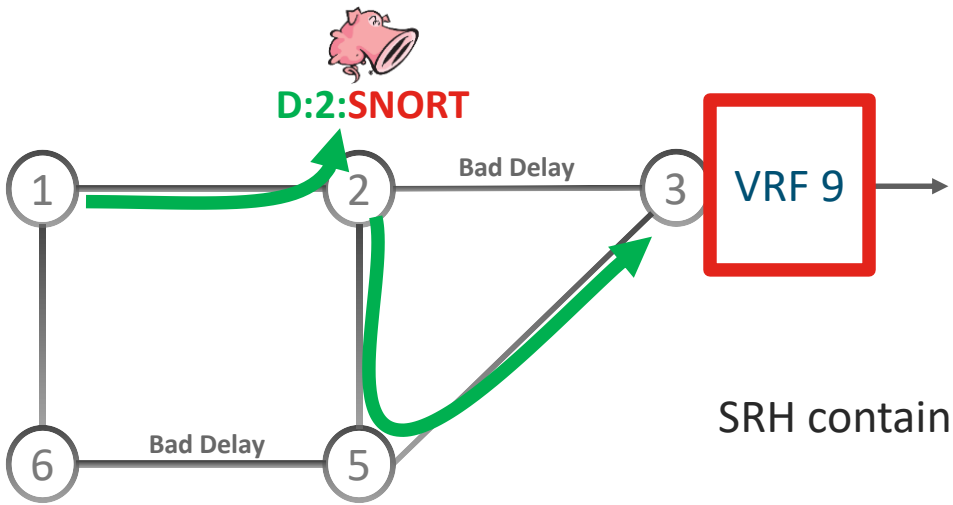
***D*: locator block is associated with *Low Delay* Flex-Algo**



Snort firewall, VPN & Low-Delay Slice

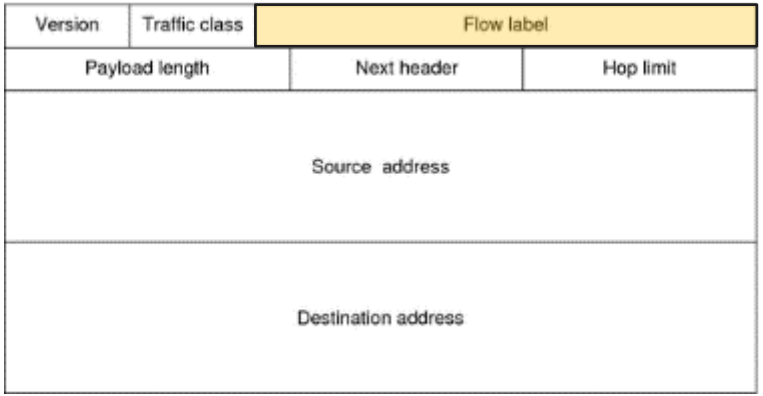
Network Program: D:2:SNORT then D:3:V(9)

***D**: locator block is associated with **Low Delay** Flex-Algo*



SRH contains 1 Single SID

Load-balancing



- 20-bit entropy
- No additional protocol
  - infamous mpls entropy label

Seamless Incremental Deployment

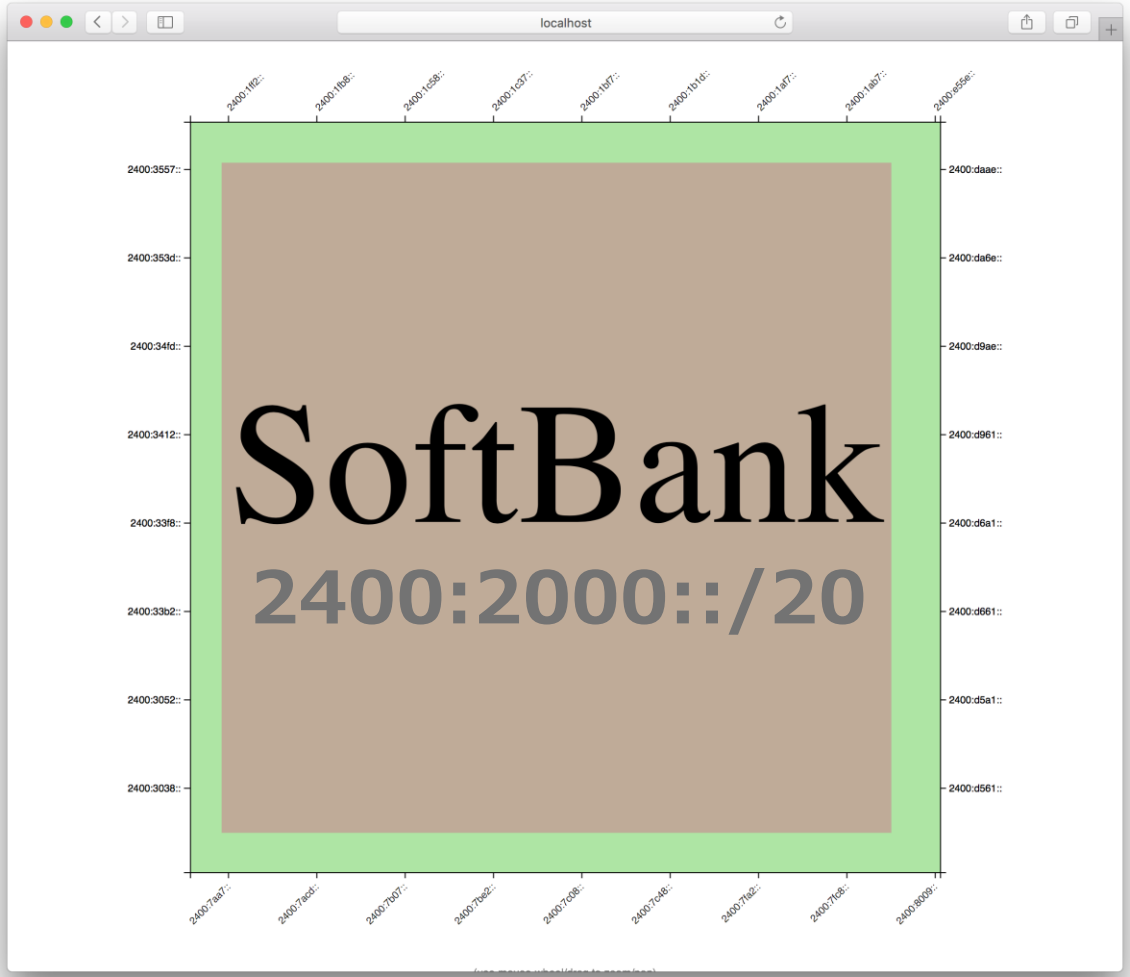
- As soon as the network supports plain IPv6 forwarding
  - a new SRv6-VPN service only requires PE upgrade
  - TE objective can be achieved with a few well selected TE waypoints
  - FRR is deployed incrementally

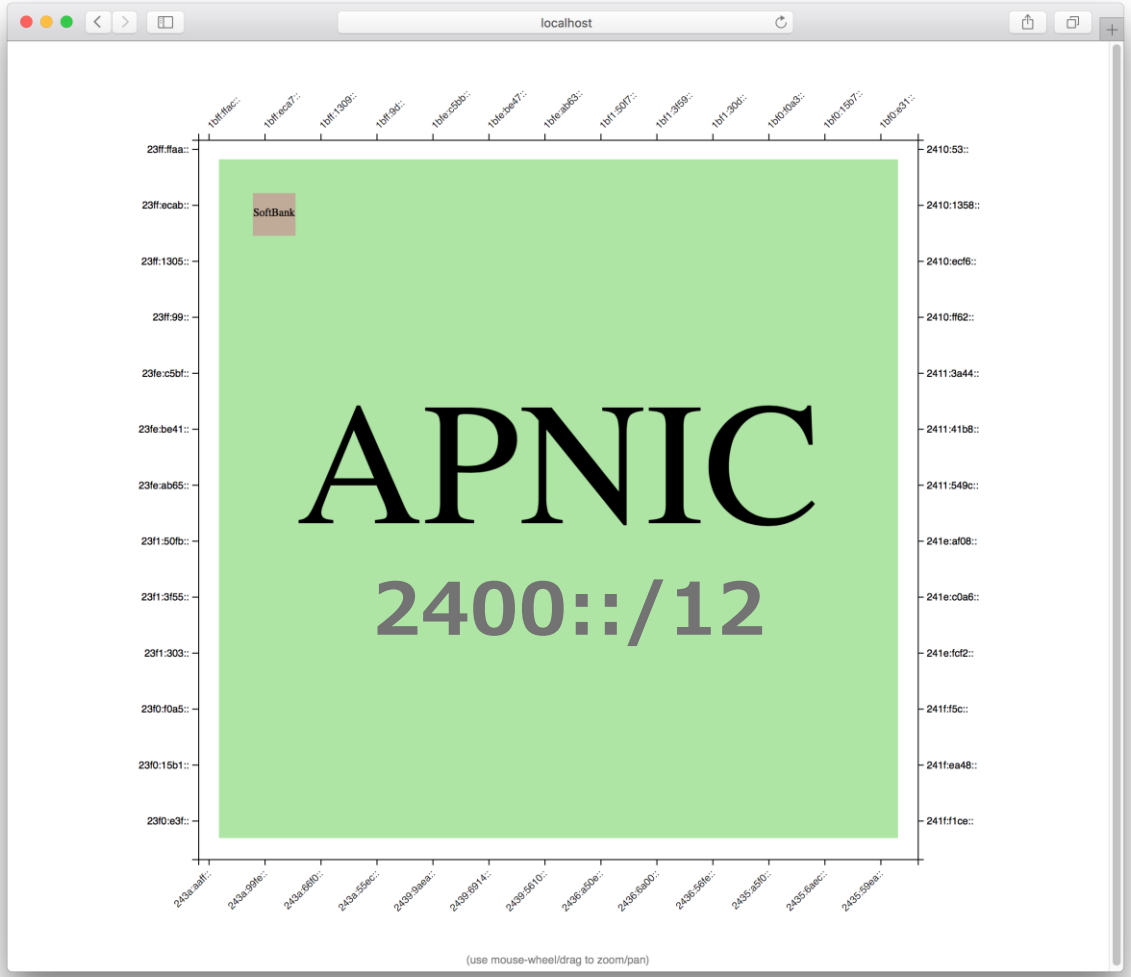
SID Block Allocation

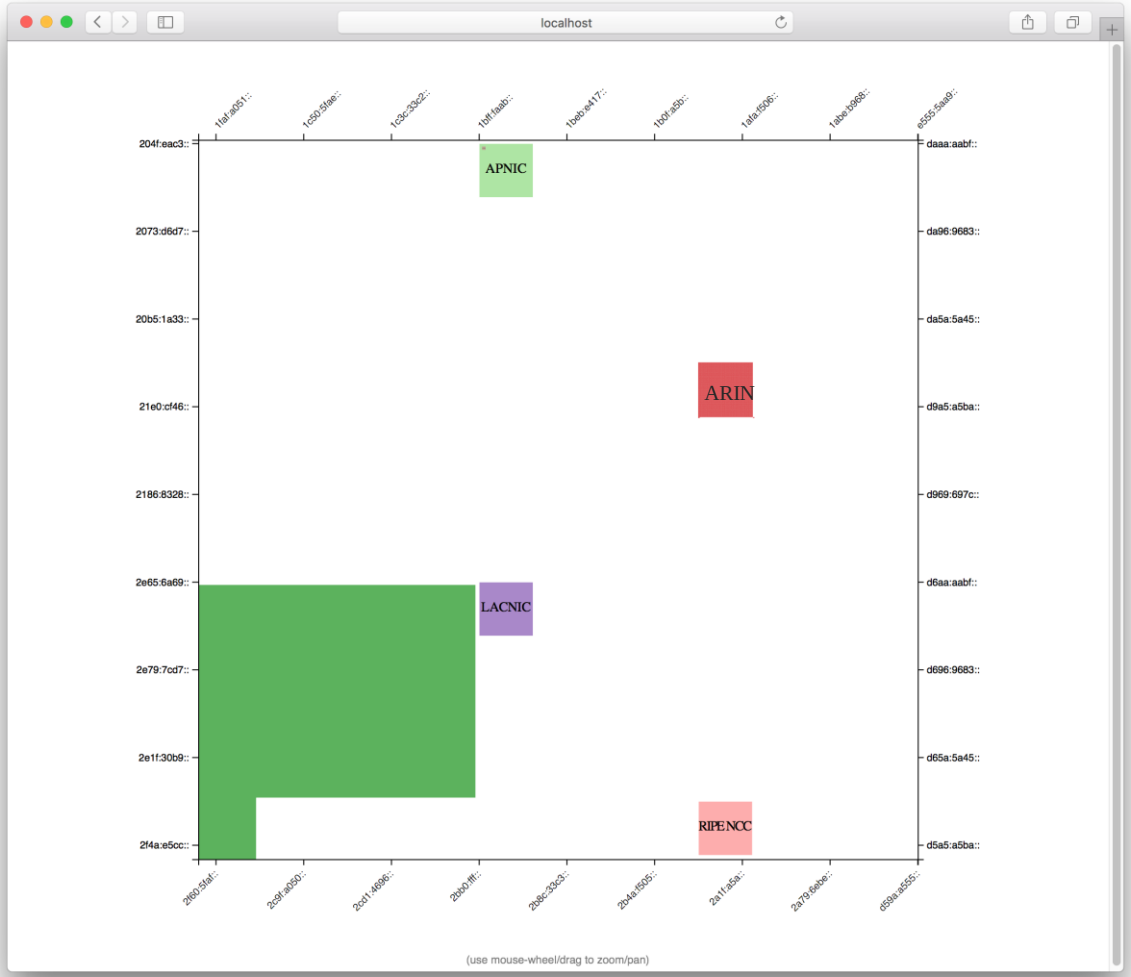
Asfia Nasir © 123RF.com

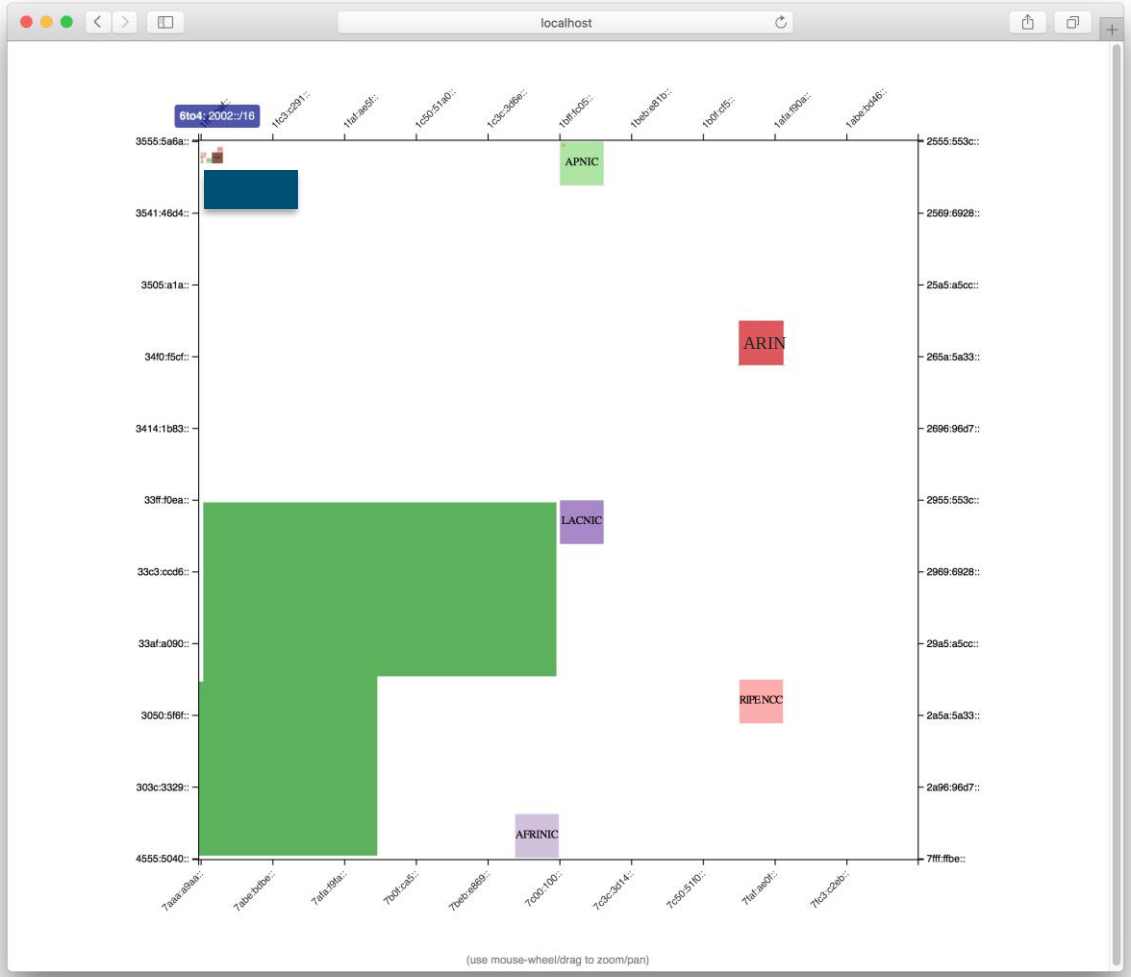
Credit to Satoru Matsushima - Softbank
who credits Vasco Astriano and Dave Plonka (Akamai)

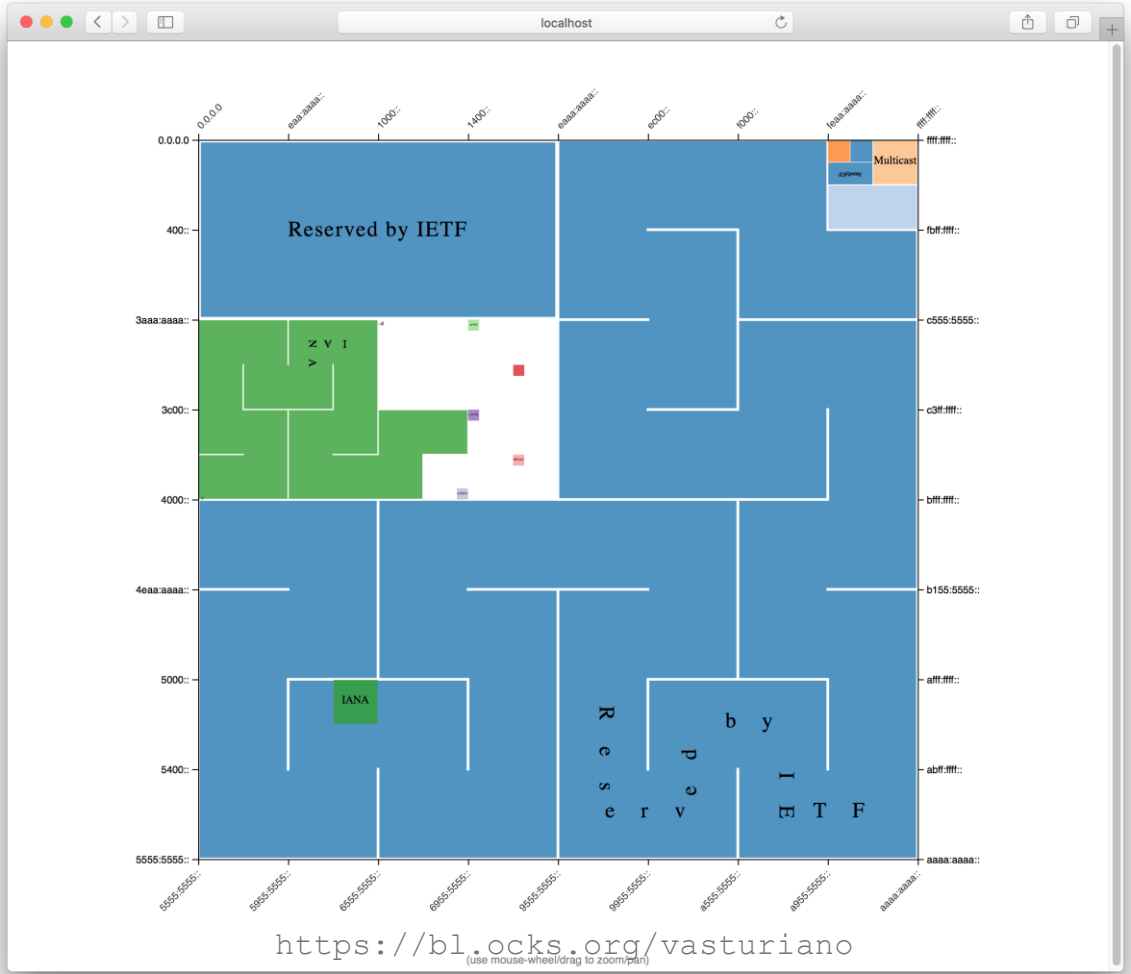

2400:20eb::
2400:2103::
2400:214e::
2400:2eac::
2400:2ec4::
2400:2f0e::
2400:2fec::
SoftBank
2400:da69::
2400:d9a9::
2400:d966::
2400:d6a6::
2400:d666::
2400:d5a6::
2400:d566::


localhost
2400:1ff2::
2400:1fb8::
2400:1c58::
2400:1c37::
2400:1bf7::
2400:1b1d::
2400:1af7::
2400:1ab7::
2400:e55e::
2400:3557::
2400:353d::
2400:34fd::
2400:3412::
2400:33f8::
2400:33b2::
2400:3052::
2400:3038::
2400:daae::
2400:da6e::
2400:d9ae::
2400:d961::
2400:d6a1::
2400:d661::
2400:d5a1::
2400:d561::
SoftBank
2400:2000::/20
2400:7ad7::
2400:7acd::
2400:7b07::
2400:7ee2::
2400:7c08::
2400:7c48::
2400:7fd2::
2400:7fc8::
2400:8009::


localhost
13ff:ffac::
13ff:eca7::
13ff:1309::
13ff:9d::
13fe:c5bb::
13fe:be47::
13fe:ab63::
13f1:50f7::
13f1:3f59::
13f1:30d::
13f0:f0a3::
13f0:15f7::
13f0:e31::
23ff:ffaa::
23ff:ecab::
23ff:1305::
23ff:99::
23fe:c5bf::
23fe:be41::
23fe:ab65::
23f1:50fb::
23f1:3f55::
23f1:303::
23f0:f0a5::
23f0:15b1::
23f0:e3f::
2410:53::
2410:1358::
2410:ecf6::
2410:ff62::
2411:3a44::
2411:41b8::
2411:549c::
241e:af08::
241e:c0a6::
241e:fcf2::
241f:f5c::
241f:ea48::
241f:f1ce::
243a:adff::
243a:99fe::
243a:66f0::
243a:55ec::
2439:9aea::
2439:6914::
2439:5610::
2436:a50e::
2436:6a00::
2436:56fe::
2435:a5f0::
2435:6aec::
2435:59ea::
SoftBank
APNIC
2400::/12
(use mouse-wheel/drag to zoom/pan)


localhost
1faf:a051::
1c50:5fae::
1c3c:33c2::
1bff:faab::
1be6:e417::
1b0f:a5b::
1afa:f506::
1abe:b968::
e555:5aa9::
204f:eac3::
2073:d6d7::
20b5:1a33::
21e0:cf46::
2186:8328::
2e65:6a69::
2e79:7cd7::
2e1f:30b9::
2f4a:e5cc::
daaa:aabf::
da96:9683::
da5a:5a45::
d9a5:a5ba::
d969:697c::
d6aa:aabf::
d696:9683::
d65a:5a45::
d5a5:a5ba::
APNIC
ARIN
LACNIC
RIPENCC
2b60:5faf::
2c9f:a050::
2cd1:4696::
2b00:fff::
2b8c:33c3::
2b4a:f505::
2a1f:a5a::
2a79:6eb8::
d59a:a555::
(use mouse-wheel/drag to zoom/pan)


localhost
6to4: 2002::/16
APNIC
ARIN
LACNIC
RIPENCC
AFRINIC
(use mouse-wheel/drag to zoom/pan)


localhost
0.0.0.0
eaa:aaaa::
1000::
1400::
eaaa:aaaa::
ec00::
fc00::
feaa:aaaa::
ffff:ffff::
Reserved by IETF
Multicast
IANA
Reserved by IETF
400::
3aaa:aaaa::
3c00::
4000::
4eaa:aaaa::
5000::
5400::
5555:5555::
fbff:ffff::
c555:5555::
c3ff:ffff::
bfff:ffff::
b155:5555::
afff:ffff::
abff:ffff::
aaaa:aaaa::
5555:5555::
5955:5555::
6555:5555::
6955:5555::
9555:5555::
9955:5555::
a555:5555::
a955:5555::
aaaa:aaaa::
https://bl.ocks.org/vasturiano
(use mouse-wheel/drag to zoom/pan)

Legacy HW and Overhead Compression

LIU MING © 123RF.com

SRv6 has excellent native Scale

- Many use-cases do not even use an SRH ☺
  - Any VPN (L3VPN, PW, eVPN)
  - Egress Peering Engineering
  - Low-Latency or Disjoint Slicing
  - Optimal Load-Balancing
- If SRH is needed, most cases will use 1 or 2 SID’s
- Prefix Summarization gain
- Talk to the operators who deployed, they are happy to share experience

Ultra Scale is natively integrated in SRv6 ☺

- We thought this a long time ago
- This is natively integrated in the SRv6 solution
  - Same SRv6 dataplane
  - Same SRv6 control plane
  - Same SRv6 architecture

SRv6 - Automation

Nicolas Menijes Crego © 123RF.com

Available

NSO “click” and the following happens

- Address allocation
  - Loopback and interfaces
- SID allocation
- Multi-Domain
- ISIS summarization and redistribution between domains
- TILFA

Configuration Automation next-step

- BFD
- ISIS Flex-Algo Slicing
- BGP Services
  - Internet
  - L3VPN
  - eVPN PW
- Linux Servers

Troubleshooting Automation

- Brainstorming
- Please ping if interested

Conclusion

Simplicity Always Prevails

~~LDP~~

~~RSVP-TE~~

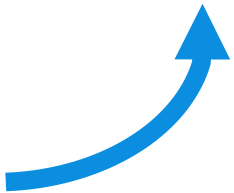
~~Inter-AS Option A/B/C~~

~~MPLS~~

~~UDP/VxLAN~~

~~NSH~~

Furthermore with more scale and functionality



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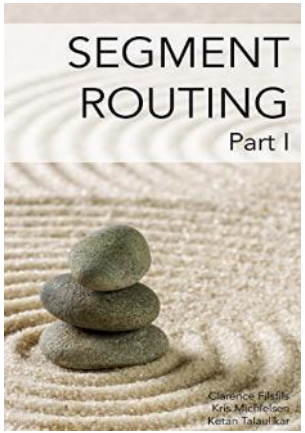
Stay up-to-date



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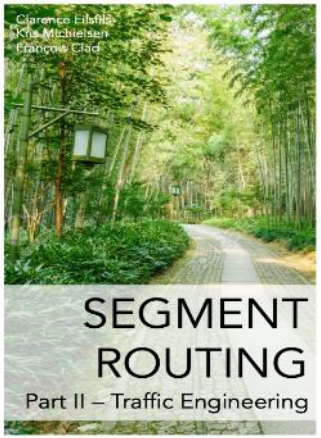

amazon.com/dp/B07N13RDM9

twitter.com/SegmentRouting

segment-routing.net

facebook.com/SegmentRouting/

linkedin.com/groups/8266623


CISCO

SRv6 - Roadmap

3dmask © 123RF.com

Shipping: NCS5500, NCS560, NCS540, ASR9k

- ISIS
  - TILFA and uLoop
  - Flex-Algo (Low-Delay Slice) with TILFA
- BGP
  - PIC Core/Edge
  - L3VPN (IPv4)
  - Internet (IPv4)
  - eVPN VPWS
- SRv6-SR-MPLS Gateway
- OAM
  - Ping
  - Trace
  - SID Verification

Also in the DC - with linerate SRv6 @ 400G

- Amazing set of SRv6 network instructions @ 400G !