

Evaluation and Measurement

Part I

Number of operations per client – 10K

Each file size - 1KB

1 Client performing operation (no concurrent)

Operation	Time (in millisecond)
Register	1314
Search	947
Obtain	5123

2 Client performing operation (Concurrent)

	Time (in millisecond)		
Operation	Peer 1	Peer 2	Average
Register	1299	1175	1237
Search	903	843	873
Obtain	5896	6005	5950.5

4 Client performing operation (Concurrent)

	Time (in millisecond)				
Operation	Peer 1	Peer 2	Peer 3	Peer 4	Average
Register	2460	1925	2088	1819	2073
Search	857	850	809	668	796
Obtain	10998	10154	11015	10671	10790.5

6 Client performing operation (Concurrent)

	Time (in millisecond)						
Operation	Peer 1	Peer 2	Peer 3	Peer 4	Peer 5	Peer 6	Average
Register	3029	2403	2992	2679	2165	2275	2590.5
Search	633	815	825	729	977	752	793.5
Obtain	16390	16529	16678	16881	16359	16021	16476.333

8 Client performing operation (Concurrent)

	Time (in millisecond)								
Operation	Peer 1	Peer 2	Peer 3	Peer 4	Peer 5	Peer 6	Peer 7	Peer 8	Average
Register	4206	3189	3365	3452	3214	3106	2896	2568	3249.5
Search	465	395	358	964	975	984	764	602	688.375
Obtain	26497	26249	29756	26745	27569	26472	26136	26942	27045.75

Analysis-

Average statistic for all combination mentioned above

Concurrent clients	Register	Search	Obtain
1	1130	993	4155
2	1237	873	5950.5
4	2073	796	10709.5
6	2590.5	793.5	16476.333
8	3249.5	688.375	27045.75

Average Response time per operation

- Average response time (in milliseconds) per operations when 1 client performing operation

- Average response time for Register operation = 0.113
- Average response time for Search operation = 0.0993
- Average response time for Obtain operation = 0.4155

- Average response time (in milliseconds) per operations when 2 client performing operation

- Average response time for Register operation = 0.1237
- Average response time for Search operation = 0.0873
- Average response time for Obtain operation = 0.5950

- Average response time (in milliseconds) per operations when 4 client performing operation

- Average response time for Register operation = 0.2073
- Average response time for Search operation = 0.0796
- Average response time for Obtain operation = 1.0709

- Average response time (in milliseconds) per operations when 8 client performing operation

- Average response time for Register operation = 0.324
- Average response time for Search operation = 0.0688
- Average response time for Obtain operation = 2.704

- Aggregate Achieved throughput for operation (1 client)

- Average time for Register operation per second = 8849.557
- Average time for Search operation per second = 10070.49
- Average time for Obtain operation per second = 2406.738

- Aggregate Achieved throughput for operation (2 client concurrently)

- Average time for Register operation per second = 8084.074
- Average time for Search operation per second = 11454.753
- Average time for Obtain operation per second = 1680.531

- Aggregate Achieved throughput for operation (4 client concurrently)

- Average time for Register operation per second = 4823.926
- Average time for Search operation per second = 12562.814
- Average time for Obtain operation per second = 933.750

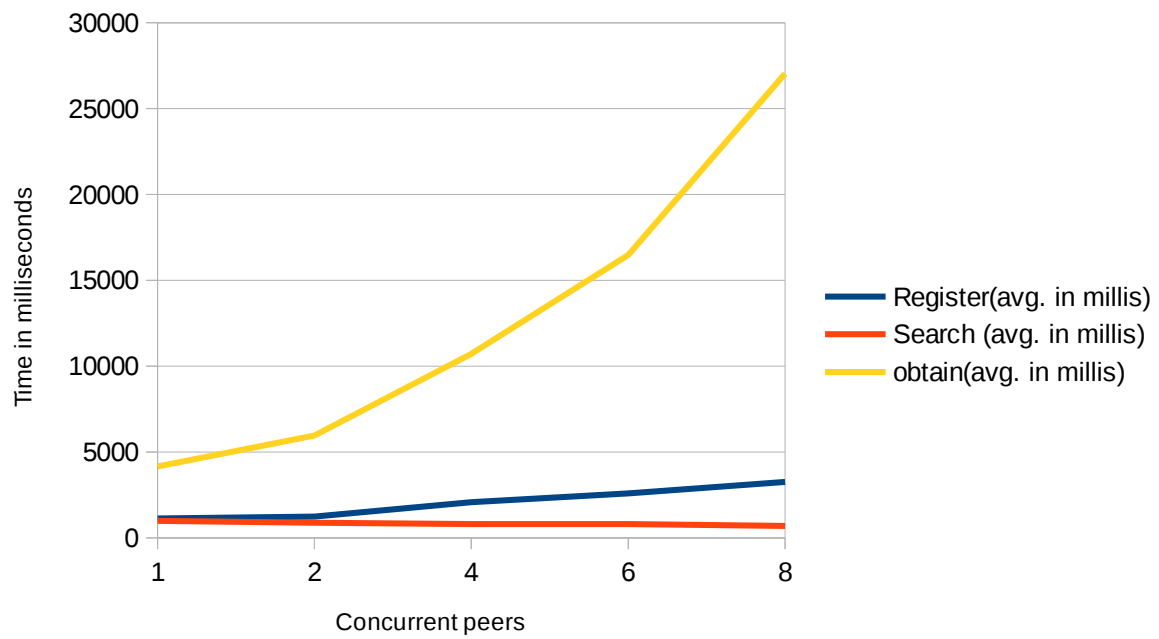
- Aggregate Achieved throughput for operation (6 client concurrently)

- Average time for Register operation per second = 3860.25
- Average time for Search operation per second = 12602.39
- Average time for Obtain operation per second = 606.931

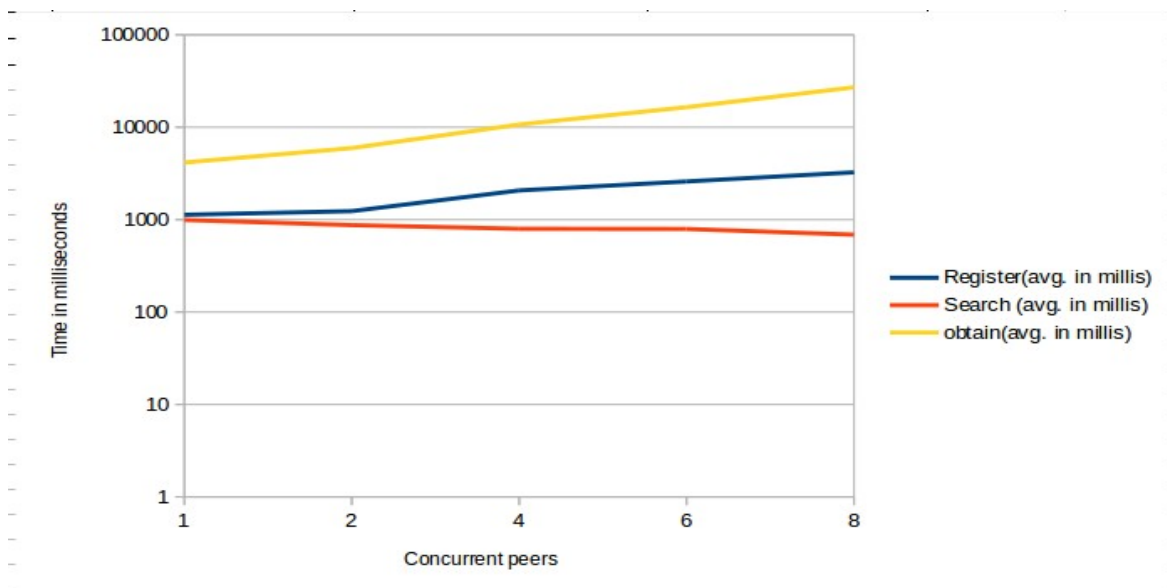
- Aggregate Achieved throughput for operation (8 client concurrently)

- Average time for Register operation per second = 3077.396
- Average time for Search operation per second = 14526.965
- Average time for Obtain operation per second = 369.743

Graph – Below is graph representing average response time (in milliseconds) vs Number of concurrent node performing different operation like (Register, Search and Obtain)



Logarithmic graph



Conclusion

- From graph we can conclude that download operation takes more time as compared with Search and Register.
- Search operation taking same time even we increased the number of concurrent operations as this operation is not required lot of processing and no streams get busy for long time, like download operation.
- Register operation is taking a slightly more time than search operation as it required to lookup into the hash and make entry if same key is not present, in which Hash map get locked for sometime while making registry entry.
- As this is Distributed file sharing system concurrently we use all server so load get increased but get divided among all the server so its time increases gradually unlike centralized system.
- So trend of Search and Register are some what similar compared to Download operation.
- Download operation taking highest time compared to Register and Search, because download operation involves large amount of data and streams need to use for long time. So it cost more time compared to other operation.
- For Download operation initially till 4-6 concurrent client its time increases linearly but as it goes on increasing to 8 concurrent client it turns into exponential.

Part II

Measure throughput with different file size

Number of client =8

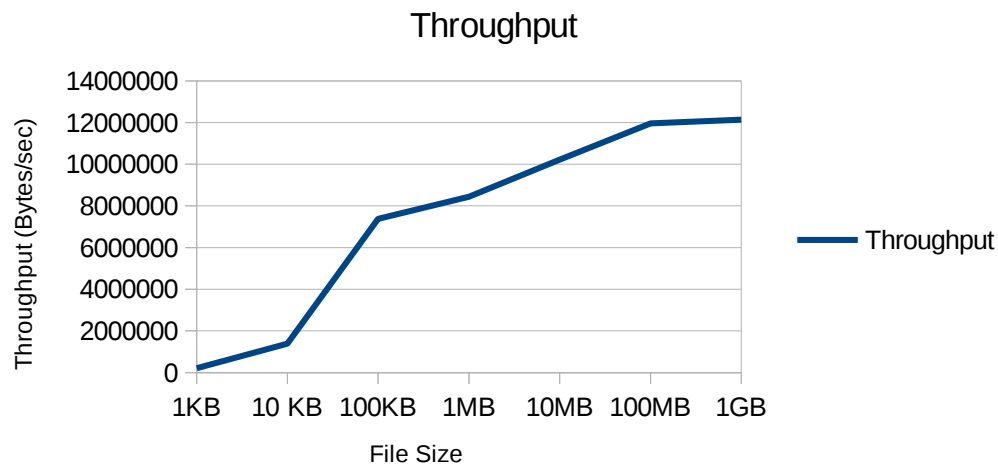
- We have performed the all operation by keeping fixed number of client that is 8.
- we have used different size of files to test performance against number of files.
- we tried to keep the execution time close to each other so that evaluation can be compared
- we have calculate throughput by Number of bytes transferred to total time taken to transfer those bytes.

File Size	Bytes	Peer1	Peer2	Peer3	Peer4	Peer5	Peer6	Peer7	Peer8	Avg Time (in milliseconds)	Avg Time (in seconds)
1KB	12000000	57965	58012	56875	58452	53697	55479	52479	52478	55679.625	55.679625
10 KB	150000000	125789	125789	112656	115478	98655	105541	90221	89452	107947.625	107.947625
100KB	150000000	30896	31005	32547	14552	13578	12796	13545	13597	20314.5	20.3145
1MB	500000000	76515	64895	65942	65841	52416	49685	49632	48895	59227.625	59.227625
10MB	1000000000	105456	116974	116478	106547	93658	94623	70559	78546	97855.125	97.855125
100MB	1000000000	87659	91456	83695	84796	86412	79562	79562	75689	83603.875	83.603875
1GB	1000000000	60456	88695	85012	84201	89647	80456	84262	86354	82385.375	82.385375

Average statistic for all combination mentioned above

File Size	Bytes	Avg Time (in seconds)	Throughput
1KB	12000000	55.679625	215518.692879128
10 KB	150000000	107.947625	1389562.76249709
100KB	150000000	20.3145	7383888.35560806
1MB	500000000	59.227625	8442006.58054413
10MB	1000000000	97.855125	10219188.8263389
100MB	1000000000	83.603875	11961168.0678677
1GB	1000000000	82.385375	12138076.6914031

Graph - Below is graph representing Throughput in Bytes per sec vs Different size of files like (1KB, 10KB, 1 MB etc)



Conclusion

- From graph we can conclude that system perform well when we have small number of files with large size compared to large number of files of small sizes.
- From above graph we can say that for 100kb size files the trend of throughput increases a significantly , while at the same time when file size goes beyond 100Mb file(100000 KBs) the trend shows the throughput remains constant.
- Here system need to perform large number of Read and Write operation when we have small size but large number of files.
- Unlike that when we have few files of large size system does not required to perform large number of read and write operation, instead of that it continues to read and write same file for longer time.
- This decreases the system level interrupts count and increases the system performance.

PART III

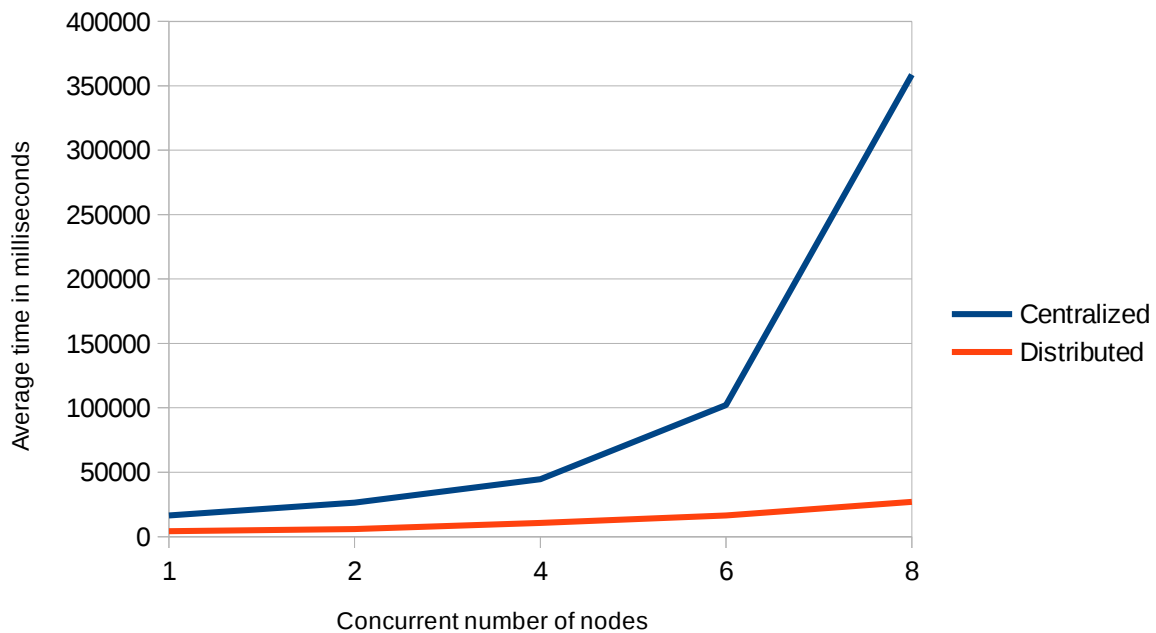
Centralized vs Distributed

- Here we have compared the performance of centralized system against distributed system.
- we have conducted same set of operation on centralized system like distributed system with following parameter
- File size = 1KB
- Number of files = 10 K

Number of concurrent clients	Centralized	Distributed
1	16475	4155
2	26327	5950.5
4	44697.45	10709.5
6	102056.5	16476.333
8	358741	27045.75

Graph-

Below graph represent performance of centralized vs distributed for Time to download 10 K files of fixed size 1KB.



Conclusion:

- As in centralized system all request are redirected to central Index server load of centralized index server increases and performance start decreases if request count increases.
- Unlike centralized system in distributed system all request get divide among the all system so its load not increases like load increases in centralize system.
- From above graph we can conclude that for downloading request initially both centralized and distributed system perform same, but as the number of request goes on increasing the performance of centralize system goes down and take more time to perform the operations.
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Note: Evaluation has performed on single machine with configuration of

RAM: 4 GB

HDD: 500 GB

Processor: i5