

SRv6 for User Plane in 5G

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Abstract

The 5G system's Service-Based Architecture (SBA) supports access-neutral service availability, with 3GPP Rel-15 introducing the Non-3GPP Inter-Working Function (N3IWF) for interoperability between the 5G Core (5GC) and untrusted non-3GPP networks. N3IWF acts as a gateway, establishing an IPsec tunnel between User Equipment (UE) and 5GC, while GTP-U creates a tunnel between N3IWF and UPF. To streamline transport and support network slicing, we explore SRv6 as an alternative to IPsec and GTP-U, running tests with free5GC and a virtual router to compare SRv6 and IPsec between UE and N3IWF.

Keywords: 5G User Plane; SRv6; IPsec

Problem Statement

Tunneling Protocol that supports adaptability, simplicity, and ability to handle diverse 5G requirements such as Network Slicing and Service Flexibility without any protocol translation protocol translations and network function adaptations for legacy as well Cloud-Native 5G Architectures.

Context

In 5G networks, untrusted non-3GPP access refers to connecting to the 5G core network via a non-3GPP (non-cellular) network that is considered "untrusted" from a security standpoint. This can include Wi-Fi networks, or other IP-based networks that are not inherently secure by the 3GPP standards. N3IWF acts as a gateway between the untrusted network and the 5G core, handling authentication, encryption, and secure tunneling. Secure IPsec tunnels are established between the user equipment (UE) and the N3IWF to ensure data integrity and confidentiality.

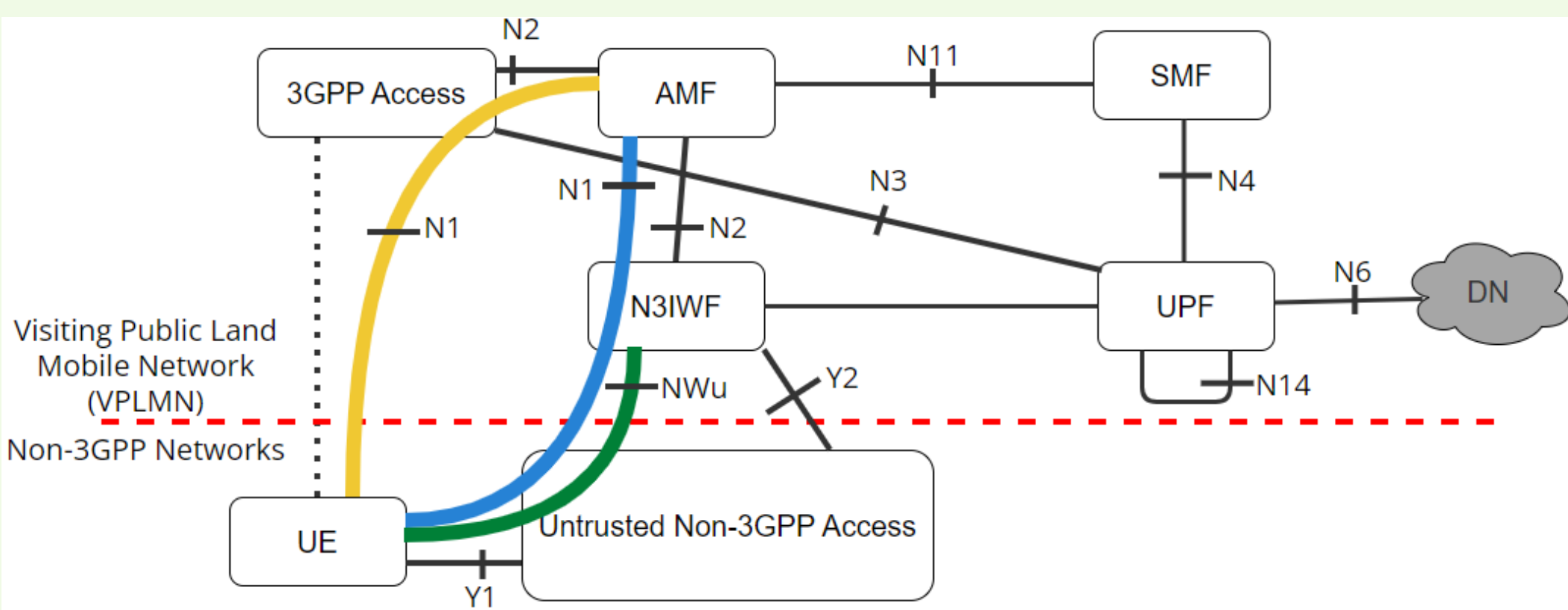


Figure 1: Untrusted non-3gpp Access in 5G.

Objectives

The aim of this is to :

- Connecting a physical UE to N3IWF and replace IPsec with SRv6.
- To enable a “unified fabric” end to end by eliminating various transport protocols.

Network Setup

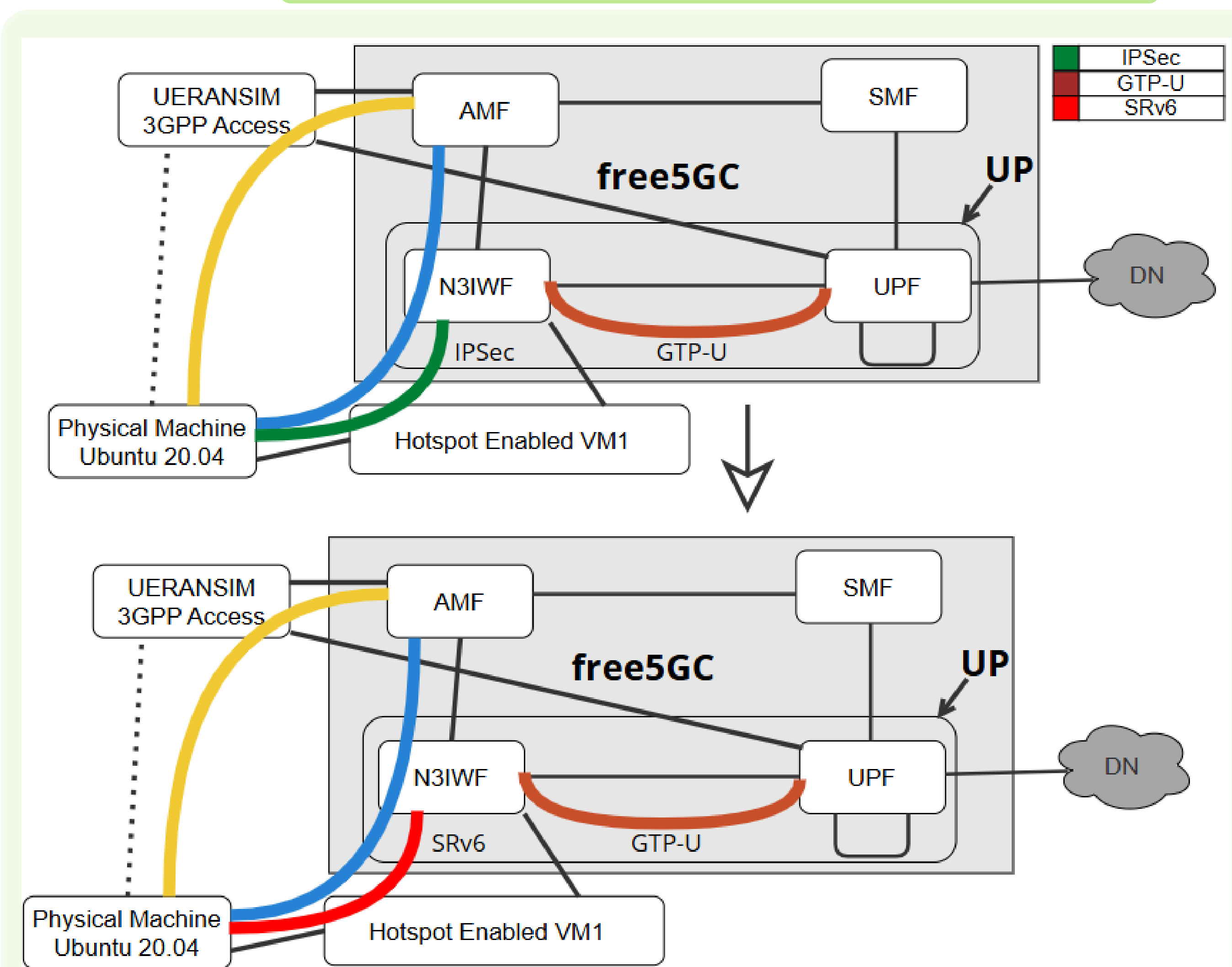


Figure 2: SRv6 between UE and N3IWF.

Results and Analyses

```
bilal@bilal:~$ ifconfig xfrm0
xfrm0: flags=193<UP,RUNNING,NOARP> mtu 1400
inet 10.0.0.1 netmask 255.255.255.252
inet6 fe80::40ff:2fca:735c:40e4 prefixlen 64
scopeid 0x20<link>
    unspec 00-00-00-00-00-00-00-00-00-00-00-00
    txqueuelen 1000 (UNSPEC)
    RX packets 24 bytes 2016 (2.0 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 24 bytes 2016 (2.0 KB)
    TX errors 0 dropped 11 overruns 0 carrier 0
    collisions 0

bilal@bilal:~$ ping -I xfrm0 10.0.0.1 -c4
PING 10.0.0.1 (10.0.0.1) from 10.0.0.2 xfrm0: 56(84) bytes of data:
64 bytes from 10.0.0.1: icmp_seq=1 ttl=64 time=0.484 ms
64 bytes from 10.0.0.1: icmp_seq=2 ttl=64 time=1.38 ms
64 bytes from 10.0.0.1: icmp_seq=3 ttl=64 time=1.24 ms
64 bytes from 10.0.0.1: icmp_seq=4 ttl=64 time=1.28 ms
--- 10.0.0.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3012ms
rtt min/avg/max/mdev = 0.484/1.096/1.377/0.356 ms
bilal@bilal:~$
```

Figure 3: IPsec Tunnel between N3WIF and UE.

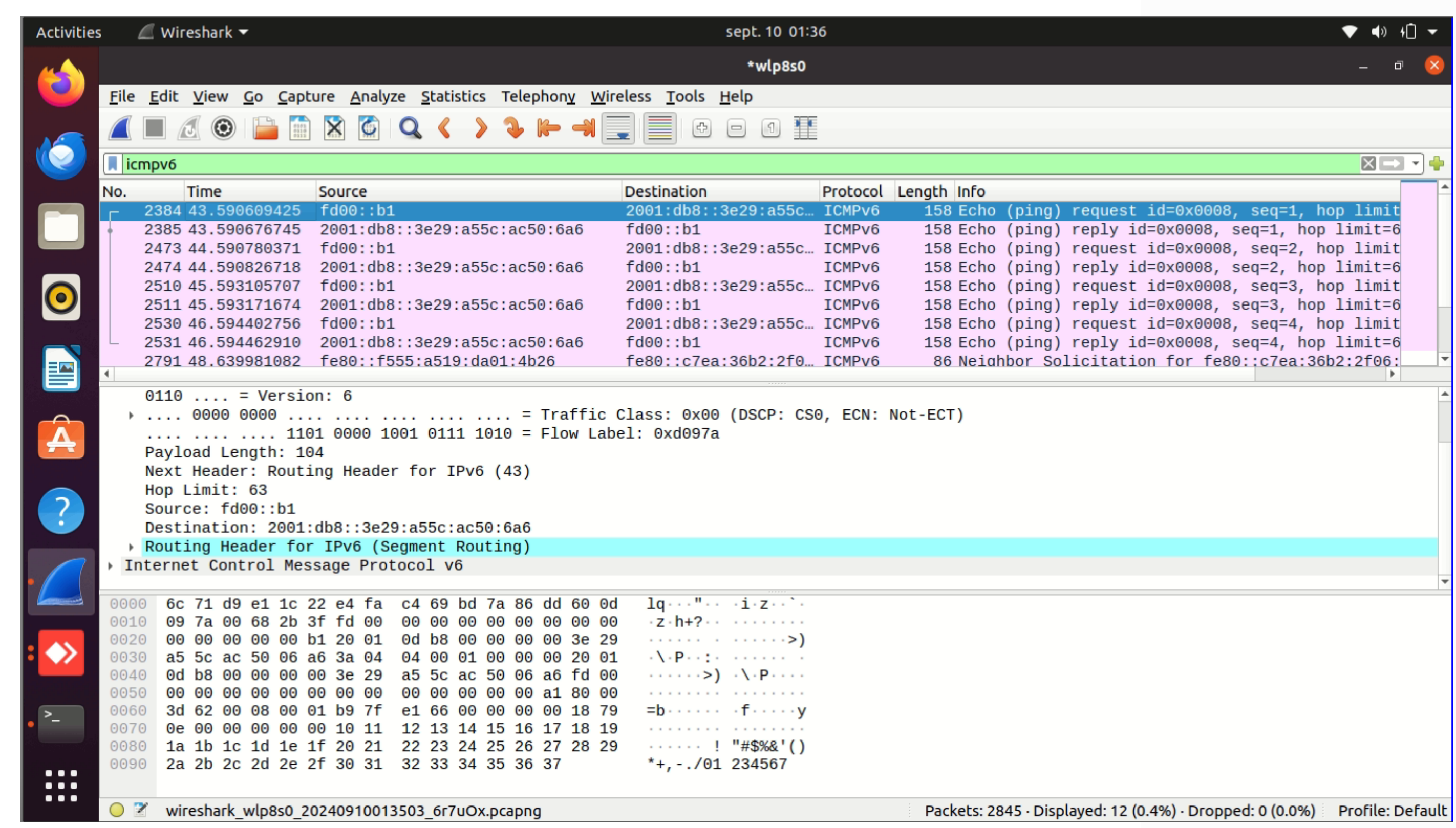


Figure 4: SRv6 between N3WIF and UE.

Future work

- Stateless translation from IPsec and GTP-U to SRv6 in free5GC

References

1. <https://www.free5gc.org/>

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