CS 4457A: Computer Networks II  
Department of Computer Science  
Western University  
Assignment 1  
Fall 2019  
Due Date: Oct 6th, 2019

Purpose

The goals of this assignment are the following:

• Get experience with ISP networks architecture, design, and ISP’s major technical functionalities

Problems

1. Imagine yourself as a Central Office (CO) capacity planner. You are given a detailed CO level network topology (i.e., how the network equipment NEs are connected inside a CO), current capacity details of these routers/NEs (i.e., current utilization levels), and projected traffic load (how much additional future traffic is estimated that need to be served by this CO). Your task is to develop a methodology that can be used to determine if any additional router/line cards are required in this CO to meet the projected traffic demand; and if any new purchases are necessary what would be the estimated capital expense. (25 points)

2. Based on a number of given Internet services and their bandwidth requirement on a fixed Internet platform (for a single residential customer), you will develop methodologies and a bandwidth requirement forecast tool (excel file based simple model) to estimate the residential Internet bandwidth/speed for an average sized household. (25 points)

3. As discussed in the class, bringing the media content closer to the end-users/customers not only improves the customer experience but also saves operational expenses for the ISPs. Imagine yourself as a content delivery network designer, and your job is to design on-net locations (inside ISP network) for placing the content servers. In order to design such content architecture, which layers (core, edge, aggregation etc.), what type of architecture (i.e., centralized or distributed), and what metrics you would consider (and why) to evaluate your design choices/options. (25 points)

4. As discussed in the class, a number of factors lead to network upgrade activities (i.e., infrastructure modernization) for an ISP. Some of these drivers are new technology, new product, network equipment (NE) reliability/security issue, network performance issue, customer requirement, NE end of support etc. Given a limited budget for network upgrade activity, as a network modernization manager, develop a step-by-step guideline that you would use to perform the network upgrades/modernization plan. (25 points)
Marking Scheme:

Problems 1:

1. Your analysis is based on different network layers capacity details [5 points]
2. Your analysis addresses router capacity configuration details [5 points]
3. Your analysis addresses some capacity utilization threshold practices (for example, router slots utilization should not exceed x%) [5 points]
4. You discuss how to estimate the cost for new capacity augment [5 points]
5. Your methodology addresses capacity requirement from connectivity perspective. For example, to support x Gbps of traffic amount in a particular CO, DR/s needs to have available capacity (ports) to connect to its Access router/s to support x Gbps as well as available capacity (ports) to connect to its PE router/s to support x Gbps [5 points]

Problems 2:

1. You identify the residential Internet applications and their bandwidth requirement distribution [10 points]
2. You discuss how to find the average household size [5 points]
3. Your model captures some realistic consumer behavior pattern [5 points]
4. Users of your model should be able to edit/modify any input parameters and your results should reflect those changes/modifications [5 points]

Problems 3:

1. You discuss the various technical and business factors that to be considered for such design [5 points]
2. You develop thee possible content delivery architecture [5 + 5 + 5 points]
3. To evaluate your proposed three different architecture, you discuss what specific metrics should be (and why) used (i.e., how do you determine which architecture/design is the most suitable for this purpose) [5 points]

Problems 4:

1. You discuss the possible drivers behind the network upgrade activities [10 points]
2. You assigned the priority to the network upgrade drivers and the justification [10 points]
3. Can you think of any approach that would address network upgrade issue/s but it would not require purchasing of new/additional network equipment [5 points]