Modeling of the Shrew: the Quest for a "Model" Network Model

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The question should not be

“What is in the network model?”

but rather...

“What to model in the network?”
Looking back: successes!

- open loop networks:
  - loss, delay, throughput
  - “Kleinrock legacy”
- bounding techniques:
  - network calculi
- self-similarity, LRD
- small, closed-loop nets
  - TCP models

Consider a network....

No more queues in isolation!
Raising the level of abstraction

- packets: too microscopic
- coarser-grained models
  - large scale networks
  - dimensioning, provisioning
- flow-level abstractions
  - call models in telephony
  - WWW transfer: document is workload unit
  - fluid models

Challenges
- multiple bottlenecks
- open and closed loop control
- long and short-lived flows
- micro-macro-micro
  - effects of aggregation, de-aggregation
Flow-level modeling: simple example

- **flow rate**: determined by link capacity, sharing requirements
- **networks** of processor-sharing-like queues

- Roberts, Massoulie, Gibbens, ...
- Bu, Towsley
What to model?

- we excel in data plane
  - loss, throughput, delay

- Q: What measures do people really care about?
  - “robustness”
  - “complexity of control”
  - maintainability
  - adaptability
  - reconfigurability
  - security

- modeling these is hard!
  - “efficiency” not the most important measure!
  - little/no past work!
  - metrics and models undefined!

- example: modeling a soft state protocol
Example: soft state control

- Conventional wisdom: “soft-state is robust, less complex than hard-state signaling”
  - really?
  - how to define “robustness”?
  - how to define “complexity”?

- Posing/answering such a question is:
  - hard: no well-accepted models, paradigms
  - easy: little/no past research
  - important: a fundamental question
Summary

- *lots* of successes to be proud of!
- new frontiers:
  - application-driven modeling
  - higher level of modeling abstraction
  - modeling “on beyond performance”