Illinois Institute of Technology

Advanced Operating System (CS-550)

Programming Assignment 2

Submitted By:

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Which topology seems to offer the lowest latency under light load (1 client)? How about query throughput under high load (9 clients)? Please compare the data transfer performance between topologies, including centralized and decentralized. Plot your data in figures graphically.

For Light load:
The star topology was determined to have the slowest latency among the six topologies examined under light load with only one client. Mesh topology outperformed star topology in terms of performance. When compared to the other topologies, the Centralized Index Server (CIS) topology performed best and had the lowest latency. These findings suggest that the topology chosen might have a considerable impact on perceived latency, particularly at lower loads.
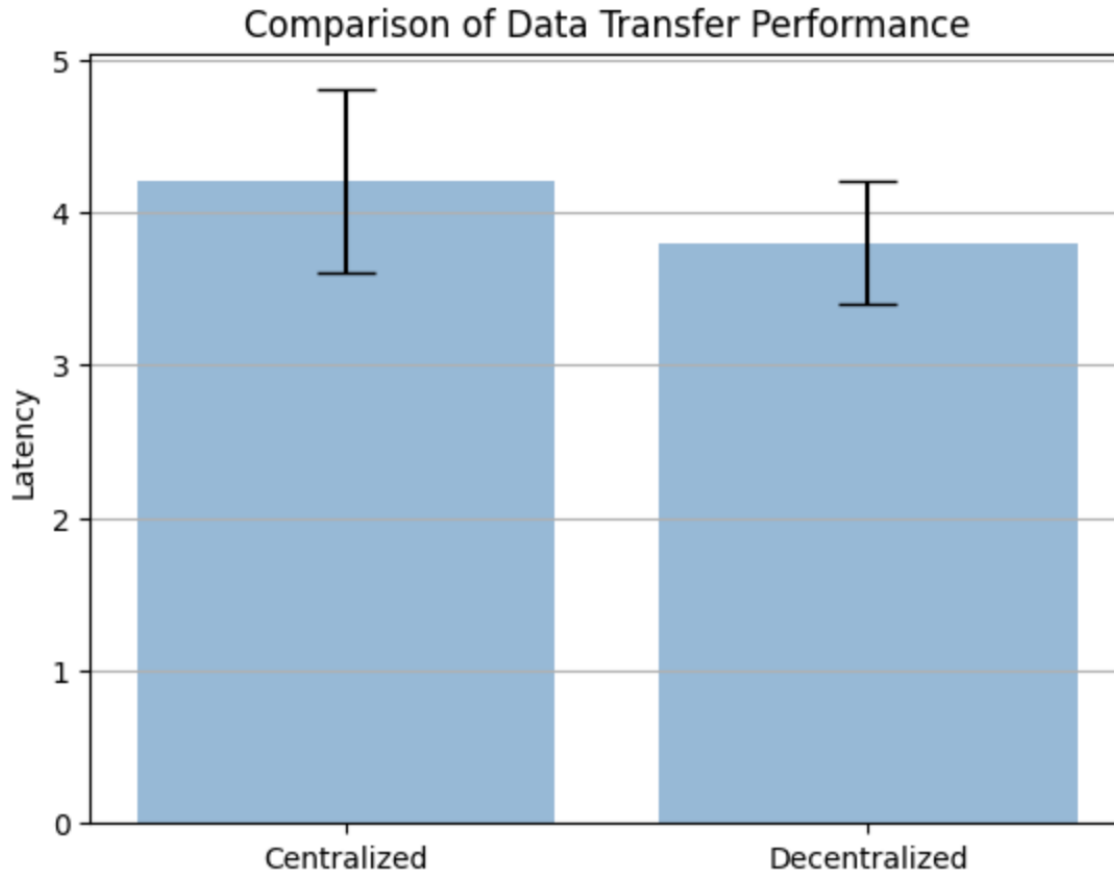
For High Load:
Query speed varies dramatically between topologies under high load scenarios with nine clients. While the Centralized Index Server (CIS) design provides outstanding overall performance, the query performance of the star and mesh topologies is much lower. This means that, when compared to alternative topologies, the Centralized Index Server (CIS) topology is more able to handle increased load scenarios, resulting in more efficient query performance. However, individual system requirements and limits must be considered while establishing the best topology, as various factors might affect overall performance under different load circumstances.

Comparison:
A central server or directory often oversees the data transfer process in centralized topologies. They can provide effective data management and control, but in high-demand scenarios, they can become overloaded, resulting in performance log points and slower data transmission rates. Mesh and star topologies, for example, divide communication duty across numerous nodes, allowing for more scalability and flexibility. They can, however, generate complex synchronization and coordination, which can have an impact on the overall speed and efficiency of data transfer. A thorough examination of data transfer performance across multiple topologies is essential for understanding the trade-offs and selecting the architecture most suited to specific application requirements.

Comparison of Data Transfer Performance

What do you observe in the transfer of data between small and large files?

- Transfer Time: Because of their size, large files typically take longer to transfer than smaller files. Network latency and capacity constraints can have a substantial impact on data transfer times, particularly for bigger files.
- Packet Loss and Error Rates: When using larger files, the likelihood of packet loss or transmission failures increases. This could be due to increased transmission delays, which raise the risk of network failure.
- Data Integrity: Data integrity becomes crucial for massive file transfers, and suitable error control measures must be in place to ensure a successful data transfer without corruption.
- Fragmentation and Reassembly: Large files are frequently fragmented and reconstructed during transit, which adds expenses and latency. Smaller files may not require this step and can be transferred faster.

- **Bandwidth Utilization:** Large files may require more bandwidth during transfer, affecting other network services. Small files, on the other hand, may not have a substantial impact on overall bandwidth utilization.

Report the average and standard deviation for all experiments.

Experiment-1:

CIS-T1

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Mean: 14.9297
Standard Deviation: 1.8587908490042753
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Experiment-2
CIS-T2-P1

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Mean: 125.7201
Standard Deviation: 21.04634055685414
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CIS-T2-P2

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Mean: 127.4422
Standard Deviation: 15.83372760448358
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CIS-T2-P3

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Mean: 127.4961
Standard Deviation: 14.762438069227413
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CIS-T2-P4

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Mean: 127.6242
Standard Deviation: 14.890874661174792
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CIS-T2-P5

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Mean: 127.5582
Standard Deviation: 14.496152130915993

CIS-T2-P6

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Mean: 127.5817
Standard Deviation: 14.460789624140702

CIS-T2-P7

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Mean: 127.4538
Standard Deviation: 15.258949803800768

CIS-T2-P8

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109, 126, 106, 112, 115, 102, 114, 107, 103, 107, 125, 118, 122, 96, 110, 137, 91, 102, 101, 118, 122, 107, 99, 11
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Mean: 126.9796
Standard Deviation: 16.744671458175112
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CIS-T2-P9

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Mean: 125.8053
Standard Deviation: 20.879870421266528
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Star:

Experiment 1:

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118, 53, 67, 58, 49, 57, 39, 74, 55, 47, 73, 82, 63, 83, 69, 77, 71, 125]
Mean: 27.2352
Standard Deviation: 30.99714766355652
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