Stress Testing Open5GS UPF Implementation
Measuring resource consumption and latency in virtual environment

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Background

In a 5G network, the Core Network (CN) orchestrates communication and management of user data, consisting of Control and User Plane. The User Plane Function (UPF) is a crucial component responsible for forwarding and routing user traffic, and passing on network usage information. It interfaces with the Radio Access Network (RAN) to deliver high-throughput, low-latency services.
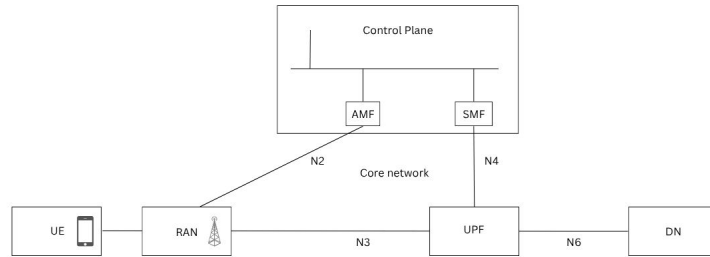

Figure 1. A simplified overview of the 5G Network Infrastructure

Contribution

- Analysis of the UPF latency behaviour under various load.
- Provide optimal UPF configuration to balance latency and resource consumption.
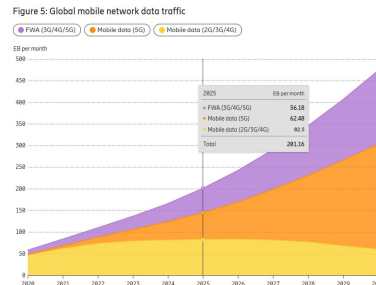- Provide a mathematical queueing model to generalize the result.

Figure 2. The estimated data traffic from 2025 to 2030 [1]

Research Question

- How do different traffic loads impact the computational requirements the performance of the UPF?

- What are the optimal UPF configurations to balance resource consumption and performance trade-offs?

- How can we model the latency using queueing model?

Methodology

- Benchmarking under different traffic intensities λ
  - **CPU**, **memory** usage
  - **Throughput**, **latency**
  - LSE M/M/1 model:
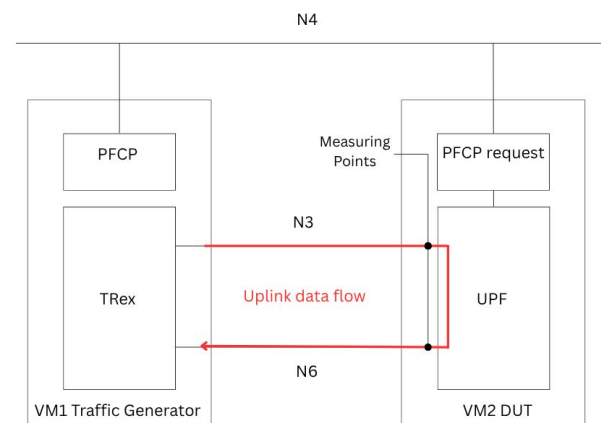
$$L = \frac{fac}{\mu - \lambda} + c$$

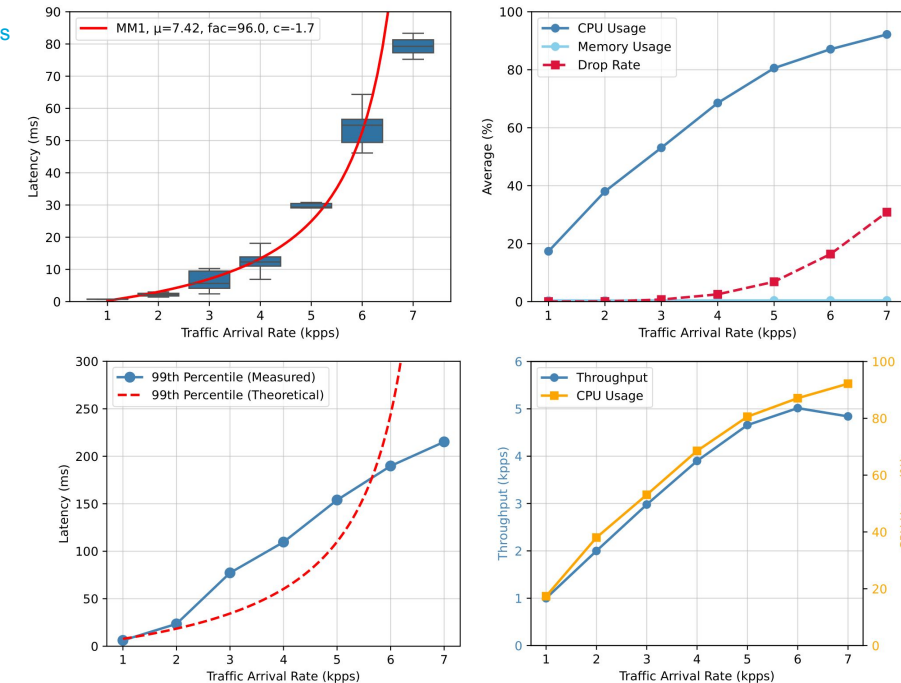Figure 3. The set up of the experiment using VM

Results

Figure 4. The measured resource consumption and performance metrics

Conclusion & Future Work

- Optimal CPU load 50-70%.
- Comparing alternative queueing models.
- Benchmarking a wider range of network functions.

References

[1] Precedence Research. (2025, February 5). 5G Devices Market Size to Hit USD 2,896.68 Billion by 2034. Precedence Research. Retrieved May 8, 2025, from https://www.precedenceresearch.com/5g-devices-market