**Client-Server Data Transmission Tests**

**Overview**

This document presents the results of a series of tests on client-server data transmission using two protocols (TCP and UDP), two mechanisms (streaming and stop-and-wait), and various message sizes. The goal of the tests was to measure the time to transfer various amounts of data under different conditions.

**Options**

The following options were available for the client and server:

**Protocol**

* **TCP**: A connection-oriented protocol that provides reliable, ordered, and error-checked delivery of data.
* **UDP**: A connectionless protocol that provides unreliable, unordered, and unchecked delivery of data.

**Mechanism**

* **Streaming**: Data is sent continuously without waiting for an acknowledgment from the receiver.
* **Stop-and-wait**: Data is sent one message at a time, and the sender waits for an acknowledgment from the receiver before sending the next message.

## Results

The following tables summarize the results of the tests for each combination of protocol, mechanism, and message size.

|  |  |  |  |
| --- | --- | --- | --- |
| Message Size = 1000MB | Number of Messages | Transmission Time | Buffer |
| TCP Stop-Wait | 16132 | 1.076 | 65000 |
| TCP Streaming | N\A | N\A | 65000 |
| UDP Stop-Wait | 16132 | 248.753 | 65000 |
| UDP Streaming | 16132 | 4.676 | 65000 |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Size = 500MB | Number of Messages | Transmission Time | Buffer |
| TCP Stop-Wait | 8066 | 0.632 | 65000 |
| TCP Streaming | N\A | N\A | 65000 |
| UDP Stop-Wait | 8066 | 124.561 | 65000 |
| UDP Streaming | 8066 | 2.368 | 65000 |

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| --- | --- | --- | --- |
| Message Size = 50MB | Number of Messages | Transmission Time | Buffer |
| TCP Stop-Wait | 807 | 0.067 | 65000 |
| TCP Streaming | 807 | 9.163 | 65000 |
| UDP Stop-Wait | 807 | 12.472 | 65000 |
| UDP Streaming | 807 | 0.237 | 65000 |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Size = 5MB | Number of Messages | Transmission Time | Buffer |
| TCP Stop-Wait | 81 | 0.005 | 65000 |
| TCP Streaming | 81 | 0.089 | 65000 |
| UDP Stop-Wait | 81 | 1.257 | 65000 |
| UDP Streaming | 81 | 0.249 | 65000 |

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| --- | --- | --- | --- |
| Message Size = 1000MB | Number of Messages | Transmission Time | Buffer |
| TCP Stop-Wait | 32264 | 1.489 | 32500 |
| TCP Streaming | N\A | N\A | 32500 |
| UDP Stop-Wait | 32264 | 498,101 | 32500 |
| UDP Streaming | 32264 | 9.105 | 32500 |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Size = 500MB | Number of Messages | Transmission Time | Buffer |
| TCP Stop-Wait | 16132 | 0.758 | 32500 |
| TCP Streaming | N\A | N\A | 32500 |
| UDP Stop-Wait | 16132 | 248.977 | 32500 |
| UDP Streaming | 16132 | 4.488 | 32500 |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Size = 50MB | Number of Messages | Transmission Time | Buffer |
| TCP Stop-Wait | 1614 | 0.076 | 32500 |
| TCP Streaming | 1614 | 18.325 | 32500 |
| UDP Stop-Wait | 1614 | 24.906 | 32500 |
| UDP Streaming | 1614 | 0.453 | 32500 |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Size = 5MB | Number of Messages | Transmission Time | Buffer |
| TCP Stop-Wait | 162 | 0.009 | 32500 |
| TCP Streaming | 162 | 0.177 | 32500 |
| UDP Stop-Wait | 162 | 2.499 | 32500 |
| UDP Streaming | 162 | 0.455 | 32500 |

**Observations**

The following observations can be made from the test results:

* TCP Stop-Wait had the fastest transmission times for all messages sizes.
* TCP Streaming was faster than UDP on smaller messages size like the 5MB.
* UDP Streaming had a lot faster transmission than UDP Stop-Wait as the message size increased.
* TDP Stop-Wait transmission time is slightly increase from doubling the buffer size (from 32500 to 65000) unlike the rest doubled.
* UDP Stop-Wait is the most affected when the buffer size is doubled.
* We can notice that UDP Streaming seems to improve the transmission time when the message size increased from 5 MB to 50 MB, but the improvement is not kept when the size gets to 500MB.

**Conclusion**

The choice of protocol and mechanism can have a significant impact on the time to transfer data over a network, especially for different message sizes. In general, TCP Stop-Wait provides the fastest transmission times for all scenarios. UDP Stop-and-Wait mechanism are significantly slower than UDP Streaming mechanism for all message sizes. The results of these tests can be used to inform decisions about the appropriate protocol and mechanism to use for different types of data transmission scenarios based on the written code.