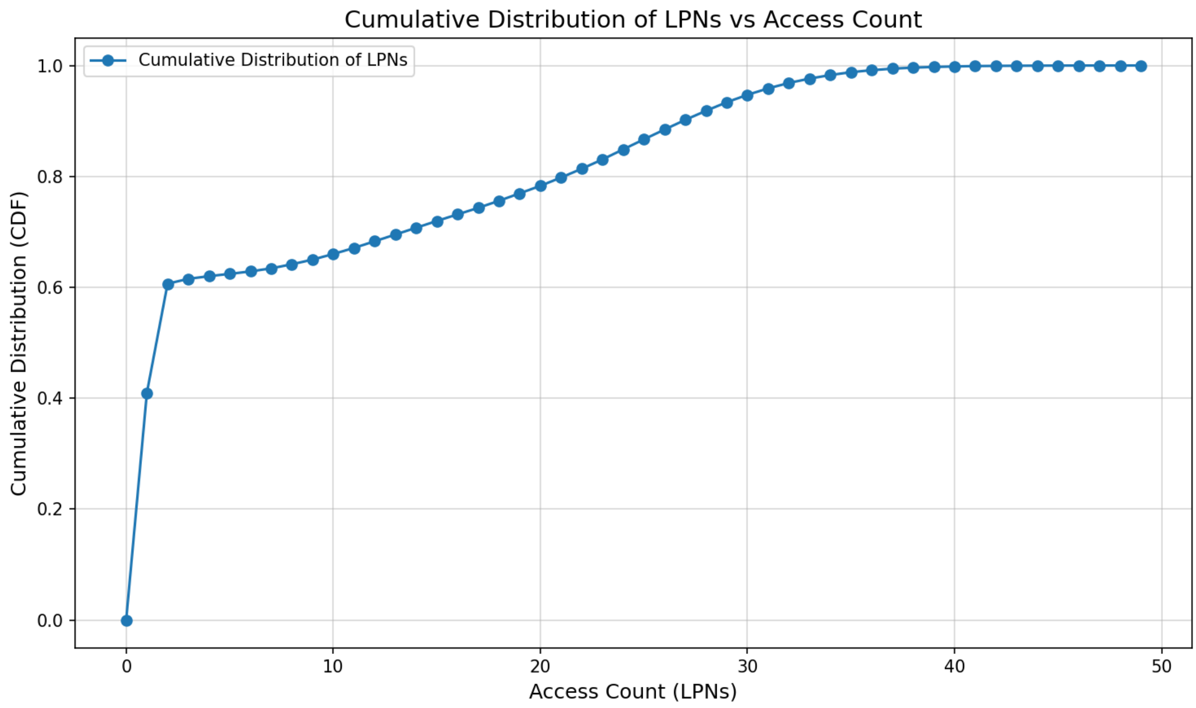
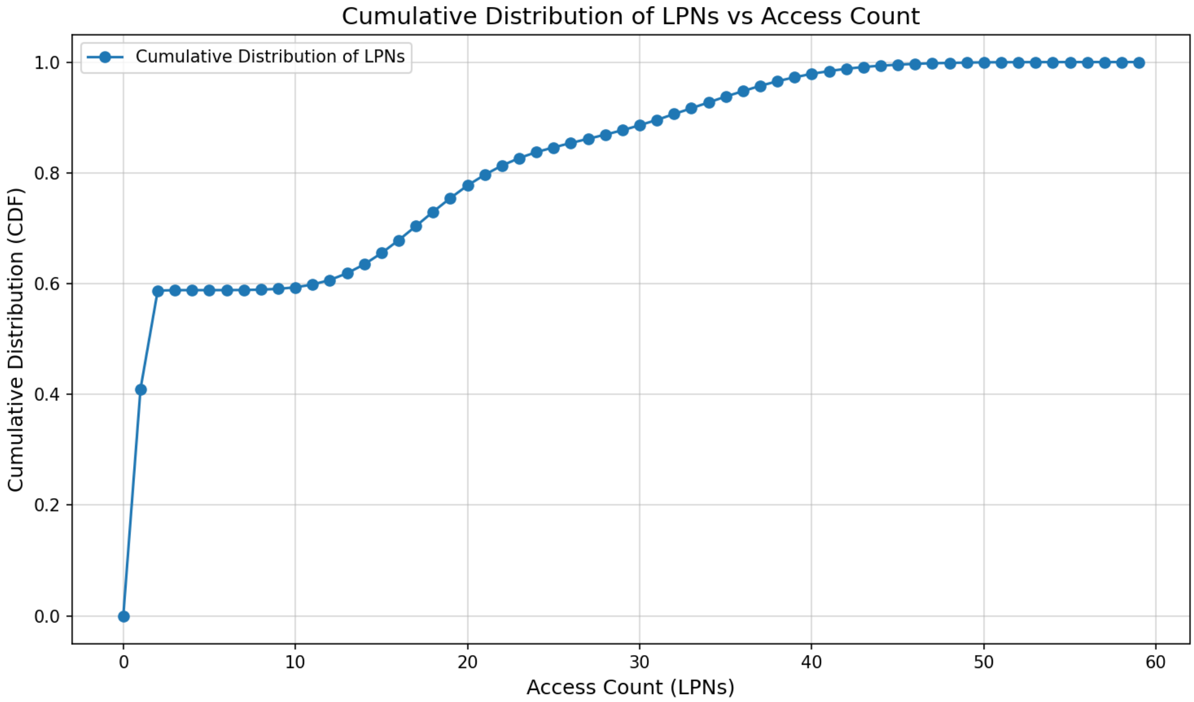
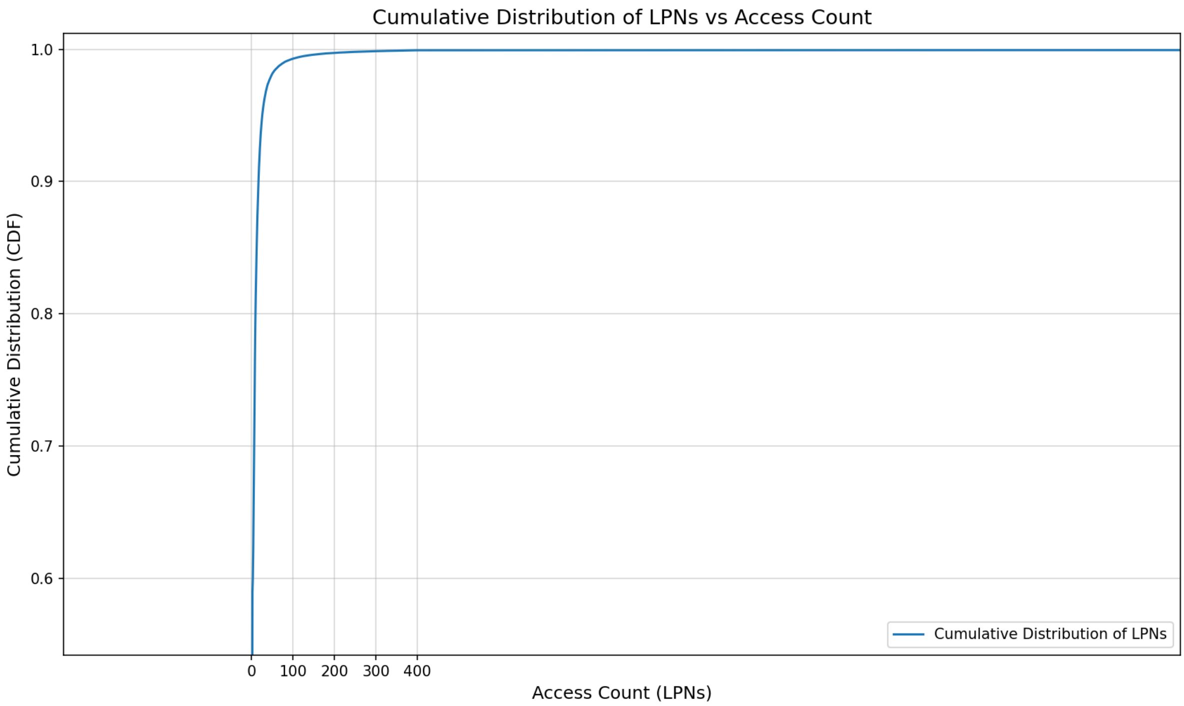
[Graph type 1]

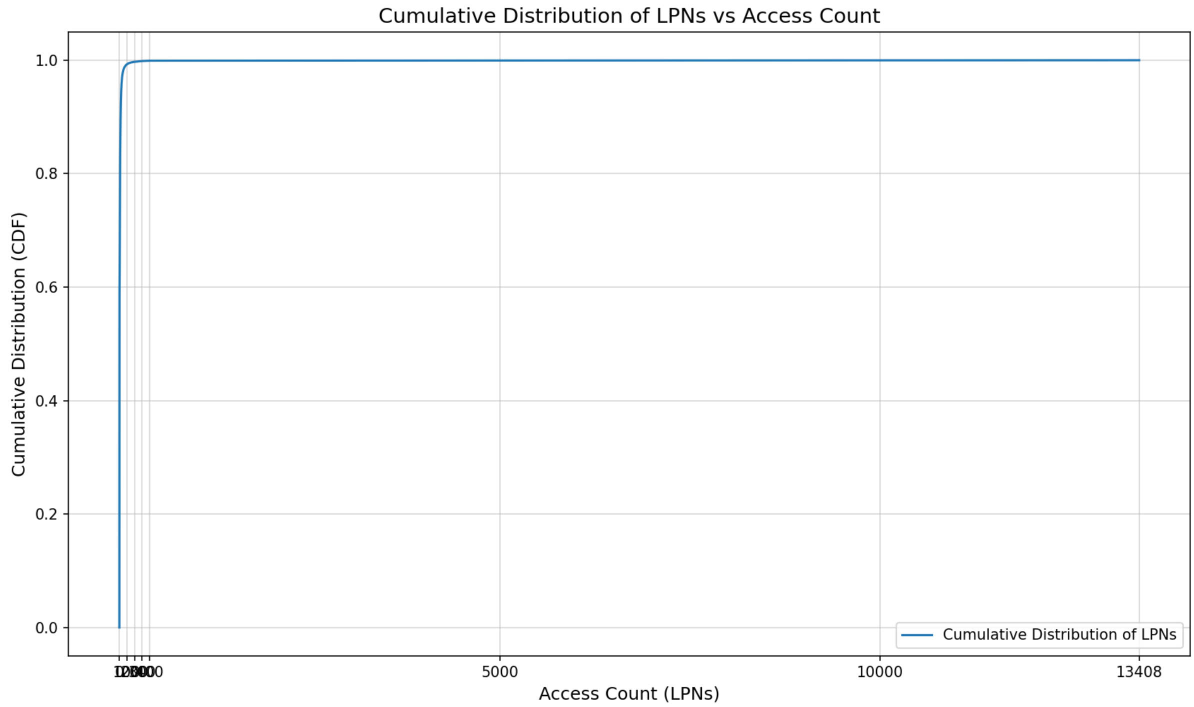


The data was generated based on a normal distribution (normal: 1.0), and Thresholds A, B, and C were set according to specific criteria. These criteria were determined by the points where the CDF reaches 0.7, 0.8, and 0.9, respectively. Looking at the graph, there is an initial section where the CDF increases sharply. This sharp rise is due to most LPNs being accessed 1 or 2 times at the beginning.

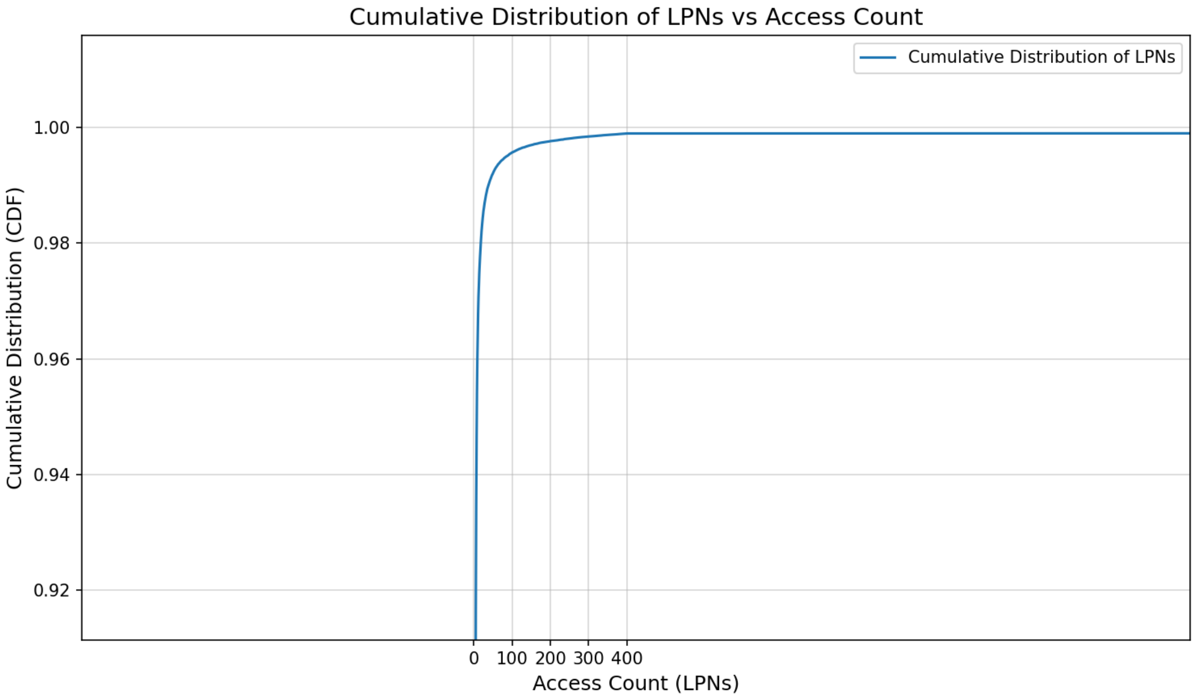


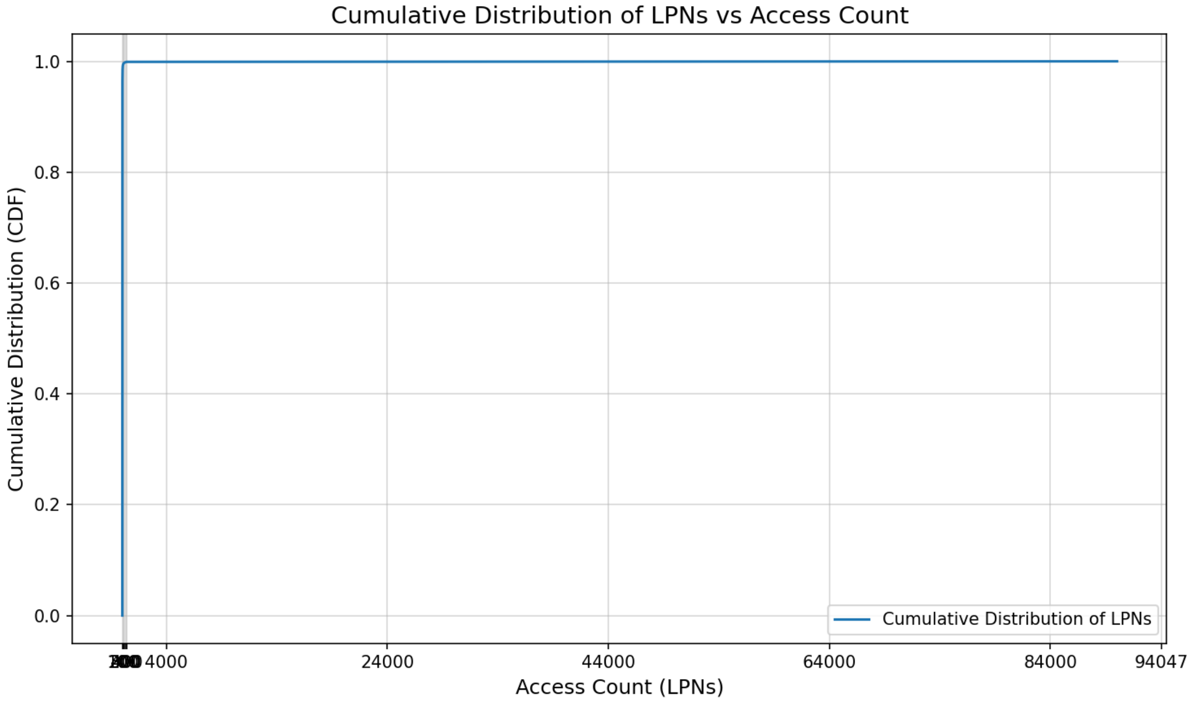
The data was generated based on a Pareto distribution (pareto: 0.5), and Thresholds A, B, and C were set at the points where the CDF reaches 0.7, 0.8, and 0.9, respectively. Most LPNs are accessed 1 or 2 times, resulting in a steep rise at the beginning.



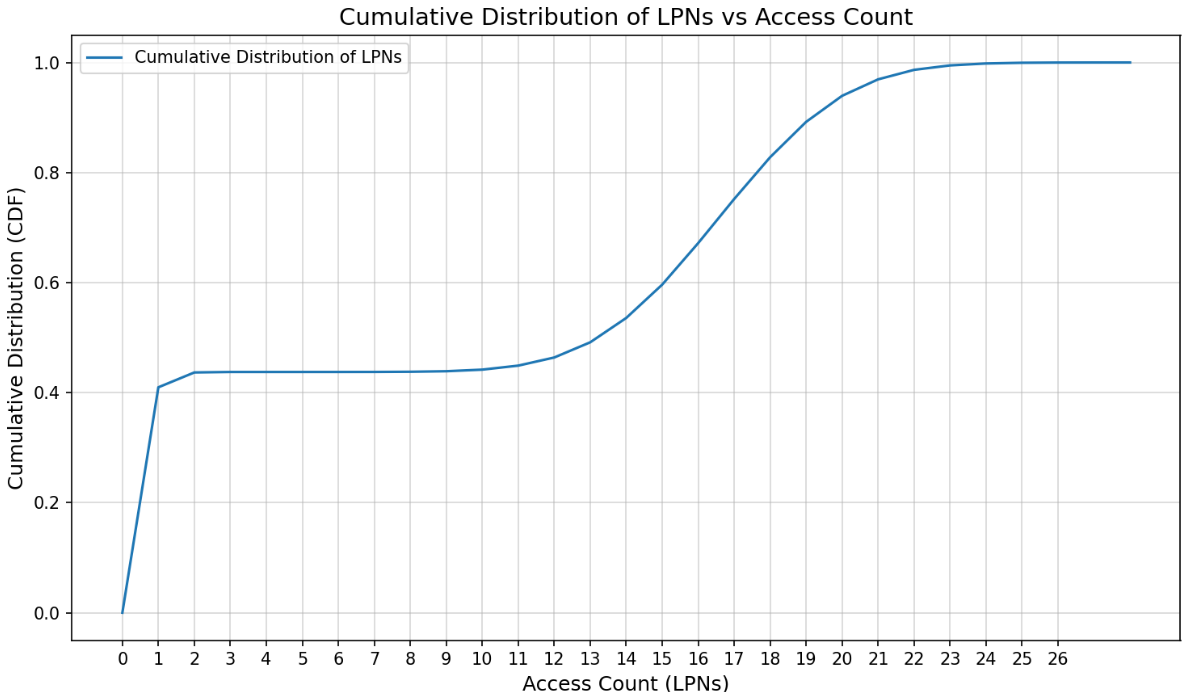


The data is based on a Zipf distribution (zipf: 0.8), with Threshold A, B, and C set at the points where the CDF reaches 0.7, 0.8, and 0.9 respectively. A small number of pages are accessed repeatedly, resulting in some pages having significantly higher access counts.



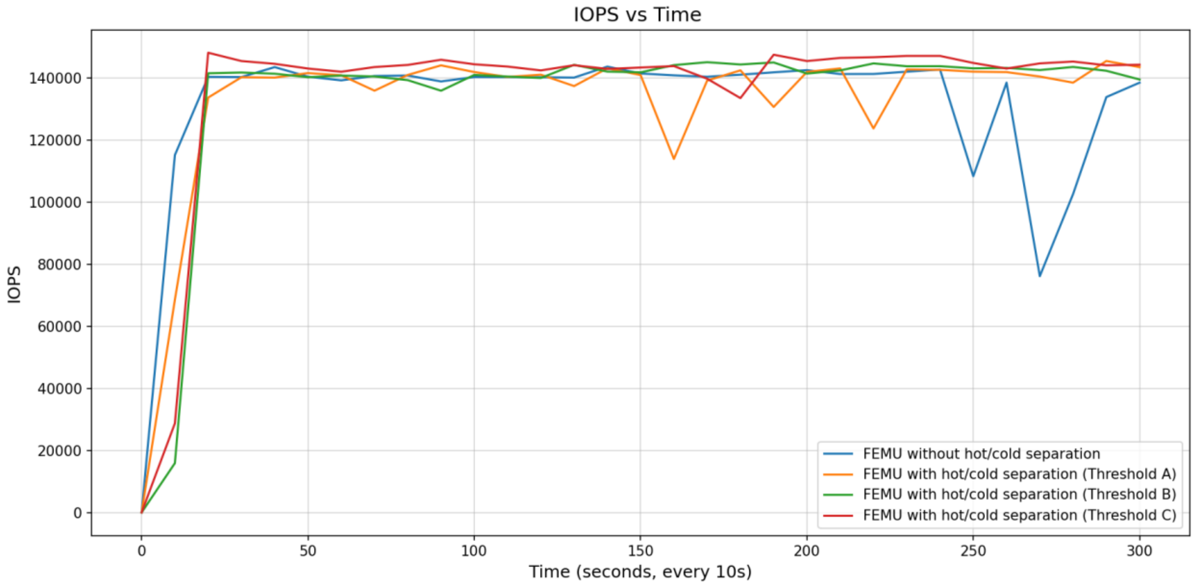


The data is based on a Zipf distribution (zipf: 1.2), with Thresholds A, B, and C set at the points where the CDF reaches 0.7, 0.8, and 0.9, respectively. Once again, the access count is concentrated at the beginning, with a few pages being accessed repeatedly, resulting in pages with higher access counts. It appears that even fewer pages were accessed compared to Zipf 0.8.

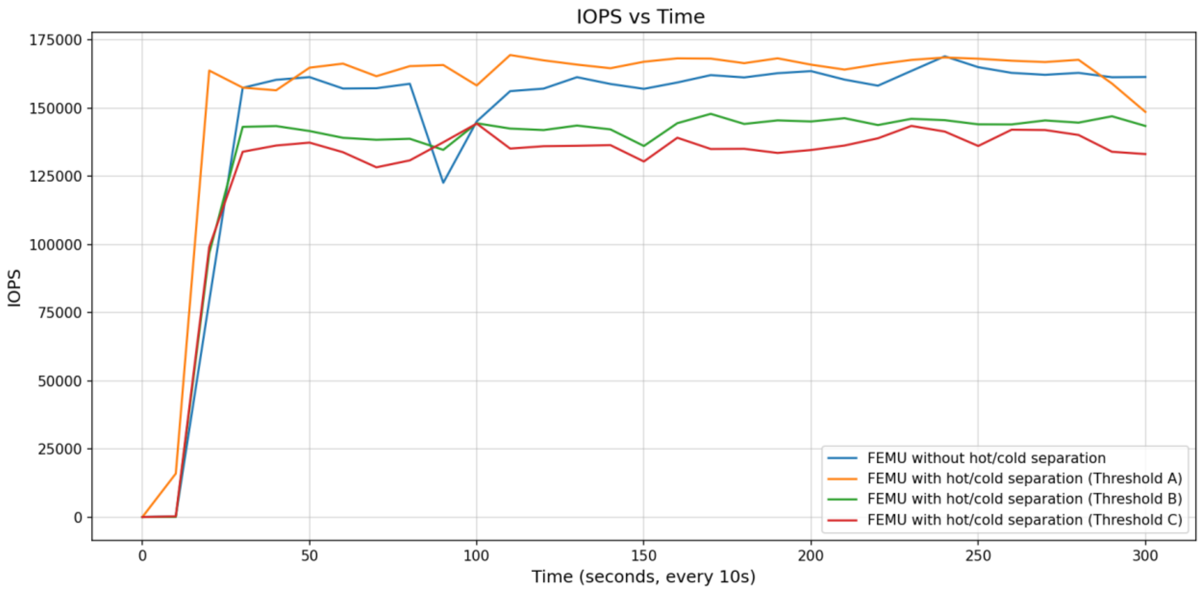


The data is based on a random distribution (random: 1.0), with Thresholds A, B, and C set at the points where the CDF reaches 0.7, 0.8, and 0.9, respectively. The access pattern is evenly distributed without concentrating on specific data, demonstrating uniform access.

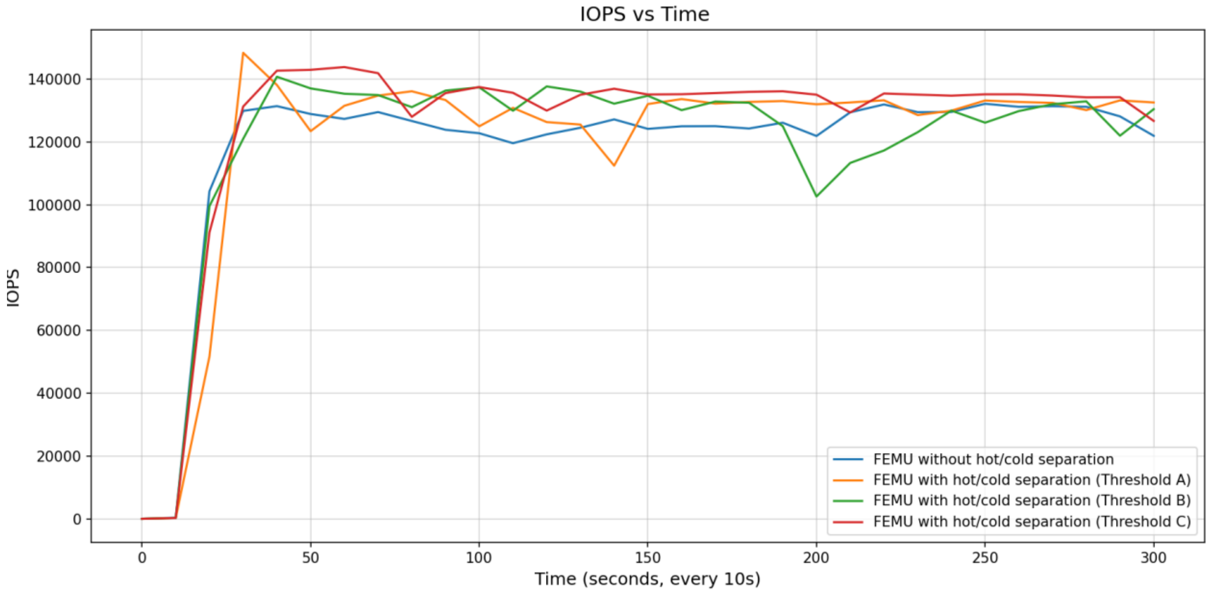
[Graph type 2]



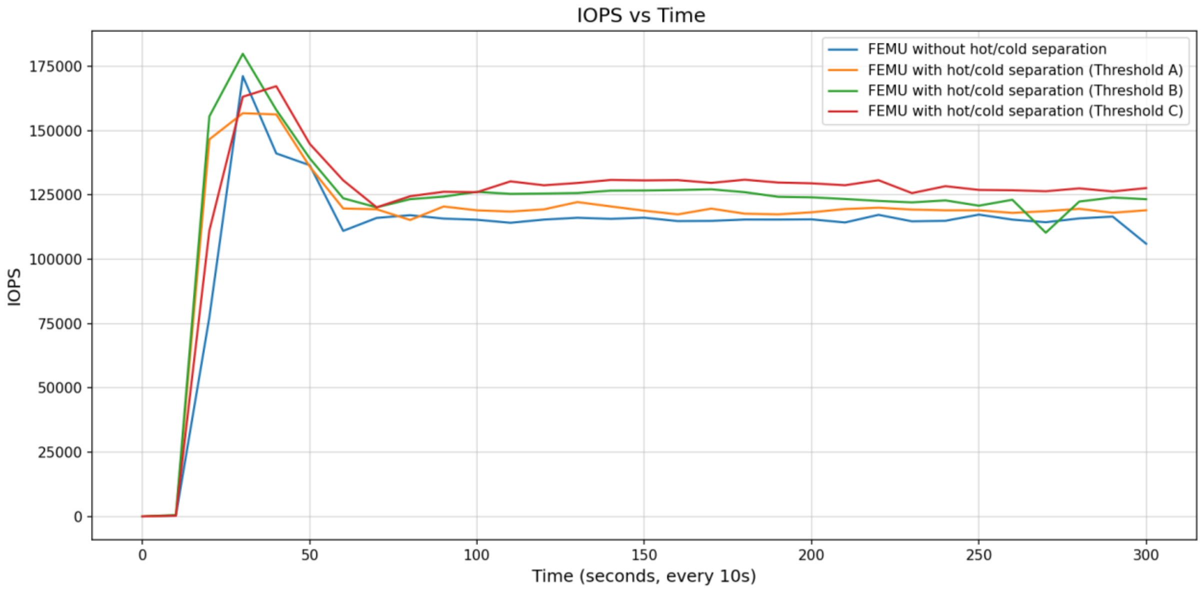
This graph shows the IOPS over time, comparing the performance with and without hot/cold data separation. Thresholds were set as criteria for distinguishing between hot and cold data, with Threshold A (15), Threshold B (23), Threshold C (29), and the default (0) used in the experiments. When the Threshold is 0, there is a noticeable sudden fluctuation in IOPS at a certain point, suggesting an excessive workload may have occurred.



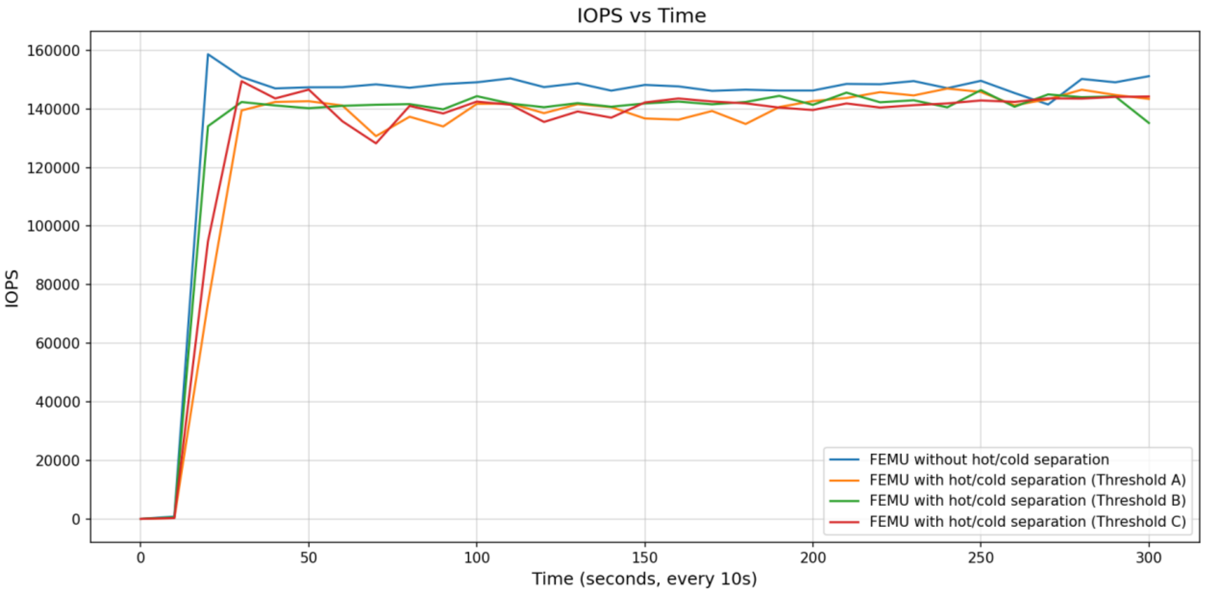
This graph shows the IOPS over time, comparing the performance with and without hot/cold data separation. Excluding the test with the default Threshold 0, it is evident that Threshold A provides the best performance. Additionally, the graph demonstrates that setting a threshold results in relatively stable performance.



Data separation significantly improves IOPS performance, with Threshold A (7) delivering the highest performance. However, Threshold B (10) appears to be the most suitable configuration in terms of balancing stability and performance.

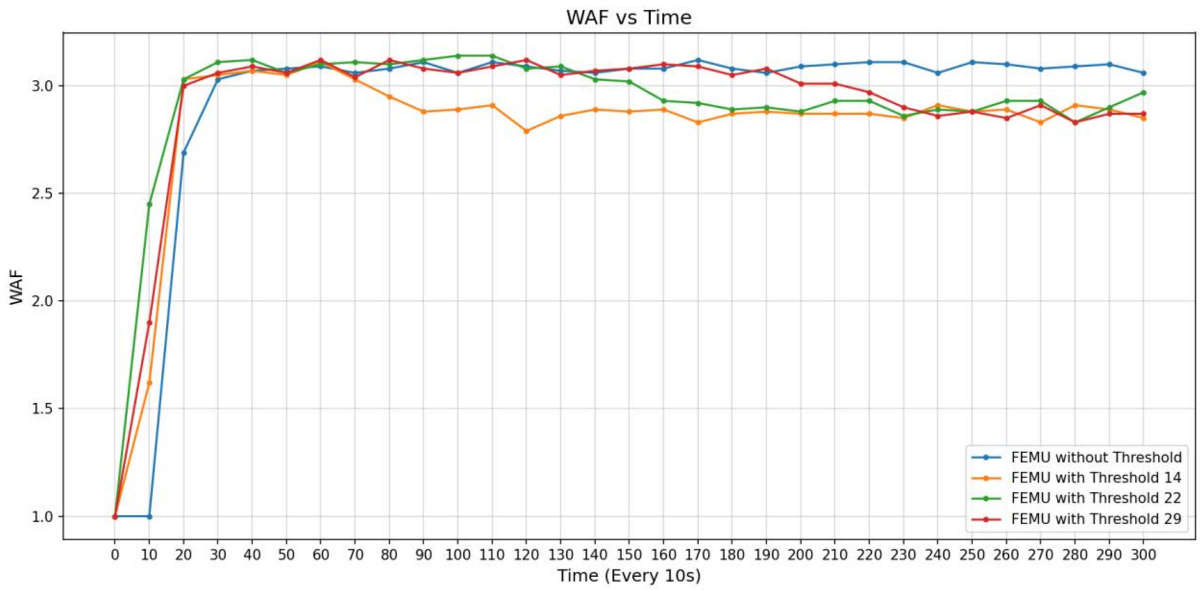


The performance drop observed in the graph can be interpreted as a write cliff phenomenon. This suggests that internal Garbage Collection (GC) and write operations have become highly active. It can be seen that performance is best when the threshold is set to C, while the performance is the worst when using the default value (0).

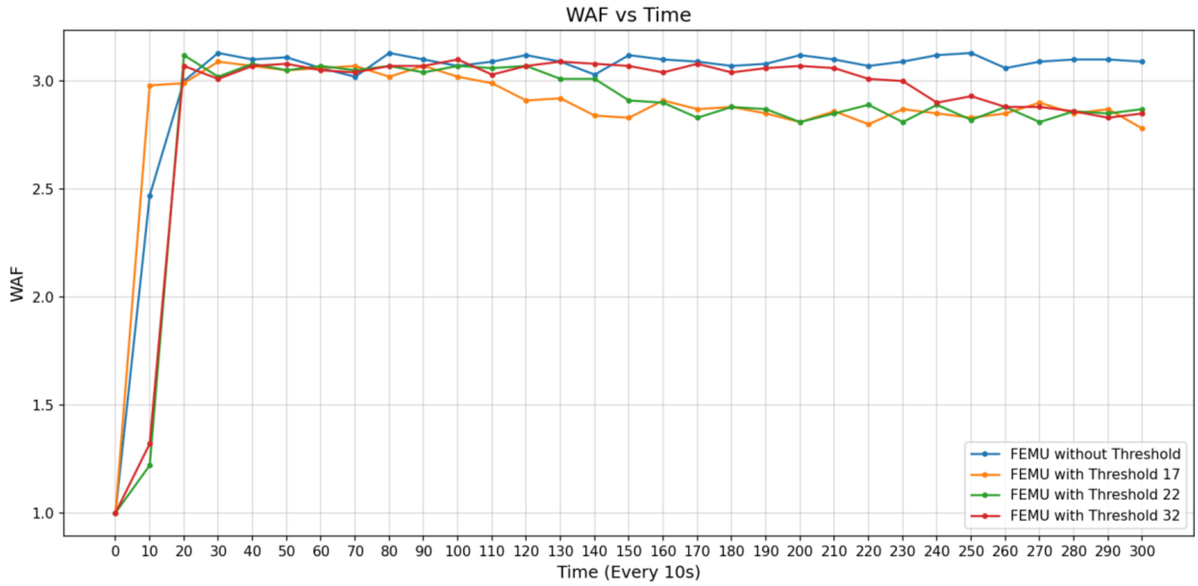


When the Threshold is set to 18 and 17, a balance between performance and stability is maintained, and it can be observed that the IOPS values converge to a certain extent.

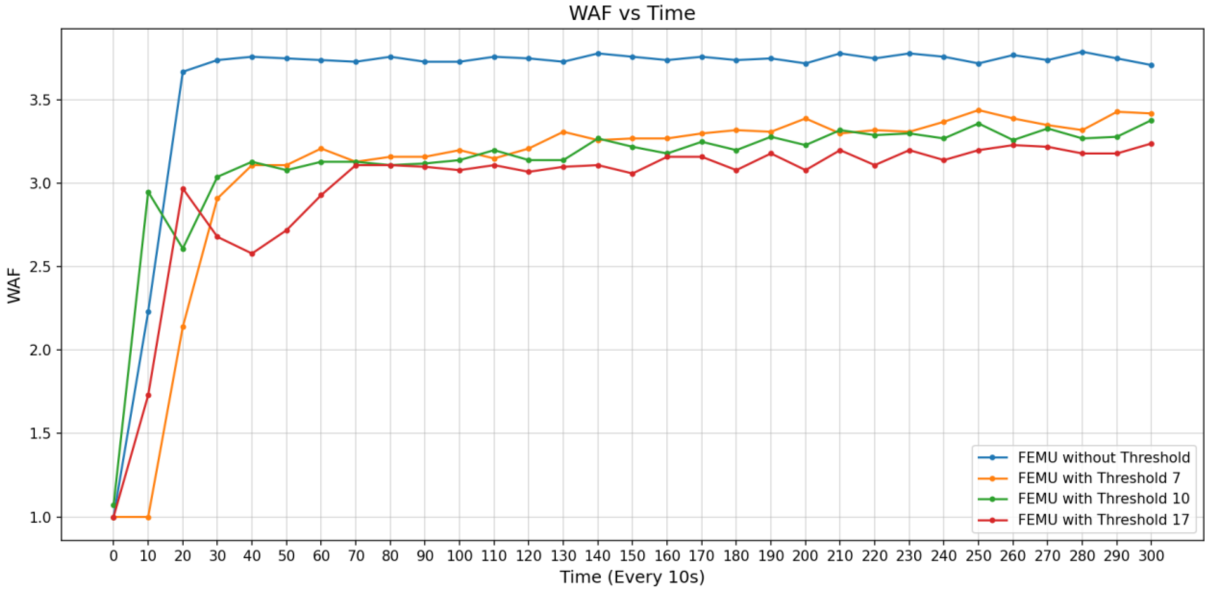
[Graph type 3]



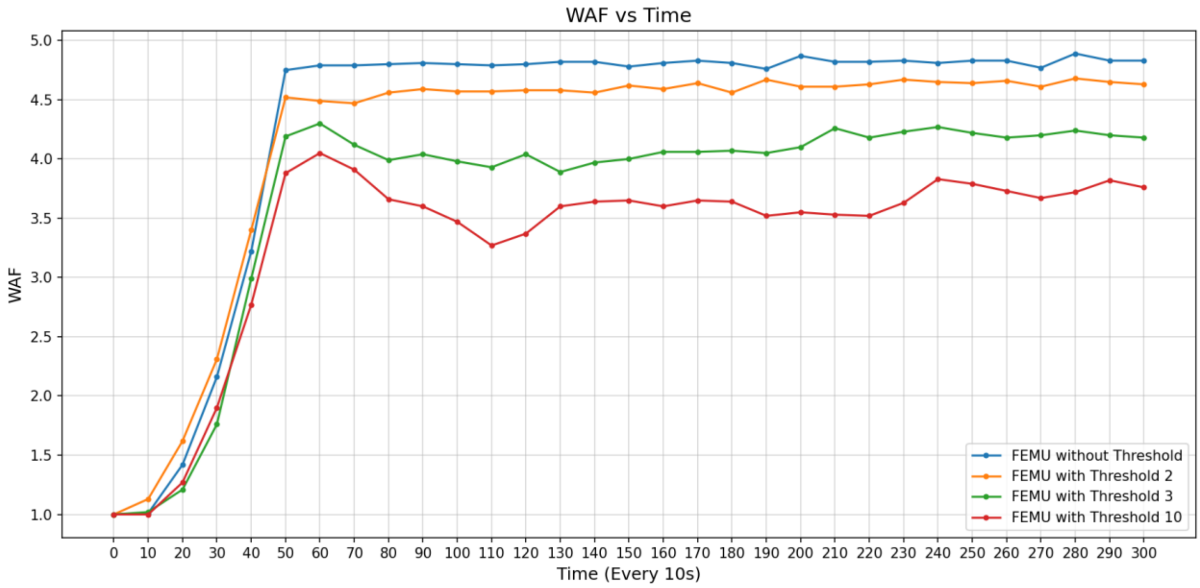
In Normal: 1.0, Threshold A (14) manages hot data broadly, minimizing WAF and providing the most efficient write environment. On the other hand, No Threshold shows the highest WAF, indicating relatively poor performance.



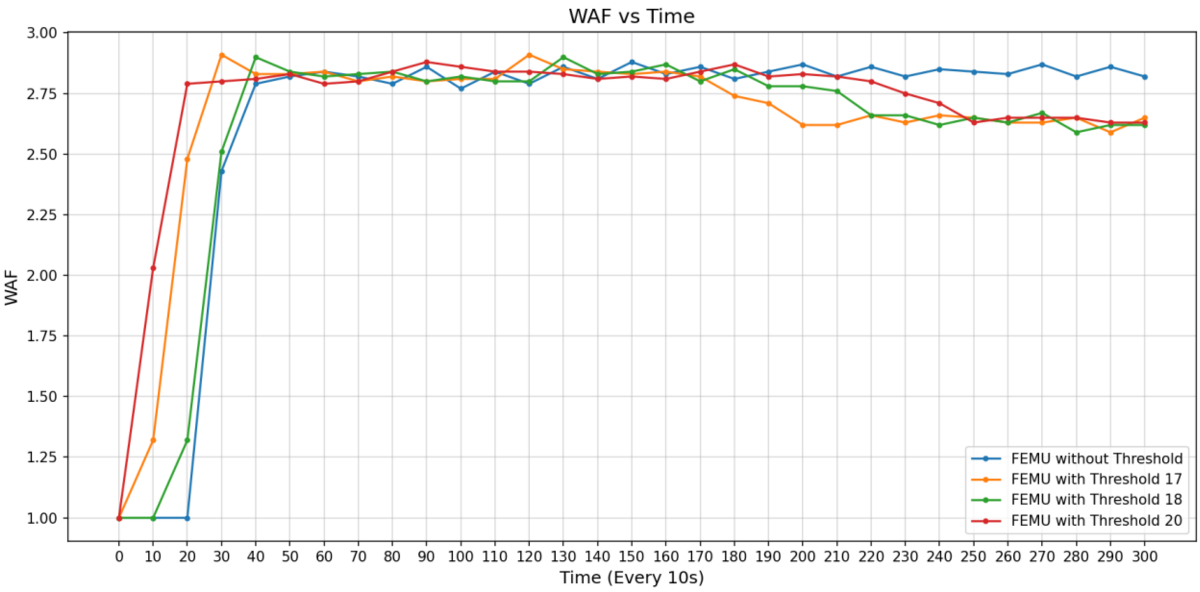
In Pareto: 0.5, Threshold A (17) maintains the lowest WAF, maximizing write efficiency. Threshold B (22) balances stability and performance, making it a suitable configuration for real-world environments. Once again, it is evident that the performance is the worst when the Threshold is set to 0.



In Zipf: 0.8, Threshold A (7) achieves the lowest WAF, maximizing data management efficiency. Threshold B (10) is the most suitable in terms of balancing stability and performance, while Threshold C (17) provides stable performance but shows relatively lower efficiency. It is evident that there is a significant performance difference compared to the default Threshold (0).



In Zipf: 1.2, Threshold C (10) maintains the lowest WAF, while Threshold B (3) is also suitable in terms of stability and efficiency, making it an appropriate choice for real-world environments. On the other hand, Threshold A (2) and No Threshold exhibit high WAF, resulting in reduced data management efficiency.



In Random: 1.0, it can be observed that the performance is similar across thresholds, except when using the default threshold value.