
Project Assignment - Part 1

Introduction

This is the first part of the project assignment in Networks and Security - Fall 2014.

This is an individual assignment, and must be passed, in order to attend the exam. As a prerequisite for the exam, it is to be considered a part of the exam, and rules for cheating are the same as the exam.

Your solution must be uploaded in the e-learn.sdu.dk (Blackboard) system no later than

Wednesday November 19th. at 16.00. Late submissions will not be accepted.
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Read the entire assignment text before you start, so you know what you must turn in.

1 Problem 1: Distance Vector Algorithm

This exercise is designed to get you familiar with the Distance Vector algorithm.

Download and understand the code

Download the code from

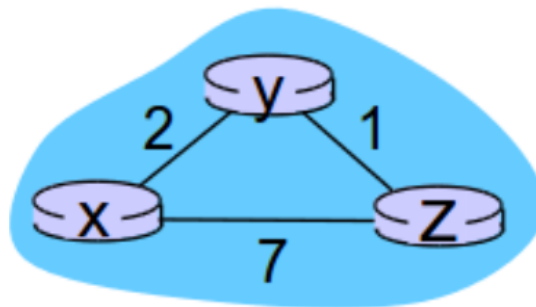
<http://imada.sdu.dk/~jamik/dm543-13/material/distance-vector.zip>.

The Main class handles setting up the routers, informing them of the number of total routers, their neighbours and the cost to each other.

The class you will have to work on is the Router.java

Try to identify:

- How is the Main class setting up the network with weights? Does that correspond to the network in the figure below? What is different?
- Study the runAlgorithm method. Make sure you understand what happens in the loop.



Implement the missing methods

- Open `Router.java`, and notice the three methods with a `TODO`. These must be implemented, so the program terminates with the correct distance matrices. (The values are in the slides here: <http://imada.sdu.dk/~jamik/dm543-14/material/chapter4.html#Distance-vector-algorithm---example>).
- *incomingDistanceVector* must update the distance matrix with values from neighbour
- *calculateDistanceMatrix* must calculate the distance vector for the router, and prepare an outgoing distance vector if there are any changes.
- *outgoingDistanceVector* if the distance vector have changed, it must return the new one. It should however only return this new vector once, and null, if there is not a new vector.

Changing weights

- Edit `Main.java`, and change the main method to run the other problem (*runReferenceProblemFromSlides()*) which is commented out. It is the next problem from the slides, where you can see how the algorithm handles new weights on an edge.

Answer these questions when turning in your assignment.

- Run the program, and describe what happens.
- How many iterations does the changes take? Any surprise? Explain why or why not.

2 Problem 2: Wireshark: DHCP

In this problem, we'll take a quick look at DHCP. DHCP is covered in Section 4.4.2 of the textbook. Recall that DHCP is used extensively in corporate, university and home-network wired and wireless LANs to dynamically assign IP addresses to hosts (as well as to configure other network configuration information).

DHCP Experiment

In order to observe DHCP in action, we'll perform a few DHCP-related commands and capture the DHCP messages exchanged as a result of executing these commands. Do the following:

Start up the Wireshark packet sniffer, as described in the introductory Wireshark lab and begin Wireshark packet capture.

Depending on your operating system do:

On Windows

In a command prompt, issue:

```
ipconfig /release  
ipconfig /renew
```

two times.

On Linux

In a command prompt, issue:

```
sudo dhclient wlan0
```

two times (or whichever your active network card is called if not `wlan0` - use `ifconfig` to examine).

On Mac

Follow this guide, to renew your IP address twice:

<http://osxdaily.com/2013/02/11/renew-dhcp-lease-mac-os-x/> (Warning, this is not tested, just googled - may contain errors!)

Stop Wireshark packet capture.

2.1 Examining the capture

Now let's take a look at the resulting Wireshark window. To see only the DHCP packets, enter into the filter field "bootp". (DHCP derives from an older protocol called BOOTP. Both BOOTP and DHCP use the same port numbers, 67 and 68. To see DHCP packets in the current version of Wireshark, you need to enter "bootp" and not "dhcp" in the filter.)

Make sure you have the BOOTP/DHCP protocol enabled (Analyze→Enabled protocols)

You should hand in a screen shot of the Command Prompt window containing the DHCP packets. Whenever possible, when answering a question below, you should hand in a printout of the packet(s) within the trace that you used to answer the question asked. Annotate the printout¹ to explain your answer. To print a packet, use File→Print, choose Selected packet only, choose Packet summary line, and select the minimum amount of packet detail that you need to answer the question.

Answer the following questions in your assignment:

1. Are DHCP messages sent over UDP or TCP?
2. Draw a timing diagram illustrating the sequence of the first four-packet Discover/Offer/Request/ACK DHCP exchange between the client and server. For each packet, indicated the source and destination port numbers.
3. What is the link-layer (e.g., Ethernet) address of your host?
4. What values in the DHCP discover message differentiate this message from the DHCP request message?
5. What is the value of the Transaction-ID in each of the first four (Discover/Offer/Request/ACK) DHCP messages? What are the values of the Transaction-ID in the second set (Request/ACK) set of DHCP messages? What is the purpose of the Transaction-ID field?

¹What do we mean by "annotate"? If this was a paper copy, please highlight where in the printout you've found the answer and add some text (preferably with a colored pen) noting what you found in what you've highlight. Since this is an electronic copy, it would be great if you could also highlight and annotate in a similar way.

6. A host uses DHCP to obtain an IP address, among other things. But a host's IP address is not confirmed until the end of the four-message exchange! If the IP address is not set until the end of the four-message exchange, then what values are used in the IP datagrams in the four-message exchange? For each of the four DHCP messages (Discover/Offer/Request/ACK DHCP), indicate the source and destination IP addresses that are carried in the encapsulating IP datagram.
7. What is the IP address of your DHCP server?
8. What IP address is the DHCP server offering to your host in the DHCP Offer message? Indicate which DHCP message contains the offered DHCP address.
9. Explain the purpose of the router and subnet mask lines in the DHCP offer message.
10. What is the purpose of the DHCP release message? Does the DHCP server issue an acknowledgment of receipt of the client's DHCP request? What would happen if the client's DHCP release message is lost?

3 What to hand in

You must make a zip file with the following structure:

```
<your-sdu-username>.zip
|_ code
|_ doc
```

- The *code* folder must contain the .java files from problem 1
- The *doc* folder must contain a single pdf with your answers for the questions in this assignment.