Course Projects

- Logistics on the class website
  - Meetings once a week
  - Final report due on 12/13
  - Any topic related to parallel or distributed computing

- Phases of the project:
  - Do some background reading
  - Formulate the problem
  - Do a systems design/implementation or a theoretical analysis

Overlay Networks

- Can overlay networks be used for rearchitecting the Internet?
  - Stiff opposition to modifying internet protocols
  - Difficult to demonstrate benefits of new proposals outside of simulations
  - Overlay networks are a nice medium to demonstrate utility of protocols in medium-scale setting

- What would one want to redesign?
  - Propose new routing protocols
  - Propose new transport layer communication mechanisms

Routing Protocols

- Detour was the first project to propose using overlay routing for obtaining better performance
  - Either shorter paths
  - Or lower lossrate paths
  - But never demonstrated it in a real setting

- Project: design an overlay routing protocol that finds better paths on Planetlab and could be used as an "ISP"
  - Should take into account latency/lossrate of existing connections
  - Should take into account congestion level of the nodes at any given point in time

- Project: Is Planetlab actually diverse enough?

Value-Added Overlays

- Can we provide "quality-of-service" in overlay networks?
  - Guarantee that an end-user always sees a certain level of quality irrespective of the current conditions of the Internet
  - Overlay would automatically reroute to provide the desired quality of service

- Can we prevent "denial-of-service" attacks on overlays?
  - Forward only authenticated traffic?
  - Make sure that authentication is faster

- Can internal routers be of help in overlay networks?
  - Overlay multicast sends multiple copies of the same packet
  - Can internal routers use compression techniques to determine duplicate packets?

Overlay Mesh Construction

- Most overlay mesh construction algorithms find a good quality mesh using overlay measurements
  - They do not take into account underlying physical topology
  - What is the point of lambda.cs.yale.edu having two overlay links to mc1.cs.princeton.edu and mc2.cs.princeton.edu?
  - Project: design an overlay mesh construction algorithm that takes into account physical topology into consideration

Resource Management and Economics

- How do you schedule resources when you have complex requirements?
  - A process wants some much compute power, so much disk power etc.
  - A process wants to be geographically close to some users/data
  - Problem: find an optimal schedule

- When resources are owned by independent autonomous entities:
  - Need to ensure fair exchange of resources
  - Use currencies for the exchange
  - Problem: devise a marketplace for bartering of resources
Large Data Sets

- Indexing of multidimensional data
  - Explore new kinds of data and new kinds of queries
  - Consider using a different approach that SkipIndex or Mercury

- Large-scale publish-subscribe systems:
  - Producers of events and consumers of events
  - Perform matching of producers with consumers
  - Perform in a distributed setting
  - Minimize latency of communicating events to receivers

Other Topics

- Routing in delay tolerant networks
- Distributed/parallel crawlers
- Consistency models
- Parallelizing applications
  - Bioinformatics applications, etc.