CS 524 Homework #3

Due: March 14, 2017

This homework contains both technical and business-related problems, for the total of **100** points. Note that Problem 3 requires a good deal of a self-study. To this end, consider it a typical every-day problem you would need to solve if you worked as a product manager in a large company or ran a start-up company yourself.

1. (**10 points)** Given the token bucket size, *b bytes*; token rate, r bytes/sec; and maximum output rate *M* bytes/sec, what is the maximum burst time *T*?

2. **(60 points)** Study the *AWS Direct Connect* service and answer the following questions:

    a. (**business)** You own a company with a data center in Sapporo, Japan. Which company would you choose to connect this location to the Amazon service? Can you find out about pricing and QoS guarantees? (This may require a good deal of research. If you are unable to find the exact answers, describe what you have done to find them and what remains to be done.)

    b. **(technical)** As you have noticed, the *AWS Direct Connect* service description refers to the IEEE standard 802.1q. Read this standard (available at http://standards.ieee.org/getieee802/download/802.1Q-2005.pdf) and explain how a dedicated connection can be partitioned into multiple virtual interfaces so as to allow you to "use the same connection to access public resources such as objects stored in Amazon S3 using public IP address space, and private resources such as Amazon EC2 instances running within an Amazon Virtual Private Cloud (VPC) using private IP space."

3. (**10 points)** Describe how the *AWS Direct Connect* service can be used with the *Amazon Virtual Private Cloud (VPC).*

4. (**10 points)** Note that *Amazon VPC* provides NAT.

    a. Explain why you would want to use *NAT* for a *virtual private subnet with* the *Amazon Direct Connect* service. Do you see any cases where you would *not* want to use it?

    b. What is the maximum number of connections a single NAT box can maintain? (You need to check the specifications of the three existing transport-layer protocols on the Internet: TCP, UDP, and SCTP, and also keep in mind that the first 4,096 ports have been reserved.)

5. (**10 points)** Read RFC 1930 (http://www.ietf.org/rfc/rfc1930.txt) and answer the following questions:

a. To use AWS Direct Connect with *Amazon VPC,* the Border Gateway Protocol is required. Why?

b. Can you use your own *ASN* to connect to VPC?

c. Which RIR would you go to when you need to establish an ASN for your data center in Sapporo, Japan?