**CS550 “Advanced Operating Systems”**

**Homework 5**

**Submission:**

**This is an INDIVIDUAL written assignment.**

**For prepare exam only, no grading.**

**Total points 100**

**Please do NOT email your assignment to the instructor and/or TA!**

1. What is PFS and what are its design goals? Discuss its strengths and weaknesses briefly.
2. How does data distribution work in PFS?
3. Provide an explanation of the concept of I/O Performance Gap and how it relates to I/O bottleneck. Additionally, describe the potential causes of an I/O bottleneck and its effects on system performance. (I/O Guest Lecture)
4. What is the concept of hot and cold data and how do they differ and store? In what scenarios would you choose to use hot data instead of cold data, and vice versa? (I/O Guest Lecture)
5. Describe various data distribution strategies that can be employed in multi-tiered

storage systems to optimize I/O performance and storage efficiency.

1. How does message logging differ from checkpointing in distributed systems? Explain the concept of message logging and compare it to checkpointing.
2. What is coordinated checkpointing?
3. In the two-phase commit protocol, why can blocking never be eliminated, even when the

participants elect a new coordinator?

**Reading and writing assignment**

**(a bonus assignment, due with term project presentation, 50 pts)**

**Homework Assignment:** Multi-tiered Storage Systems for I/O Optimization

Objective: This bibliographic study aims to deepen students' understanding of multi-tiered storage systems and their role in optimizing I/O operations. Students are required to select and summarize three technical papers related to multi-tiered storage systems, focusing on the following key areas for each paper:

1. **Abstract Summary:** Provide a concise summary of the paper, outlining the problem statement, proposed solution, and main findings.
2. **Problem Addressed:** Describe the specific challenges or limitations in I/O operations that the paper aims to overcome.
3. **Solution Overview:** Discuss the proposed multi-tiered storage approach, including any novel techniques or methodologies introduced.
4. **Evaluation and Results:** Summarize the evaluation methods and key results, focusing on how the solution improves I/O performance or efficiency.
5. **Impact and Applications:** Reflect on the potential impact of the proposed solution on real-world applications, considering scalability, adaptability, and practical implementation challenges.
6. **Critical Analysis:** Critically evaluate the strengths and weaknesses of the paper's approach, considering aspects such as innovation, effectiveness, and potential areas for improvement.

**Format:** The assignment should be structured as a report, with a separate section for each paper. Each section should systematically address the points listed above. The report should conclude with a comparative analysis, discussing how the approaches from the selected papers could be integrated or complement each other to optimize I/O in multi-tiered storage systems.

**Submission:** Submit the report in PDF format. Ensure to include a reference list citing the three papers analyzed, following the IEEE citation style.

**Paper suggestions (but remember to search online more to find your personal choices):**

* [**https://www.usenix.org/system/files/conference/hotstorage12/hotstorage12-final22.pdf**](https://www.usenix.org/system/files/conference/hotstorage12/hotstorage12-final22.pdf)
* [**https://dl.acm.org/doi/pdf/10.1145/3439839.3458733?casa\_token=YO77FnRR3zAAAAAA:I37r59KYfJ9a0gmUwAqOmE-imG59m4V6aUeSsj-xx05KyZ3v7ZKnKvrhdr-ebSdpmIE-b9Aw-mCHCAk**](https://dl.acm.org/doi/pdf/10.1145/3439839.3458733?casa_token=YO77FnRR3zAAAAAA:I37r59KYfJ9a0gmUwAqOmE-imG59m4V6aUeSsj-xx05KyZ3v7ZKnKvrhdr-ebSdpmIE-b9Aw-mCHCAk)
* [**https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8805417&casa\_token=iXUbuEoQZKUAAAAA:VI9b8ktTOMk8XzLGwwy39aQQB6YQV0AQ52Becu\_MYhK0\_FjDQekVlICLn5OzBxP-3WiEA3u2dmM&tag=1**](https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8805417&casa_token=iXUbuEoQZKUAAAAA:VI9b8ktTOMk8XzLGwwy39aQQB6YQV0AQ52Becu_MYhK0_FjDQekVlICLn5OzBxP-3WiEA3u2dmM&tag=1)
* [**https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8821026&casa\_token=3wIUDTsIY6oAAAAA:FF-J5skqXfSylifkIuynlVKmr6WqHJWh7o3j258ZMMu8WM4tRdg-axa4tf3yUogfW9tHsrGDYvw**](https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8821026&casa_token=3wIUDTsIY6oAAAAA:FF-J5skqXfSylifkIuynlVKmr6WqHJWh7o3j258ZMMu8WM4tRdg-axa4tf3yUogfW9tHsrGDYvw)
* [**https://dl.acm.org/doi/pdf/10.1145/2663165.2663333?casa\_token=ldlxb2hWDKQAAAAA:QLVl3xAQh37f1m5K9nSyx90riHo5bRklohWcpfsm76sAtdBfOF6b8BQ2YzoYqtAkXbv\_eswBb0GNB\_w**](https://dl.acm.org/doi/pdf/10.1145/2663165.2663333?casa_token=ldlxb2hWDKQAAAAA:QLVl3xAQh37f1m5K9nSyx90riHo5bRklohWcpfsm76sAtdBfOF6b8BQ2YzoYqtAkXbv_eswBb0GNB_w)
* [**https://dl.acm.org/doi/pdf/10.1145/3035918.3064023?casa\_token=kz6tR1qkzuoAAAAA:19omYfl4ejIAqavdnR1R3aPh-5XKpQtDyhKy9F-\_ha3oeuq0jmcPAYYYBszQ6P6DN6IVzU0-MrBZ5dE**](https://dl.acm.org/doi/pdf/10.1145/3035918.3064023?casa_token=kz6tR1qkzuoAAAAA:19omYfl4ejIAqavdnR1R3aPh-5XKpQtDyhKy9F-_ha3oeuq0jmcPAYYYBszQ6P6DN6IVzU0-MrBZ5dE)
* [**https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8215562&casa\_token=jER\_1bNORzAAAAAA:Jt2EHvjJkyeDq-N2Q0MPFYTIQK9JDxpkP\_gjDmzSJ4GmDgOUDF5XBi-1GNlUQhuT\_G0hD8sFkSo**](https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8215562&casa_token=jER_1bNORzAAAAAA:Jt2EHvjJkyeDq-N2Q0MPFYTIQK9JDxpkP_gjDmzSJ4GmDgOUDF5XBi-1GNlUQhuT_G0hD8sFkSo)
* [**https://dl.acm.org/doi/pdf/10.1145/3078597.3078611**](https://dl.acm.org/doi/pdf/10.1145/3078597.3078611)