Network Emulator
Project4

Daniel Salami
Department of Computer Science
Western Kentucky University
Bowling Green, KY 42104
danielolumide.salami432@topper.wku.edu

Noah Gary
Department of Computer Science
Western Kentucky University
Bowling Green, KY 42104
noah.gary394@topper.wku.edu

I. Introduction

The goal of this project is to create a simulator composed of network routers and links. In this simulator, you are to create router processes (essentially router objects or processes) that can be located anywhere in the network (unique IP address). The simulation consists of adding routers to the network by spawning the router process and initializing its links to other routers. The network simulator should be designed to accommodate up to 10 network routers. The simulator should also include a program for visualization. This program shouldn't modify the network. Its purpose is to give a visual snapshot of the current state of the network. The visualization program should react changes to the network (add/remove routers/links) in (near) real time.

A. Approach

The approach taken in order to accomplish the completion of this project is rather complicated and different. Seeing as this is the first time we are actually working on a network simulator. We decided we could easily make a router class to handle the router objects and the properties needed for the entire router like neighbours, IP and Port number. We also made a monitor class that extends the router class; this class acts like a driver class for the entire program. The monitor class connects to the router class and creates router objects. It connects the router objects to one another. In the monitor class, we import a graph library called networkx which enables us create a GUI for the entire program.

B. Resources Used

The resources used for this project include things like the language, the library, websites used to research the required knowledge etc. The language used is python, we decided to go with python because the course was broken down into several different projects consisting of project 1, project 2, project 3 and project 4. From the beginning of the project, both group partners have started with python and when this python demanded us working in teams, we pretty much went along with each other because we started off with the same language. Python also makes this project alot easier compared to other languages like JAVA and C. Although python is pretty much less complicated, there are other languages that make this project alot easier, like GO. For the other part of the project, we had to provide a visual interface for the network simulation. we looked up the documentation of graphs in python, and we went with the one that seemed the most useful. Networkx! you have to install the package in the python compiler, more of this in the how to run section. The graph library is really handy at the same time, has some difficulties. For example, dealing with router objects as nodes, it doesnt provide a very good way to label the nodes. One would have to cast the router object name parameter as a simple string for the nodes of the graph to be labelled. A lot of research had to be done also to get to the current state that the project is. We used certain websites as references including the website body in charge of the networkx package and also i think its irrelevant to mention stackoverflow, we pretty much check the website everyday for different classes. We also referenced a couple of class slides to get rid of some arguements regarding certain misconceptions.

C. Challenges

First off, this project is definitely one that i didnt expect to be this demanding. We attempted to work on the challenges but it was futile. mostly because our approach wasn't completely detailed and we didnt account for everything we needed to cover. One of the challenges we encountered was making the GUI as well as getting challnge 3 to work sinc that was the one we really aimed for. We also tried to implement a more friendly environment so its easier to run and debug. Another challenge we had was making up time, this project is quite demanding and we were unlucky in the sense that we had a difficult time meeting and working on the project. Almost all our classes require a project or a paper of some sort. if we wanted to get the full grade on this paper, we would need to pay less attention and time to some other project but there has to be balance so time management was key to completing the project. The group also consists of just two members as opposed to other groups that have three members (can't imagine doing this alone in 4 weeks with every other project i had to do). The group members also consists of people with different approaches to most of the challenges, we needed to agree on a certain approach in order to get to the point the project is up to. Another challenge we never quite got over simply cause we didn't have enough time spent on the project;

updating the GUI as the user decides to update or remove routers, this is quite annoying as i realize a do while loop would have probably done the trick but this limitation is as a result of not having a completely solid foundation of python.

D. Problems Overcome

There were certain problems to overcome over the course of the project. first off, we had different approaches to the project. Since we are just two, there wasn't really a way to agree to the best approach to take. One of us pretty much had to agree to the other person in order to get the best out of the project. It was also too late to decide to work on it alone so team agreement was a problem we had to overcome. Another issue we had was implementing certain functions; due to the dynamic structure of python, we had to debug smartly in order to figure out where we were having mistakes. Another problem we had was understanding the documentation for the graph library we were using, it was quite different from other libraries we have worked with. These were problems we faced and overcame over the course of this project.

E. Networkx

NetworkX is a Python language software package for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks. Networkx has quite a number of features, for example, Networkx features Python language data structures for graphs, digraphs, and multigraphs, many standard graph algorithms, Network structure and analysis measures, Generators for classic graphs, random graphs, and synthetic networks. Networkx is pretty simple to use but gets complicated with certain functionalities.

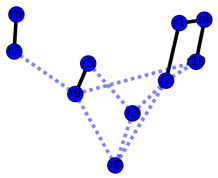

Fig. 1: Graph using Networkx

F. How to Run the Program

- The best way to run this program is on a UBUNTU operating system, using the terminals.
- You will need to download the networkx graph library package. http://networkx.readthedocs.io/en/stable/download.html this provides documentation on how to install the required package for the required OS. sudo apt-get install python-networkx for UBUNTU sudo apt-get install matplotlib.pyplot (might have to remove the .pyplot)
- The Project comes with two different python classes, router.py and monitor.py and a client.py as well as server.py
- The client and server codes were initially ment for the challenge 3.
- To Run the code, simply type
- python monitor.py
- The monitor.py class was designed to act as a driver for the entire project.
- Note: The GUI doesnt fully show the entire content, it simply displays a graphical representation of the router objects.
- Most of the required output can be seen on the terminal.

G. How to visualize the Challenges

- For challenge one, simply run the monitor.py
- you can close the figure image. Note: It also saves it to your download folder.
- pick one of the specified functions to view it.
- For challenge 2, we tried it on 2 computers using one router and it worked. Therefore all you have to do is specify the IP.

II. Conclusion

This project is definitely a more complex, demanding and time consuming one. Overall, we are glad we got the project done and a little of the challenges. We aimed to not have to take the final but that is probably not going to happen. I am glad i worked on this project because it increased my knowledge about alot Networks. We got challenge one, challenge two im not totally convinced but it worked sometimes.