Advanced Computer Networks
Project Description

Instructions to Students -

Dear students, we appreciate your interest in the elective Advanced Computer Networks. As part of this course we hope to run you through a complete hands-on project which is modelled on a real world network design challenge. Please see below instructions to be followed for the assignment -

- The project needs to be carried out in a team of 3 students each
- The project will be evaluated for **25 marks** across three touchpoints
- Each team will be assigned a project. You will not be given a choice.
- The project question/scenario presented to you is intentionally vague (This is how problems and requirements flow in as you work with real customers). In case you are making assumptions, please call them out clearly in your documentation.
- Please feel free to be as creative as you would like to in the presentation of your project. There is no single right way to solve the problems presented to you.
- You will be evaluated across three touchpoints -
    - Touchpoint 1 - 2 March 2019
    - Touchpoint 2 - 21 March 2019
    - Touchpoint 3 - 20 April 2019
- While we encourage discussion and learning, we would appreciate if you could be ethical and fair with the submissions. Kindly call out the contribution of every team member as part of your documentation and during every evaluation. Note that in case of plagiarism we will be forced to mark ZERO to both the teams involved in the act.
- All deliverables and documentation submission will be strictly soft copy based. Let us save paper on this :)
- For any queries, please feel free to reach out to your instructors -
    - Aayush Agarwal - aayush.a15@gmail.com
    - Dr. Oshin Sharma - droshinsharma@pes.edu

Project Details

For the scenario assigned to you, complete your proposal including costs for computing equipment, network infrastructure, network servers, printers, and related hardware, software, and accessories. Include as much detail as possible as well as justification for your selections. Diagram and explain your physical network and computer design as well as the logical network design (server installation, domain layout, etc.). As you are a small business, cost is a major factor and should be minimized. Your plan should include a complete network and computer system that meets these requirements and future expansion plans.

Touchpoint 1 -

- Chalk out the scope of your project.
- Convert business requirements to technical requirements and design goals.
- Complete your trade-off chart and justify how much you will focus on each goal/constraint
- Chart out your understanding of the existing network in the form of a network map.
- Identify the QoS parameters you will include as part of the SLA with your customer
- Explain your architecture and design choices and tradeoffs. This is your proposal.
- All of this needs to be handed over in the form of project documentation. Include as much detail as you can. During the touchpoint, your instructor will run through your documentation in your presence and ask for justification as required.

Touchpoint 2 -

- Full completion of design
- First modeling in Claynet to show the functional working of the design.

Touchpoint 3 -

- Submit a full project report
- Demonstrate how you met all the QoS, technical and business goals

Project #1

Paramount health care is a health care enterprise founded in 2015. The health care company was founded with the primary goal of providing advanced and affordable health care to stuntsmen from the entertainment industry. The hospital has 5 doctors specializing in different fields. Each doctor has his/her own cabin (all cabins are on different floors) with a standalone physical desktop and printer through which they would require to access the intranetwork as well as the internet. They have recently heard about OpenMRS, an electronic medical record system and would like the same to be implemented. The 4 operating rooms of the health care unit also have stand alone desktops through which the staff primarily accesses SaaS based medical imaging software and patient records. The administration staff of the company are 3 in number and the company also has 2 employees who manage the finance affairs. All these employees also have standalone physical desktops and dedicated printers. Note that the finance department deals with sensitive data. The enterprise has 2 servers where they host their internal applications and data. Since the health care enterprise primarily caters to patients from the entertainment industry, the company offers free Wifi access to the admitted patients. It was noted in the past that the admitted patients primarily wanted to stream content from Netflix or YouTube. However, they all complained that "My videos always keep buffering". The hospital staff have also complained that while they were always able to access the intranet, they always faced issues when accessing the internet. Since the enterprise is primarily concerned with providing affordable health care, they are looking for a solution that is affordable. They will only go ahead if you promise a five 9's availability and require a medical grade network. (You may read more about a Medical Grade Network here and here).

Project #2

Foodies is a food and retail store. Foodies has a storage warehouse 200m away from the store and an administration office 2km away from the store where the CEO and the vendor management team is based. Currently the store has only 5 computers (1 on each floor for billing) and 1 computer in the warehouse. All employees in the administration office bring their own devices to work (BYOD). They connect to the LAN cables, but they would like to be offered a wireless network access. They want to be able to work on a suite of software tools so that they may communicate effectively - Google search, office 365, outlook for email.

The store is based on manual data entry at each level. Since the billing is also based on manual entry, customers are now facing long wait-times at the counters. The store is also having coordination issues with the administration office and the warehouse. There have been times in the store when certain products are empty in the store racks even though there is a surplus of the same product in the warehouse. On other occasions, more of the same items have been sent from the warehouse even though the racks at the store were already filed with those items. The CEO would like to optimize this.

Foodies now wants to solve their issues with a renewed network design, but they are extremely concerned about the affordability of the solution. Here are a few thoughts they have -

- They would like all the on-ground sales staff in the store to have a mobile device to interact with each other and with the warehouse/vendor management employees.
- They would like to setup 2 standalone touch screen desktops at the entrance of the store using which the customers can browse the store catalog and also identify the racks of the products they are interested in.
- In the past Foodies has faced issues with the manageability and connectivity of the networking devices. They plan to recruit an IT admin who will be based out of the administration office and will manage the entire network.
- Foodies wants to eliminate all the manual data entry and make their process more efficient

Project #3

You are interested in starting your own Music Store, Quality Sounds, in a suburban area of your town. You need to design and build a network and computing solution for your stores. You have done some initial planning and you will start with two stores (but you plan to add two more stores across town within one year). Your store will sell new and used music and allow customers to get "online" in your stores and download music. You also will offer classes on how to setup music downloads and configure MP3 devices. You took computer networking courses in college and you feel you can tackle this solution yourself. Upon initial planning, you have identified the following requirements for your network:

- Connects three office computers and one computer used for Point-of-Sale (POS) services at each of your stores. You also want six (6) computers in the lobby/store where patrons can download music and you can run "training classes" for people to learn about using MP3 players and get other basic information. The two offices have to be connected into one cohesive network, sharing POS services and other critical company information. You also need to provide a casual area for people to stop in and discuss music and connect wirelessly to the Internet (you might even offer free coffee to entice people to come in to your store).
- Provides adequate security for all of the company communications and documents (especially sensitive sales documents). All POS services must be protected. All general network access should be segmented from the company POS services.
- Fast and have additional capacity as the company grows
- Provides for centralized printing
- Supports the eventual addition of other stores to the network
- Provides customers with a general information Website and a secure Website where clients can buy services, and products
- Provides for limited downtime (24 hour downtime maximum)
- Provides for centralized management and control of the computers in the two stores, so that you can maintain the network from off-site
- Provides for long-term cost effectiveness
- Provides a suite of software tools for the employees to effectively communicate and a POS solution for the stores

The company does not have any equipment. Your plan should include a complete network and computer system that meets these requirements and future expansion plans.

The two store locations will (eventually) be within a five-mile radius of each other. The locations are within a suburban area that has current technological infrastructures and related technology offerings. The stores will need a sales system and print services for invoices.

Project #4

ACN University is an established university with CSE, EEE and ECE departments. The university started off in a single building which housed all the three departments. They had a common staff room for all the faculty. They have now increased their intake of students and have expanded to 2 buildings. CSE department will now occupy the newly constructed building. The other two departments will continue to function in the existing building. The university will now be providing a cabin to each faculty member and these will be spread across all the floors of the two buildings. Network separation is a must for the different departments. In addition to the aforementioned departments, there are admissions and finance departments which deal with sensitive information. These 2 departments are housed in an administration office 2km away from the university premises.

The university wants to put in place a learning management system for students and faculty. They are very particular about hosting the application on-prem. The learning management system will be used for course submissions, for hosting video lectures/resources and conducting online examinations. Therefore this service must be highly available (at least 4 9's availability). The CSE department is also planning to host the Claynet software which will require a dedicated server in the CSE network. The CSE department would like students to be able to work on this software from home as well. However, they are concerned about security. In the past there have been malicious activities by students which have pulled down the network. The management of the university wants to make sure that the network is appropriately monitored as well.

The website of the ACN university will also be managed as part of this network itself. The university is also planning to start the department of mechanical engineering in the next few months in a separate building to be constructed.

Project #5

ACN Software Solutions is an e-commerce startup based out of India. They started off with 5 employees with no specific roles. However, they have now secured funding from a venture capitalist and plan to expand their operations. So far they had a flat network topology which was sufficient for their needs. Their ecommerce website was also hosted on an on-prem web server. They are now moving to a new facility and have hired and restructured as follows -

- 3 employees are in finance department,
- 5 employees are in HR,
- 4 employees are in Marketing and
- 4 employees are in software development

Every department of the organization is on different floors: Finance on the first floor and HR, Marketing and Software development are on the second, third and fourth floors respectively. Ground Floor takes care of Walk in customers, who can use organization networks in their smart devices but along with following constraints:

- customers can access internet only on smartphones
- customers cannot access any social media sites
- only mode of internet access is Wi-Fi.

You can also provide 2 computers in this section where customers can find more information about the organization.

Constraints with respect to Departments:

- No one can access the data related to finance Department but vice a versa is possible.
- HR department can access Marketing and Software development department but vice a versa is not true.
- Marketing and software departments can communicate to each other over network and data is transparent to each other.
- Provides adequate security for all of the company communications and documents (especially sensitive sales documents)
- Fast and have additional capacity as the company grows
- Provides for centralized printing in every floor.
- Provides customers with a general information Website and a secure Website where clients can buy services, and products.
- Provides for 3 9's availability
- Provides for centralized management and control of the, so that you can maintain the network from remote location.
- Provides for long-term cost effectiveness
- Provides a suite of software tools for the employees to effectively communicate. Google search, office 365, outlook for email

For this organization network, all the phases of PPDIOO will impact the design decision making. Along with this following design points should be taken care: Designing LANs and Utilizing remote connection design.