TAILBENCH BENCHMARK STATISTICS

IMG-DNN (CPU INTENSIVE - 6 cores, 6 threads)

```
tailbench@TBUB18:~/Tailbench/tailbench/img-dnn$ /usr/bin/time -v taskset -c 0-5 sudo ./run.sh
TBENCH_MAXREQS = 1000000
TBENCH_WARMUPREQS = 5000
TBENCH_MINSLEEPNS = 10000
TBENCH_RANDSEED = 0
TBENCH_QPS = 500000
Read testX successfully, including 784 features and 10000 samples.
Read testY successfully, including 10000 samples
correct: 0, total: 1000000, accuracy: 0
End-to-end run time: 709.425 second
        Command being timed: "taskset -c 0-5 sudo ./run.sh"
        User time (seconds): 703.40
        System time (seconds): 6.04
        Percent of CPU this job got: 557%
        Elapsed (wall clock) time (h:mm:ss or m:ss): 2:07.30
        Average shared text size (kbytes): 0
        Average unshared data size (kbytes): 0
        Average stack size (kbytes): 0
        Average total size (kbytes): 0
        Maximum resident set size (kbytes): 151216
        Average resident set size (kbytes): 0
        Major (requiring I/O) page faults: 0
        Minor (reclaiming a frame) page faults: 383667
        Voluntary context switches: 973634
        Involuntary context switches: 784
        Swaps: 0
        File system inputs: 0
        File system outputs: 0
        Socket messages sent: 0
        Socket messages received: 0
        Signals delivered: 0
        Page size (bytes): 4096
        Exit status: 0
```

```
tailbench@TBUB18:~/Tailbench/tailbench/img-dnn$ python3 ../utilities/parselats.py lats.bin
svc: mean 1.007 ms | p95 1.295 ms | p99 1.406 ms | max 6.245 ms
end2end: mean 1.870 ms | p95 3.617 ms | p99 6.809 ms | max 23.124 ms
```

MOSES (CPU INTENSIVE - 8 cores, 8 threads)

```
Moses finished
        Command being timed: "taskset -c 0-7 sudo ./run.sh"
        User time (seconds): 466.65
        System time (seconds): 28.10
        Percent of CPU this job got: 731%
        Elapsed (wall clock) time (h:mm:ss or m:ss): 1:07.61
        Average shared text size (kbytes): 0
        Average unshared data size (kbytes): 0
        Average stack size (kbytes): 0
        Average total size (kbytes): 0
        Maximum resident set size (kbytes): 772276
        Average resident set size (kbytes): 0
        Major (requiring I/O) page faults: 0
        Minor (reclaiming a frame) page faults: 837768
        Voluntary context switches: 864013
        Involuntary context switches: 129801
        Swaps: 0
        File system inputs: 0
        File system outputs: 9688
        Socket messages sent: 0
        Socket messages received: 0
        Signals delivered: 0
        Page size (bytes): 4096
        Exit status: 0
```

```
tailbench@TBUB18:~/Tailbench/tailbench/moses$ python3 ../utilities/parselats.py lats.bin
svc: mean 3.987 ms | p95 5.086 ms | p99 5.519 ms | max 17.296 ms
end2end: mean 29869.017 ms | p95 56622.027 ms | p99 58986.334 ms | max 59565.257 ms
```

MASSTREE (MEMORY INTENSIVE 8 core, 8 threads)

```
Command being timed: "taskset -c 0-7 sudo ./run.sh"
User time (seconds): 2021.42
System time (seconds): 178.50
Percent of CPU this job got: 251%
Elapsed (wall clock) time (h:mm:ss or m:ss): 14:34.65
Average shared text size (kbytes): 0
Average unshared data size (kbytes): 0
Average stack size (kbytes): 0
Average total size (kbytes): 0
Maximum resident set size (kbytes): 14838308
Average resident set size (kbytes): 0
Major (requiring I/O) page faults: 0
Minor (reclaiming a frame) page faults: 4141293
Voluntary context switches: 4719943
Involuntary context switches: 6352
Swaps: 0
File system inputs: 0
File system outputs: 93752
Socket messages sent: 0
Socket messages received: 0
Signals delivered: 0
Page size (bytes): 4096
Exit status: 0
```

```
tailbench@TBUB18:~/Tailbench/tailbench/masstree$ python3 ../utilities/parselats.py lats.bin
svc: mean 0.609 ms | p95 0.688 ms | p99 0.750 ms | max 14.425 ms
end2end: mean 433686.037 ms | p95 822406.970 ms | p99 856117.483 ms | max 864748.489 ms
```

SILO (MEMORY INTENSIVE - 8cores, 8 threads)

```
Command being timed: "taskset -c 0-7 sudo ./run.sh"
User time (seconds): 440.25
System time (seconds): 55.88
Percent of CPU this job got: 189%
Elapsed (wall clock) time (h:mm:ss or m:ss): 4:22.26
Average shared text size (kbytes): 0
Average unshared data size (kbytes): 0
Average stack size (kbytes): 0
Average total size (kbytes): 0
Maximum resident set size (kbytes): 25149400
Average resident set size (kbytes): 0
Major (requiring I/O) page faults: 0
Minor (reclaiming a frame) page faults: 21678564
Voluntary context switches: 280948
Involuntary context switches: 784
Swaps: 0
File system inputs: 0
File system outputs: 5632
Socket messages sent: 0
Socket messages received: 0
Signals delivered: 0
Page size (bytes): 4096
Exit status: 0
```

```
tailbench@TBUB18:~/Tailbench/tailbench/silo$ python3 ../utilities/parselats.py lats.bin
svc: mean 0.319 ms | p95 0.923 ms | p99 1.339 ms | max 7.140 ms
end2end: mean 10385.458 ms | p95 14887.983 ms | p99 15439.134 ms | max 15587.182 ms
```

SPECJBB (MEMORY - 8 cores, 8 threads)

```
Timing Measurement began Thu Sep 02 19:21:44 IST 2021 for 16666666.67 minutes
        Command being timed: "taskset -c 0-7 sudo ./run.sh"
        User time (seconds): 310.68
        System time (seconds): 14.26
        Percent of CPU this job got: 256%
        Elapsed (wall clock) time (h:mm:ss or m:ss): 2:06.93
        Average shared text size (kbytes): 0
        Average unshared data size (kbytes): 0
        Average stack size (kbytes): 0
        Average total size (kbytes): 0
        Maximum resident set size (kbytes): 6130312
        Average resident set size (kbytes): 0
        Major (requiring I/O) page faults: 9
        Minor (reclaiming a frame) page faults: 1559833
        Voluntary context switches: 4699710
        Involuntary context switches: 87
        Swaps: 0
        File system inputs: 1824
        File system outputs: 117408
        Socket messages sent: 0
        Socket messages received: 0
        Signals delivered: 0
        Page size (bytes): 4096
        Exit status: 0
```

```
tailbench@TBUB18:~/Tailbench/tailbench/specjbb$ python3 ../utilities/parselats.py lats.bin
svc: mean 0.073 ms | p95 0.087 ms | p99 0.294 ms | max 269.951 ms
end2end: mean 59526.287 ms | p95 112958.847 ms | p99 117664.926 ms | max 118840.895 ms
```

SPHINX (CPU INTENSIVE - 32 cores, 32 threads)

```
[sudo] password for tailbench:
TBENCH_MAXREQS = 5000
TBENCH_WARMUPREQS = 10
TBENCH_MINSLEEPNS = 10000
TBENCH_RANDSEED = 0
TBENCH_QPS = 500
        Command being timed: "taskset -c 0-31 sudo ./run.sh"
        User time (seconds): 9966.90
        System time (seconds): 138.47
        Percent of CPU this job got: 3115%
        Elapsed (wall clock) time (h:mm:ss or m:ss): 5:24.39
        Average shared text size (kbytes): 0
        Average unshared data size (kbytes): 0
        Average stack size (kbytes): 0
        Average total size (kbytes): 0
        Maximum resident set size (kbytes): 3486544
        Average resident set size (kbytes): 0
        Major (requiring I/O) page faults: 0
        Minor (reclaiming a frame) page faults: 65353952
        Voluntary context switches: 454172
        Involuntary context switches: 133276
        Swaps: 0
        File system inputs: 0
        File system outputs: 240
        Socket messages sent: 0
        Socket messages received: 0
        Signals delivered: 0
        Page size (bytes): 4096
        Exit status: 0
```

```
tailbench@TBUB18:~/Tailbench/tailbench/sphinx$ python3 ../utilities/parselats.py lats.bin
svc: mean 2027.427 ms | p95 4265.354 ms | p99 5944.899 ms | max 8446.489 ms
end2end: mean 153606.124 ms | p95 291615.852 ms | p99 303874.695 ms | max 306933.296 ms
```

XAPIAN (CPU Intensive - 8 cores, 8 threads)

```
TBENCH_MAXREQS = 500000
TBENCH_WARMUPREQS = 2500
TBENCH_MINSLEEPNS = 100000
TBENCH_RANDSEED = 0
TBENCH_QPS = 50000
        Command being timed: "taskset -c 0-7 sudo ./run.sh"
        User time (seconds): 432.38
        System time (seconds): 100.57
        Percent of CPU this job got: 759%
        Elapsed (wall clock) time (h:mm:ss or m:ss): 1:10.20
        Average shared text size (kbytes): 0
        Average unshared data size (kbytes): 0
        Average stack size (kbytes): 0
        Average total size (kbytes): 0
        Maximum resident set size (kbytes): 53624
        Average resident set size (kbytes): 0
        Major (requiring I/O) page faults: 0
        Minor (reclaiming a frame) page faults: 131606
        Voluntary context switches: 387041
        Involuntary context switches: 716
        Swaps: 0
        File system inputs: 0
        File system outputs: 23440
        Socket messages sent: 0
        Socket messages received: 0
        Signals delivered: 0
        Page size (bytes): 4096
        Exit status: 0
```

```
tailbench@TBUB18:~/Tailbench/tailbench/xapian$ python3 ../utilities/parselats.py lats.bin
svc: mean 0.967 ms | p95 2.438 ms | p99 2.833 ms | max 4.253 ms
end2end: mean 29945.815 ms | p95 56773.292 ms | p99 59134.417 ms | max 59729.240 ms
```

SHORE (MEMORY INTENSIVE ? - Not Working)

```
linux-mon: ./src/util/procstat.cpp:254:print_interval: (1.1) (990.0)
linux-mon: ./src/util/procstat.cpp:254:print_interval: (1.1) (1120.0)
linux-mon: ./src/util/procstat.cpp:254:print_interval: (1.1) (1614.0)
linux-mon: ./src/util/procstat.cpp:254:print_interval: (1.1) (1198.0)
linux-mon: ./src/util/procstat.cpp:254:print_interval: (1.1) (2015.0)
        Command being timed: "sudo ./run.sh"
        User time (seconds): 31.59
        System time (seconds): 4.51
        Percent of CPU this job got: 40%
        Elapsed (wall clock) time (h:mm:ss or m:ss): 1:30.07
        Average shared text size (kbytes): 0
        Average unshared data size (kbytes): 0
        Average stack size (kbytes): 0
        Average total size (kbytes): 0
        Maximum resident set size (kbytes): 2174812
        Average resident set size (kbytes): 0
        Major (requiring I/O) page faults: 0
        Minor (reclaiming a frame) page faults: 551676
        Voluntary context switches: 398752
        Involuntary context switches: 3275
        Swaps: 0
        File system inputs: 0
        File system outputs: 367376
        Socket messages sent: 0
        Socket messages received: 0
        Signals delivered: 0
        Page size (bytes): 4096
        Exit status: 0
abhi@hadoop-slave1:~/Tailbench/tailbench-v0.9/shore$
```

```
abhi@hadoop-slave1:~/Tailbench/tailbench-v0.9/shore$ python3 ../utilities/parselats.py ./lats.bin
svc: mean 3.129 ms | p95 2.401 ms | p99 91.935 ms | max 1334.576 ms
end2end: mean 38660.457 ms | p95 75063.265 ms | p99 77601.917 ms | max 78028.770 ms
abhi@hadoop-slave1:~/Tailbench/tailbench-v0.9/shore$
```

Tailbench Applications Runtime Statistics

Application Name	CPU %	No. of Cores	Memory %	Resident Set size (kB)	Minor Page Faults	Major Page Faults	Voluntary Context Switches	Involuntary Context Switches
IMG-DNN	557	6	0.23	151216 (147.67M)	3,83,667	0	9,73,634	784
MOSES	**731**	8	1.178	772276 (754.17M)	8,37,768	0	8,64,013	1,29,801
MASSTREE	251	8	23.03	**14838308** (14.1G)	41,41,293	0	47,19,943	6,352
SPHINX	**3115**	32	5.38	3486544 (3.32G)	6,53,53,952	0	4,54,172	1,33,276
SPECJBB	256	8	9.38	**6130312** (5.92G)	15,59,833	**9**	46,99,710	87
SHORE	40	-	6.669	**2174812** (2.07G)	5,51,676	0	3,98,752	3,275
XAPIAN	**759**	8	0.083	53624 (52M)	1,31,606	0	3,87,041	716
SILO	189	8	38.56	**25149400** (23.98G)	2,16,78,564	0	2,80,948	784

IMG-DNN : CPU Intensive
MOSES : CPU Intensive
SPHINX : CPU Intensive
XAPIAN : CPU Intensive
MASSTREE : Memory Intensive
SILO : Memory Intensive
SPECJBB : Memory Intensive

Tailbench Applications Benchmark Latencies

Application Name	SVC				End2End			
	Mean μ (ms)	P_{95} (ms)	P_{99} (ms)	Max (ms)	Mean μ (ms)	P_{95} (ms)	P_{99} (ms)	Max (ms)
IMG-DNN	1.007	1.295	1.406	6.245	1.870	3.617	6.889	23.124
MOSES	3.987	5.086	5.519	17.296	29869.017	56622.027	58986.33	59565.257
MASSTREE	0.609	0.688	0.750	14.425	433686.03	822406.97	856117.483	864748.48
SPHINX	2027.427	4265.354	5944.899	8446.489	153606.124	291615.852	303874.695	306933.296
SPECJBB	0.073	0.087	0.294	269.951	59526.287	112958.847	117664.926	118840.895
SHORE	3.129	2.401	91.935	1334.576	38660.457	75063.265	77601.917	78028.770
XAPIAN	0.967	2.438	2.833	4.253	29945.815	56773.292	59134.417	59729.240
SILO	0.319	0.923	1.339	7.140	10385.458	14887.983	15439.134	15587.182

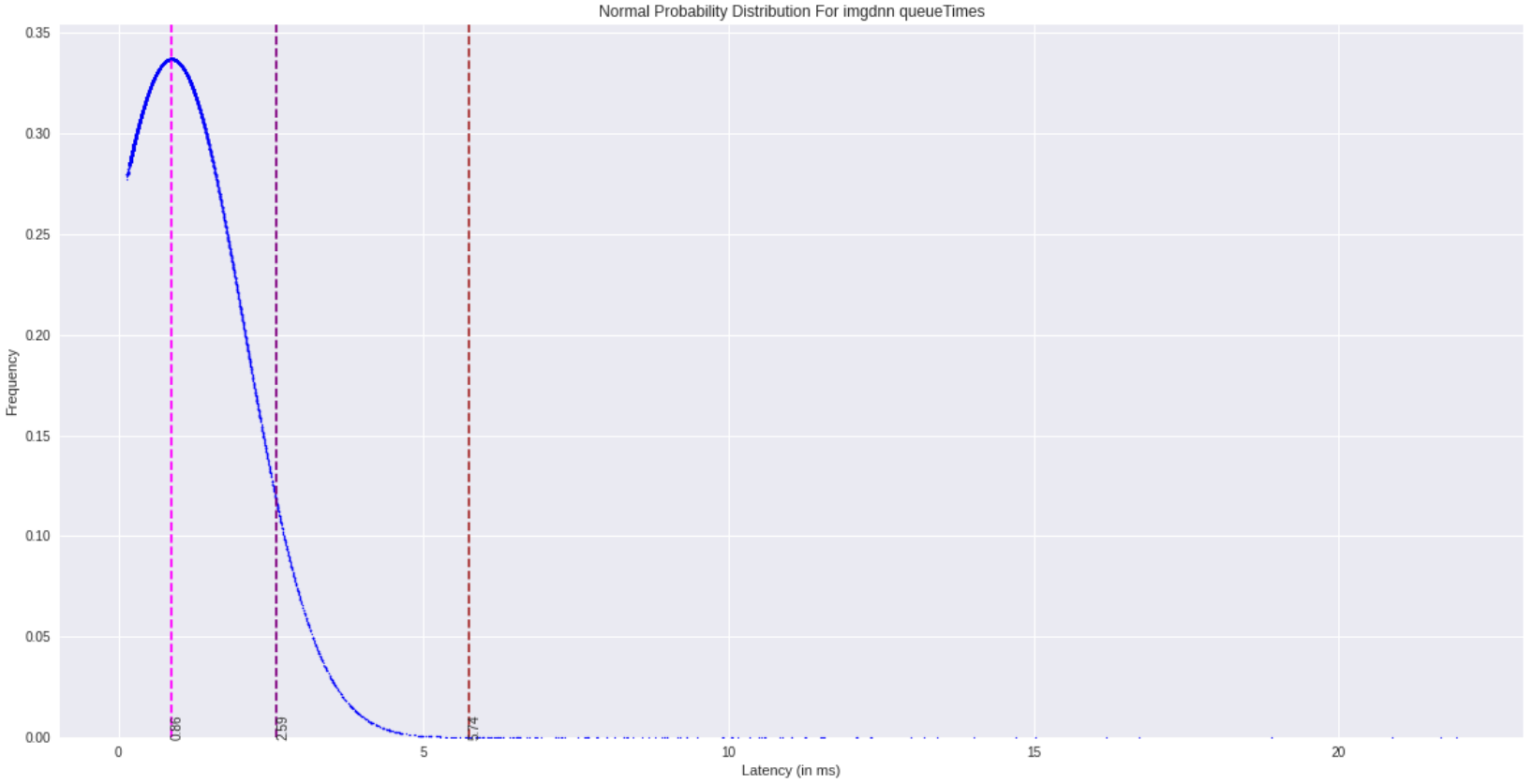
RED = Not Updated / Not executed / Not working

Tail Latency Ratio

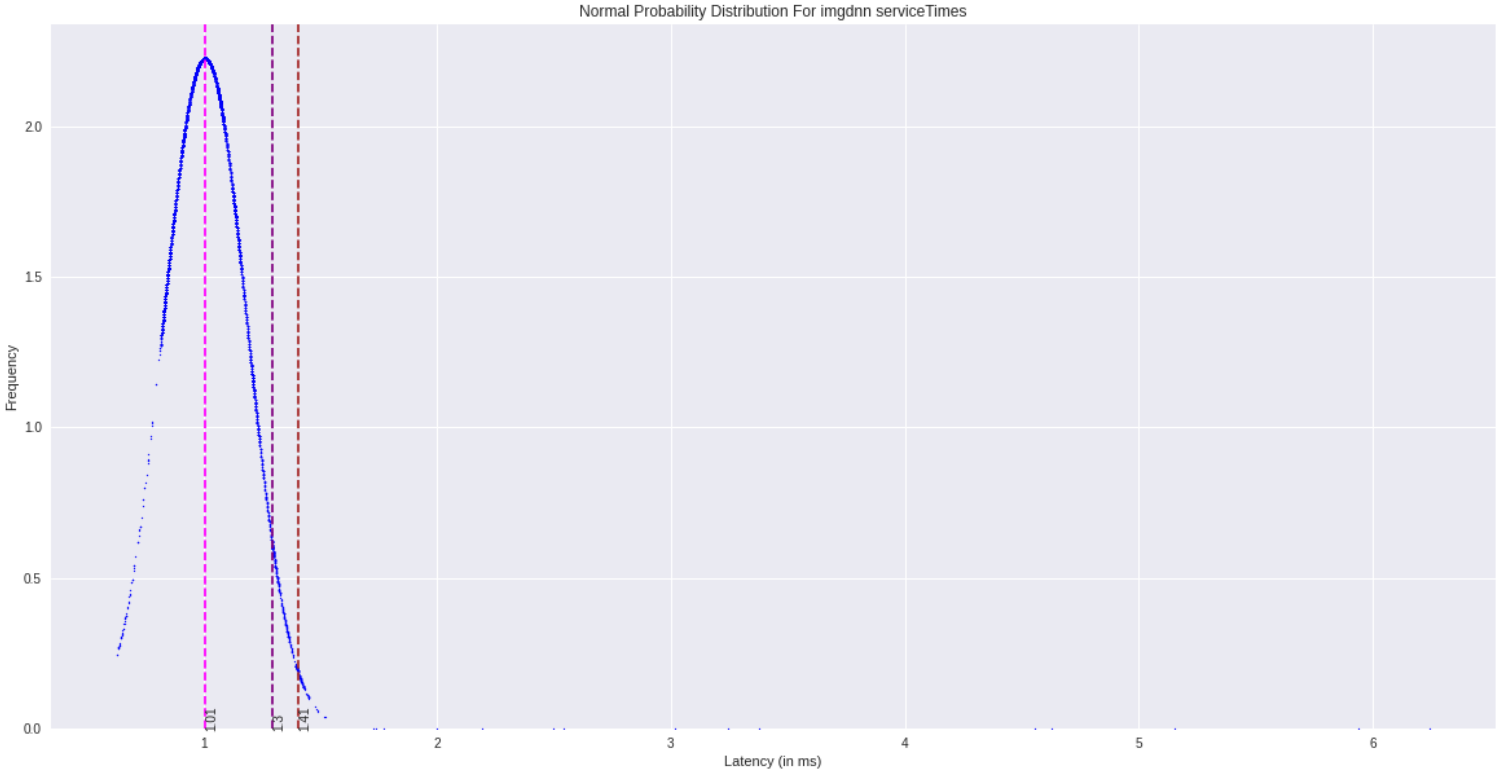
Application Name	SVC		End2End	
	Ratio (P_{95}/μ)	Ratio (P_{99}/μ)	Ratio (P_{95}/μ)	Ratio (P_{99}/μ)
IMG-DNN	1.285	1.396	1.934	3.683
MOSES	1.275	1.384	1.895	1.99
MASSTREE	1.129	1.231	1.896	1.974
SPHINX	2.103	2.93	1.898	1.978
SPECJBB	1.191	4.027	1.897	1.976
SHORE				
XAPIAN	2.521	2.929	1.895	1.974
SILO	2.893	4.197	1.433	1.486

Graphs of Tailbench Applications

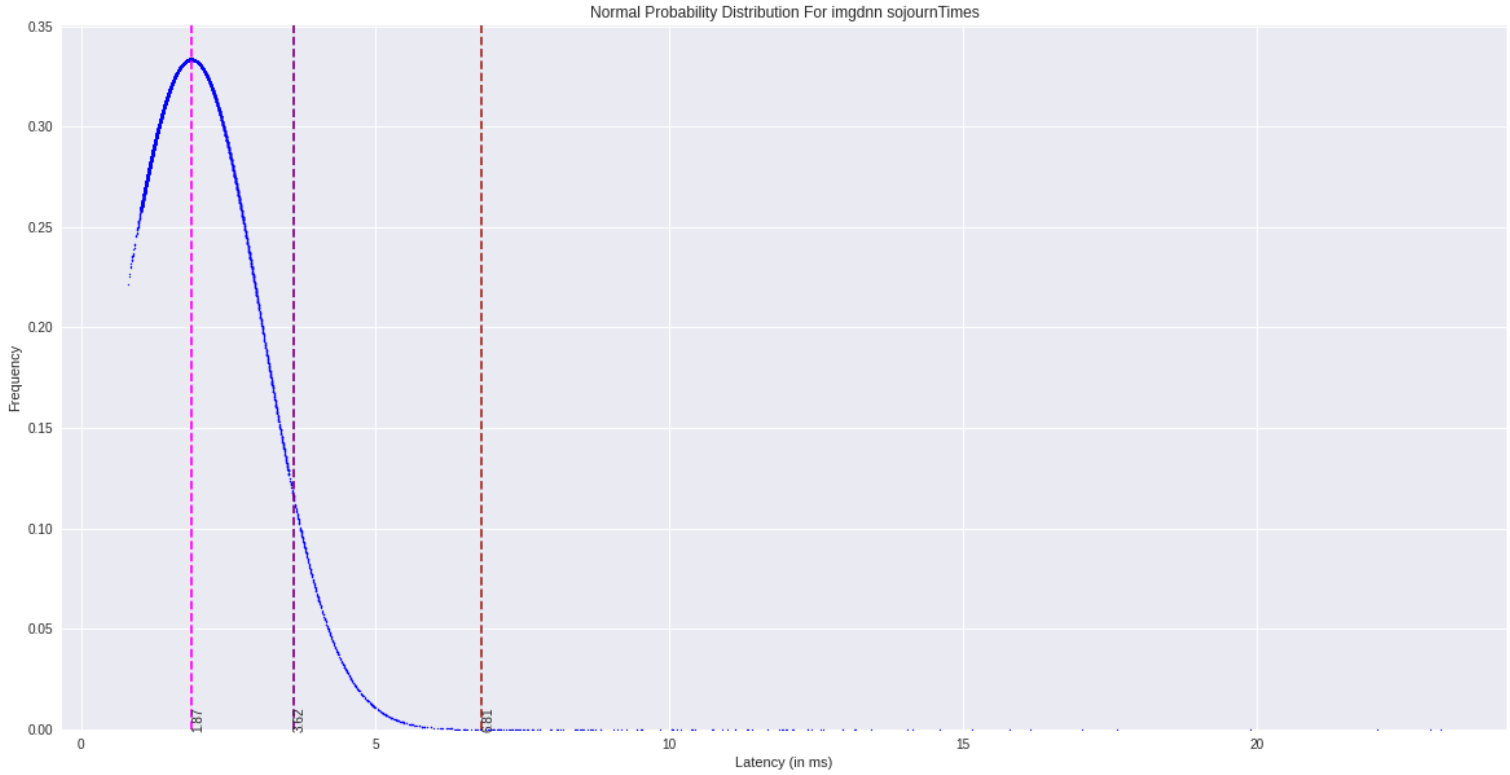
IMG-DNN - QueueTimes



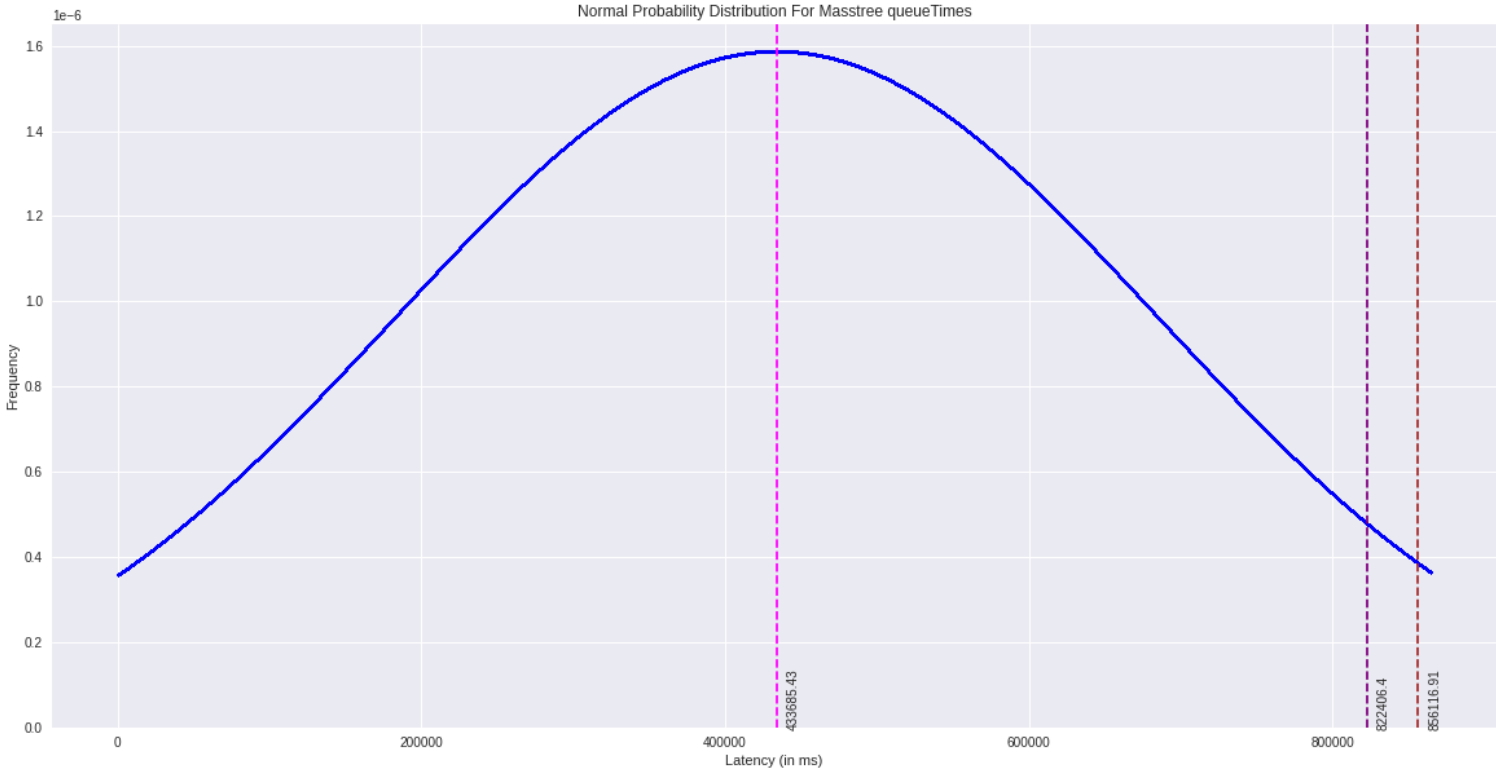
IMG-DNN - ServiceTimes (svc)



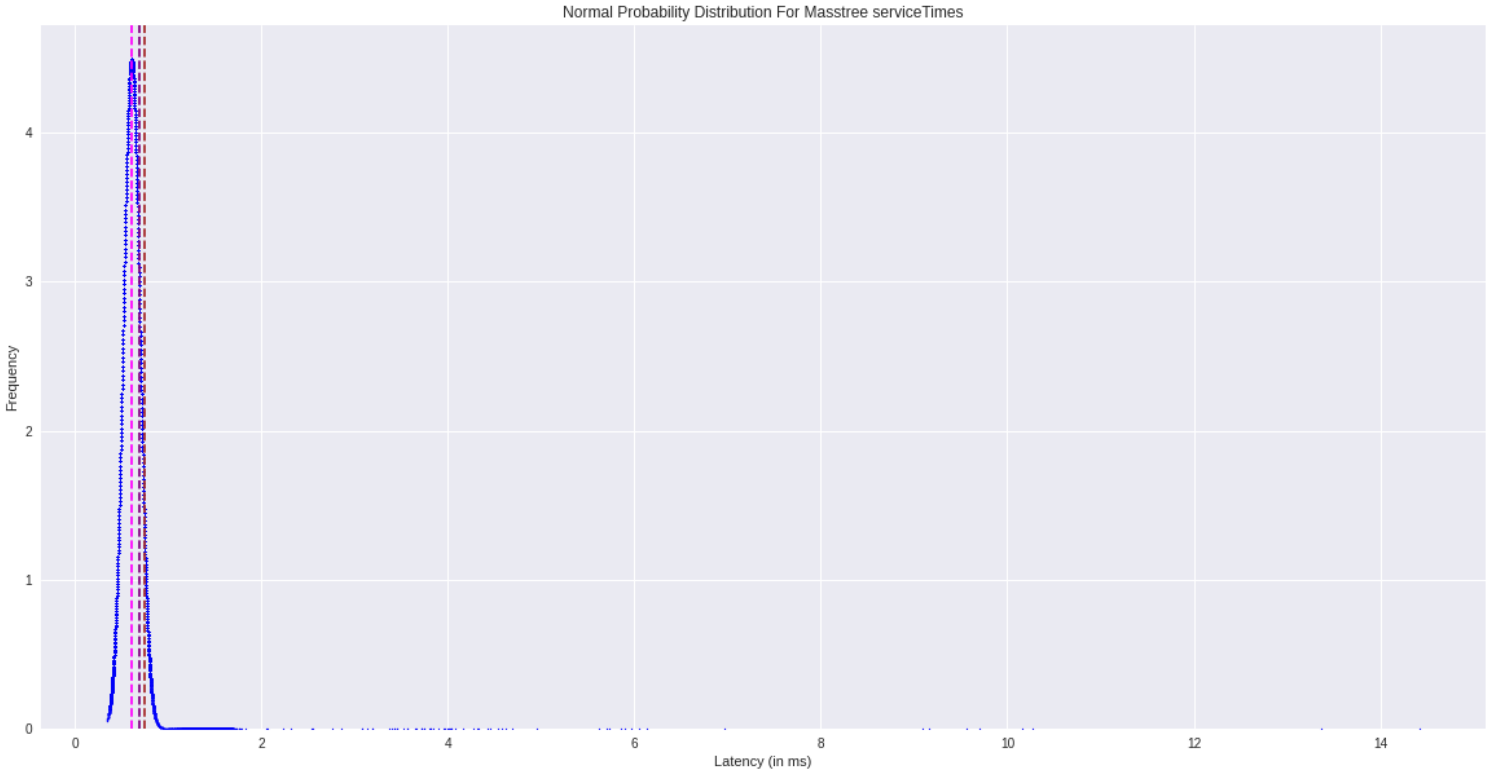
IMG-DNN - SojournTimes (End2End)



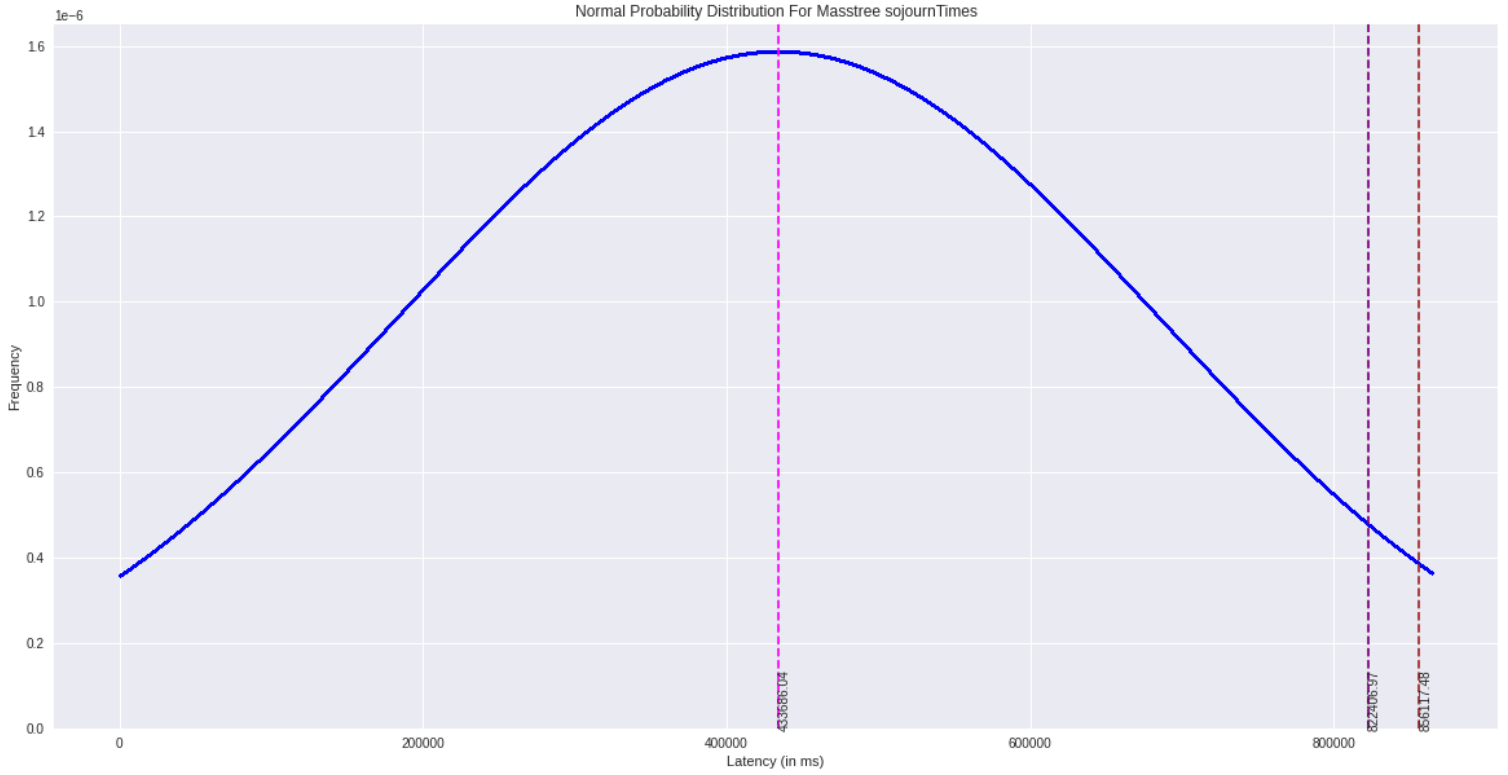
MASSTREE - QueueTimes



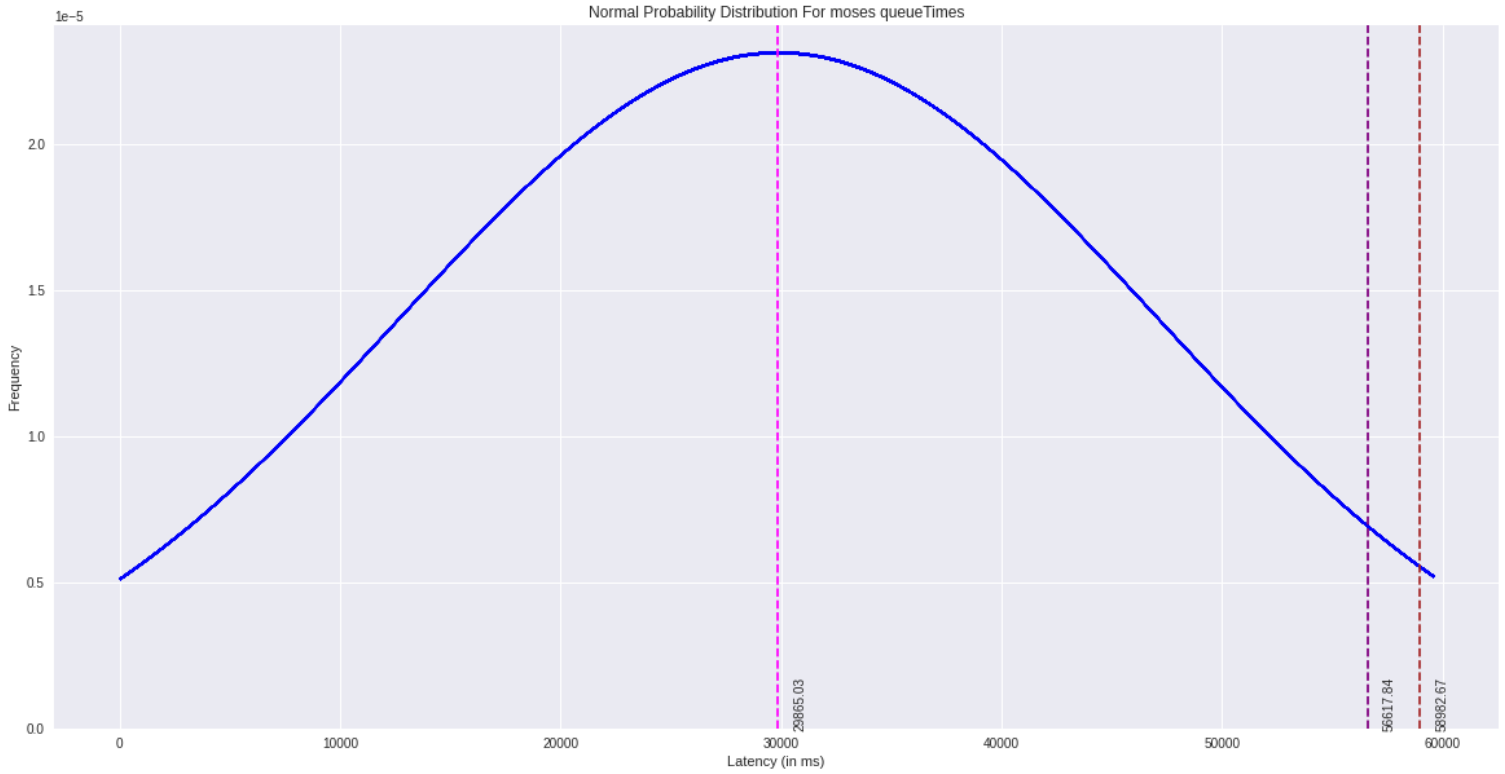
MASSTREE - ServiceTimes(svc)



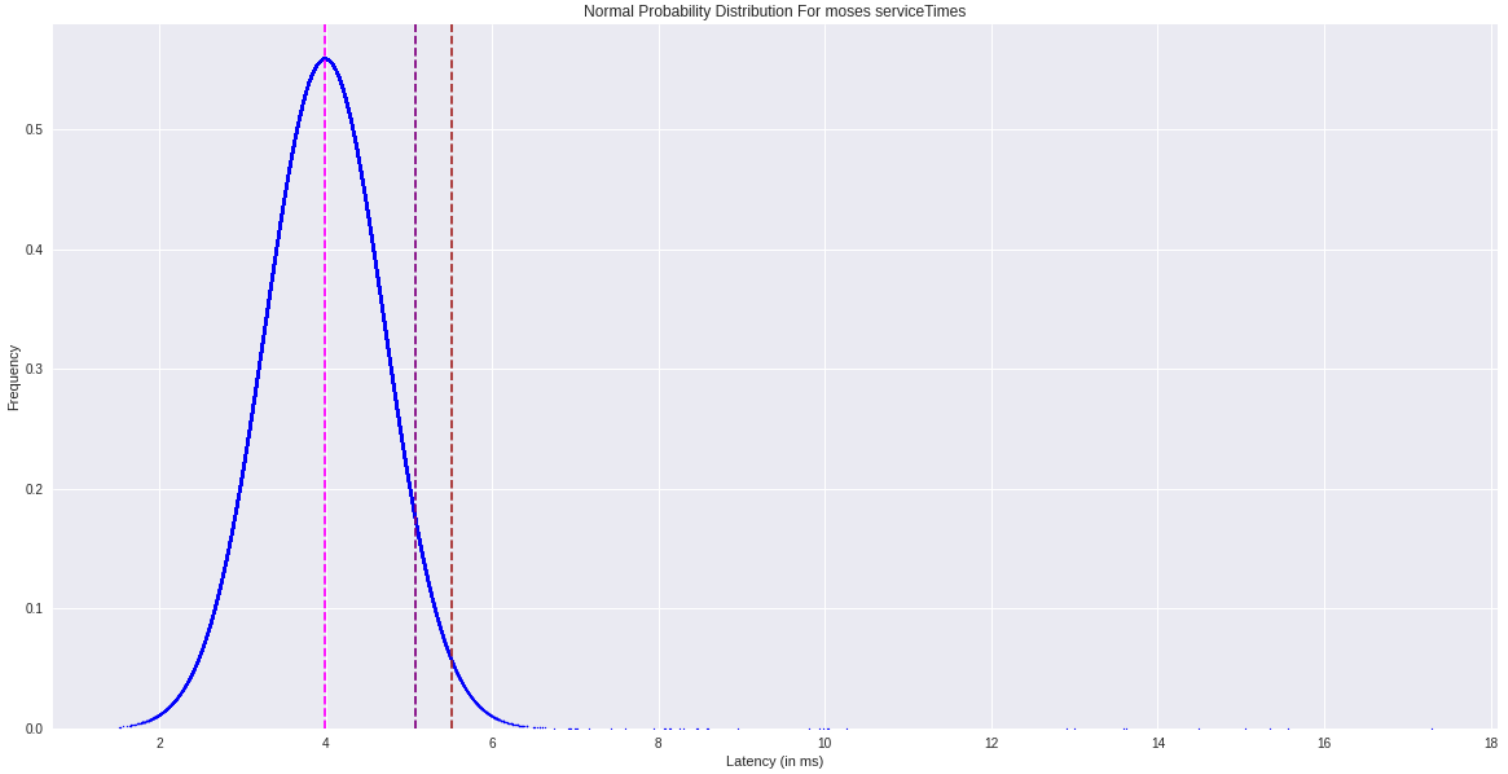
MASSTREE - SojournTimes (End2End)



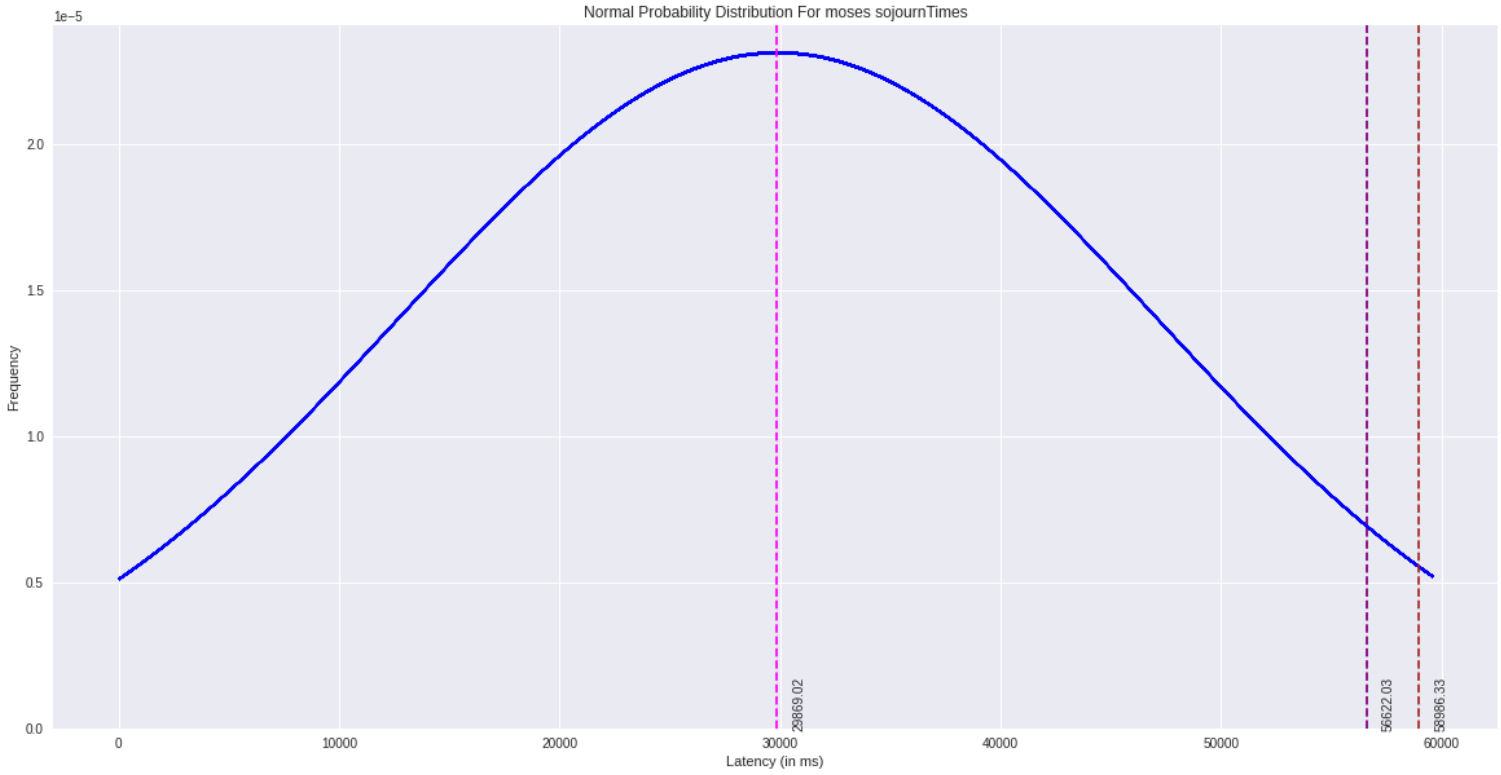
MOSES - QueueTimes



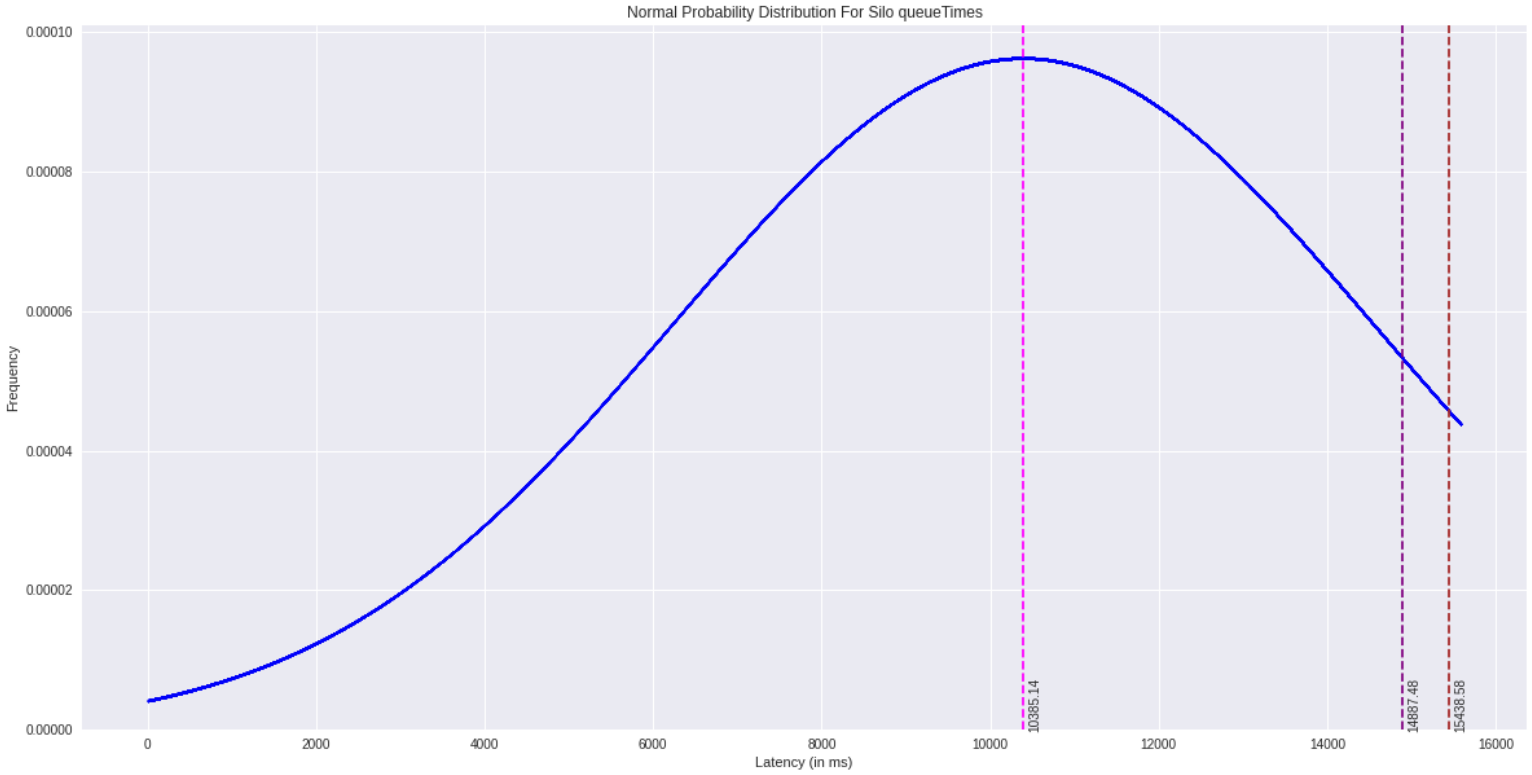
MOSES - ServiceTimes (svc)



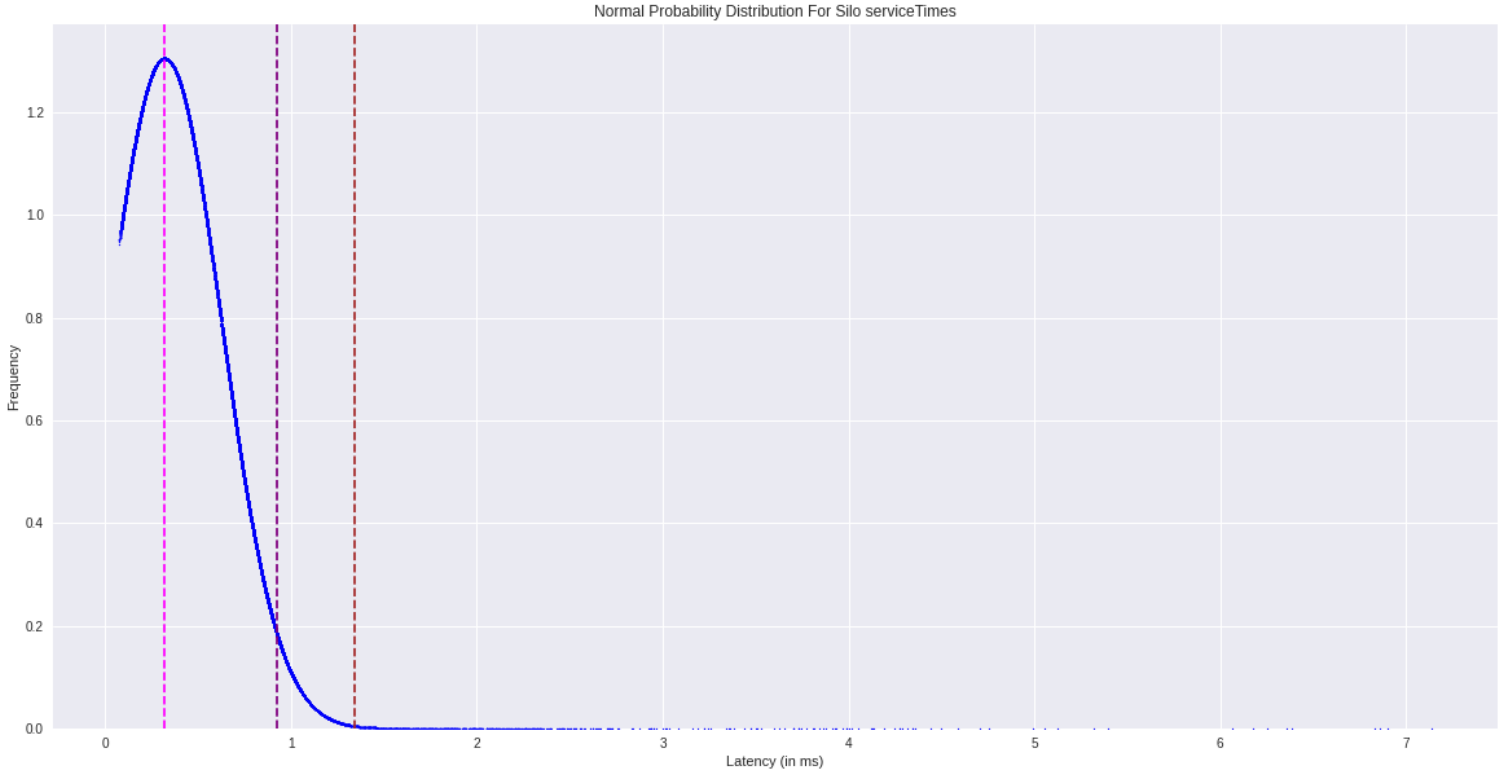
MOSES - SojournTime (End2End)



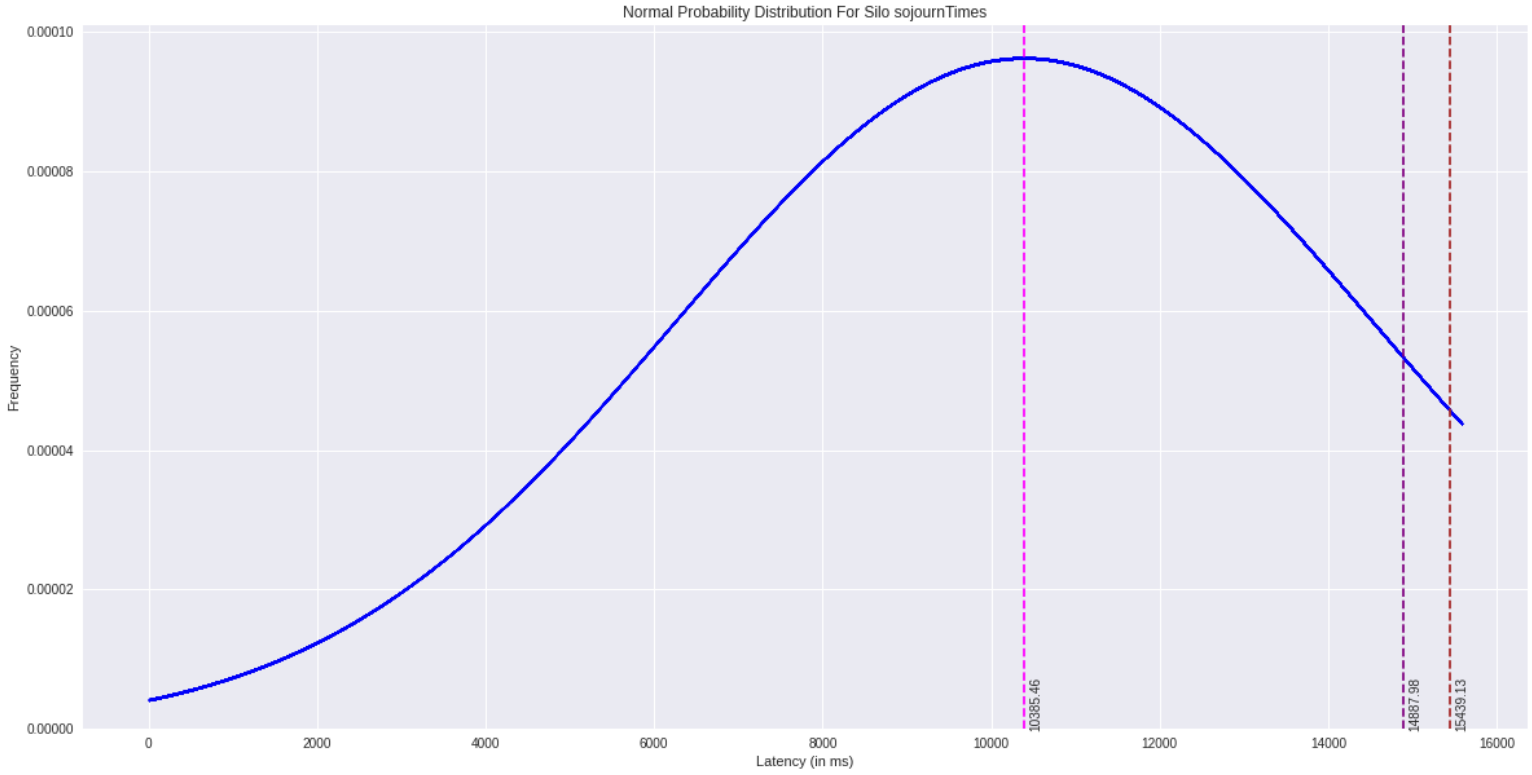
SILO - QueueTimes



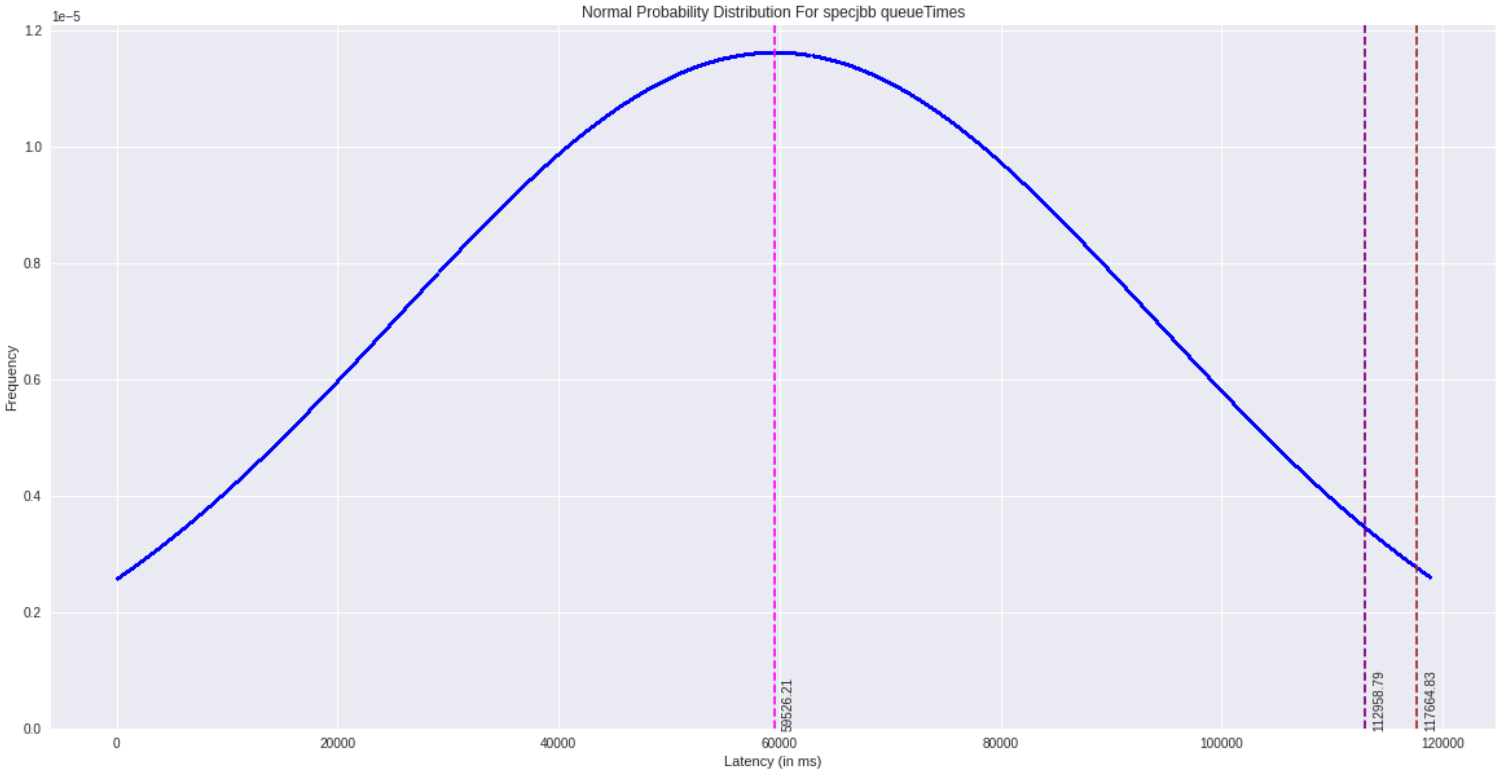
SILO - ServiceTimes (svc)



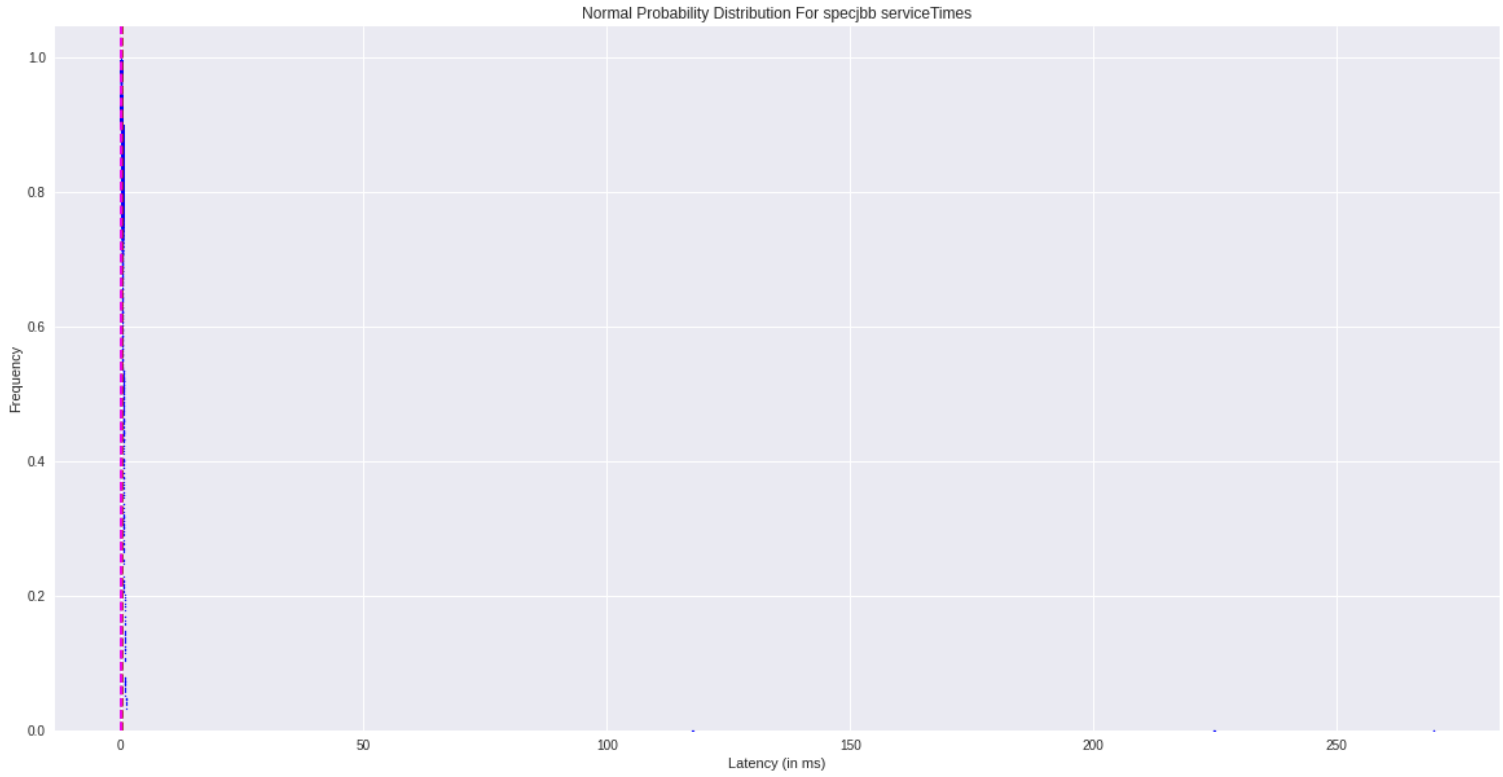
SILO - SojournTimes (End2End)



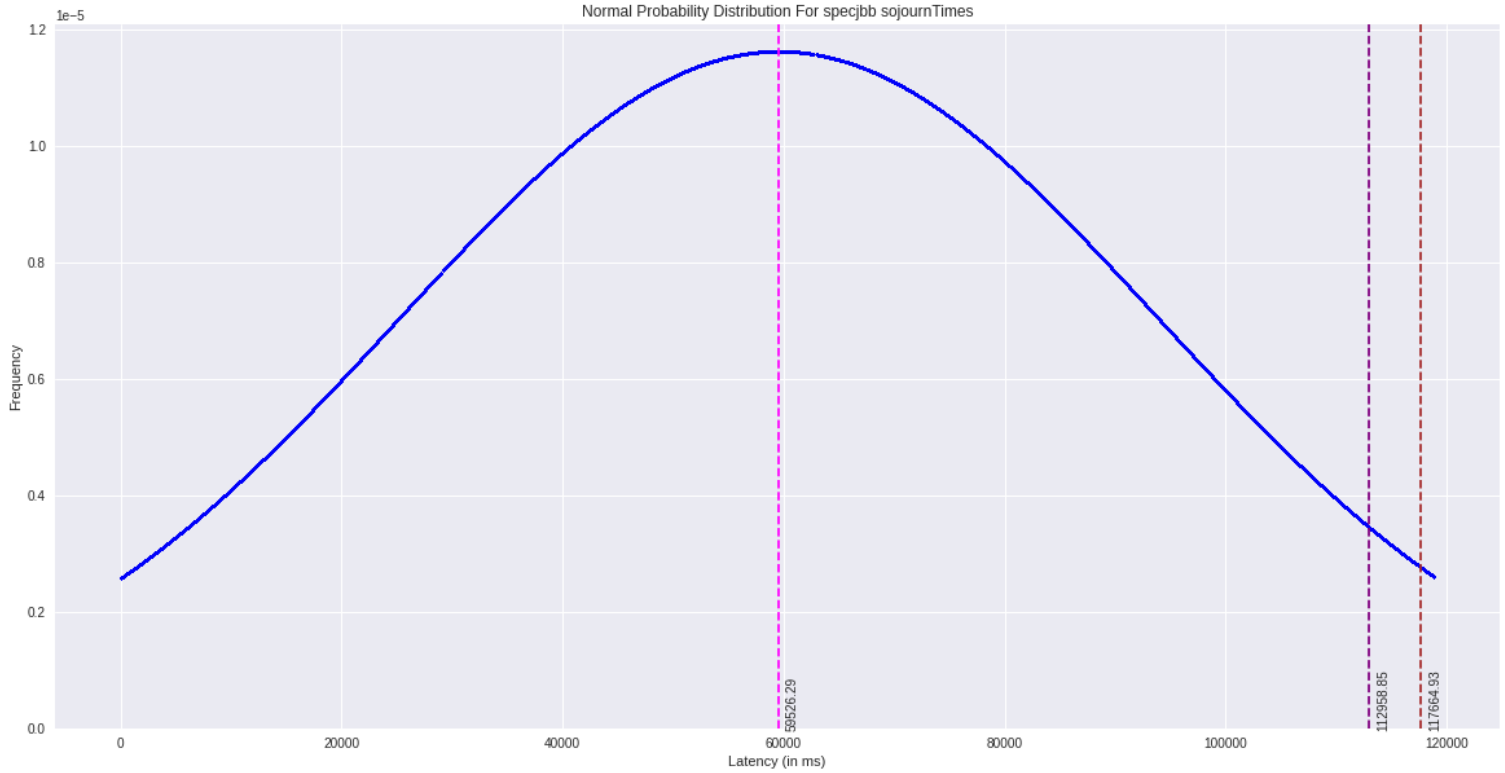
SPECJBB - QueueTimes



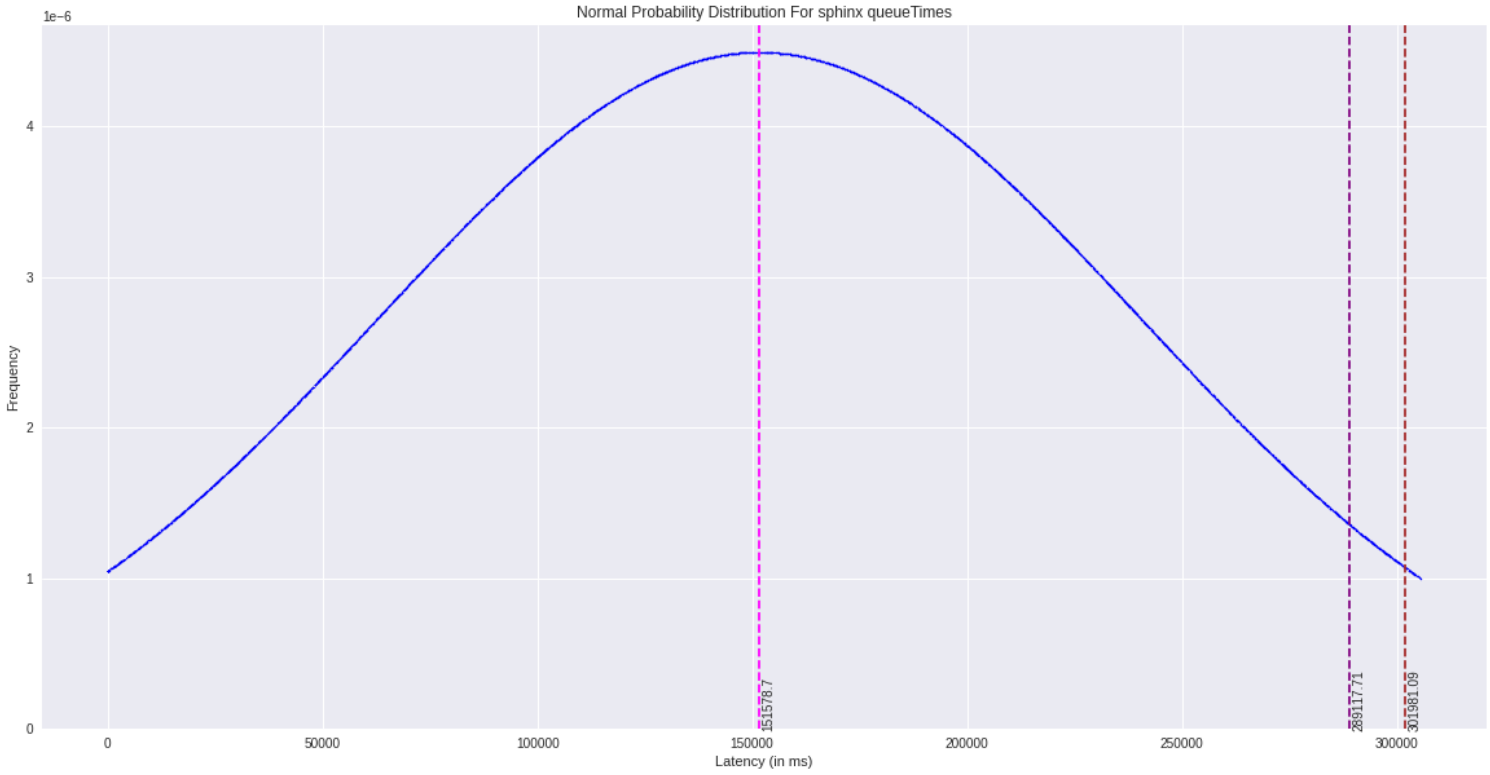
SPECJBB - ServiceTimes (svc)



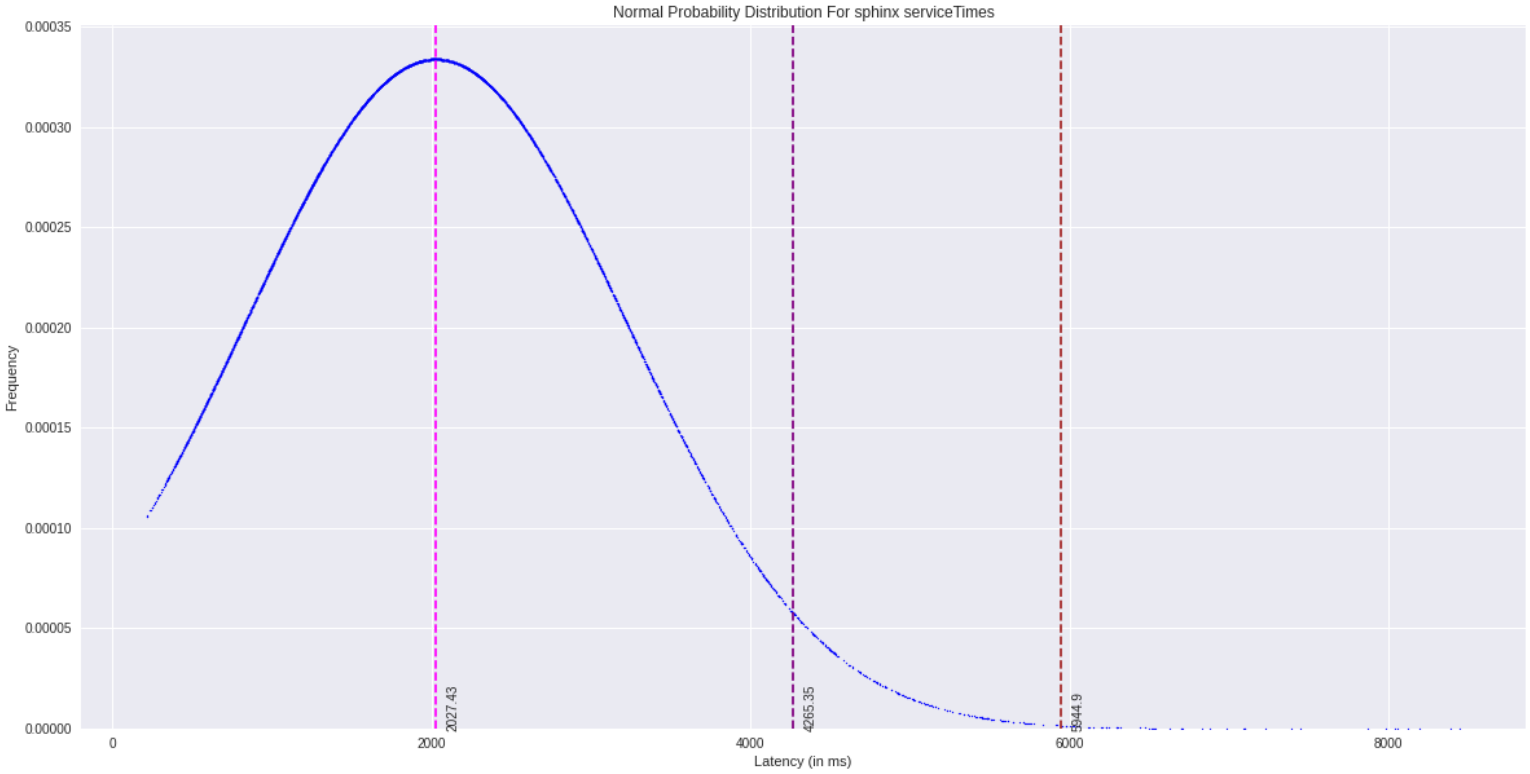
SPECJBB - SojournTimes (End2End)



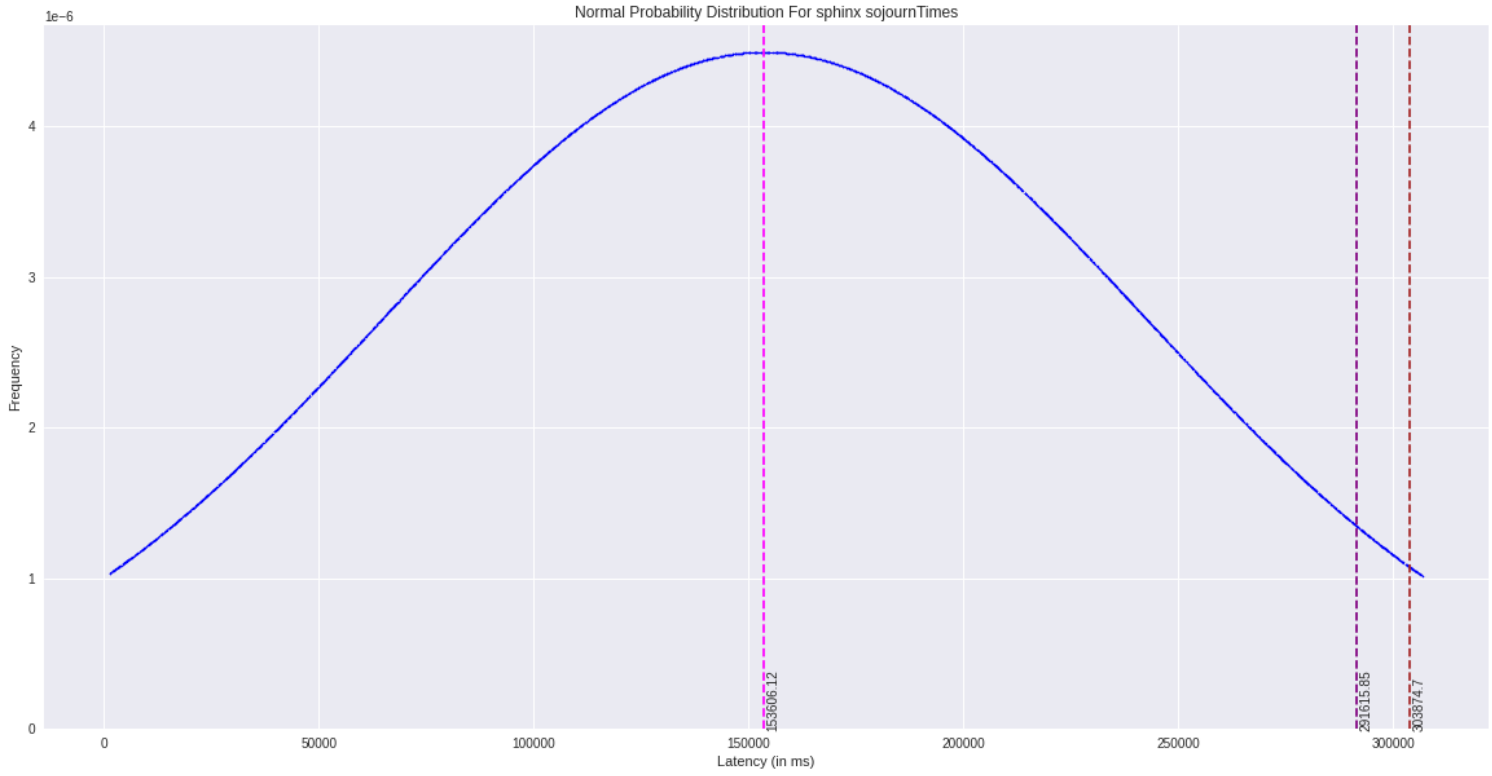
SPHINX - QueueTimes



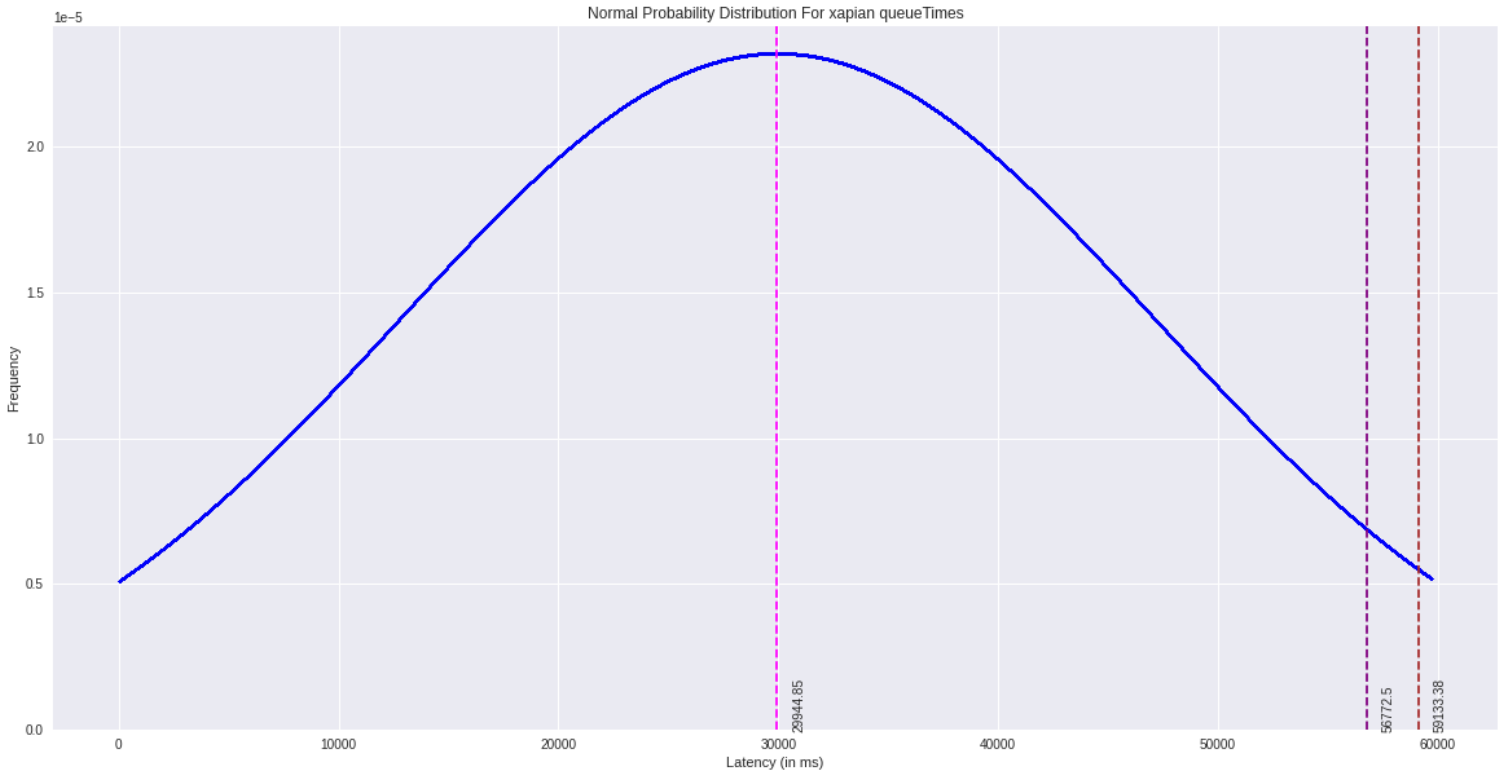
SPHINX - ServiceTimes (svc)



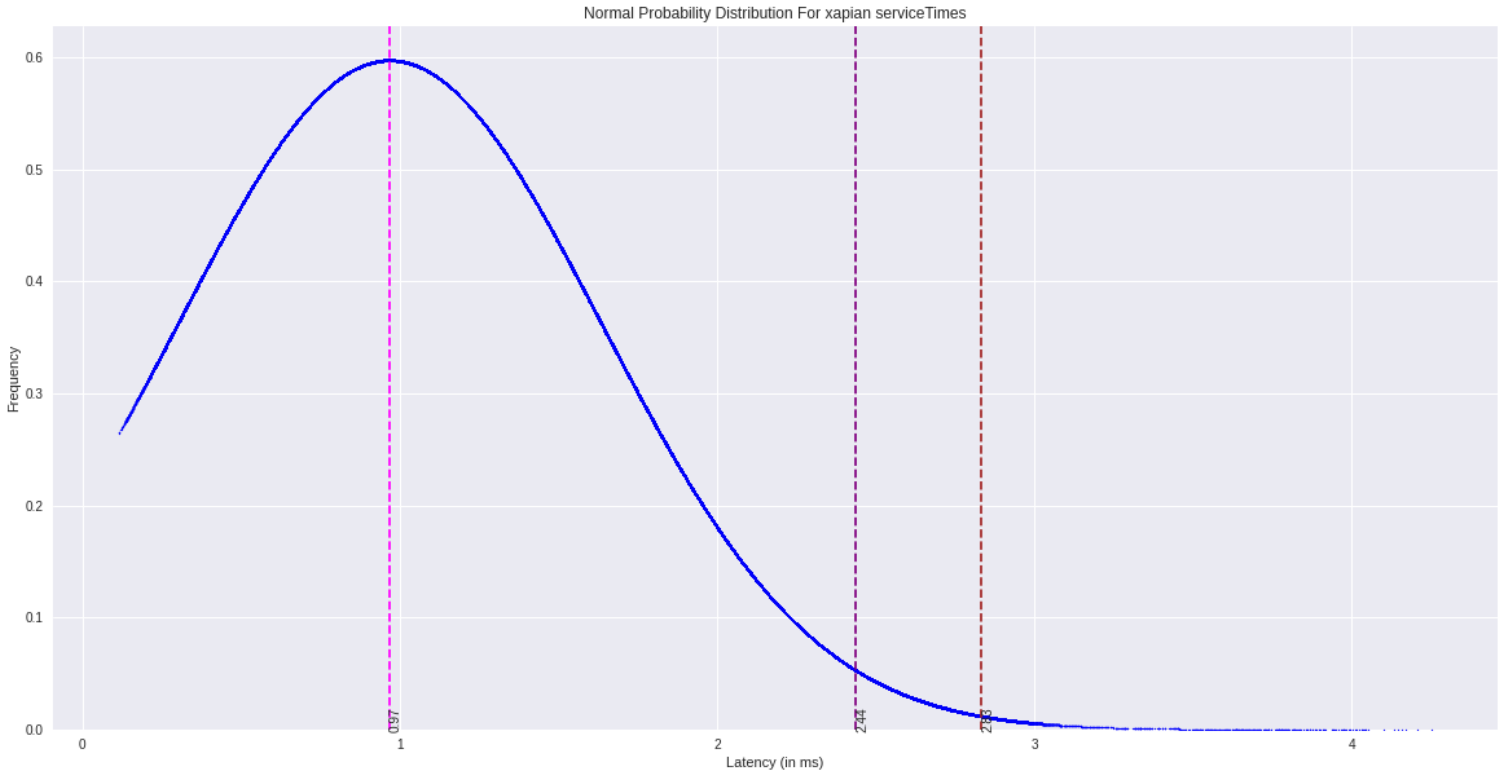
SPHINX - SojournTimes (End2End)



XAPIAN - QueueTimes



XAPIAN - ServiceTimes (svc)



XAPIAN - SojournTimes (End2End)