Making Greed Work in Networks:
A Game Theoretic Analysis of Switch Service Disciplines

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CS 395T: Agent Based Electronic Commerce

November 4th, 2003

Summary

- Several users sharing a switch
- Each selfishly optimizing $U_i(r_i,c_i)$
- Central service discipline determines allocation
- Self-optimizing users + equilibrium => Nash equilibrium

Summary

- Goal is to design a service discipline that yields Nash equilibria with desirable properties
- Consider two disciplines:
  - FIFO
  - Fair Share

Summary

- Efficiency (Pareto optimality):
  - No discipline guarantees Pareto optimality
  - Fair Share is optimal when possible
- Fairness (Envy-free):
  - Fair Share is envy-free.
  - No other service discipline is envy-free.

Summary

- Uniqueness
  - Fair Share always has a unique Nash equilibrium
  - No other service discipline always has a unique Nash equilibrium
- Robust Convergance (Nash + Stackelberg equilibria):
  - Fair Share always converges
  - No other service discipline has Nash => Stackelberg

Summary

- Rapid Convergence (via Newton's method)
  - Fair Share always has a nilpotent relaxation method
  - No other service discipline has a nilpotent relaxation method
- User Protection
  - Fair Share is protective
  - No other service discipline is protective

In Defense of Selfishness

1. Users don't know their utility curves *a priori*
2. Cooperation "chains the network to obsolete technology"
3. Vulnerability to selfish users

- Do the benefits of selfishness outweigh sub-optimality?

Discussion

- Utility functions represent only an internal ordering; no inter-agent comparisons are possible. What are the pros and cons of this?

Discussion

- How well would these results scale to networks of switches?
  - Efficiency?
  - Fairness?
  - Convergence?

Discussion

- What real world problems can be modeled as a search for single switch disciplines?

Discussion

- How does the discipline reported in the paper compare to a model where each user reports its utility function to the switch, which then applies Fair Share?

Discussion

- What opportunities exist for collusion?

Discussion

- If a given Nash equilibrium is *not* also a Stackelberg equilibrium, what opportunities do users have to strategize, given that they do not know other users' utility functions?