

# CS138 Homework Assignment 4

*Due: 11:59pm, April 29, 2008*

1. In lecture XVII we discussed delegation, which involves the use of privilege attribute certificates (PACs). Slide XVII-34 gives an example in which a client contacts a print server, and the print server contacts a file server on the client's behalf. Explain how the print server can prove to the file server that it may access the client's files. Be sure to explain what it is that the print server passes to the file server to do this and how it obtained whatever is passed. Be sure to indicate which information is encrypted and in which key it is encrypted.

Note that PACs are contained in tickets (they are encrypted along with the other ticket contents). For the print server to prove to the file server that it is the client's delegate, it must show that the PAC contained in the file-server ticket (sent by the print server to the file server) is really the client's PAC, as prepared by Kerberos. And you must show how it can put such a file-server ticket together.

2. In the second half of lecture XVII we discussed the notion of capabilities. Among the sorts of capabilities we discussed were "read capability" and "write capability" capabilities, allowing the holder to get a capability from an object and to send a capability to an object, respectively. Later we discussed the implementation of capabilities in the Amoeba system. Can the read capability and write capability capabilities be implemented in Amoeba? I.e., is Amoeba capable of restricting the transfer of capabilities from one process to another? Explain.

Hint: can an Amoeba object owner verify that the holder of a capability is the process that obtained it from the object owner in the first place?

3. We would like to add an atomic append operation to NFS version 2. Assume that the server never crashes (though network connections might be lost).
  - a. Why is this difficult?
  - b. Explain how it could be done.

Note: you are not to construct an append operation using standard write operations and NLM, since it won't work (NLM supports only advisory locks). You're to create a new remote procedure that appends data to the end of a file.

4. In lecture XX we discussed Map Reduce. The master process is an important component. To what extent is it a bottleneck? In particular, what parameters does its involvement depend upon and how does it depend on them? For example, does it depend upon the number of splits? If so, how does it depend upon the number of splits? (Is it logarithmic, linear, quadratic?)