A Whittle's Index Based Approach for QoE Optimization in Wireless Networks

Arjun Anand

The University of Texas at Austin
Austin, Texas, USA
arjun_anand@utexas.edu

Gustavo de Veciana

The University of Texas at Austin
Austin, Texas, USA
gustavo@ece.utexas.edu

ABSTRACT

The design of schedulers to optimize heterogeneous users' Quality of Experience (QoE) remains a challenging and important problem for wireless systems. Our paper ([1]) explores three inter-related aspects of this problem: 1) non-linear relationships between a user's QoE and flow delays; 2) managing load dependent QoE trade-offs among heterogeneous application classes; and 3), striking a good balance between opportunistic scheduling and greedy QoE optimization. To that end we study downlink schedulers which minimize the expected cost modeled by convex functions of flow delays for users with heterogeneous channel rate variations. The essential features of this challenging problem are modeled as a Markov Decision Process to which we apply Whittle's relaxation, which in turn is shown to be indexable. Based on the Whittle's relaxation we develop a new scheduling policy, Opportunistic Delay Based Index Policy (ODIP). We then prove various structural properties for ODIP which result in closed form expressions for Whittle's indices under different scheduler scenarios. Using extensive simulations we show that ODIP scheduler provides a robust means to realize complex QoE trade-offs for a range of system loads.

CCS CONCEPTS

• **Mathematics of computing** → **Stochastic control and optimization**; • **Networks** → **Mobile networks**; *Wireless access points, base stations and infrastructure; Network algorithms*;

KEYWORDS

Wireless networks, Opportunistic scheduling, Whittle's Index

ACM Reference Format:

Arjun Anand and Gustavo de Veciana. 2018. A Whittle's Index Based Approach for QoE Optimization in Wireless Networks. In *SIGMETRICS '18 Abstracts: ACM SIGMETRICS International Conference on Measurement and Modeling of Computer Systems Abstracts, June 18–22, 2018, Irvine, CA, USA*. ACM, New York, NY, USA, 1 page. <https://doi.org/10.1145/3219617.3219633>

REFERENCES

- [1] Arjun Anand and Gustavo de Veciana. 2018. A Whittle's Index Based Approach for QoE Optimization in Wireless Networks. *Proc. ACM Meas. Anal. Comput. Syst.* 2, 1, Article 15 (April 2018), 39 pages. <https://doi.org/10.1145/3179418>