HTW-Berlin / Fachbereich-4
Internationaler Studiengang Medieninformatik
Modul: Netzwerke
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Aufgabenblatt-02

Hochschule für Technik und Wirtschaft Berlin
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Homework Instructions

Submission Deadline: The homework must be submitted within the next two weeks.

Grading Criteria:

- Your assignment will be graded as either **1 (Pass)** or **0 (Fail)**.
- To receive a passing grade, you must solve **75% or more** of the assignment correctly.
- **Feedback Policy**: Detailed feedback on individual solutions will not be provided. After the submission deadline, a complete solution will be published, allowing you to compare your work with the ideal solution. Use this to evaluate your approach and understand any mistakes.

Important:

- Please make sure to submit your work on time. Late submissions will not be accepted.
- Make sure to clearly explain your calculations and reasoning.
- **Solution Steps and Clarifications**: Be prepared! The lecturer may ask any student in your group during class or online to explain the solution steps and reasoning for any problem. Make sure that everyone in your group understands the approach and can explain why the problem was solved in that particular way.
- **Group Contribution**: For each homework problem, list the name(s) of the student(s) from your group who worked on that specific problem. This will help in tracking contributions and ensuring everyone participates.
- **Language**: You may write your answers in **German, English, or a mix of both**. Choose the language you feel most comfortable with.

Homework Problem 1: HTTP Delay Analysis. (25 Points)

Calculate and compare the delay for two HTTP requests using non-persistent and persistent connections between two hosts with one router that uses store and forward between the client and the server. Use the provided values to compute each delay component and illustrate your findings with a timing diagram.

Scenario

- Hosts: Host A (Client) and Host B (Server) communicate over HTTP.
- Router: A single router is located between Host A and Host B.

Each HTTP request follows the path:

1. From Host A to the Router
2. From the Router to Host B

Given Values

1. Propagation Delay (Host A to Router): D_AtoR = 10 ms
2. Propagation Delay (Router to Host B): D_RtoB = 20 ms
3. Processing Delay (Router): D_proc = 5 ms
4. Queuing Delay (Router): D_queue = 10 ms
5. Transmission Rate of Link (Host A to Router and Router to Host B): R = 1 Mbps

Data Packet Sizes:

- First HTTP Data Packet Size: L1 = 50 KB
- Second HTTP Data Packet Size: L2 = 100 KB

Round-Trip Time (RTT) (excluding transmission delay) can be calculated as:
RTT=2×(D_AtoR + D_RtoB + D_proc + D_queue).

Task Instructions:

1. Calculate Total Delay for Non-Persistent HTTP Connection:
    a. Non-Persistent Connection: Each HTTP request uses a new TCP connection with a separate three-way handshake (SYN, SYN-ACK, ACK).
    b. Calculate the total time it takes for the client starting from initiating the TCP-Connection till it receives both packets completely.
2. Calculate Total Delay for Persistent HTTP Connection:
    a. Persistent Connection: A single TCP connection is established, shared by both HTTP requests, and requires only one three-way handshake. For the following packets it would take only a one RTT and transmission delay instead of two RTT and transmission delay
    b. Calculate the total time it takes for the client starting from initiating the TCP-Connection till it receives both packets completely.
3. Draw the Timing Diagram:
    a. Create a timing diagram illustrating each delay component (handshake, data transmission, processing, queuing, propagation) for both non-persistent and persistent connections.
    b. Label each part of the delay in the diagram.
4. Summary (100 words):
    Briefly explain the difference in delay times between non-persistent and persistent connections.

Homework Problem 2: Choosing a Network Application Architecture. (15 Points)

Scenario: You are tasked with designing a network-based application. Describe its purpose and basic requirements, then choose either a Client-Server or Peer-to-Peer architecture based on these needs.

- Application Requirements: Define and document the following minimum requirements for your application. (150-250 Words):
    - Purpose and User Interaction: Describe the application's purpose and how users will interact with it. (Examples: messaging app, file-sharing service, multiplayer game).
    - Key Decision Factors: For each factor below, specify the needs of your application:
        - Timing: Does the application require real-time responsiveness (e.g., online gaming), or is some delay acceptable?
        - Throughput: Is high data transfer (e.g., video streaming) critical, or will lower throughput suffice?
        - Reliable Data Transfer: Does your application need reliable delivery of all data (e.g., file sharing), or is it more tolerant of potential data loss?
        - Security: Describe any security requirements. Does the application need strict access control, encryption, or secure data management (e.g., financial transactions), or are security needs minimal?
- Choose the Architecture: Select one of these two architectures for your application and reason your choice. Give one disadvantage of the chosen architecture. (150-250 Words):
    - Client-Server Architecture: Centralized servers manage user requests and data. This architecture can provide strong control over security, reliability, and data consistency, but may face challenges with scalability and latency.
    - Peer-to-Peer Architecture: Users (peers) connect and share resources directly, enhancing scalability and throughput for large data sharing. However, it may compromise security and reliable data delivery, as control is decentralized.

Homework Problem 3: Choosing Between UDP and TCP. (10 Points)

Scenario: You are tasked with designing a network-based application. Describe its purpose and basic requirements, then choose either UDP or TCP as the transport protocol based on the application's needs.

Application Requirements: Define the following minimum requirements for your application:

1. Purpose and User Interaction: Describe the application's purpose and how users will interact with it. (Examples: live video streaming, file download service, messaging app, real-time multiplayer game).

2. Key Decision Factors: For each factor below, specify the needs of your application:
    a. **Reliability:** Does the application need reliable data transfer, where every packet must be received in the correct order (e.g., file download), or is it tolerant of some data loss (e.g., live video streaming)?
    b. **Latency:** Is low latency (minimal delay) important for user experience (e.g., real-time gaming), or is a small delay acceptable as long as all data arrives correctly (e.g., file transfers)?
    c. **Throughput:** Does the application need high throughput for transferring large amounts of data quickly, or can it work with a lower data rate?

Task: Choose the Transport Protocol
Select one of these two transport protocols for your application:

- TCP (Transmission Control Protocol): TCP provides reliable, ordered, and error-checked delivery of data packets. It is suitable for applications that require data integrity and delivery guarantees but may introduce some delay due to error checking and packet retransmission.
- UDP (User Datagram Protocol): UDP provides fast, connectionless data transfer without error-checking guarantees. It is suitable for applications that prioritize speed over reliability, such as live streaming or gaming, where some data loss is acceptable.

In 150-200 words, explain your choice based on:

- Why the protocol is suitable for your application's purpose and decision factors (reliability, latency, and throughput).
- One advantage and one drawback of the chosen protocol for your application.

Homework Problem 4: Multiple choice. (12 Points).

Solve the multiple choice questions (1, 2, 3, 5, 7, 9, 11, 12) of chapter-2 on the companion website of the book and Show all steps in detail.
https://media.pearsoncmg.com/ph/esm/ecs_kurose_compnetwork_8/cw/content/self-assessment-mc/self-assessment-mc.php#self-assessment-mc-2

Homework Problem 5: True or False. (8 Points).

Solve the true or false questions (1, 2, 3, 6, 7, 8, 9, 11) of chapter-2 on the companion website of the book. Reason your answers in detail.
https://media.pearsoncmg.com/ph/esm/ecs_kurose_compnetwork_8/cw/content/self-assessment-tf/self-assessment-tf.php#self-assessment-tf-2

Homework Problem 6: HTTP Packet Capture and Analysis Using Wireshark. (30 Points)

Objective:
The purpose of this assignment is to give you hands-on experience with network traffic analysis by using Wireshark (https://www.wireshark.org/) to capture and analyze HTTP requests. By doing so, you will gain insight into how data packets are structured and transmitted over a network.

Instructions:

- Group Work Requirement:
  - This assignment is a group project; however, each group member must complete the packet capture and analysis individually. Each member's findings will be compiled into a final group report.
  - Include screenshots from Wireshark that support each summary.

- Wireshark Setup:
  - You may use Wireshark on any operating system (Windows, macOS, or Linux).
  - Ensure you have the appropriate permissions to run Wireshark, especially on Linux systems, where additional setup might be needed.

- Task: Read the paper, run wireshark and answer all questions at the end:
  - The paper is available on the companion website of the book. Under wireshark labs choose getting started v8.1.
  - If you click the link below the paper will be downloaded in MS-Word document format.
  - https://www-net.cs.umass.edu/wireshark-labs/Wireshark_Intro_v8.1.docx

Good Luck