SCHULICH School of Engineering

TELUS ADAPTIVE BANDWIDTH THROTTLING

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Abstract

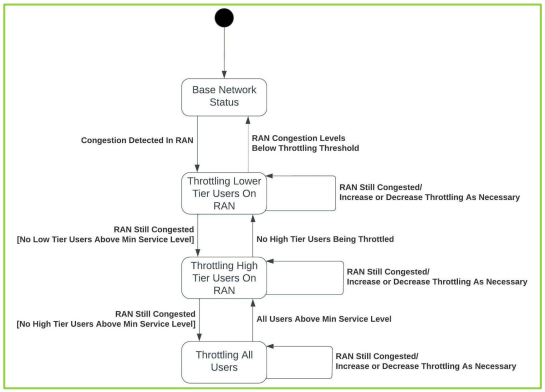
TELUS Communications has partnered with the University of Calgary to develop a dynamic quality of experience (QoE) for video streaming on mobile devices in response to LTE network congestion within localized geographic areas. This project aims to create a proof of concept through a simulation of the TELUS architecture and the implementation of a bandwidth throttling mechanism.

Introduction

The growing demand for high-quality video streaming on mobile devices has driven the need for efficient bandwidth management solutions. This project explores the feasibility and viability of an adaptive bandwidth throttling solution in real-world scenarios through a simulation-based proof of concept.

Methods and Materials

In order to develop an effective bandwidth throttling mechanism for video streaming, a custom simulation was created which takes into account the user's subscription plans and network congestion levels. The algorithm (illustrated in the state diagram below) prioritizes throttling based on subscription tiers in congested areas. Users with lower-tier plans are throttled first before higher-tier users if congestion persist. As network congestion decreases, users with higher-tier plans regain their original bandwidth allocations first, followed by those with lower-tier plans.

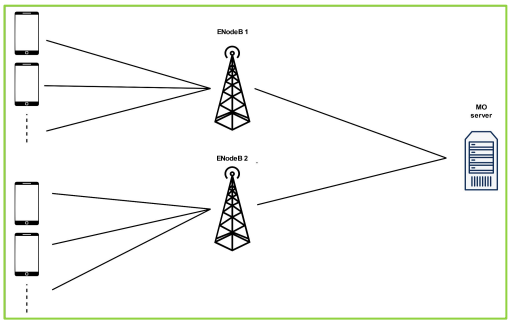


This method ensures that higher-tier users receive a preferential bandwidth allocation while maintaining a fair distribution of resources during periods of high network congestion.

To validate the effectiveness of the custom throttling method, extensive simulations were conducted using various network topologies, traffic patterns, and congestion levels. These simulations enabled the team to evaluate the performance of the algorithm under diverse conditions and fine-tune its parameters to optimize QoE for all users.

The project relied on virtual simulations, utilizing personal devices and servers as hardware. Key software components included:

- GNS3 - Software used for the network simulation
- Ostinato - The application used within GNS3 for traffic generation
- Github - Version control software



Discussion

The motivation for this project stems from a combination of factors, including the need for more equitable resource allocation which will help to prevent network outages, and the potential financial benefits of promoting higher-tiered plans or the possibility to make mobile services more accessible to users with lower budgets. The primary focus of this project is to develop a solution that addresses the broader challenges faced by mobile network operators.

By implementing adaptive bandwidth throttling, TELUS can more efficiently allocate resources during periods of high network congestion, reducing the likelihood of outages and improving overall customer satisfaction. Additionally, by prioritizing higher-tier users, the solution incentivizes customers to opt for more expensive subscription plans, which could contribute to increased revenue for the operators. Moreover, this approach enables TELUS to further segment their subscription plans, potentially offering more affordable options for lower-tier users. By providing a wider range of plans, TELUS can attract customers who may not have been able to afford their services previously, expanding their customer base and promoting digital inclusion.

As the custom throttling method was developed within the constraints of limited time and research, there remains significant potential for further exploration and improvement in this area. The project's success demonstrates the viability of adaptive bandwidth throttling and paves the way for future research projects and capstone opportunities for students.

Results and Conclusion

After creating the simulation and executing the methods, we were able to successfully create a simulation of a dynamically varying video streaming quality to customers based on the number of users in the area of a cell tower. The simulation satisfies the criteria given to us by the sponsors. As a result this proof of concept was successful. This gives TELUS the opportunity to continue research and execution in this area.

Contact

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