TOR VERGATA
UNIVERSITÀ DEGLI STUDI DI ROMA

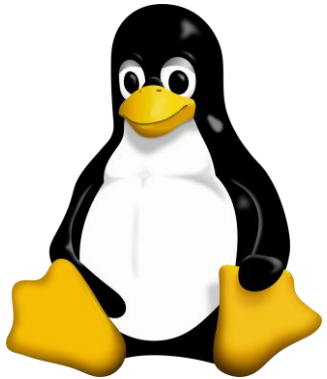
cnit consorzio nazionale interuniversitario per le telecomunicazioni

SRv6 in Linux Kernel, FRR and eBPF : review the current status and plan the future evolution

Organizer: Stefano Salsano

University of Rome Tor Vergata / CNIT

Netdev 0x19 - Zagreb, Croatia
March, 11th 2025



SRv6 - Segment Routing over IPv6

- A cornerstone for modern network programmability
- SRv6 embeds instructions directly into the IPv6 packet headers
- Standardized under IETF RFC 8986, SRv6 has evolved significantly since its initial support in Linux kernel 4.10 (2017)

SRv6 in Linux kernel networking

- SRv6 employs lightweight tunnel infrastructures

  seg6 and **seg6local**

- SRv6 extends its support to key subsystems like **Netfilter** and **eBPF**, fostering its adoption in diverse scenarios

Goals for today: learn, discuss & plan

- Explore how SRv6 innovations have shaped the Linux ecosystem (***learn***)

- Delve into future opportunities for SRv6 (***discuss*** and ***plan***)

Learn SRv6 and how it is used

- SRv6 in Linux kernel

- Several projects leverage the Linux kernel's SRv6 implementation for advanced networking functionalities
    - FRR
    - SONiC
    - Cilium

Learn SRv6 and how it is used

- FRR facilitates L3VPN services and integrates SRv6 behaviors across its daemons
- SONiC leverages SRv6 to deliver scalable routing services and policy management for large-scale deployments
- Cilium harnesses SRv6 with eBPF for container networking: high performance and observability in Kubernetes

Discuss and plan

- An SRv6 performance issue in Linux kernel and its mitigation
- Identify the current limitations of SRv6 in the Linux kernel
- Plan a roadmap for improvements and new features
- Ask feedback and support within the netdev community!

Today's program

09:00 - 09:15	Stefano Salsano Introduction to the workshop
09:15 - 09:35	Ahmed Abdelsalam Technical intro to SRv6, IETF status, interoperability status
09:35 - 10:05	Andrea Mayer SRv6 in Linux kernel: past, present and future
10:05 - 10:20	Ahmed Abdelsalam SoNIC and SRv6
10:20 - 10:50	Carmine Scarpitta FRR: status and evolution of SRv6 support
10:50 - 11:10	COFFEE BREAK
11:10 - 11:25	Stefano Salsano eBPF and SRv6
11:25 - 11:40	Angelo Tulumello eBPF and SRv6: a use case for RoCEv2 support
11:40 - 12:00	Emilien Wansart Mitigating the Double-Reallocation Issue for IPv6 Lightweight Tunnel Encapsulations
12:00 - 12:30	Stefano Salsano (Moderator) Panel discussion on next steps for SRv6 in Linux networking

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SRv6 Open Source Ecosystem

ROSE - Research on Open SRv6 Ecosystem

Stefano Salsano

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The ROSE project

- ROSE is an “umbrella” project, started in 2017, to develop and maintain an Open Source Ecosystem for SRv6.

- The ROSE project has contributed to the standardization of SRv6 in IETF.

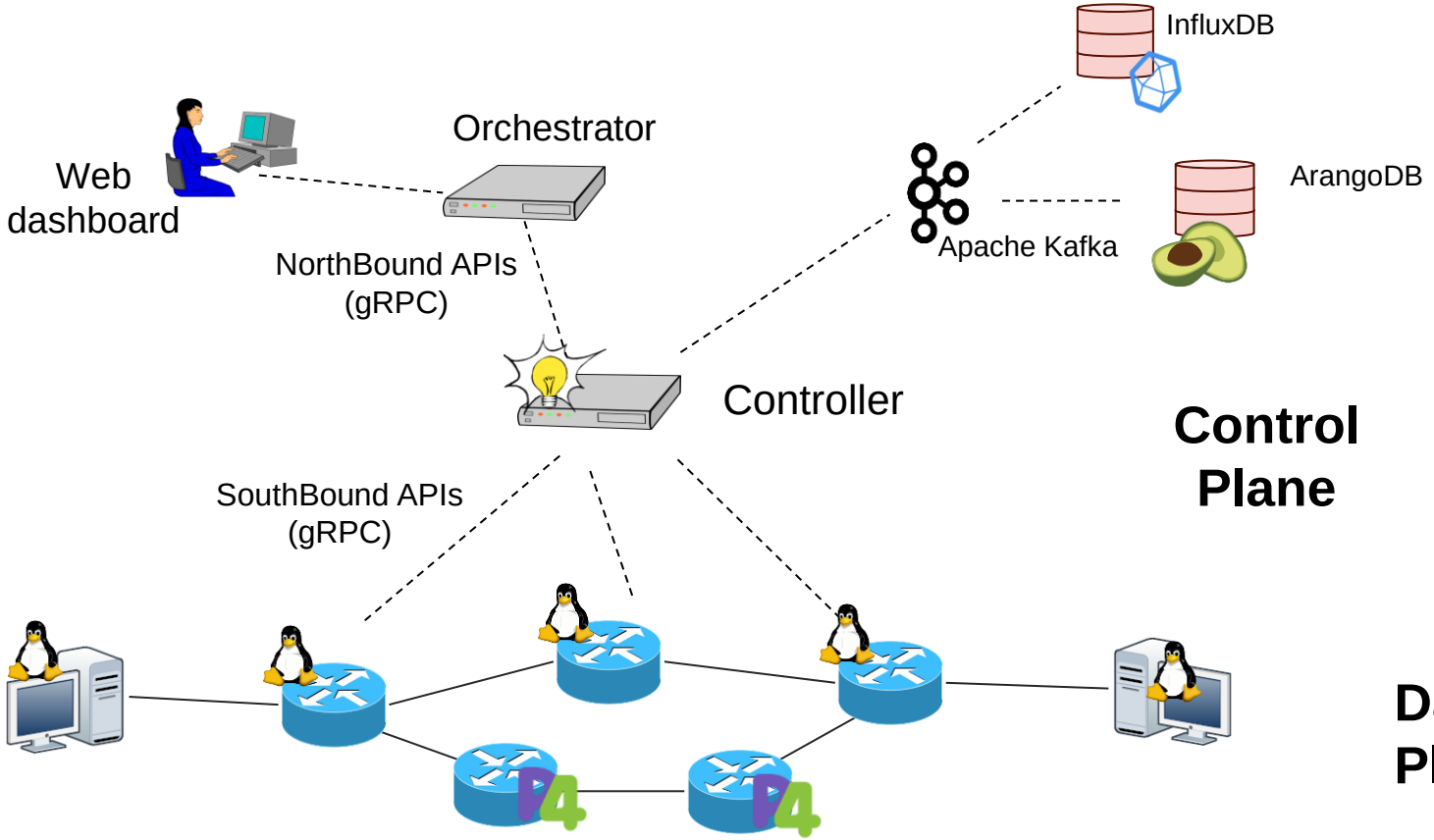
- Over the years, ROSE has received funding by CISCO, under the CISCO University Research Program.

The ROSE project

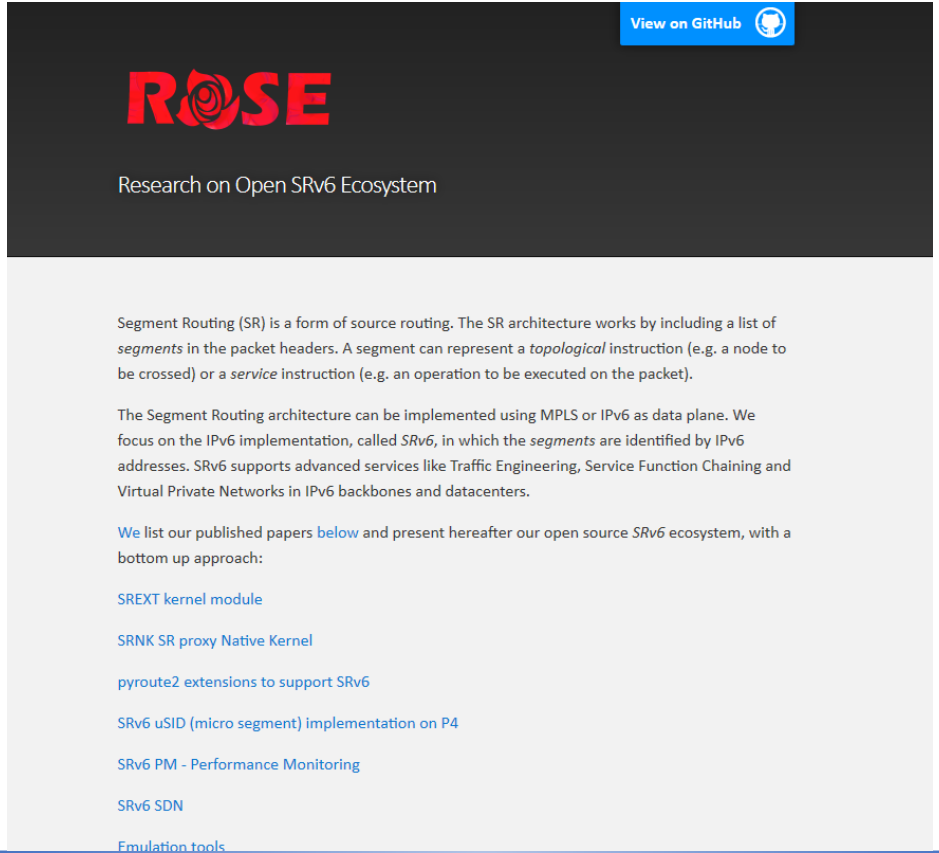
ROSE includes several sub-projects (10+), related to multiple aspects of the SRv6 technology:

- Data Plane
- Control Plane
- SRv6 host networking stack
- SRv6 integration with applications
- SRv6 integration with Cloud/Data Center Infrastructures

The ROSE ecosystem for SRv6



https://netgroup.github.io/rose/



Scientific papers

More than 15 scientific papers (see in https://netgroup.github.io/rose/), including this tutorial:

P. L. Ventre, S. Salsano, M. Polverini, A. Cianfrani, A. Abdelsalam, C. Filsfils, P. Camarillo, F. Clad,

"Segment Routing: a Comprehensive Survey of Research Activities, Standardization Efforts and Implementation Results",

IEEE Communications Surveys & Tutorials, First quarter 2021 (~200 cits.)

SRv6 VM and Tutorials

https://netgroup.github.io/rose/rose-vm.html

A ready-to-go Virtual Machine is available for tutorial and development
It includes an emulated network environment based on Mininet and relies on the Linux kernel for implementing the SRv6 data plane.

Two step-by-step tutorials are included:

- Manual creation of SRv6 tunnels in the Linux SRv6 data plane
- ROSE Control Plane : setting up SRv6 tunnels from the SDN controller

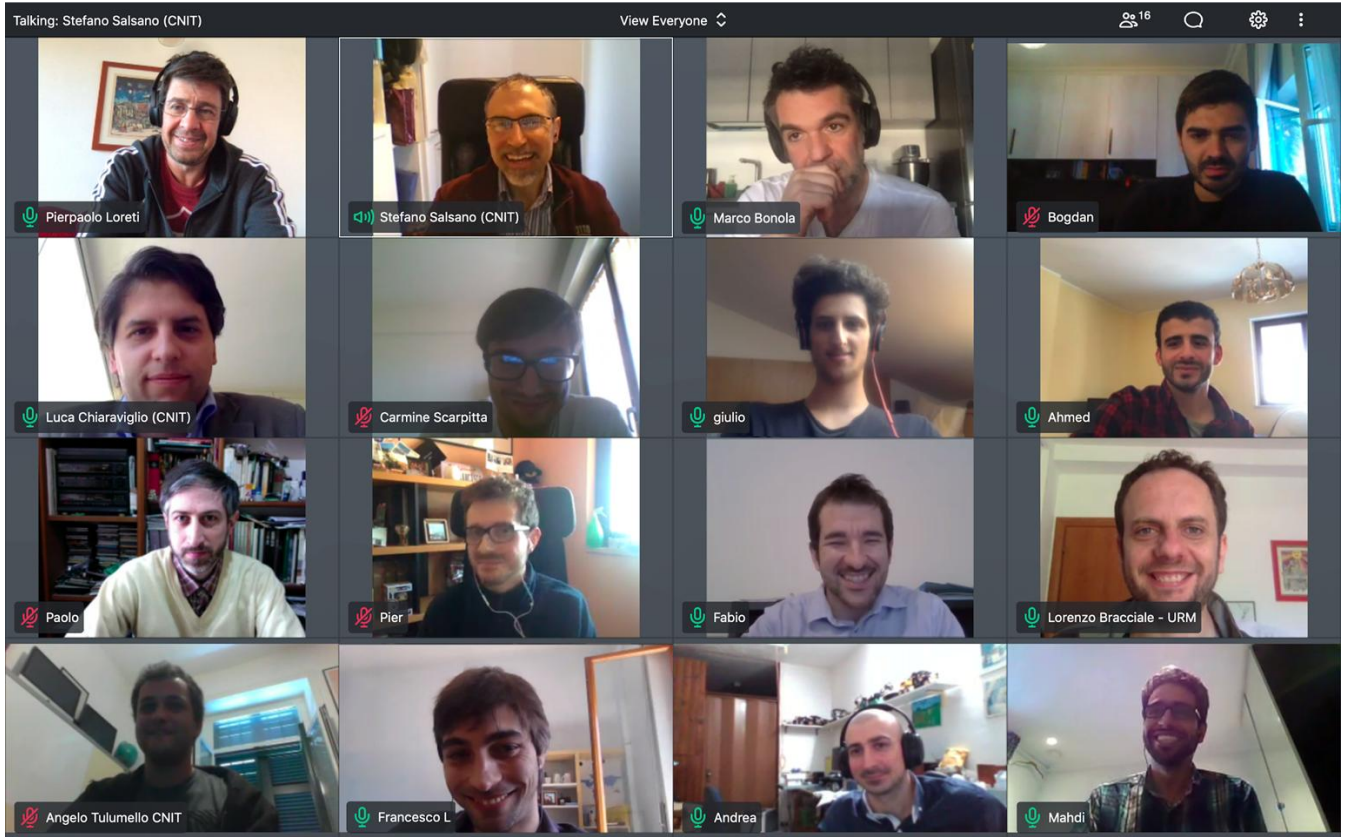
Team work…

Many people contributed to the projects…

Pier Luigi Ventre
Ahmed Abdelsalam
Andrea Mayer
Paolo Lungaroni
Francesco Lombardo
Carmine Scarpitta
Bogdan Iatco
Giulio Sidoretti
Mahdi Tajiki
Arianna Quinci

Lorenzo Bracciale
Pierpaolo Loreti
Angelo Tulumello
Marco Bonola
Luca Chiaraviglio
Fabio D'Andreagiovanni
Marco Ferrari
Daniele Zaccariello
Emanuele Altomare
Stefano Salsano

Team work…


Talking: Stefano Salsano (CNIT)
View Everyone
16
Pierpaolo Loreti
Stefano Salsano (CNIT)
Marco Bonola
Bogdan
Luca Chiaraviglio (CNIT)
Carmine Scarpitta
giulio
Ahmed
Paolo
Pier
Fabio
Lorenzo Bracciale - URM
Angelo Tulumello CNIT
Francesco L
Andrea
Mahdi

Thank you for your attention!

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