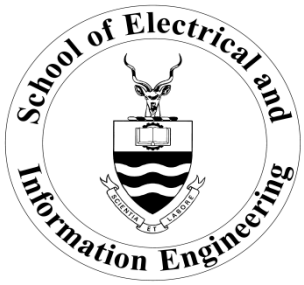
School of Electrical and Information Engineering
University of the Witwatersrand, Johannesburg.



ELEN4017: Network Fundamentals
Instructor : Prof. Ling Cheng

File Transfer Application

1. Introduction

The goal of this project is to create a file transfer application system. The file transfer application system will make use of the networking principles studied in the class e.g. protocols, application and transport layer, socket programming etc. You can imagine the components of the file transfer application system that we use in our daily lives e.g. FTP application to have an idea of basic functions/entities in a file transfer application system, however the project requires implementation of only some of these functions/entities so as to limit the scope.

Just like other file transfer application systems, your application should allow any user to send and receive different types of files via the file transfer client. File transfer client will interact with the corresponding server and should be able to either receive/download or send/upload files to a desired repository on the server.

Note that although programming languages like Python may provide libraries that implement the required protocol i.e. FTP for you but this hides away the functionality of these protocols. Hence, you are **not allowed to use the standard libraries for these protocols** and should only use the basic socket methods. This would also imply that you would need to consult the RFC (Request for Comment) document for the FTP protocol in order to implement the protocol in a standard manner. Once the protocol is implemented as per the RFC, your file-transfer client be able to communicate and exchange files with your own developed server and should also be able to perform these tasks with standard FTP servers as well.

2. Project Tasks

Developing the file-transfer application would require implementation of the following features. These are minimal features to be implemented. You can extend them based on your needs:

A. Features of the File-Transfer Client

1. A simple user interface allowing the user to perform required tasks e.g. login, upload/download files, enlist files in the server directory, status etc.

2. The implemented tasks should be performed as per the methodology specified in the FTP RFC document for that particular function/task.
3. The client should implement at least a basic commands of the FTP protocol. Section 5.1 in the document of RFC 959 [1] discusses a set of commands for minimal implementation which can be considered as a reference for the minimum set of commands to be implemented.
   You are welcome to implement more commands from the RFC, if needed.

B. Features of the File-Transfer Server

1. The file-transfer application server should maintain the records and repositories for different users. Please consult if RFC specifies anything in this regard.
2. Implement the server-side of the implemented commands e.g. the commands mentioned in section 5.1 of RFC 959 for a minimal implementation.
3. Note that many of the protocol commands from the client would solicit a reply from the server, see section 4.2 in RFC 959. You are not required to implement all the reply codes but should implement at-least 5 reply codes, preferably from different reply code groups. Please specify the reply codes implemented in your final report as well as justify your choice of implemented reply codes.
4. Your file-transfer application server should not only be able to interact with your own implemented client, but also with a standard FTP client e.g. FileZilla etc.
5. A Multi-threaded version of the file transfer application server must also be created.

C. Other Features

1. Your file-transfer application must be able to deal with different types of files i.e. text, images, video clips etc.

2. The implemented file-transfer application server should be able to talk to the implemented client in both the cases: 1) client and the server are both hosted on the same PC/host and 2) client are server are on different hosts in the network.

3. The client and the server should be able to deal with common errors and generate appropriate responses as per RFC. Please specify the errors catered for in your final report.

4. You should be able to show that Wireshark can be used to monitor protocol messages between the client and the server.

5. The protocol implementations should strictly follow the respective RFC for the format of all the request and response messages and the order and types of messages exchanged. For this, you will have to go through the details of the RFC concerning your implemented commands and actions. This is important for communicating with the standard clients and servers, for which it is also important to know the type and version of protocols implemented by the concerned standard clients and servers.

6. You are ONLY allowed to use low level socket class and associated methods for implementing the protocols needed for the file-transfer application, and the use of higher-level classes/libraries for such purposes is not allowed. However, for other aspects such as parsing, dealing with multimedia etc. you can make use of built-in libraries, if needed.

Finally, any suggestions to modify/improve the above system are welcome and can be discussed in class. Any cool additional features can get you bonus marks.

3. Project Assessment

This project contributes 30% to the total mark for the course. The assessment policy is as shown in the following table:

Outcomes	**Checklist**	**Marks**
Features Implemented as per section 'Project Tasks' above.	1. FTP client basic features 2. FTP server basic features 3. Interaction with standard FTP server and client 4. Ability to deal with different types of files 5. Multithreading 6. Use of Multiple PCs 7. Use of Wireshark	14%
Demo + Q&A	- Questions related to theory concepts related to the project as well as about the coding will be asked individually during the demo.	4%

Report	- Each group should submit a single report - Maximum 5 double-column pages excluding the appendices. Should contain: 1. Introduction 2. Description of the implemented system and the implemented features. What features could not be implemented and why. 3. Brief description of commands/replies for each protocol that were implemented. 4. Implementation of features in detail **5. Division of Tasks and Individual Contribution (in code and report)** 6. Results (Wireshark Screenshots etc.) 7. Critical Analysis 8. Basic structure of the code (Classes, methods etc.) and how to use the code 9. References 10. Appendix	10%
Source Code	– Should be well commented – Must have a readme file detailing how to use the code – Should be sent electronically	2%

4. Other Details

- You should form a group of 2 students. Groups must be **finalized by April 2nd and details of group members must be sent to the course instructor** at ling.cheng@wits.ac.za so that a Group Number can be allocated to each group.
- Slots for demos will be published later and each group will select a slot. You will be required to give a demo of the implemented features for different cases. You are expected to know both the theory as well as the coding aspects of the project and you might be asked about any relevant concept, any portion of the code and/or to modify the code during demo.
- I would recommend doing the implementation in Python language, but in case you prefer to use another language, kindly let me know beforehand. **Please specify your language, OS and IDE before your demo. It would be your responsibility to make sure beforehand that your software is working on the systems that will be used for demos.**
- **Individual Contribution**

- The final report must describe all work undertaken in the project, and must explicitly describe the individual's contribution
- A good description would be "wrote function xyz() in server implementation." A bad description would be "wrote some server code".
- The individual must discuss the implementation of their own code in the report.
- The source code must clearly indicate which individual has authored each code segment.

- Plagiarism in any form will be strictly dealt with as per School's policy.

5. Submission and Demonstration Details

The submission deadline, as per deadlines given by School for 4th year projects, is at **07h50 on Monday, ~~May 6th, 2019~~**. You are required to submit the following project components by the given deadline:

1. Electronic-copy of all the project material (report, source code etc.) via email. All project material should be zipped as a single file and submitted with the name 'Group_X' where X would be the group number allocated to you.
2. The project will be demonstrated on ~~Tuesday, May 7th, 2019.~~

Late submission will be penalised according to guidelines specified in the "*Red Book*".

References:

1. https://tools.ietf.org/html/rfc959
2. https://www.wired.com/2010/02/ftp_for_beginners/
3. https://www.go4expert.com
4. https://www.ncftp.com/libncftp/doc/ftp_overview.html