Qualifying Exam: Network Architecture
Jan. 2015
Date: Friday, 2015/1/9 (1 hour)

Instruction:
- Put your name and student number on all your answer sheets.
- You have 60 minutes to complete the exam.
- **Show all your work. Partial credit will be considered, if you show intermediate steps in obtaining the answer.**

Question #1 (20pt):
   a) Packet switching can accommodate bursty traffic of computer network applications by statistical multiplexing concept. Explain statistical multiplexing technology. *(Hint: compare to circuit switching technologies such as TDM, FDM)*
   b) The Internet provides high survivability in the face of network failure. One of the key enabling concept is "fate sharing". What is the main purpose of "fate sharing"? *(Hint: states at end host, or states at network nodes in stateful network such as ATM, X.25)*

Question #2 (20pt):
   a) "peering" plays very important role for inter AS packet transfer. Why is the connection to peering switch:IXP beneficial to Content provider, Root name server operators, or Top Level Domain(TLD) operator?
   c) What are the advantages of reactive mobile ad hoc routing protocol compared to proactive mobile ad hoc routing protocol. *(Hint: mobility of nodes)*

Question #3 (20pt):
   a) Packet classification is the process of categorizing packets into "flows" in an Internet router. All packets belonging to the same flow obey a predefined rule. How many different cases(regions) can be exist when n rule exist over 2 fields(dimensions)? n^2? or 2^n? Explain why.
   b) SDN separates control plane from data plane. How can you achieve "Network virtualization" using SDN concept? What is the role of "FlowVisor"?

Question #4 (20pt):
   d) Why is "retransmission time out(RTO) so critical to TCP performance in terms of end to end throughput? *(Hint: RTT with long RTT)*
   e) What is the "Incast problem of TCP for data center networks"? How can you solve this problem? *(Hint: MapReduce: Reduce() procedure)*

Question #5 (20pt):
   a) What is the advantage of "server centric structure of data center network" compared to "switch centric structure of data center network".
   b) Why are "content centric networks" robust against "DDOS attack? *(Hint: number of targets to attack)*