Project Ideas

ELEN E6761 - Computer Communication Networks
Fall 2000 Prof. Rubenstein

The following is a list of possible project topics for ELEN 6761. These are simply recommendations. It is o.k., and in fact encouraged, if you come up with your own ideas for topics.

- **TBIT:** Several versions of TCP exist. Each version has various requirements and options that should be provided as specified in various RFCs. TCP is designed such that the TCP receiver is the same under these various versions, and that the differences are implemented at the sender side of the protocol. What is the fraction of servers that are implementing a particular version of TCP? Are they implementing all of the options correctly? TBIT is a tool devloped at ACIRI (AT&T Center for Internet Research at ICSI in Berkeley, CA) that connects with a server using a TCP connection and probes the server by varying the behavior at the receiver end in such a way that it is possible to distinguish between versions, and can test whether certain options / requirements are being met. Researchers at ACIRI have posed several questions that their TBIT tool cannot yet detect, but that they are interested in adding to the tool. For instance:

  - Is the version of TCP really randomly choosing its initial sequence number?
  - CISCO routers sometimes drop packets whose ECN bit is set. How often does this occur?
  - The time between transmissions during TCP timeout is supposed to increase exponentially. Is the version of TCP implementing this correctly?

  For more information, see the TBIT website on the web-page http://www.aciri.org/tbit. Groups embarking on this project would likely get the opportunity to interact with the folks at ACIRI, which is in itself a fantastic opportunity.

- **Soft State:** Soft-state is a mechanism style used by communication protocols in which a client node maintains some default state that it reverts to if it is not contacted by its parent periodically. The mechanism increases the fault tolerance of the network because when network faults partition communication, the system reverts to a default state. However, soft-state has a cost in terms of the bandwidth required to simply keep the connection alive, as well as the automatic termination of connections during a partition. Is there a good model that can be used to examine these tradeoffs?

- **Household IP:** It is commonly stated that soon, every household device will have its own IP address and will become a component of the Internet. What sorts of changes need to be made to the current IP infrastructure to support the needs, as well as the number, of these devices?

- **Ad-hoc routing:** imagine a laptop or a cellphone acting not only as an end-point receiving device but also as a router, forwarding packets to other destinations. With a chain of these devices, reliability could be improved (e.g., one would have less problems receiving signals in certain areas like in the subway or behind tall buildings). How should the ad-hoc routing and/or reliability mechanism be designed? Are there tradeoffs in terms of power usage or wireless bandwidth consumption?

- **Nomadic DNS:** DNS was designed under the assumption that hosts would remain fixed. However, it turns that people are not interested in reaching a given host - they are more interested in reaching the information that might exist on the host. DNS is not designed to handle information that might reside on a set of hosts for a short period of time before being moved to other sites. How can DNS be modified to support these migration services, or should a new protocol be designed to replace current DNS?

- **RED Inference:** Random Early Detection (a.k.a., RED) is a policy being implemented in Internet routers whereby packets are dropped probabilistically, where the probability that a packet is dropped is an increasing function of the exponentially weighted average of the size of the router's buffer in use.

Is RED working in practice? Before this can be answered, one first needs to know to what extent is RED being deployed. However, it is often not easy to ascertain this information from ISPs. Can it be inferred from the end-hosts as to whether or not a router, or set of routers along a given network path, are using RED?

- **Multi-Party Fair Share:** Multi-party applications, such as Internet video/audio broadcasts, or tele-videoconferencing, have the potential to usurp large shares of network bandwidth. How should these protocols be designed so that they share bandwidth "fairly" with other applications using the Internet? This problem has two interesting parts: what is a "fair" share for such an application? Once it is determined what is meant by a fair share, how can this fair share be realized?

- **SPOCs:** Several works have proposed that flows should not perform congestion control in isolation, but that flows that are congested by common points in the network should somehow cooperate. How can one detect shared points of congestion in a network? If these points move around, or if there are multiple points of congestion, what should the policy be on aggregating flows together? What is the measure used to determine whether or not to aggregate two flows?