**NETWORKING GAMES, WARDROPE EQUILIBRIUM AND OPTIMAL ROUTING**

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Many real problems in modern networks and supercomputing such as resource distribution, scheduling and routing, spam fighting, etc. can be solved by game-theoretic methods. The players here can be the users, the jobs, the packages, etc. Networking games can be divided for two classes in respect of the traffic being divided (Wardrope games) or not (KP models) for units. The players can use the selfish and cooperative strategies. Selfish players have different utility functions (for instance, latency functions of linear, quadratic or exponential form) and the main problem here is to find the equilibrium. That is a part of congestion games. We will consider the main methods of congestion and potential games. For general networks we find the potential functions and use it to construct the Nash equilibrium. Cooperative agents are interested in maximizing the common utility. Comparison of these costs is estimated by the price of anarchy. We present the different approaches how to find it. We consider the Braess paradox and discuss the conditions for its existence. Some examples of real networks are presented. Topics will include:

- Game theory definitions, cooperative and non-cooperative games;
- Bargaining theory and decision making;
- Normal and extensive form games, Nash equilibrium, Subgame perfect equilibrium;
- Congestion and potential games; Braess paradox
- Models of cooperation and selfish behavior among users;
- Routing games and Wardrope equilibrium. Price of Anarchy;
- Optimal bandwidth allocation;
- Equilibrium in queuing; and
- Economic models in networking.

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