**Critique of “Providing UE-level QoS Support by Joint Scheduling and Orchestration for 5G vRAN”**

GSU Department of Computer Science

Brandon Chung

[bchung9@student.gsu.edu](mailto:bchung9@student.gsu.edu)

Panther ID: 002495106

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**Introduction**

In their paper, *"Providing UE-level QoS Support by Joint Scheduling and Orchestration for 5G vRAN,"* authors Jiamei Lv, Yi Gao, Zhi Ding, Yuxiang Lin, Xinyun You, Guang Yang, and Wei Dong address an issue within 5G networks: delivering Quality of Service (QoS) consistently to user equipment (UE) in virtualized Radio Access Networks (vRan). 5G networks support a multitude of applications with varying performance requirements, from high bandwidth streaming to ultra-low latency communication, traditional Quality of Service mechanisms struggle to support user equipment in real-time. The authors propose a solution, and that solution is UQ-vRan. UQ-vRAN is a framework that supports scheduling and orchestration to dynamically adjust network parameters, enhancing UE-level QoS through real-time reconfigurations in response to network demand fluctuations.

**Summary**

The paper *"Providing UE-level QoS Support by Joint Scheduling and Orchestration for 5G vRAN,"* tackles the issue of ensuring Quality of Service at the level of individual user equipment in 5G virtualized Radio Access Networks (vRAN). The authors introduce UQ-vRAN, a framework designed to optimize QoS dynamically by jointly managing scheduling and resource orchestration. This framework adjusts parameters like network function splits, resource allocation, and modulation schemes in real-time, making it responsive to the fluctuating demands of different UEs. Testing shows that UQ-vRAN improves QoS compliance by up to 40% and reduces energy consumption compared to existing approaches. While effective for individual QoS needs, the solution faces challenges with scalability and testing in high-density, multi-user environments, suggesting areas for future enhancement.

**Critique**

The paper *"Providing UE-level QoS Support by Joint Scheduling and Orchestration for 5G vRAN,"* presents us with a framework that delivers improved performance of UE-level QoS in 5G networks. This framework is UQ-vRAN, and while UQ-vRAN is new and offers many strengths, there are notable limitations and flaws that could be worked on with further development.

Strengths:

1. Energy Efficiency: The authors of the paper heavily emphasized energy efficiency in their proposed solution, and UQ-vRAN demonstrates energy efficiency. According to their tests they conducted, UQ-vRAN reduced energy consumption by 17-40%. In situations where energy usage is a main concern, UQ-vRAN can become the preferred option for sustainable networks.
2. Innovative Approach to Real-Time QoS Management: A key issue with 5G vRAN environments is real-time QoS management, and UQ-vRAN addresses this issue by dynamically adjusting network resources to meet individual UE needs.
3. Practical Implementation and Testing: The authors tested UQ-vRAN on “[OpenAirInterface](https://openairinterface.org/)” and tested it using simulations and real-world testbeds. The test proved the framework’s feasibility not only in simulation but real-world. This means it would be simpler for other researchers to improve upon the framework, and this is so vital considering that %G vRAN is an emerging field.

Limitations/Flaws:

1. Limited Scope of QoS Metrics: Currently UQ-vRAN does improve QoS satisfaction but it does it a general level. It doesn’t address essential metrics such as latency, packet loss, etc. For certain applications these metrics are extremely important, so UQ-vRAN would need to address these metrics to extend its own utility to more demanding applications.
2. Scalability Challenges: Like any emerging technology, scalability is a major question. Even more so with this framework because it relies so heavily on real-time configuration adjustments. This may not be an issue in low-density network situations but in high-density situations scalability becomes an even bigger issue.
3. Comparative Analysis and Benchmarking: In the paper, UQ-vRAN was compared to other existing solutions/methods, but it lacks a more in-depth analysis against even more solutions, particularly machine learning based solutions.

**Suggested Improvements**

Addressing one of the limitations mentioned earlier, here is an improvement that could directly improve upon the scalability challenges identified in the UQ-vRAN framework for 5G vRAN. UQ-vRAN could incorporate machine learning for adaptive QoS management. Machine learning is an expanding field that could provide adaptive solutions for UQ-vRAN’s scalability challenges. So, by incorporating machine learning (ML) techniques like reinforcement learning, UQ-vRAN could dynamically adapt its resource allocation based on previous network data for real-time demands. Simply put, you could use machine learning models to predict peak times to adjust resource configurations to prevent QoS degradation.

**Conclusion**

The paper "Providing UE-level QoS Support by Joint Scheduling and Orchestration for 5G vRAN" by Jiamei Lv et al. makes a noteworthy contribution to 5G research by addressing the challenge of delivering UE-level Quality of Service in virtualized Radio Access Networks. Through the UQ-vRAN framework, the authors present a novel approach to dynamically manage and optimize QoS at the UE level, demonstrating significant improvements in both performance and energy efficiency. However, the framework faces limitations in scalability, metric coverage, and comparative benchmarking that impact its practicality in high-density network environments and with diverse applications.

To strengthen UQ-vRAN’s utility and adaptability, future work could focus on expanding QoS metrics, adopting machine learning techniques for predictive scaling, and conducting a broader comparative analysis. By addressing these areas, UQ-vRAN has the potential to evolve into a more robust solution capable of meeting the varied and stringent demands of modern 5G applications. Overall, while the paper presents a solid foundation for UE-level QoS support, targeted improvements could enhance UQ-vRAN's impact on 5G and beyond.