

The Joint Workshop on Pricing and Incentives in Networks and Systems (W-PIN+NetEcon 2014)

John Chuang
UC Berkeley

john.chuang@berkeley.edu

Patrick Loiseau
EURECOM

patrick.loiseau@eurecom.fr

Today's communication networks and networked systems are highly complex and heterogeneous, and are often owned by multiple profit-making entities. For new technologies or infrastructure designs to be adopted, they must not only be based on sound engineering performance considerations but also present the right economic incentives. Recent changes in regulations of the telecommunication industry make such economic considerations even more urgent. For instance, concerns such as network neutrality have a significant impact on the evolution of communication networks.

At the same time, communication networks and networked systems support increasing economic activity based on applications and services such as cloud computing, social networks, and peer-to-peer networks. These applications pose new challenges such as the development of good pricing and incentive mechanisms to promote effective system-wide behavior. In relation to these applications, security and privacy also require consideration of economic aspects to be fully understood.

The aim of W-PIN+NetEcon is to foster discussions on the application of economic and game-theoretic models and principles to address challenges in the development of networks and network-based applications and services. W-PIN+NetEcon was formed as a merger of the successful NetEcon (earlier P2PECON, IBC and PINS workshops) and W-PIN workshops. We received 29 submissions, each reviewed by three or four members of the program committee. Based on the reviews, we selected 10 papers and 5 posters. The papers presentations were organized into three sessions: "Mechanism design and applications," "Externalities, propagation and influence in networks," "Network pricing, advance reservation and bitcoin," and the posters were presented in a separate poster session.

In the "Mechanism design and applications" session, *Kamble and Walrand* presented their work on "Strategyproof Mechanisms for Purchasing a Shared Resource," in which they design a class of collusion-resistant mechanisms that enable a group of buyers with private utilities to jointly participate in a market for a resource that will be shared. *Manickam et al.* presented their work on "An Iterative and Truthful Multi-Unit Auction Scheme for Coordinated Sharing of Spectrum White Spaces," in which they propose an adaptation of the well known Ausubel's clinching auction for the dynamic spectrum sharing context. They also evaluate their proposed auction for the case of TV white space

(TVWS) spectrum sharing among home networks. *Sinha and Anastasopoulos* presented their work on "A General Mechanism Design Methodology for Social Utility Maximization with Linear Constraints," in which they propose a methodology to create mechanisms that maximizes social welfare at Nash equilibrium with convex constraints while keeping the message space linear.

In the "Externalities, propagation and influence in networks" session, *Weber and Guerin* presented their work on "Facilitating adoption of services with positive externalities via subsidies," in which they investigate analytically the use of fixed subsidies for a given period of time as a means of increasing initial adoption of a service with positive externalities. *Ajorlou et al.* presented their paper on "Strategic Information Diffusion: Spread vs. Exploit." They investigate dynamic pricing in networks where information spreads only locally and find that the optimal price goes to zero infinitely often for a durable product whereas it remains constant after some time for a nondurable product. *Acemoglu et al.* presented their paper on "Harmonic influence in large-scale networks," in which they investigate situations under which the harmonic influence polarizes in large-scale networks rather than being homogeneous.

In the "Network pricing, advance reservation and bitcoin" session, *Reddyvari et al.* presented their work on "Fair, Flexible and Feasible ISP Billing," in which they propose a method for transit pricing based on the "Provision Ratio" which approximates the fair Shapley value allocation with a lower computational complexity. *Gyarmati et al.* presented their paper titled "From advertising profits to bandwidth prices: A quantitative methodology for negotiating premium peering." They propose a new framework to analyze peering agreements quantitatively, based on a Nash bargaining solution with utilities modeling the extra profits due to increases QoE. They also present estimations of the model's parameters from real data. *Simhon and Starobinski* presented their work on "Advance Reservation Games and the Price of Conservatism." They study a model where users of a shared resource can choose to pay a fee to reserve a slot in advance and analyze the Price of Conservatism defined as the ratio between worst and best equilibrium for the provider's revenue. *Bentov et al.* presented their paper on "Proof of Activity: Extending Bitcoin's Proof of Work via Proof of Stake," in which they propose a new protocol for a crypto-currency that offers good security against practical attacks on Bitcoin with a relatively low network and storage overhead.

In the poster session, *Georgiadis et al.* presented a poster

on “Dynamic Exchange of Communication Services,” *Kazumori* presented a poster on “Generalizing Deferred Acceptance Auctions to Allow Multiple Relinquishment Options for Spectrum Reallocation,” *Al Daoud et al.* presented a poster on “A Game of Uncoordinated Sharing of Private Spectrum Commons,” *Poularakis et al.* presented a poster on “Quid Pro Quo: Reducing Peak Traffic Costs with (Subscriber) Price Incentives,” and *Lotfi et al.* presented a poster on “Network Non-Neutrality on the Internet: Content Provision Under a Subscription Revenue Model.”

In addition to the contributed sessions, the workshop had a keynote by Paul Milgrom and two invited talks by Asu Ozdaglar and Aaron Roth. Milgrom presented his work on deferred-acceptance auctions for radio spectrum reallocation. He detailed both the theoretical and practical aspects of these auctions, which have attractive computational and incentive properties that make them adequate in challenging environments such as the planned US auction to repurchase television broadcast rights. Ozdaglar presented a theoretical model of investments in security in a network of interconnected agents. She showed that, contrarily to predictions of prior literature, there are reasons for over-investment by some agents, including the fact that security investments do not only create positive externalities but are also strategic substitutes, and including the possibility of endogenous attack distribution. Roth showed how differential privacy provides tools to design mechanisms with remarkable incentive properties in large markets (i.e., markets with many small agents). He provided two main examples: designing mediators to coordinate equilibrium behavior in games of incomplete information, and designing ascending-price auctions such that sincere bidding is an asymptotic dominant strategy.

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