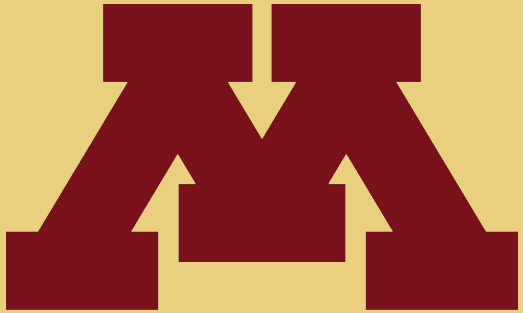

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PRAVEGA: Scaling Private 5G RAN via eBPF/XDP

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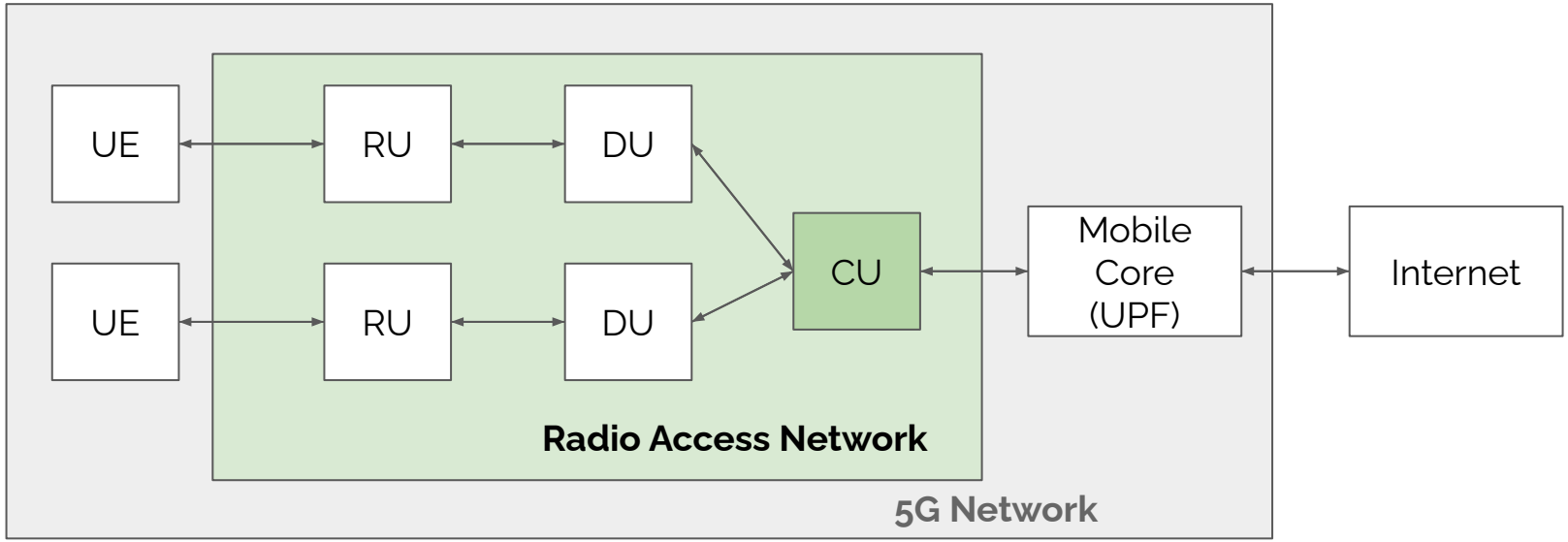
Agenda

- Introduction
- Design & Workflow
- Offloading Ciphering/Deciphering
- Preliminary Results
- Conclusion & Future Work

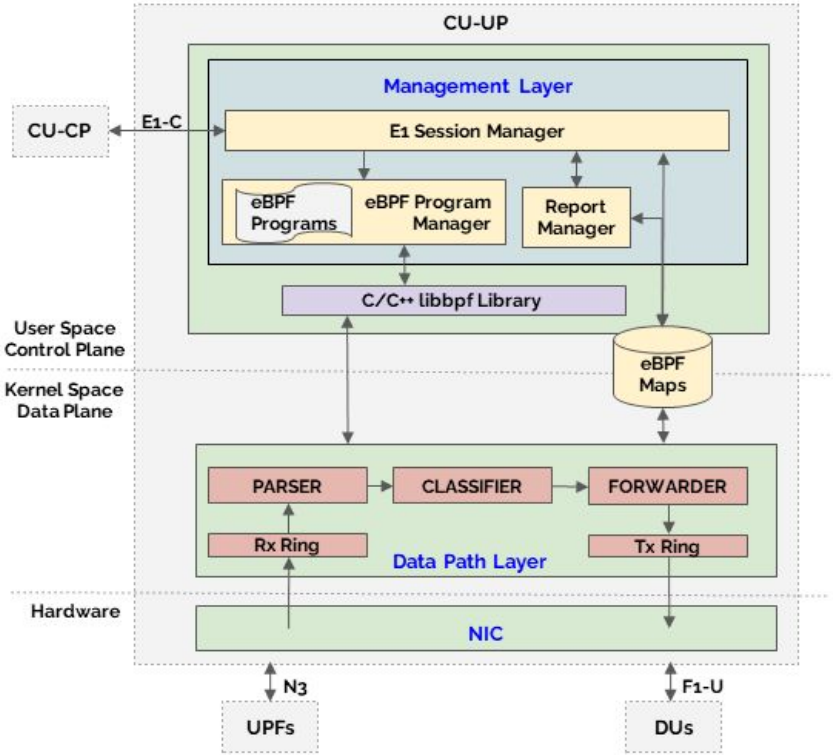
5G Architecture



CU- Central Unit; DU- Distributed Unit; RU- Radio Unit; UPF- User Plane Function
UE- User Equipment

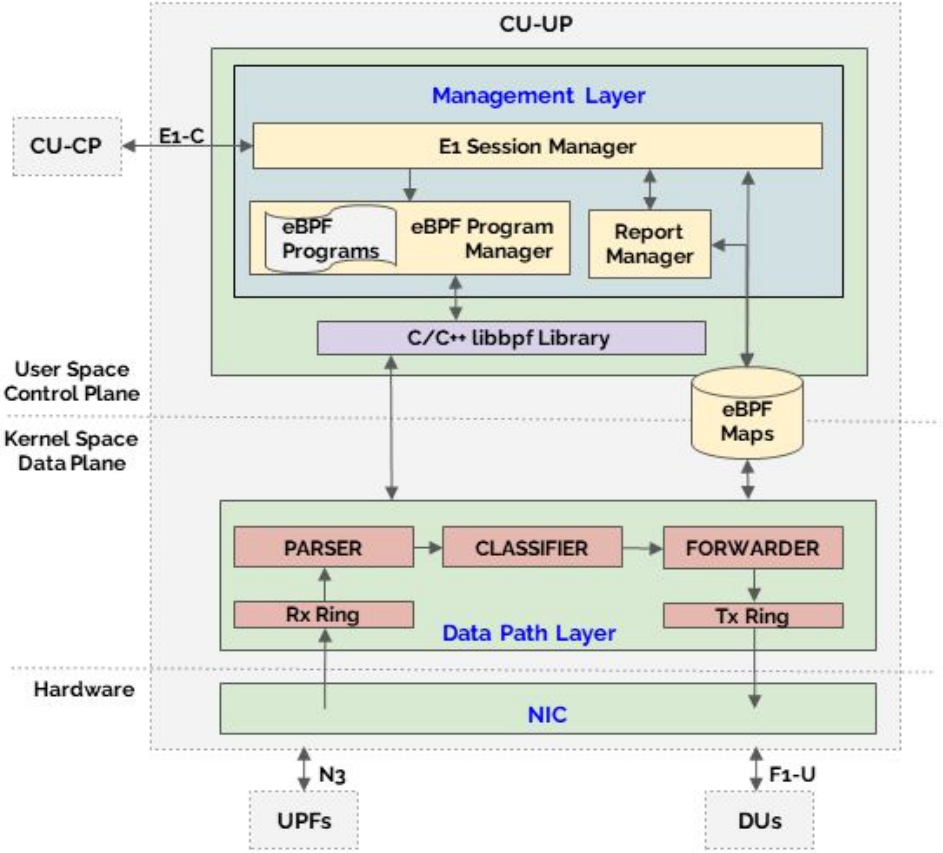
PRAVEGA - Introduction

- Central Unit User Plane (CU-UP) is likely the bottleneck for user plane data path.
- Exploit eBPF+XDP to scale and accelerate software packet processing
- CU mainly processes SDAP and PDCP layer.
- Additional options for further improvements



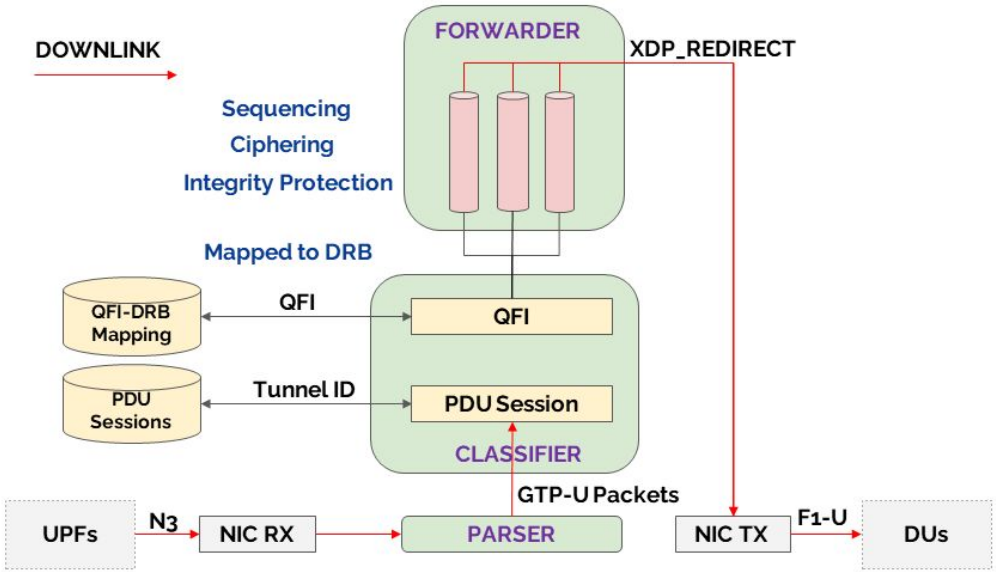
PRAVEGA - Design

- **Kernel Based CU-UP**
- **Data Path Layer are configured by the Management Layer using eBPF Maps**
- **Kernel space key components**
  - **Parser**
  - **Classifier**
  - **Forwarder**



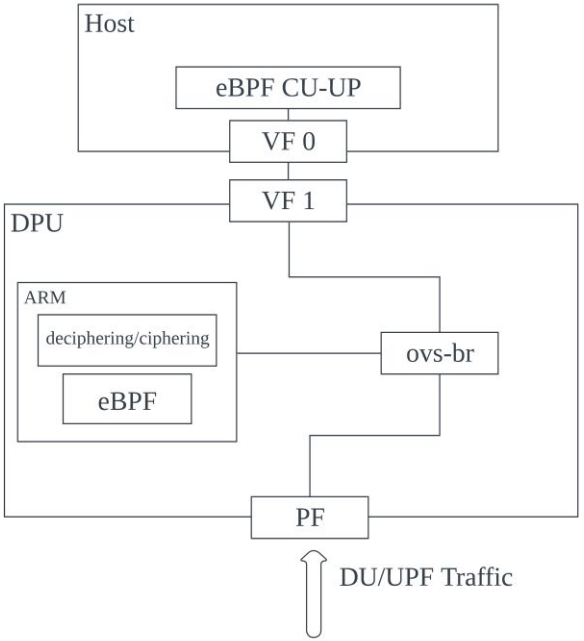
PRAVEGA - Flow

- Parser
  - Filters and send GTP-U user plane packets to 'Classifier'
- Classifier
  - Processes the SDAP layer
- Forwarder
  - Processes the PDCP layer



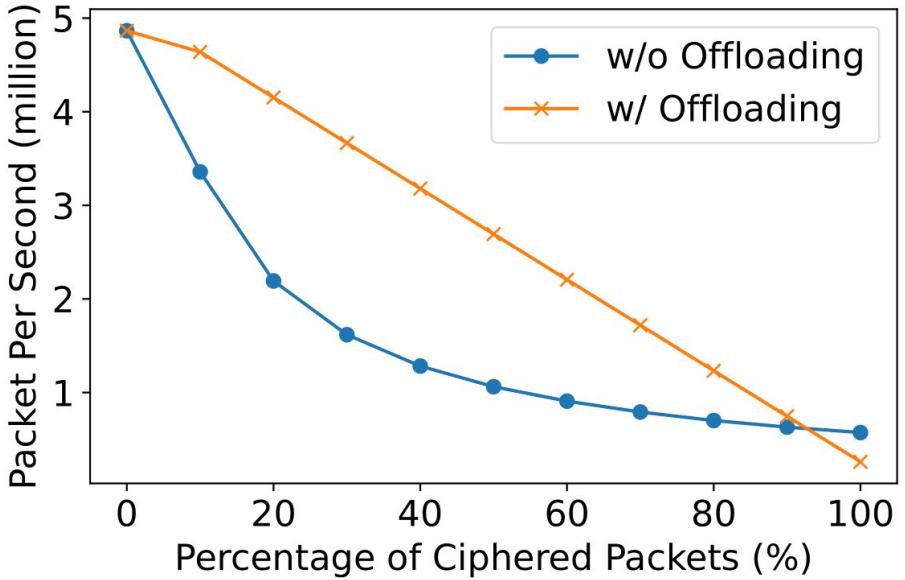
Offloading Ciphering/Deciphering

- Challenge - Ciphering/Deciphering are optional CPU-intensive operations
- Example: Voice-traffic in the mobile network
    - Ciphering algorithms such as SNOW 3G and ZUC are CPU-intensive
    - Bottleneck if not designed carefully
- Bluefield 2 (BF2) to offload expensive ciphering/deciphering operations
- Two key components
    - Mellanox ConnectX6-based switching data plane
    - 8 Arm A72 cores



Preliminary Results on Ciphering/Deciphering

- Without Offloading Scheme
  - Throughput goes down as PE increases
- With Offloading Scheme
  - Performance greatly increased



Conclusion & Future Work

Conclusion

- Designed PRAVEGA, an eBPF/XDP based fast processing CU-UP.
- Discussed other potential design options for optimization on offloading to the SmartNICs.

Future Work

- Explore techniques using dedicated cryptographic hardware.
- Incorporation on other O-RAN components.

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