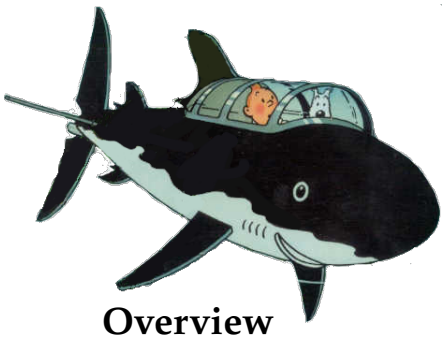
CS 447 : Networks and Data Communications

Programming Assignment #03

Total Points: 150



Assigned Date : Thursday, June 14, 2018
Due Date : Tuesday, June 26, 2018 @ 10:59:59 a.m. (Strong Deadline)

Overview

For your third (and final) project, you will implement a secure client/server application using TLS (Transport Layer Security). **Note:** This final assignment has a **firm deadline** and does not include the typical 48-hour late penalty period. Here's the back story.

Back Story

Haddock was quite happy with the new and improved email system until the Thomson and Thompson showed up one day with some devastating news. "*You know Haddock, even with authentication, we can still read all your emails using* `Wireshark`*, right Thompson?*", said Thomson. *"Precisely Thomson. In fact, anyone can use* `Wireshark` *to read all your plaintext emails,"* replied Thompson.
Haddock ran down the hallway and stormed into Calculus's office. "*Blue blistering barnacles! Calculus*", screamed Haddock. "*Those two Thompsons are using a shark to read my emails?*". Calculus calmed Haddock and explained to him that he plans to use Transport Layer Security (TLS) in the next iteration of the email system to make it even more secure.

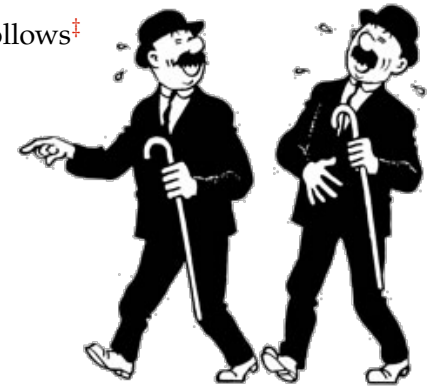
Technical Requirements

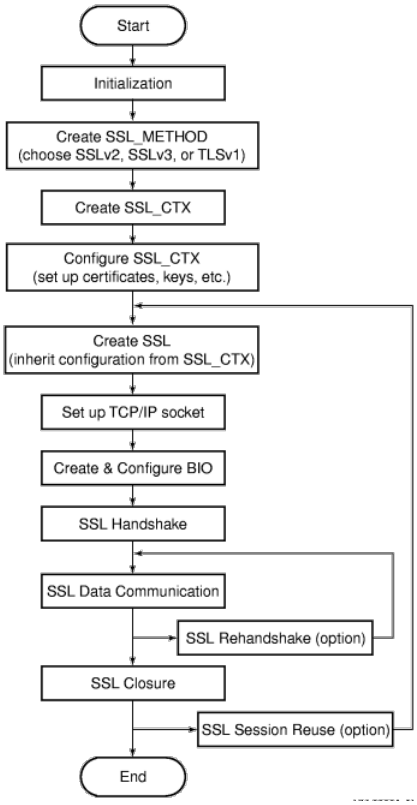
In order to keep this assignment within the time spec of the project and to accommodate the fact that TLS requires a reliable Trasport Layer protocol, the technical requirements of this assignment are simplified in the following manner.

1. Your email whole application, i.e, `sender` → `server` and `server` → `receiver`, now happens over TCP. What this means is, you will now have to re-write your SMTP portion from PR02 in TCP.
2. All other PR02 technical requirements except requirements associated with UDP still applies to PR03. This includes sender/receiver authentication, password strategy, and server incident management.
3. Before initiating the SMTP protocol interaction, your client and the server must establish a secure channel using TLS. See Logistics below for more information.
4. Your solution must use a `TLSv1` (or newer depending on your language support) negotiation. Refrain from using any of the (old) SSL negotiations.

Logistics

- All applicable PR02 Logistics requirements applies to PR03. Ignore any logistical requirements related to UDP.
- You must provide proof of secure communication. To do this, run `Wireshark` with and without SSL separately, and provide appropriately annotated screenshots in your report. Failure to provide sufficient proof of secure communication will be considered as an indication of not meeting project requirements.
- The general workflow of SSL integrated socket communication is as follows[‡]





The nature of this assignment will force you to do significant amount of unsupervised learning – online research, forum scans, trial-and-error, and troubleshooting. Most likely, you will also discover (on your own) that there are more than one library package implementation of `openssl` standard, especially for C/C++, which might further complicate your task. So, don't get frustrated but instead use this as very valuable learning opportunity. Here are some resources that I believe will help you.

1. **HP SSL Programming Tutorial:**
   http://h41379.www4.hpe.com/doc/83final/ba554_90007/ch04s03.html
2. **Fedora Security Team – Defensive Coding**
   https://docs.fedoraproject.org/en-US/Fedora_Security_Team/1/html/Defensive_Coding/index.html

[‡]Figure from the HP SSL Programming Tutorial.

3. **OpenSSL Wiki – Simple TLS Server:**
   https://wiki.openssl.org/index.php/Simple_TLS_Server
4. **OWASP – Using the Java Secure Socket Extensions:**
   https://www.owasp.org/index.php/Using_the_Java_Secure_Socket_Extensions
5. http://simplestcodings.blogspot.com/2010/08/secure-server-client-using-openssl-in-c.html
6. http://stilius.net/java/java_ssl.php
7. https://media.readthedocs.org/pdf/pyopenssl/latest/pyopenssl.pdf

Almost all of these helpful resources also include sample code that might aide you in your overall design and development.Using online resources does not mean you are allowed to copy and use someone else's code for your purpose. Such incidents, if detected, will be treated as academic dishonesty, so please do not copy-paste some else's code in your solution. Instead, try to grasp the core idea behind their solution and weave it in to your own work.
If you find a resource that you think will help your classmates, please share it with me so that I can disperse it among you colleagues.

Instructions

- **Start early!!**
- **Take backups of your code often!!**.
- Follow a good coding standard. Use a Google style guide appropriate for your favorite programming language found here https://google.github.io/styleguide/, if you don't already follow one.
- The due date of this assignment is **Tuesday, June 26, 2018 @ 10:59:59 a.m.** A dropbox will be opened for submission through Moodle. This is a **firm deadline** as the final assignment does not include the typical 48-hour late penalty period.

Deliverables

A complete solution comprises of:

- A short report (max 5 pages) in **PDF** format of the design and implementation of your system. Your report should include the followings:
  - Introduction
  - Design choices and protocol/reply codes used.
  - The output of a sample run (including screenshots where applicable).
  - Summary and Issues encountered (if applicable).

  Note: Your report will carry a significantly more weight in compared to the other two projects as it will be a reflection of your unsupervised learning efforts. Please make sure to document your efforts and to develop a good project report.
- A short **`readme`** file with compilation instructions. A **`makefile`** is mandatory if your solution involves running multiple compilation instructions. The only exception, most likely, would be Python.
- A compressed tarball of the directory containing your source code. **Do not** include executables, folders created by your programs, or your test emails in this tarball. To create a compressed tarball

of the directory source, use the following command: `tar -zcvf siue-id-pr2.tar.gz source/`. e.g. `tar -zcvf tgamage-pr2.tar.gz PR02/`.

Caution: File formatting standards (`PDF`, `readme`, `make`, and `tar.gz`) as well as some of the logistics requirements are set forth to streamline the grading process. Submissions that take a unnecessarily long time grade due to not following the standards listed in this document will be subject to penalties.

Collaborating on ideas or answering questions is always encouraged. Most times, I find that you learn a lot from your peers. However, do not share/copy/duplicate code from others. If you use code found online, remember to cite their source in your report. Issues related to academic integrity and plagiarism have **ZERO** tolerance.

Extra Credit (20%): Submissions that meet (or exceed) at least 75% of project objectives are eligible for up to 20% extra credit for `ncurses` text-based UI integration.