【信通论坛】On the Power of Preprocessing and Reconfigurable Networks

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讲座题目：On the Power of Preprocessing and Reconfigurable Networks
主讲人：Klaus-Tycho Foerster（Postdoctoral researcher，University of Vienna, Austria）

Absract：

In this talk, Klaus-Tycho Foerster will present some of his recent works on (1) preprocessing for decentralized network optimization (INFOCOM'19) and (2) for optimizing reconfigurable networks (SIGCOMM/ANCS'18), along with a short overview on some other current research, such as efficiently handling network failures.

Regarding preprocessing, as communication networks are growing at a fast pace, the need for more scalable approaches to operate such networks is pressing. Decentralization and locality are key concepts to provide scalability. Existing models for which local algorithms are designed fail to model an important aspect of many modern communication networks such as software-defined networks: the possibility to precompute distributed network state. We take this as an opportunity to study the fundamental question of how and to what extent local algorithms can benefit from preprocessing.

Regarding reconfigurable networks, we explore two directions, data centers and wide area networks. While prior work has shown the practical benefits of reconfigurable data center topologies, the underlying algorithmic complexity is not yet well understood. In particular, most reconfigurable topologies are hybrid, where parts of the network are reconfigurable (consisting of optical or wireless devices) while other parts are static (consisting of electrical switches). Current proposals enforce a routing policy that routes flows on either part “exclusively” by labeling flows as mice or elephant. We show that such artificial segregation in routing policy results in non-optimal paths and argue for algorithms that route packets across the network seamlessly.

For wide area networks, we propose the idea of adapting the capacity of fiber optic links based on their signal-to-noise ratio. We investigate this idea by analyzing the SNR of over 8,000 links in an optical backbone for a period of three years. We show that the capacity of 64% of 100 Gbps IP links can be augmented by at least 75 Gbps, leading to an overall capacity gain of over 134 Tbps. Moreover, adapting link capacity to a lower rate can prevent up to 25% of link failures. Our analysis shows that using the same links, we get higher capacity, better availability, and 32% lower cost per gigabit per second. We also propose a corresponding traffic engineering system which in data-driven simulations improves the overall network throughput by 40% while also improving the average link availability.

Bio：

As of 2018, Klaus-Tycho Foerster is a postdoctoral researcher at the University of Vienna, Austria, working with Stefan Schmid. In 2017 he was a postdoc at Aalborg University, Denmark and a visiting researcher at Microsoft Research, Redmond, USA, working with Ratul Mahajan for Fall 2016. He received his PhD degree from ETH Zurich, Switzerland, in September 2016, supervised by Roger Wattenhofer in the Distributed Computing Group. His research focus evolves around algorithms and complexity in the areas of networking and distributed computing. He co-authored over 45 papers, at venues such as ACM SIGCOMM, IEEE INFOCOM, IEE/ACM Transactions on Networking, and IEEE Communications Surveys and Tutorials.

电子科技大学信息与通信工程学院
后台入口　技术支持：弋云科技

清水河校区地址：成都市高新区（西区）西源大道2006号
电子科技大学清水河校区科研楼B区 邮编：611731

028-61830156

028-61831665

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