The joint Workshop on Pricing and Incentives in Networks and Systems (W-PIN+NetEcon 2013)

Patrick Loiseau
EURECOM
patrick.loiseau@eurecom.fr

David C. Parkes
Harvard University
parkes@eecs.harvard.edu

Jean Walrand
UC Berkeley
walrand@berkeley.edu

Today's communication networks and networked systems are highly complex and heterogeneous, and 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 telecommunications industry make such economic considerations even more urgent. For instance, new 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) and W-PIN workshops. We received 39 submissions, each reviewed by three members of the program committee. Based on the reviews, we selected 12 papers and 7 posters. The papers presentations were organized into four sessions: "Security games," "Pricing and neutrality," "Learning and coordination," and "Content, auctions and advertisement" and the posters were presented in a separate poster session.

In the "Security games" session, *Smith et al.* propose a new solution concept for multi-defender security games. They use it to analyze a model of security game on networks and find that defenders tend to over-defend even with positive externalities. *Laszka and Gueye* analyze network blocking games under budget constraints. They show that the equilibrium computation is NP-hard with a maximum-cost constraint, whereas it can be solved efficiently with an expected-cost constraint. *Dritsoula and Musacchio* propose a model of ad networks competing for publishers by selecting their revenue sharing rate and their aggressiveness in fighting click-spam. They show that, at equilibrium, ad networks are fighting click-spam aggressively and compete mostly in

prices.

In the "Pricing and neutrality" session, *Kavurmacioglu et al.* define a break-even price and a market sharing price in secondary spectrum access. They show how these prices determine the outcome of a duopoly competition for secondary spectrum demand. *Courcoubetis et al.* study a model with an internet service provider (ISP) with multiple content providers (CPs) and derive new insights on the network neutrality debate. In particular, they find that two-sided differentiated pricing is favorable for the internet ecosystem. *Park and Mo* propose a model of revenue sharing between an ISP and a CP to reduce online content piracy. They show that this cooperation can increase the revenue of both the ISP and the CP.

In the "Learning and coordination" session, *Ifrach et al.* study a market of heterogeneous consumers learning the average quality of a product while a seller uses dynamic pricing to maximize his revenue. They find that social learning is successful and *ex-ante* beneficial to the seller, and that accounting for social learning lowers the optimal dynamic price. *Dahleh et al.* provide results on how the structure of local information sharing affects the multiplicity of Nash equilibria in coordination games.

In the "Content, auctions and advertisement" session, *Abbassi et al.* propose a model of online content curation where publishers select contents and readers select publishers to follow. They show that the centralized publisher allocation problem is NP-hard but easy to approximate. They give bounds on the price of anarchy in the decentralized problem where publishers are strategic, and in the case where the readers are also strategic. *Xu and van der Schaar* design rating systems to incentivize users in a user generated content (UGC) network to produce content. They show that, under imperfect monitoring, it is sometimes preferable to allow some free-riding in order to maximize welfare. *Jiang et al.* propose a simple bidding strategy in a mean-field model of online auction without any statistical knowledge, relying on stochastic approximation techniques. *Rallapalli et al.* study the value, in targeted advertisement, of additional data that gives finer grain information. They propose a simple model and show numerical results.

In the poster session, the following posters were presented by at least one author:

- Weijie Wu, John C. S. Lui, Richard T. B. Ma. Bundling Strategies in Online Service Markets.

- Sebastian Benthall, John Chuang. Computational Asymmetry in Strategic Bayesian Networks.

- Hong Xie, John C. S. Lui. Mathematical Modeling of Product Rating.

- Roch Guerin, Jaudelice C. de Oliveira, Steven Patrick Weber. Adoption of bundled services with network externalities and correlated affinities.

- Lena Mashayekhy, Mahyar Movahed Nejad, Daniel Grosu. Incentive-Compatible Online VM Provisioning and Allocation in Clouds.

- Huseyin Guler, Berkant Barla Cambazoglu, Oznur Ozkasap. Task Allocation in Volunteer Computing Networks under Monetary Budget Constraints.

- Assane Gueye, Vladimir Marbukh. A Cost/Benefit Analysis of Network Vulnerability Reduction: Element Hardening vs. Adding Redundancy.

In addition to contributed sessions, the workshop had four invited keynote talks by Mung Chiang, Adam Wierman, Adrian Vetta and Ramesh Johari. Chiang argued in favor of smart data pricing for communication networks and showed the results of some early field experiments. Wierman discussed competition and congestion in a model of a cloud market. He argued that the structure of the market (with Saas, PaaS and IaaS) gives little market power to infrastructure providers (similarly to the case of ISPs vs. CPs) and yields inefficiencies that reduce the user performance. Vetta compared pricing mechanisms for a monopolist selling durable goods (goods that can be consumed repeatedly over time). The results quantified the extent to which a durable good monopolist can generate higher profits than an equivalent monopolist for a perishable good. Johari discussed the relationship between pricing and visibility in the mobile apps market, using a combination of data analysis and modeling. He showed that a top-rank position results in a boost in demand and that the optimal pricing consists of cycles alternating low prices to increase visibility and high prices to generate revenue.