

free5GC

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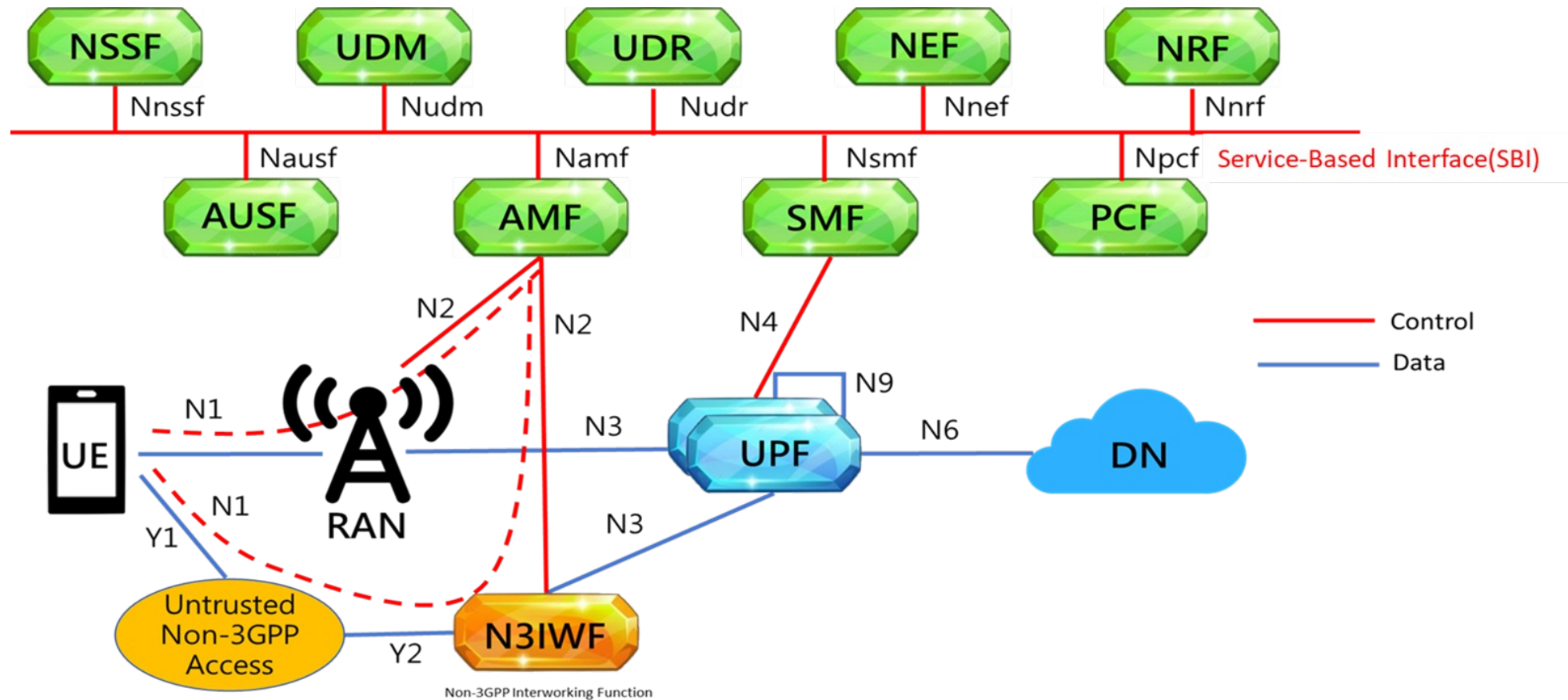


<https://www.free5gc.org/>



free5GC Mobile Network Functions

- free5GC, the world's 1st open-source 5G core (5GC) network that complies with 3GPP R15 standards
- Apache 2.0 license
- free5GC is moving forward to R16, R17, and Beyond

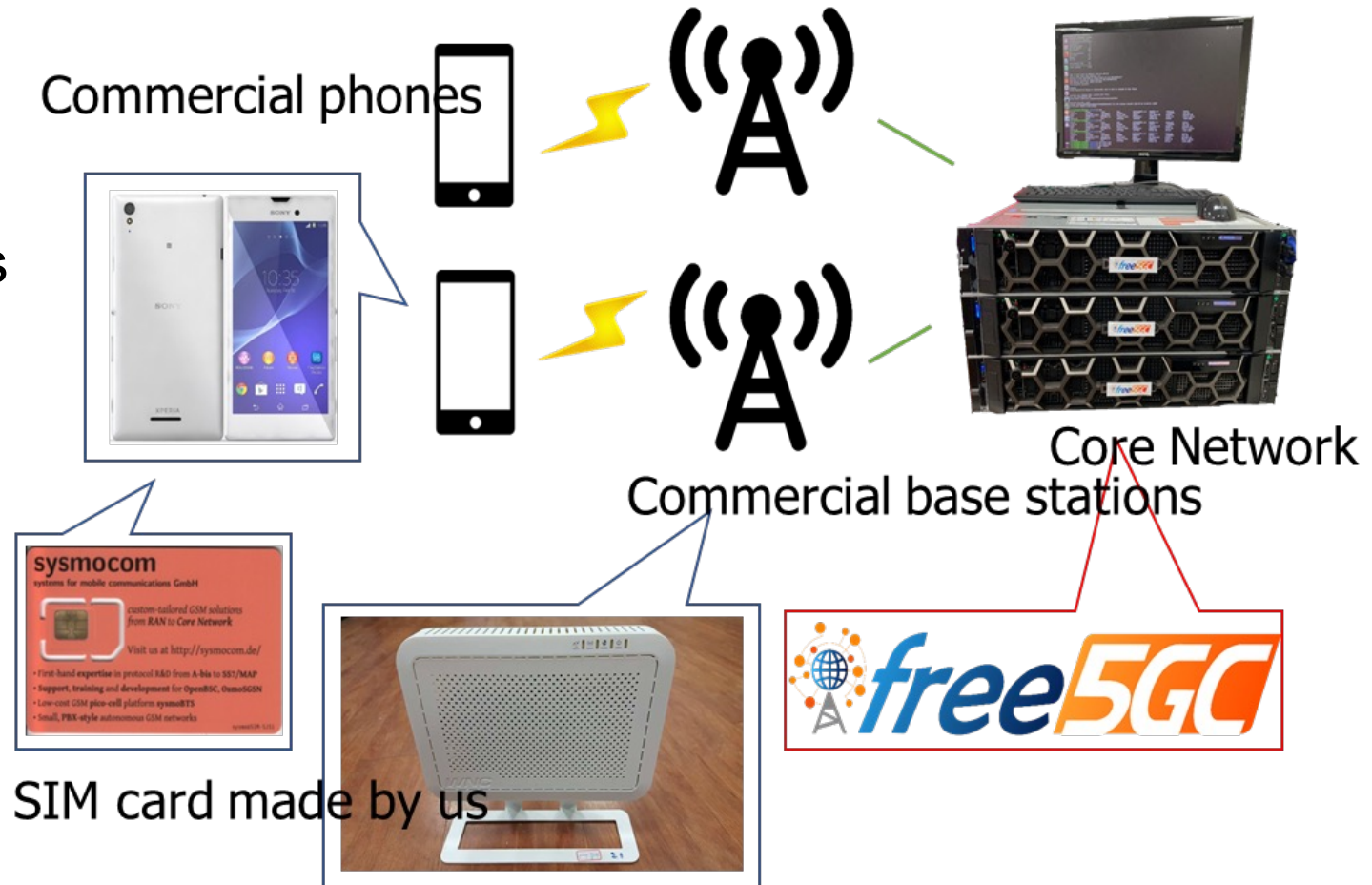


How do we test?

- Commercial base stations & UE
 - Nokia (AMIA AirScale Indoor Subrack 473098A), OpenAirInterface (OAI) with USRP, etc.
 - More Taiwan companies 5G SA gNBs such as Askey, HTC, Pegatron, Compal, Alpha, WNC, etc.
 - 5G UE (Support 5G SA): APAL Dongle, Quanta dongle, APAL 5G MiFi, Samsung S20, S21, Huawei P40, Huawei Mate30
 - Huawei P40 5G UE and Amarisoft gNodeB
 - Reported from: <https://forum.free5gc.org/t/running-free5gc-stage3-with-amarisoft-gnodeb-ue/532>
- Spirent Landslide
 - <https://www.spirent.com/products/core-network-test-5g-lte-ims-wifi-diameter-landslide>
 - Emulate both 5G SA UE and gNB

free5GC testbed performance

- Control plane
 - 20 attachments per second
 - 1,000 simultaneously active users
 - 5,000 registered users
- User plane
 - 800 Mbps / 10 Gbps
 - Highly depends on hardware

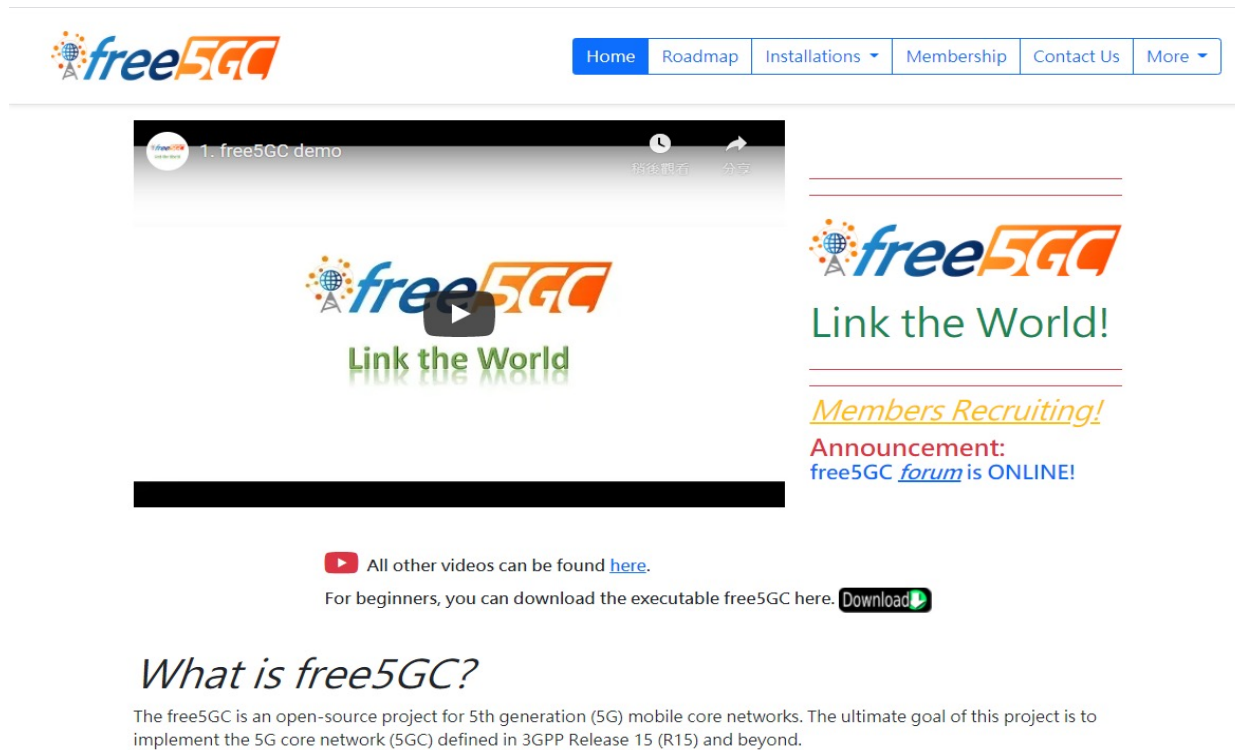


free5GC - Link the World

- Please visit free5GC website for more resources
 - YouTube free5GC courses: 48 Chinese/English training videos

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

- GitHub 14 days clone statistics



free5GC

Home Roadmap Installations Membership Contact Us More

1. free5GC demo

Link the World!

Members Recruiting!

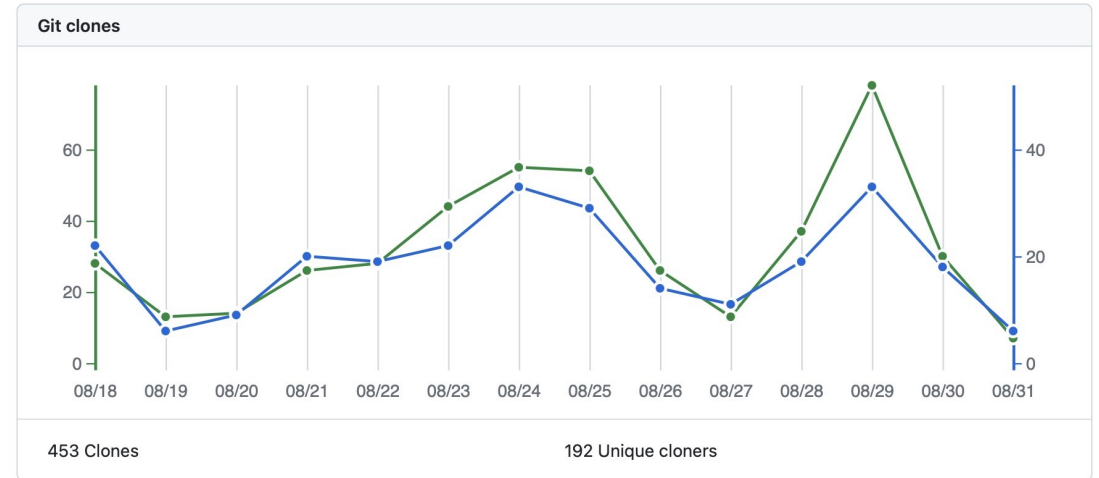
Announcement: free5GC forum is ONLINE!

All other videos can be found [here](#).

For beginners, you can download the executable free5GC here. [Download](#)

What is free5GC?

The free5GC is an open-source project for 5th generation (5G) mobile core networks. The ultimate goal of this project is to implement the 5G core network (5GC) defined in 3GPP Release 15 (R15) and beyond.



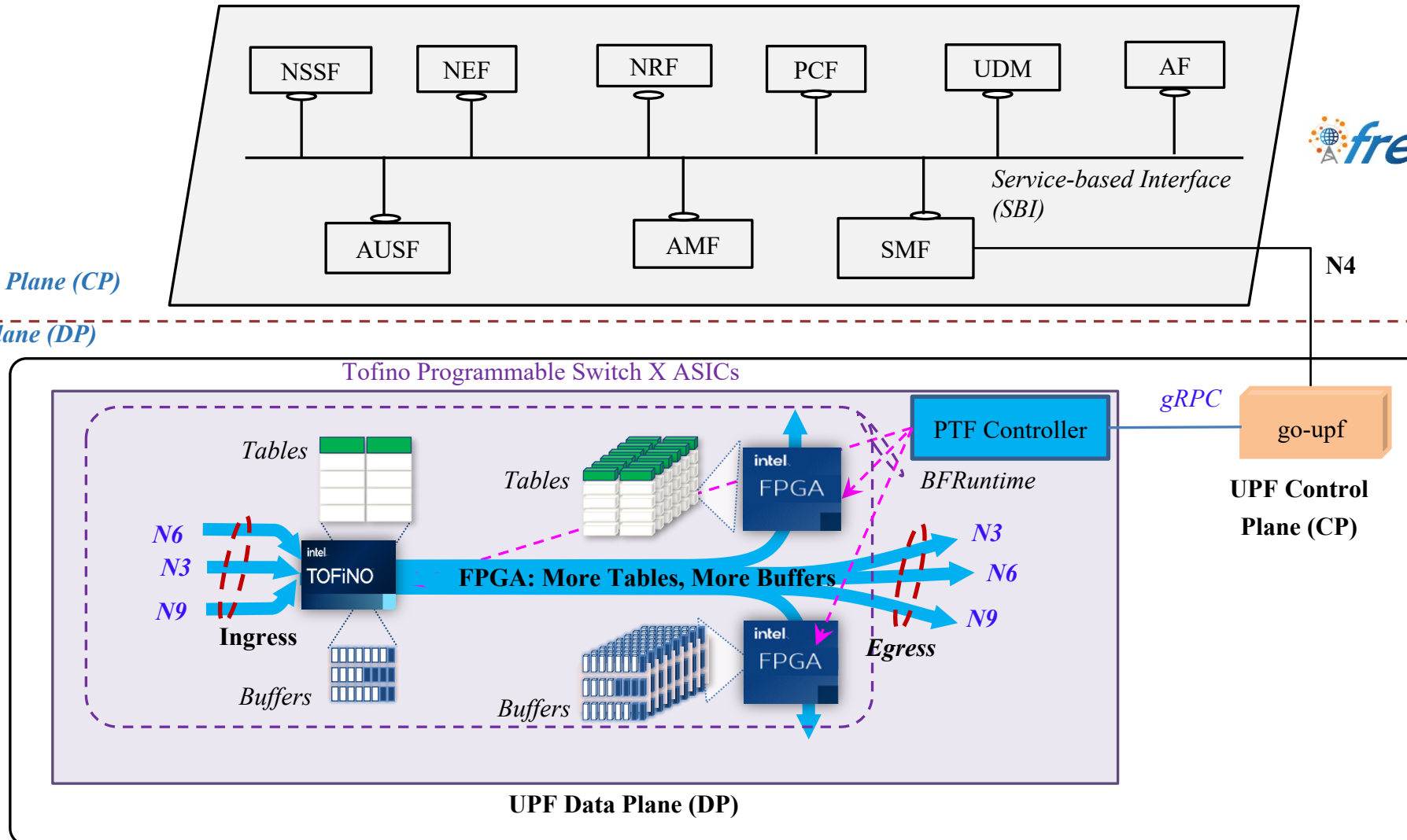
P4 Tofino UPF Design Overview

Service-based Architecture (SBA)



Control Plane (CP)

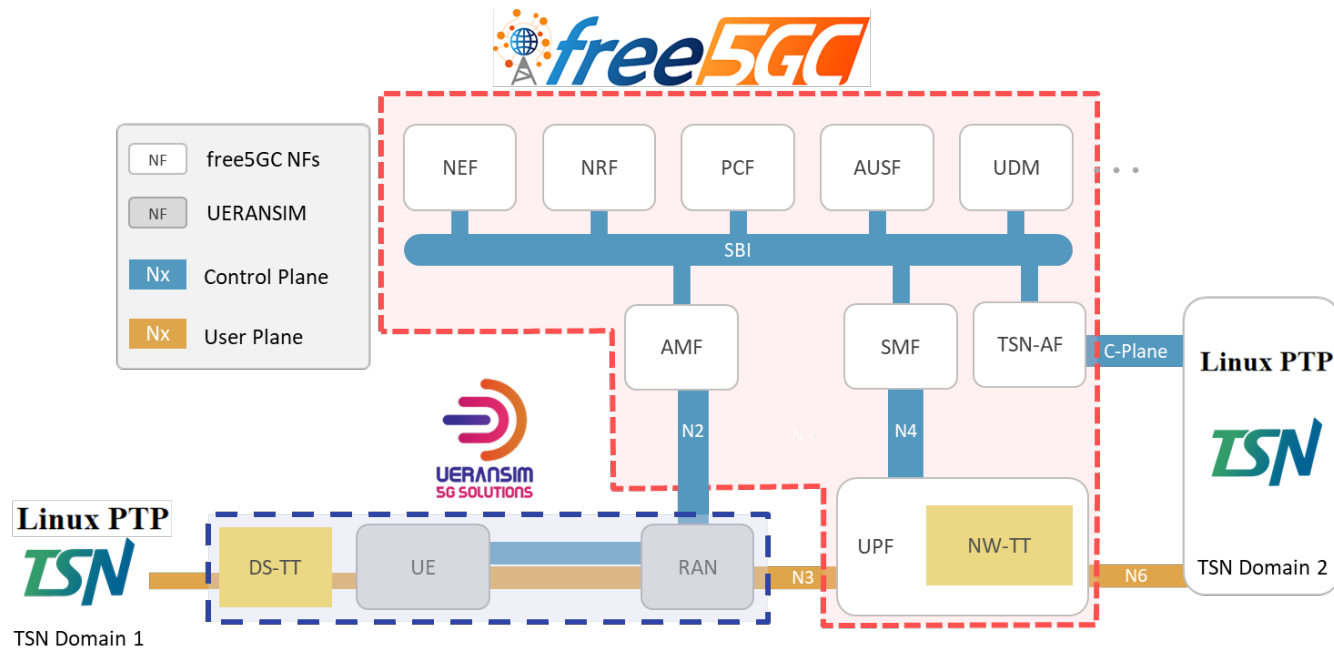
Data Plane (DP)



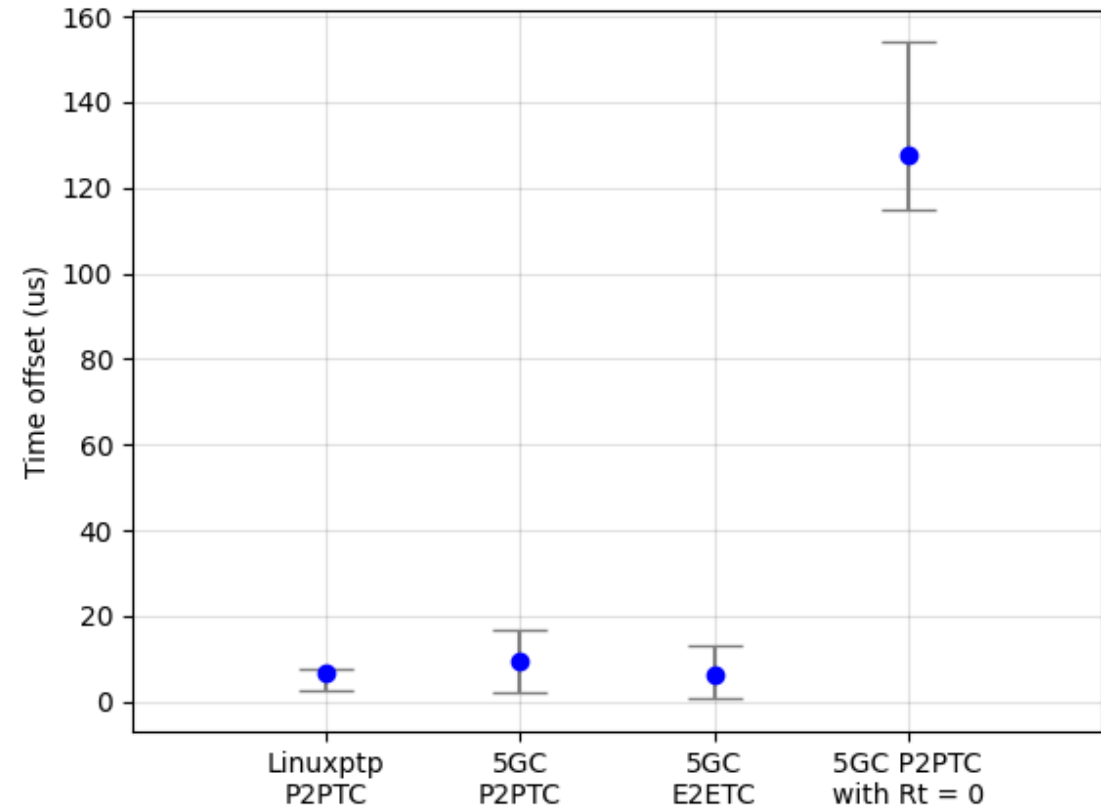
User Plane Function (UPF)

5G-TSN Integration

- 5G-TSN time synchronization

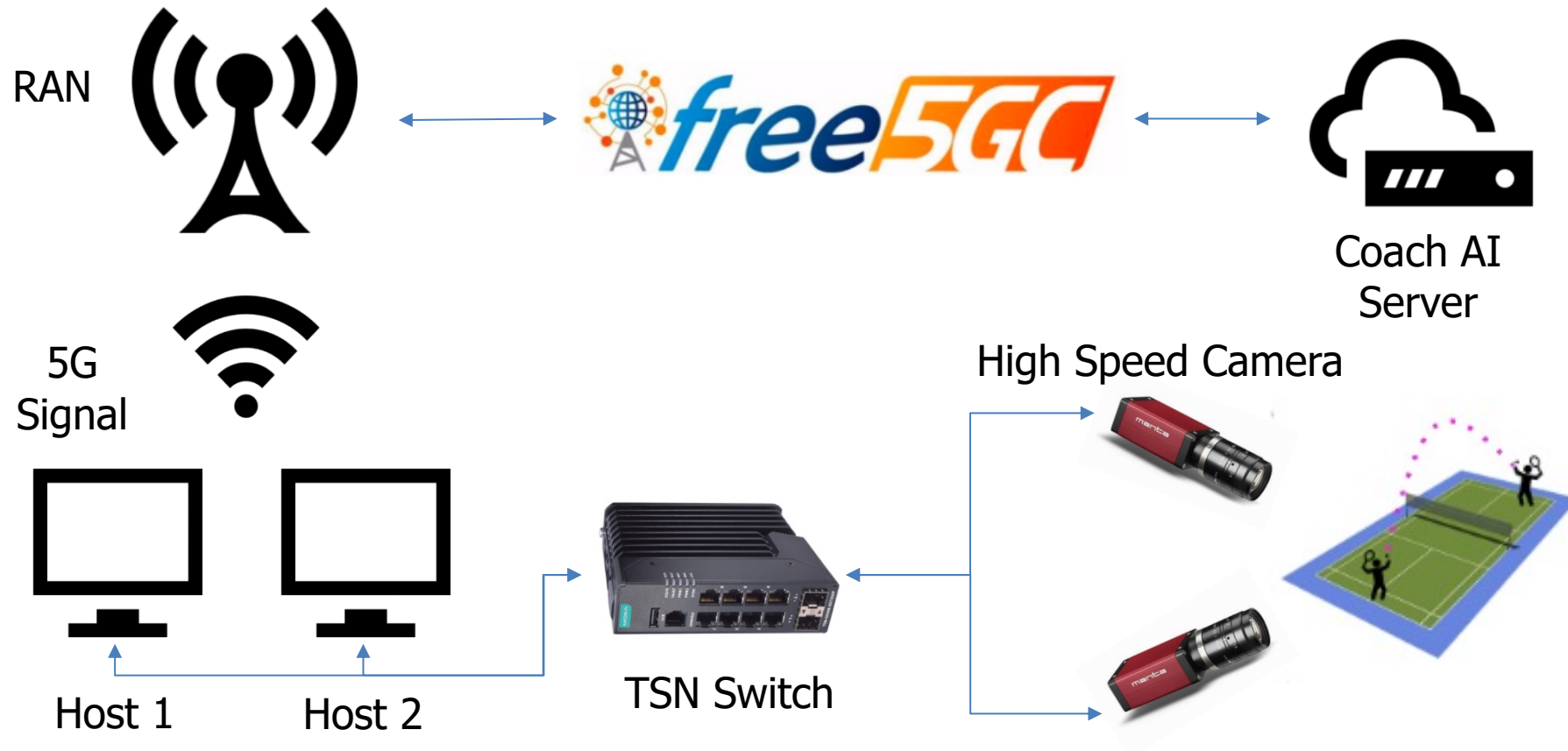


- TSN time offset comparison between different methods



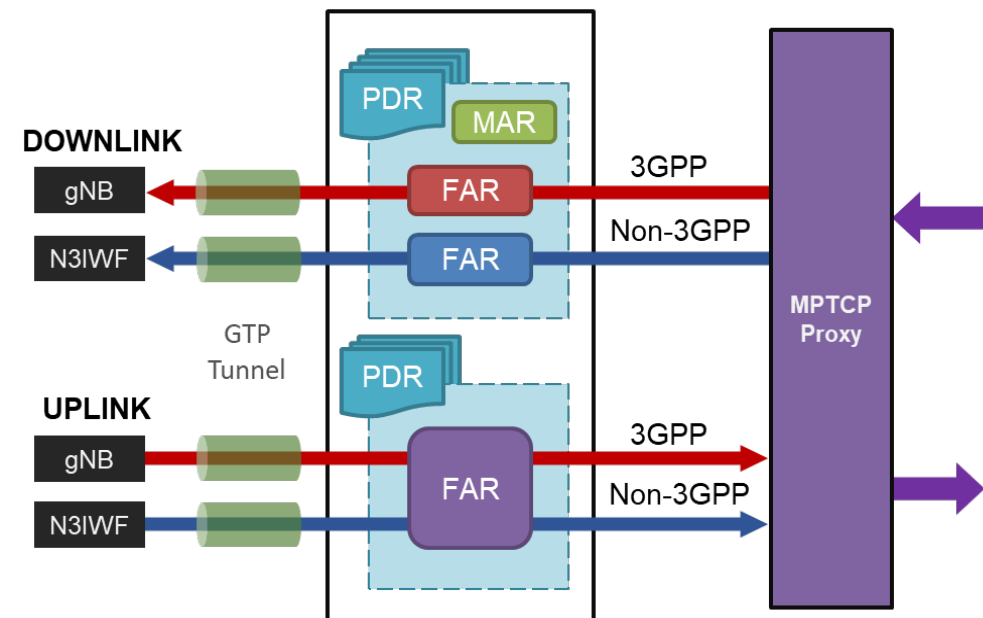
5G-TSN use case: Badminton AI coach

- Time synchronization between two cameras using TSN switch
- Transmit 2D image over 5G system
- Construct 3D trajectory of badminton using ML

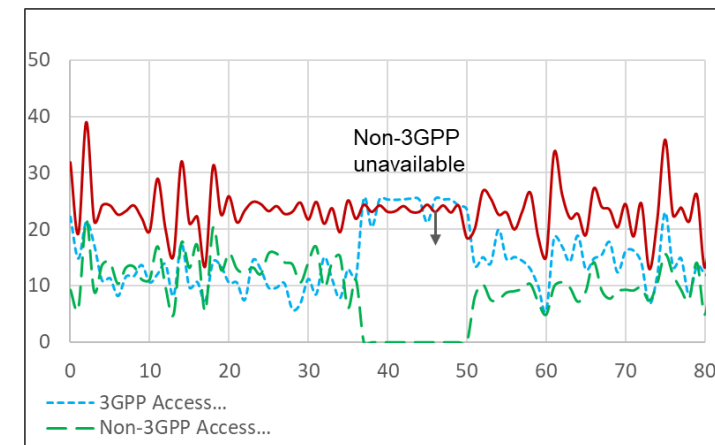
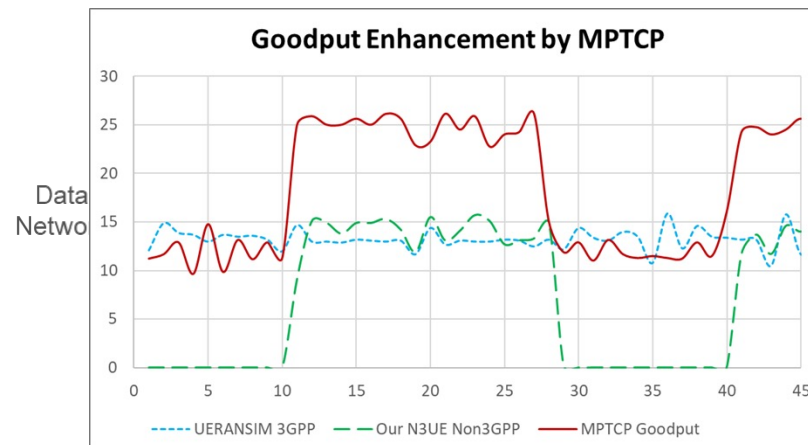


Access Traffic Steering, Switching and Splitting (ATSSS)

- Multi-access (MA) PDU Session
 - Contrary to SA-PDU (Single-Access)
 - Establish and use two accesses at the same time
 - Policies to control how traffic goes through accesses
- Multipath transport protocol to aggregate two accesses
 - MPTCP

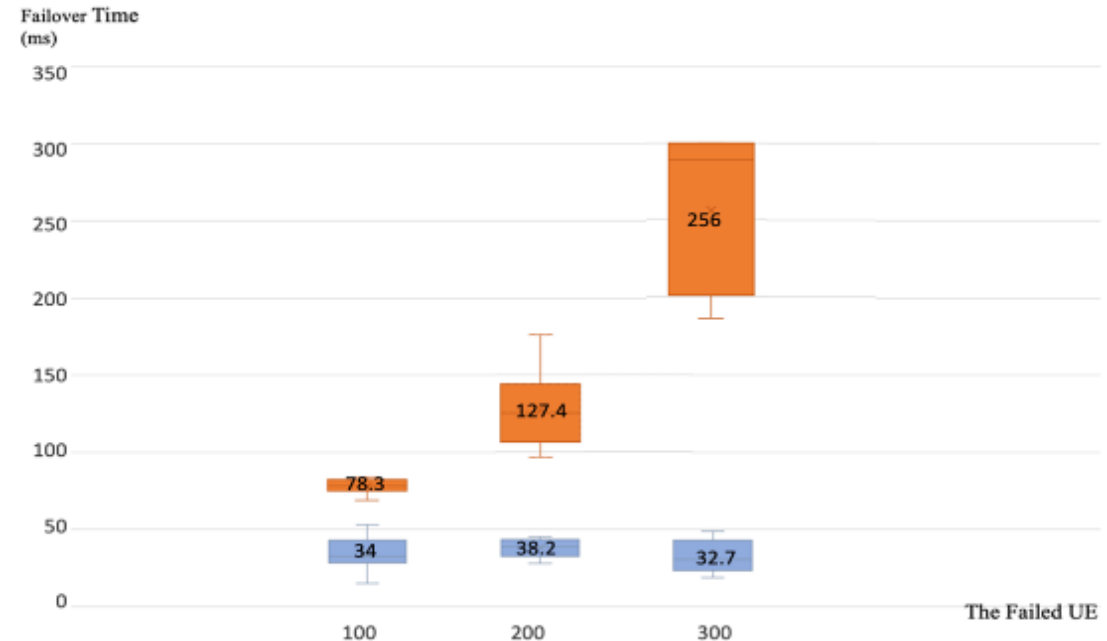
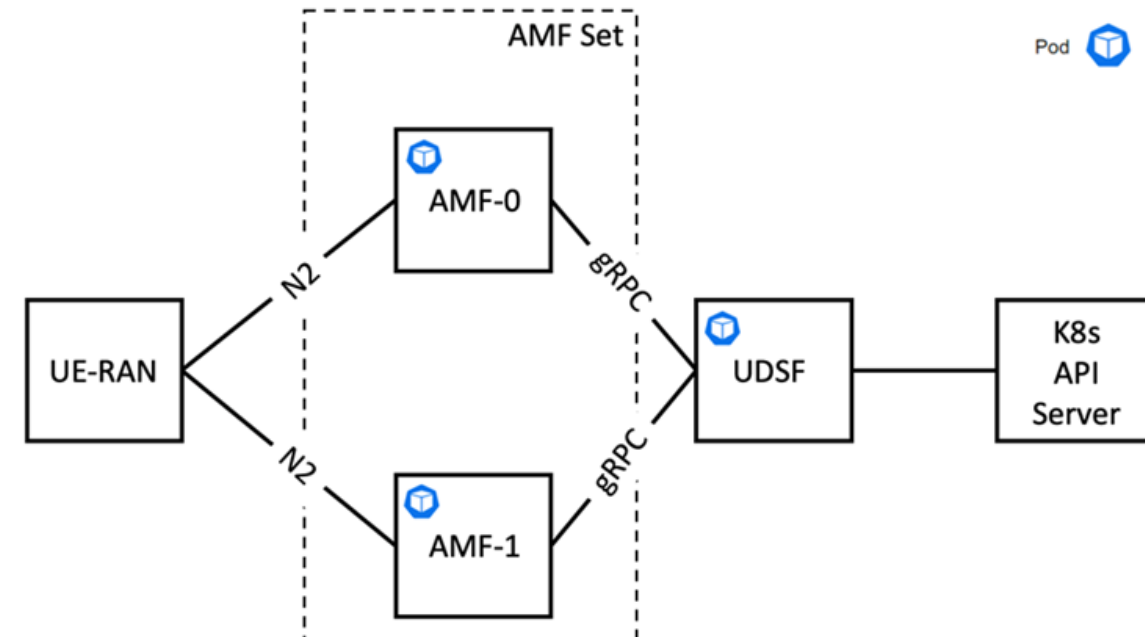


Splitting and Switching



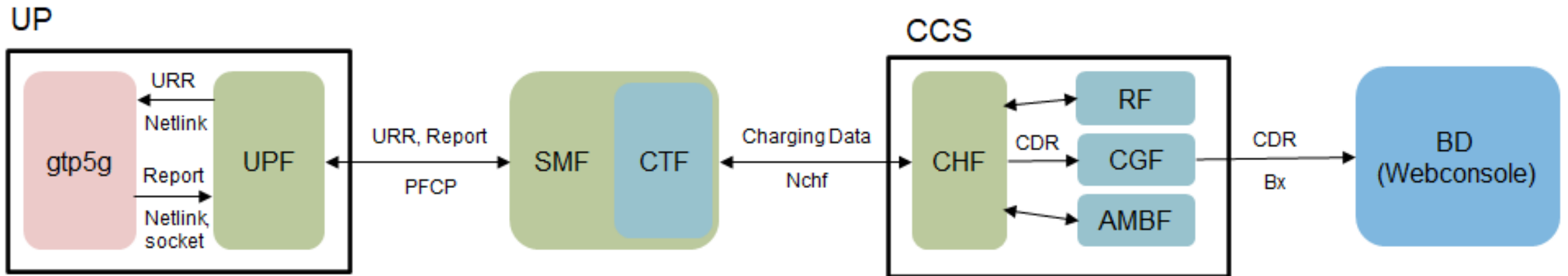
High Availability with UDSF

- Fault Tolerance Mechanism with checkpoint
 - Synchronize AMF states and UE context data to UDSF
 - Checkpoint mechanism
 - UDSF periodically synchronizes UE context data to backup AMF
 - Failover happens
 - UDSF syn rest of active UE context data to backup AMF
- Compared with AMF is stateful, UDSF is secondary storage



Converged charging system (CCS)

- Current achievements for accounting/data anomaly detection
 - CDR (Charging Data Record) architecture and management
 - Offline and online charging methods
 - SMF acts as a Charging Transfer Function (CTF) to generate charging events toward the Charging Function (CHF)
 - Converged charging system (CCS): CHF (Charging Function), RF (Rating Function), CGF (Charging Gateway Function), AMBF (Account Management Balance Function), etc.



Ongoing development in free5GC

- Network Slicing
- 5G-LAN
- V2X
- VoNR
- Multipath QUIC for ATSSS
- Untrusted non-3GPP access security protection
- Trusted WLAN access security protection
- Trusted Wired access security protection