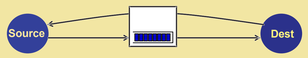
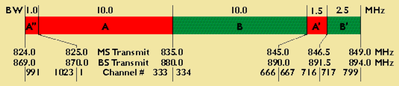
Resource Allocation in Communication Networks

Why Resource Management ?

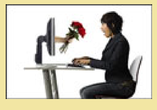
- Increasing demand
- Various applications
- Different QoS



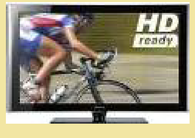
- Limited resources
  - Bandwidth
  - Buffer space
  - Battery



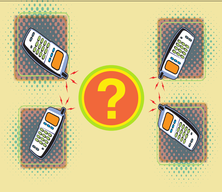
Relation with Microeconomics



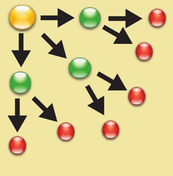
- Chat / Voice over IP
- Private good



- TV / Radio broadcast
- Public good



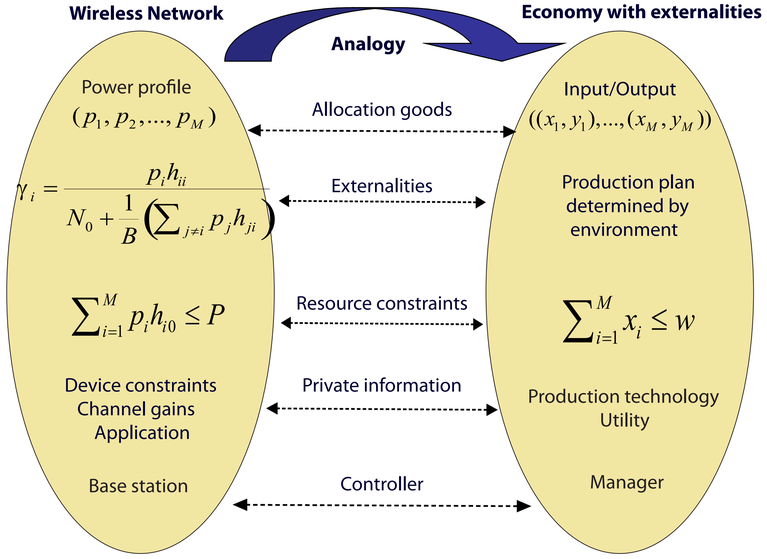
- Interference
- Externalities



- Multirate multicast
- New problem !

By: Shrutivandana Sharma

Power Allocation: Wireless-Nets



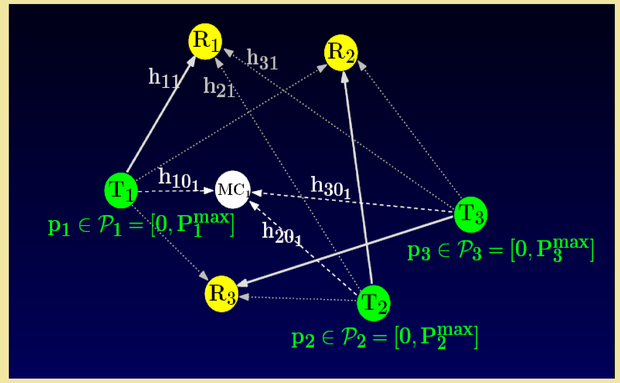
Pricing and Externalities

- Previous literature on decentarlized power allocation is based on pricing mechanisms.
- Pricing mechanisms: users announce prices and/or demands for the resource; allocations are determined by equilibria.
- Information exchange is not sufficient to obtain globally optimal allocations.
- A different approach is required to obtain globally optimal allocations.
- Mechanism design:
  - What information should users exchange?
  - How should resources be allocated ?

Nobel Prize: L. Hurwicz, E.S.Maskin, R.B.Myerson

University of Michigan, Ann Arbor

Our Work: Optimal Allocation



Objective

Determine power allocation that satisfies all constraints and maximizes sum of users' utilities.

Externality Algorithm

Accounts for transmission power externalities generated by each user to other users.

The iterative process guarantees convergence.

Results in globally optimal power allocation.

Message space dimension ~ $O((\#users)^2)$
Same as the lower bound on message space dimension required by any mechanism to obtain globally optimal allocations.

Reference:

S. Sharma and D. Teneketzis,
"An externality-based decentralized optimal power allocation scheme for wireless mesh networks",
Proceedings of IEEE SECON'07, 18-21 June 2007,
Page(s):284 - 293

Contact : svandana@umich.edu