OLTP DMBSs Analysis

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1 Introduction

However due to the increasing use of databases in industry, there is also an increasing need for standards to compare databases. In this report we aim to monitor and study some of the most known databases of OLTP useing TPC-C benchmark

1.1 Sofware

- Docker: 18.06.1-ce, build e68fc7a

- Postgres: 11.1 (Debian 11.1-1.pgdg90+1)

- Voltdb: v8.3.3

- OS: Ubuntu 16.04.1 LTS GNU/Linux 4.4.0-141-generic

- Java: openjdk 1.8.0_191

- Python: 3.5.2

- Dstat: 0.7.3

1.2 Hardware

- CPU: Intel(R) Xeon(R) E5530 @ 2.40GHz

- RAM: 40 GB, DIMM DDR3 Synchronous 1333 MHz (0.8 ns) (+ 39GiB Linux swap / Solaris partition)

- Storage: 3725GiB SCSI Disk 15000 RPM

2 Performance Test

TPC-C benchmark was used, In order for the results to be comparable and to be used in standard analysis.
In each performance test we measure and compare these parameters:

- CPU usage: measured in percent of all core usage (which is equal to the sum user usage and waited tasks)

- CPU load: number of tasks in queue of CPU.

- CPU context switches and interrupt: A consistent parameter to measure dbms DBMS batch it's tasks.

- Memory: RAM usage plus Swap reserved by all process in system.

- Disk: bytes read or write from hard disk when DBMS is under the test.

- Total Throughput: How many transactions ended successfuly in a period of time.

- Latency: How much time a transaction took to return the results.

txn Type	High Read mode	Medium mode	High Write mode
New order	40	40	30
Payment	25	45	40
Order Status	15	5	5
Delivery	5	5	20
Stock Level	15	5	5

Table 1: Transaction Type mix [%] for mode

Note that every test was ran on a single node so that the network won't effect the results.

Latency: How much time transaction taked to return the results. TPC-C was applied benchmark to Postgres and Voltdb. All tests wete ran only once and target execution time was 2 hour, which may be longer or shorter due to runtime condition.

Runnig test in 3 modes and 6 scale factor causes at most 18 results which will be compared compare and explained later. Measured scale factors were 1, 2, 3, 5, 10, 100.

Out benchmark test skipped considering disk usage growth.

For Voltdb long transaction means transactions with latency more than 10 seconds but for postgres this limit is 100 seconds. The Reason is that overall transaction latency for postgres is higher than Voltdb. The reason will be explained further.
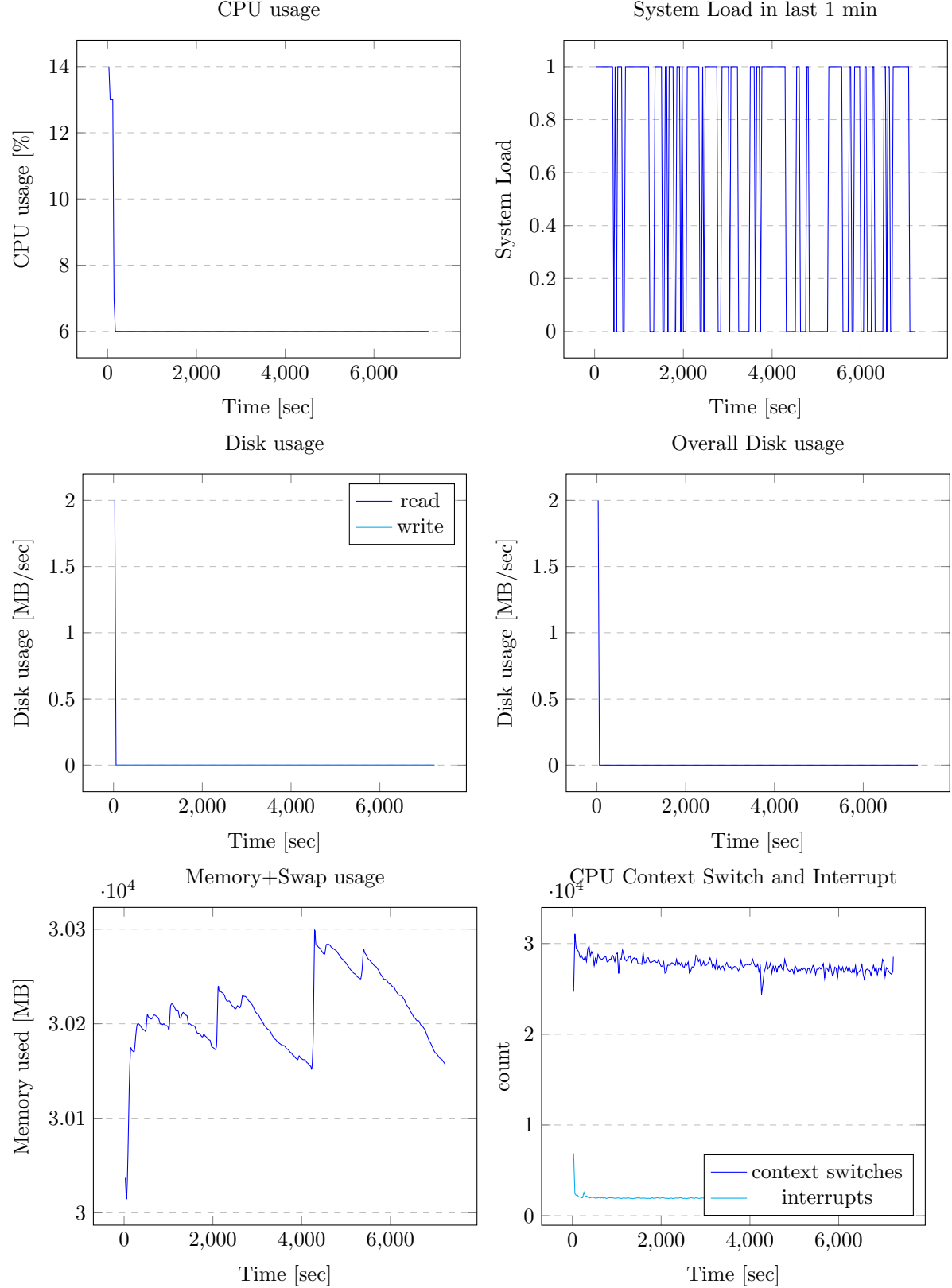
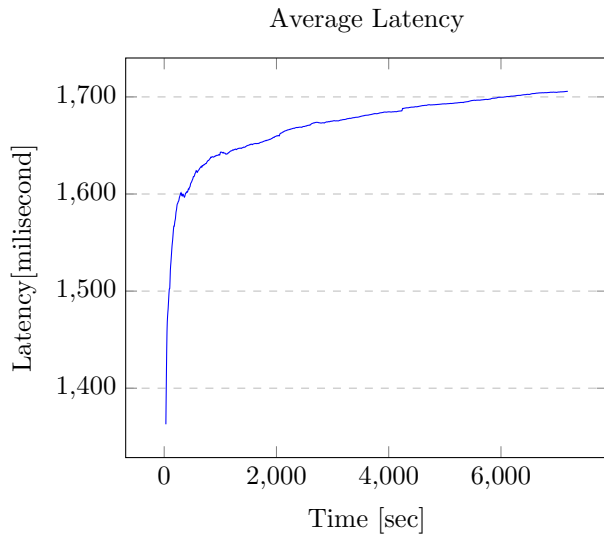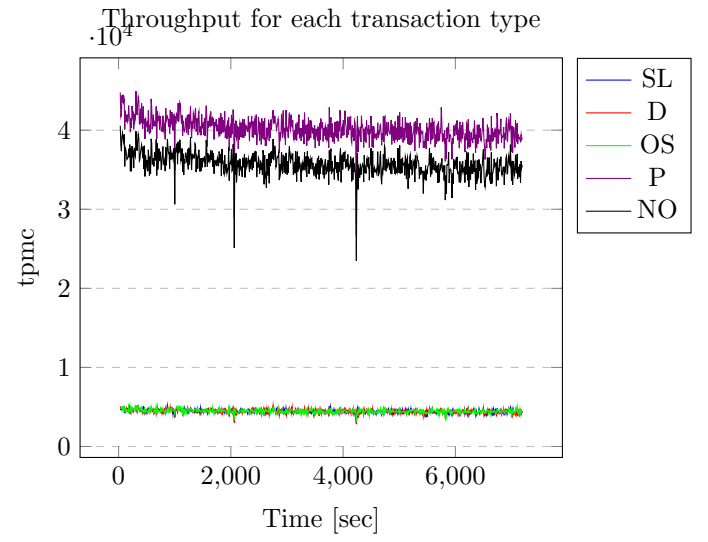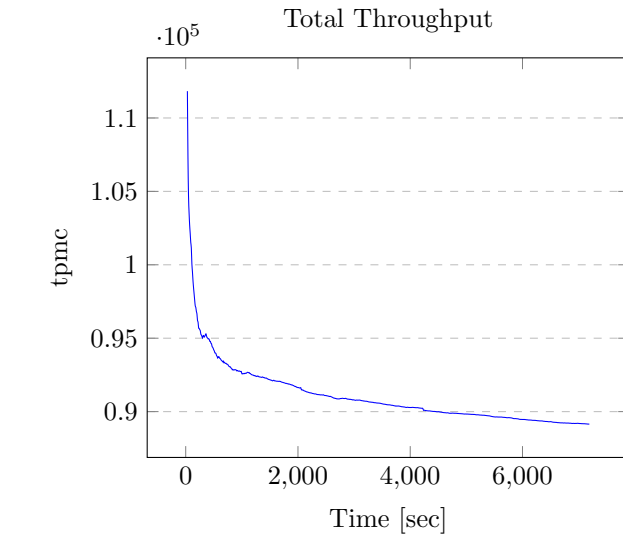| System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
1.07	30212.24 MB	0.02 MB/sec	7231.00 sec	26805 milisecond	71

Table 2: Average Parametes over Runtime in medium mode and SF equals 1

3 Voltdb results

no

medium mode and SF equals 1

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

Throughput for each transaction type

Average Latency

Transaction Type	Total Count	tpmc
Stock Level	534291	4450.41
Delivery	533695	4445.44
Order Status	535458	4460.13
Payment	4812736	40087.95
New Order	4281269	35661.07

Response Time
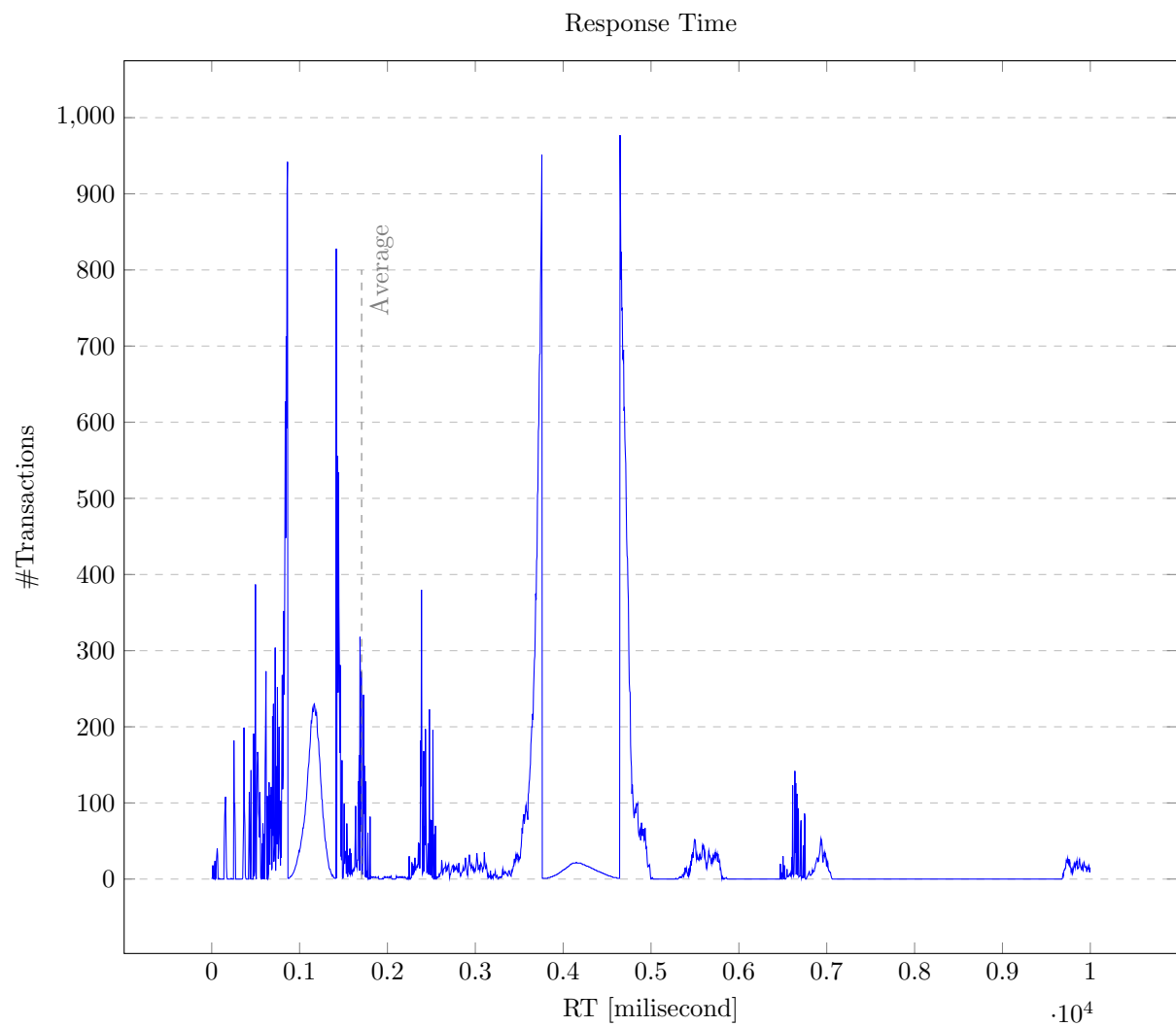
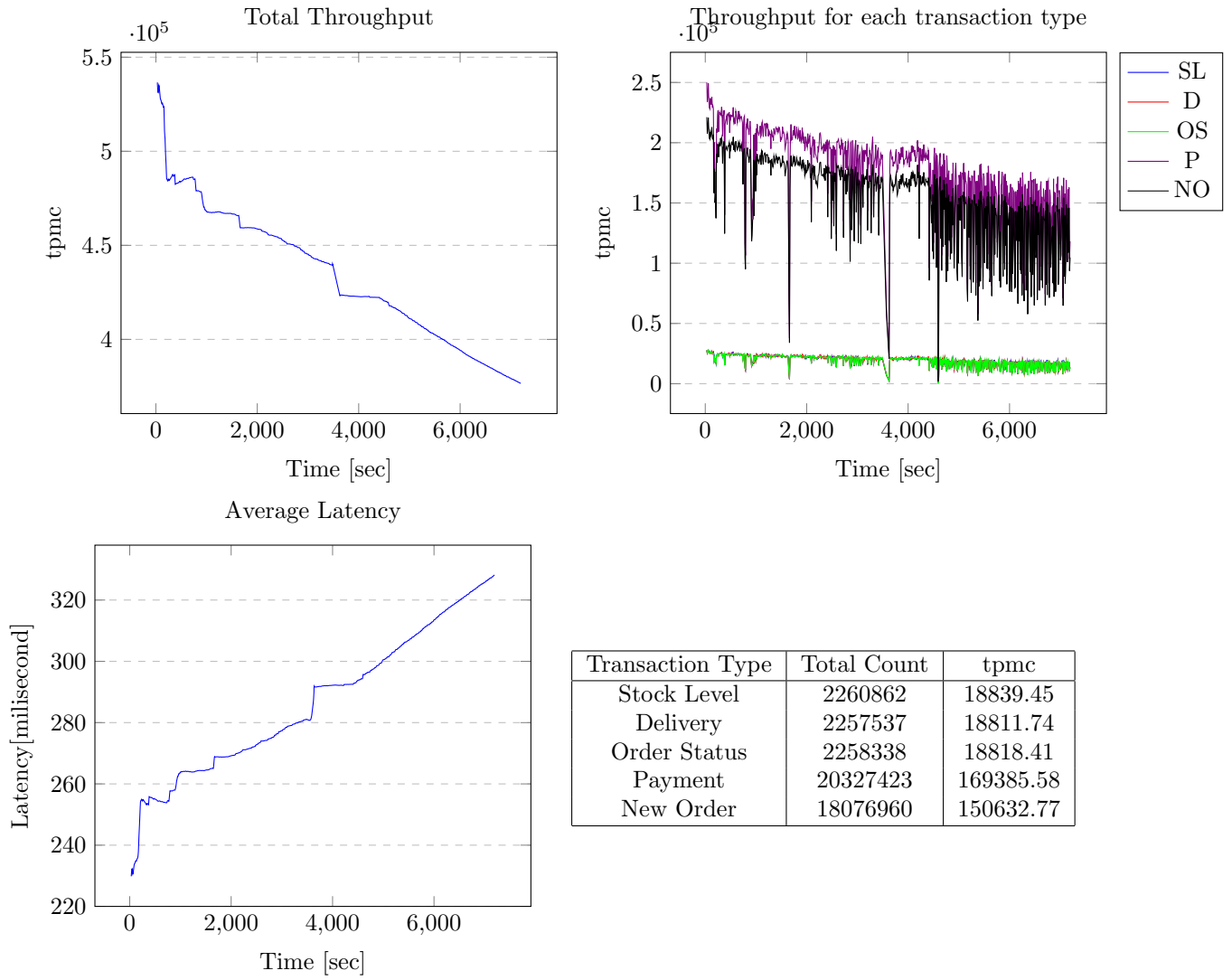At this scale factor, voltdb uses cpu very slightly but reserves memory very heavily and frees it at a

glance 3 time in a run. As expected, by increasing time and active transactions, latency will increase too and throughput decreases very fast at the begining and then decrease rate was fall down.

System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
2.26	25052.91 MB	0.83 MB/sec	7206.00 sec	15886 milisecond	8494

Table 3: Average Parametes over Runtime in medium mode and SF equals 2

medium mode and SF equals 2

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

Throughput for each transaction type

Average Latency

Transaction Type	Total Count	tpmc
Stock Level	2260862	18839.45
Delivery	2257537	18811.74
Order Status	2258338	18818.41
Payment	20327423	169385.58
New Order	18076960	150632.77
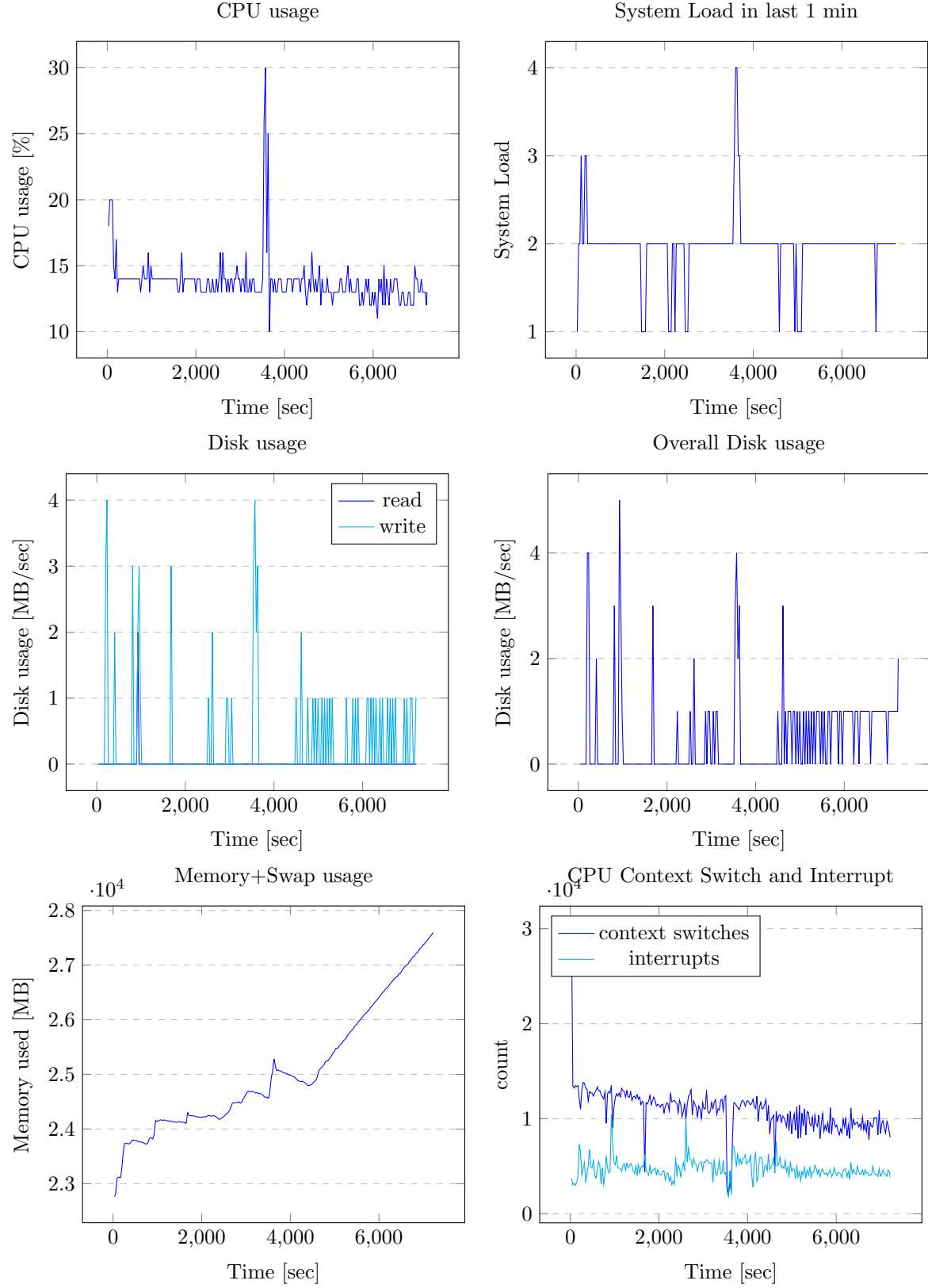
At this scale factor, voltdb writes more on disk and uses more processing resource. The intresting point is that memory resevre speed has direct relationship with latency and inverse relationship with throughput. Their diagram slope has the same pattern. some extreme falling in NewOrder type and Payment type throughput can be seen in cpu context switch and cpu load. Response time per Throughput diagram isn't normal as previous scale factor but the most important diffrence is that it has very smaller average. This

Response Time

pattern repeated several times in other tests.
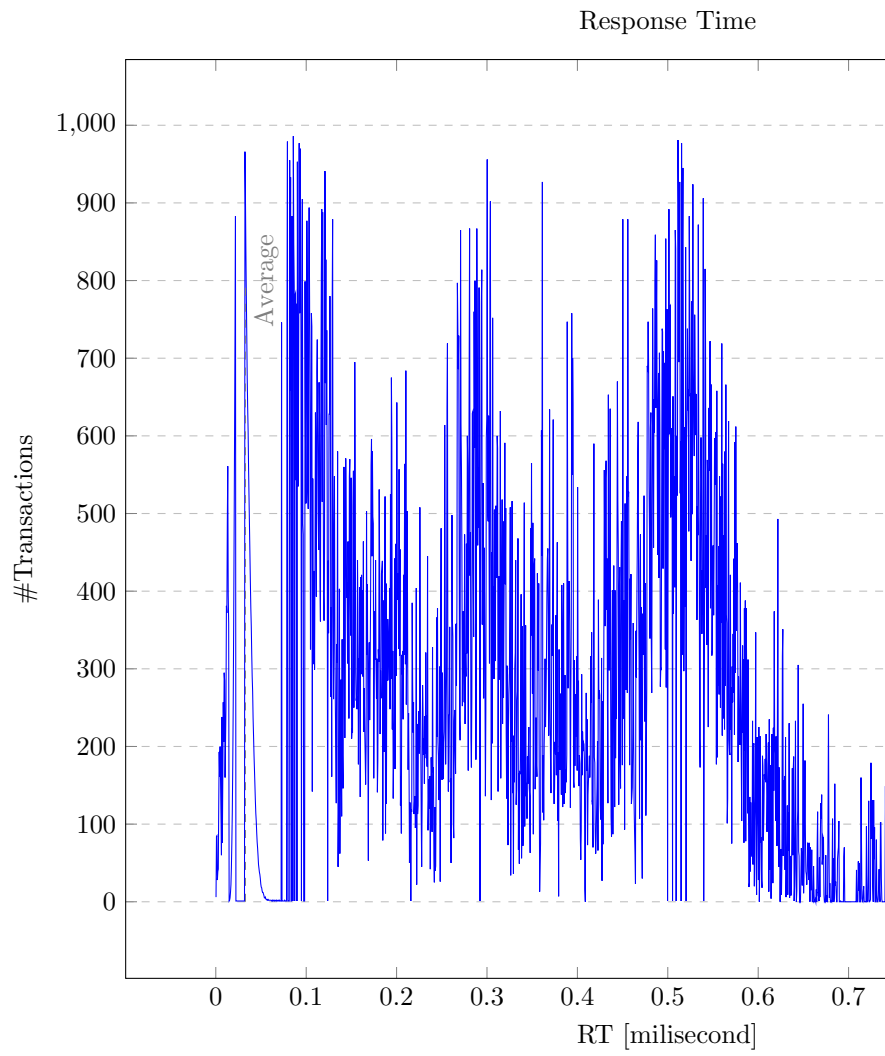
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
1.81	23702.18 MB	0.64 MB/sec	7210.00 sec	17202 milisecond	7446

Table 4: Average Parametes over Runtime in medium mode and SF equals 3

medium mode and SF equals 3

Total Throughput

Throughput for each transaction type

Average Latency
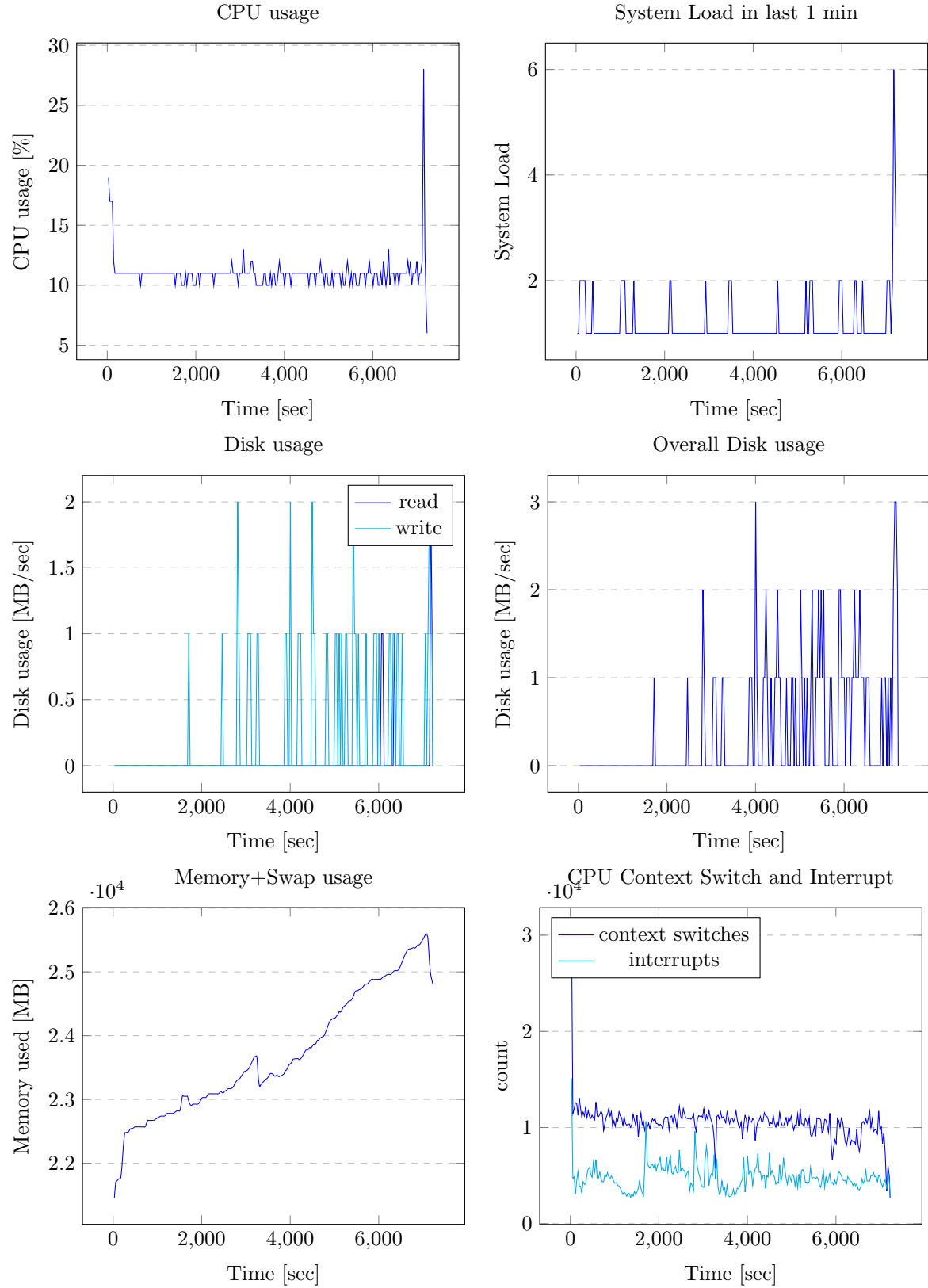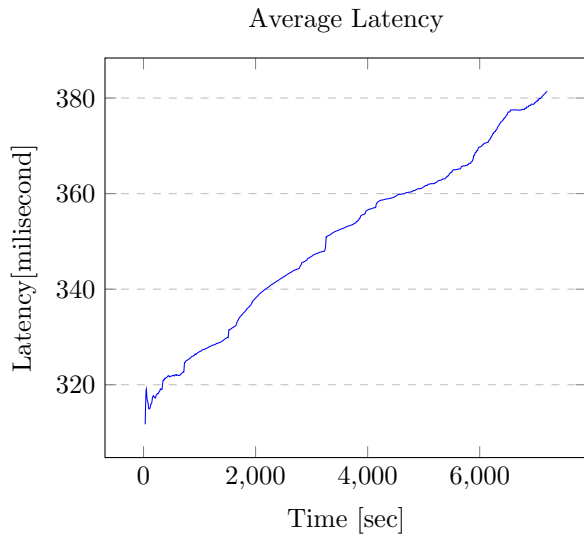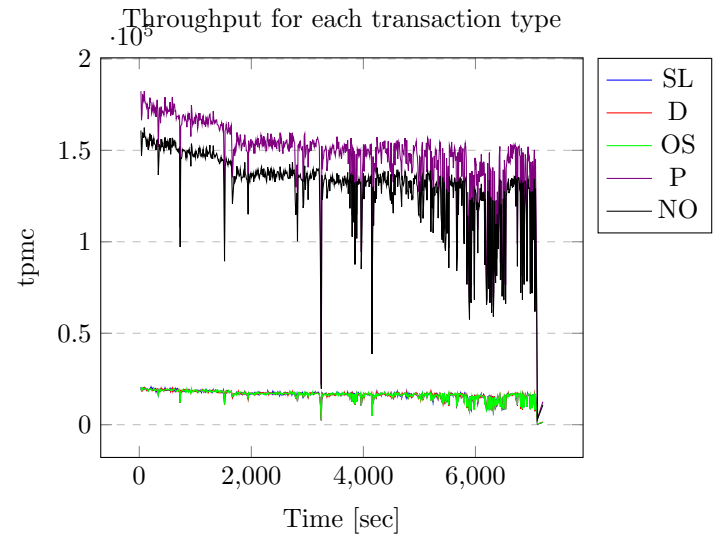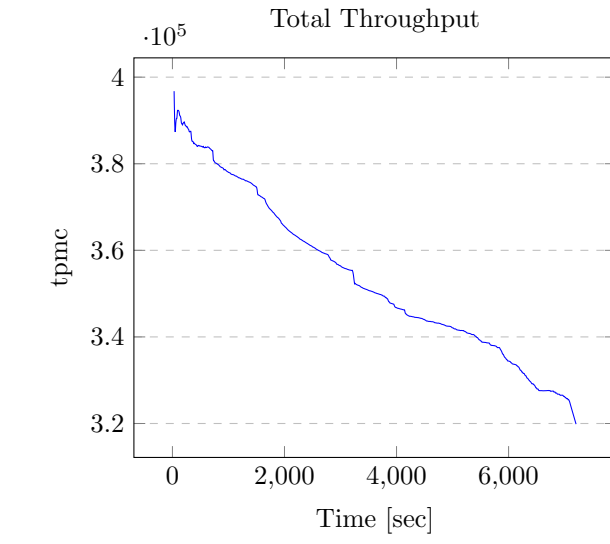
Transaction Type	Total Count	tpmc
Stock Level	1921640	16001.78
Delivery	1919535	15984.25
Order Status	1920201	15989.79
Payment	17281669	143906.97
New Order	15364995	127946.55

Response Time
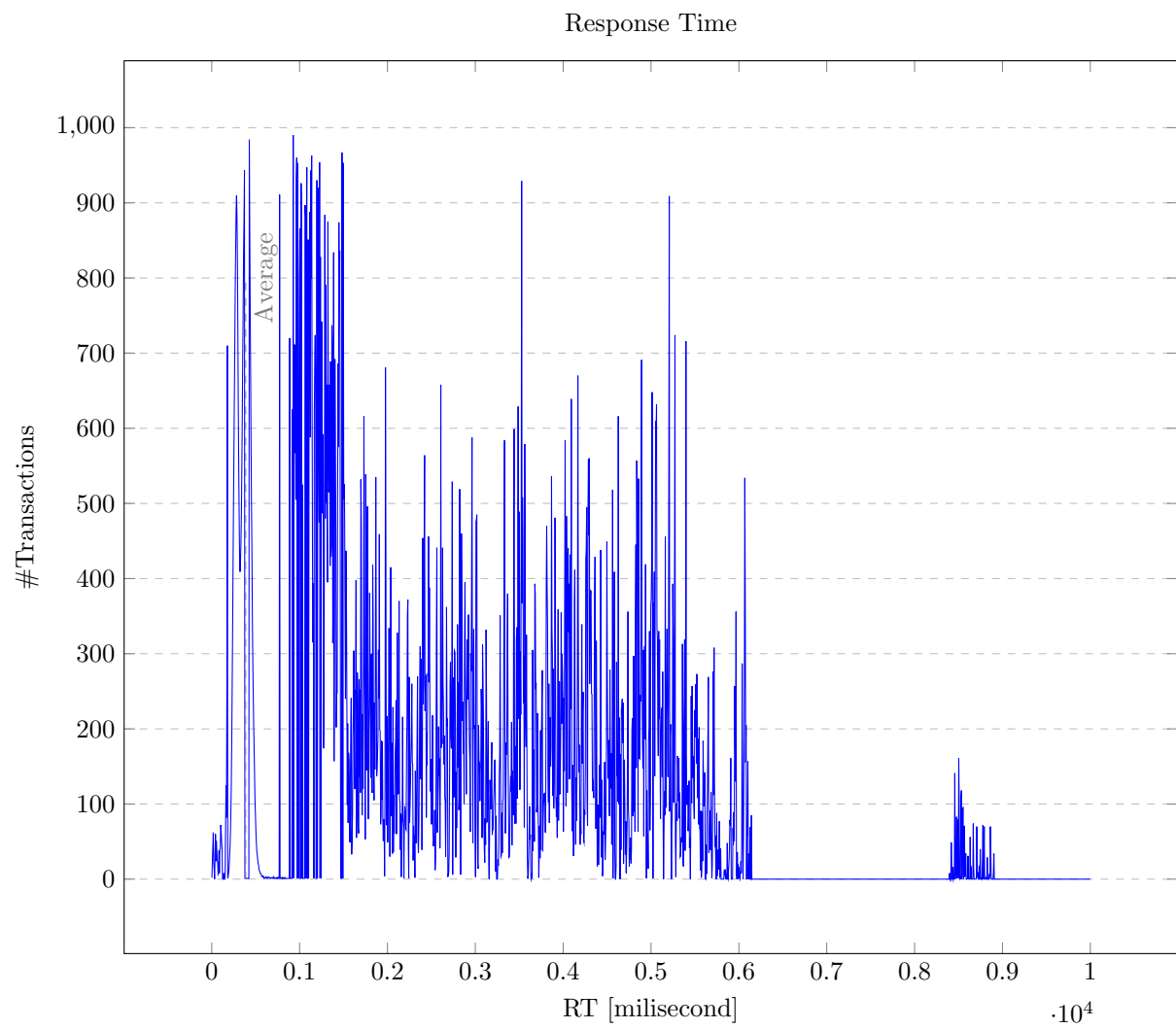
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
2.34	28429.59 MB	1.06 MB/sec	7361.00 sec	190705 milisecond	15589

Table 5: Average Parametes over Runtime in medium mode and SF equals 5
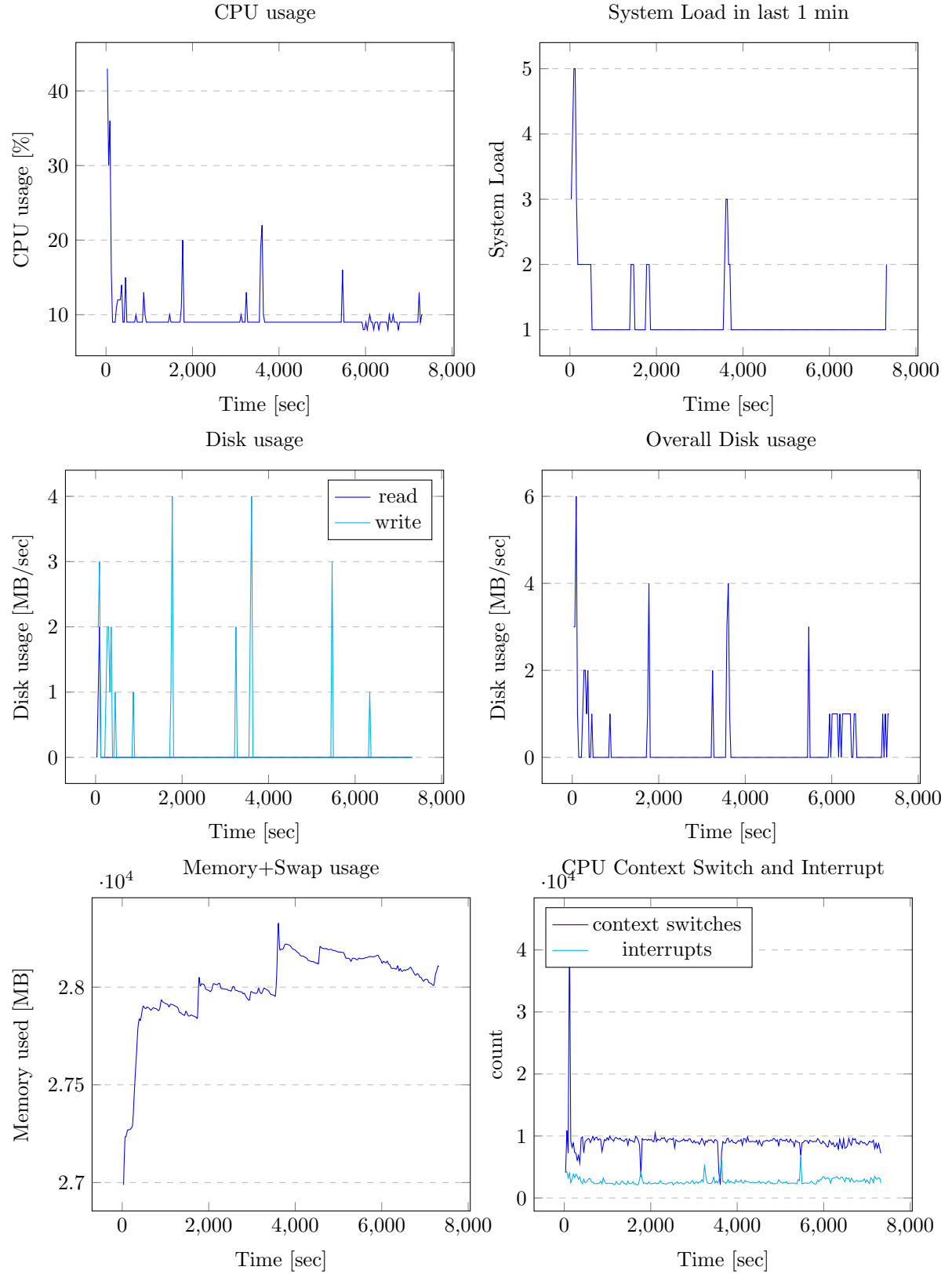
medium mode and SF equals 5

Total Throughput

Throughput for each transaction type

Average Latency
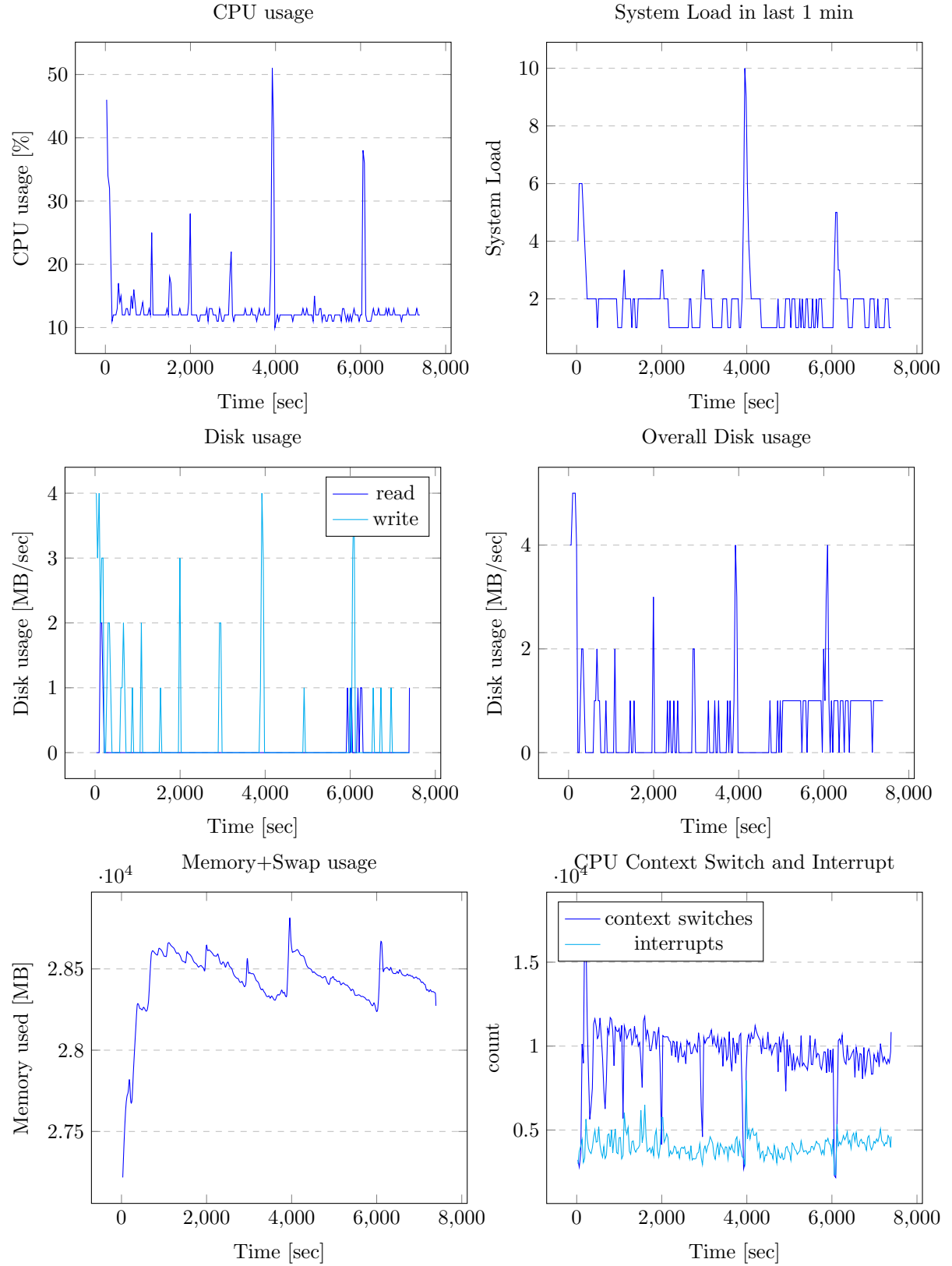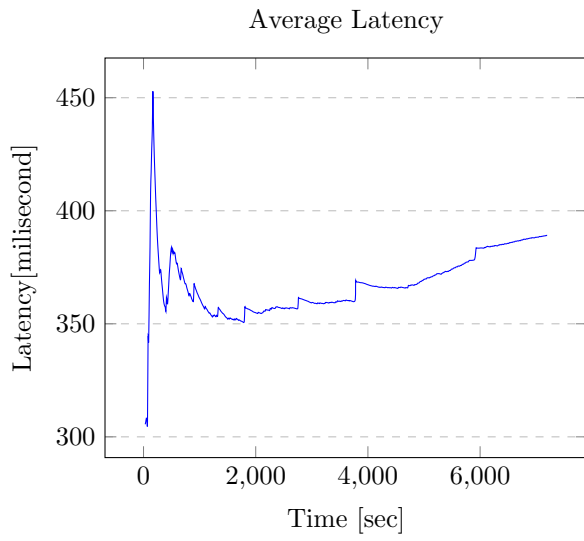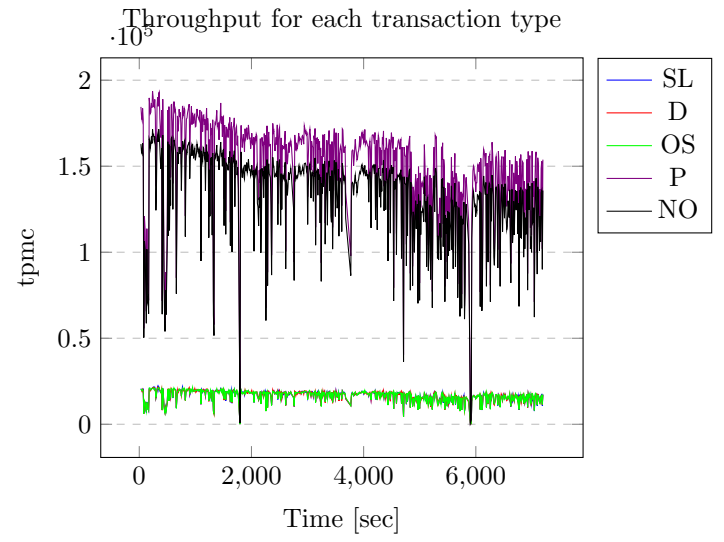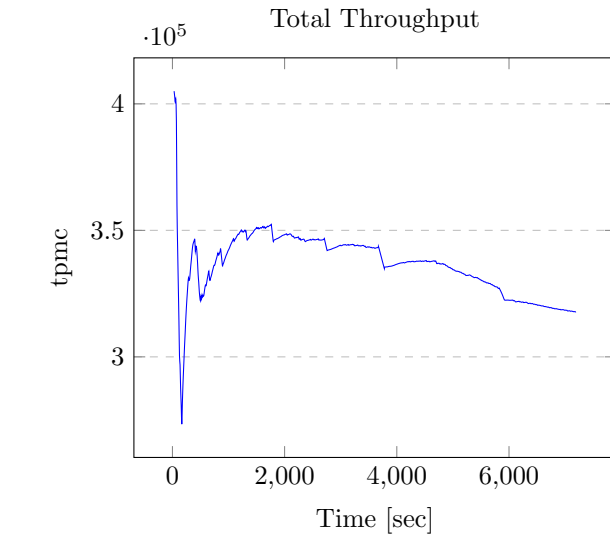
Transaction Type	Total Count	tpmc
Stock Level	1908292	15901.38
Delivery	1906263	15884.47
Order Status	1906536	15886.75
Payment	17160271	142992.81
New Order	15256609	127130.00

Response Time

#Transactions

RT [milisecond]

$\cdot 10^4$
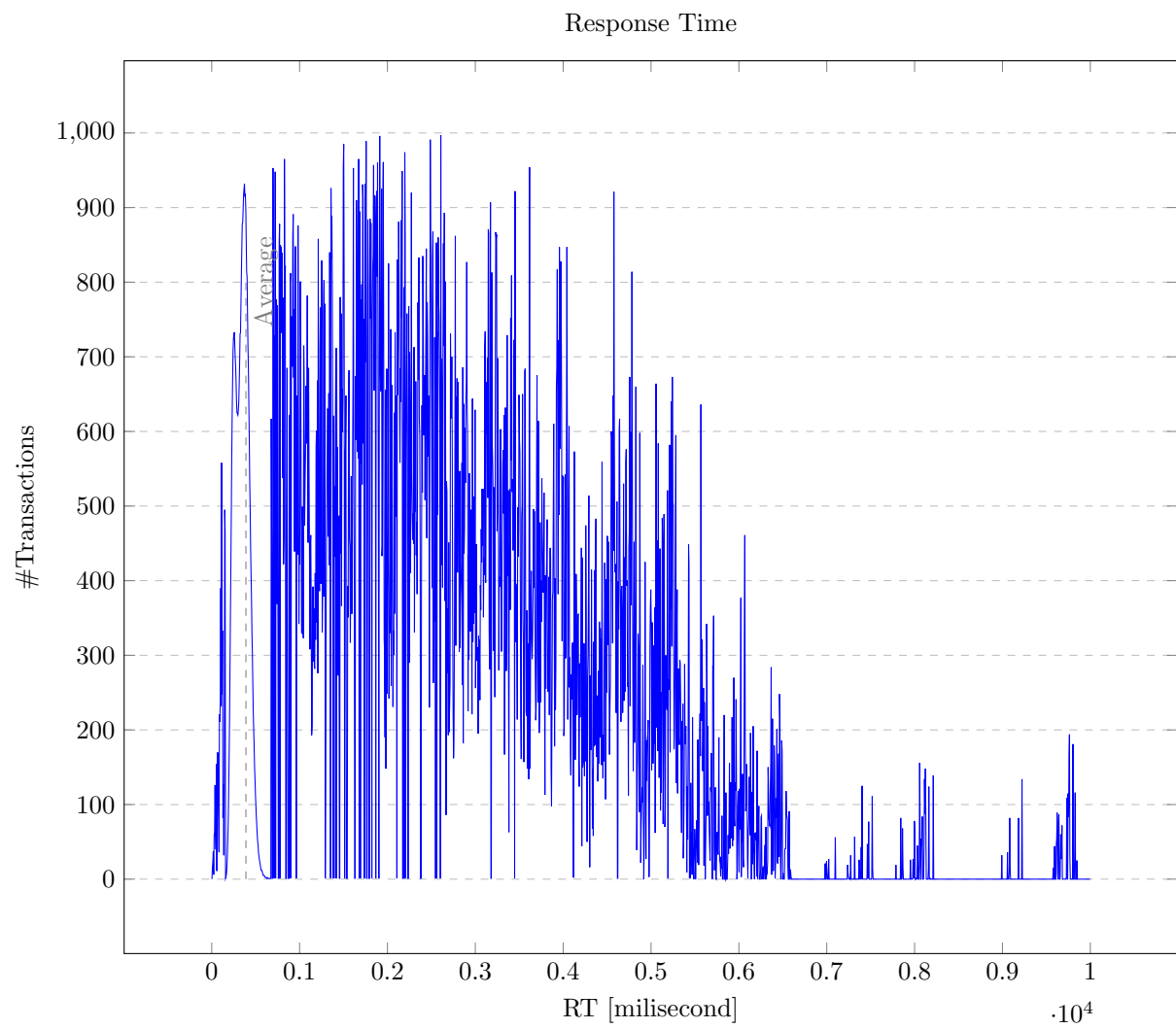
Average

System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
1.58	28013.26 MB	0.46 MB/sec	7309.00 sec	113067 milisecond	7412

Table 6: Average Parametes over Runtime in medium mode and SF equals 10

medium mode and SF equals 10

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

Throughput for each transaction type

Average Latency
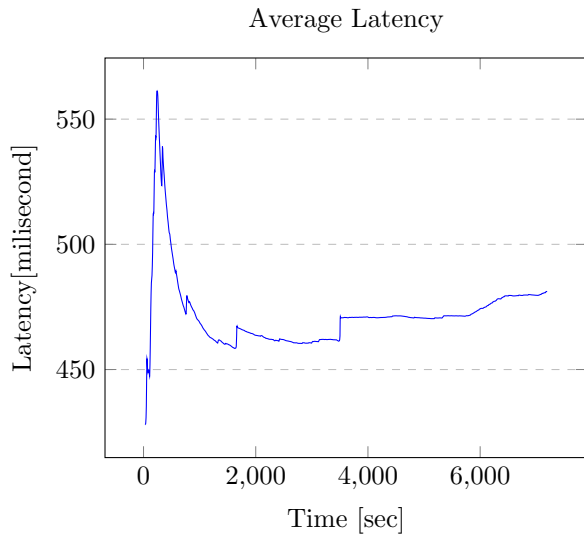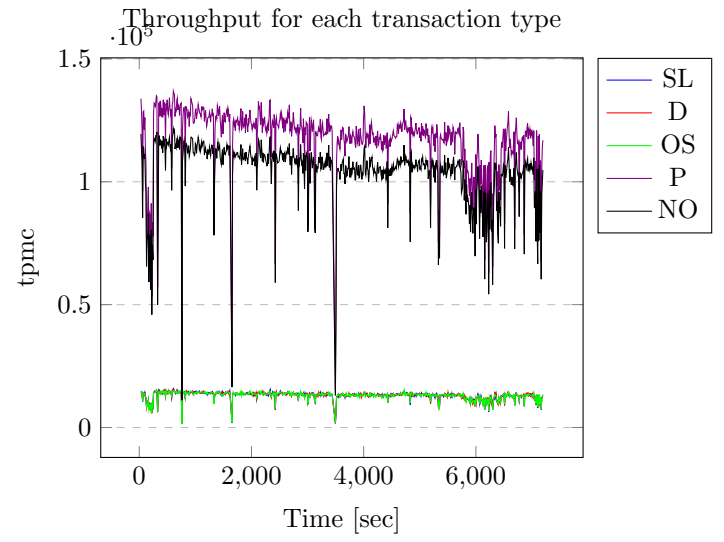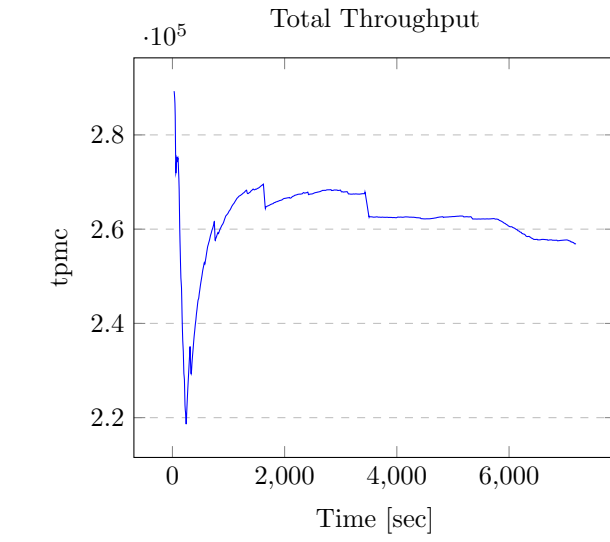
Transaction Type	Total Count	tpmc
Stock Level	1542747	12855.46
Delivery	1540638	12837.88
Order Status	1540722	12838.58
Payment	13870603	115581.47
New Order	12333936	102776.67

Response Time
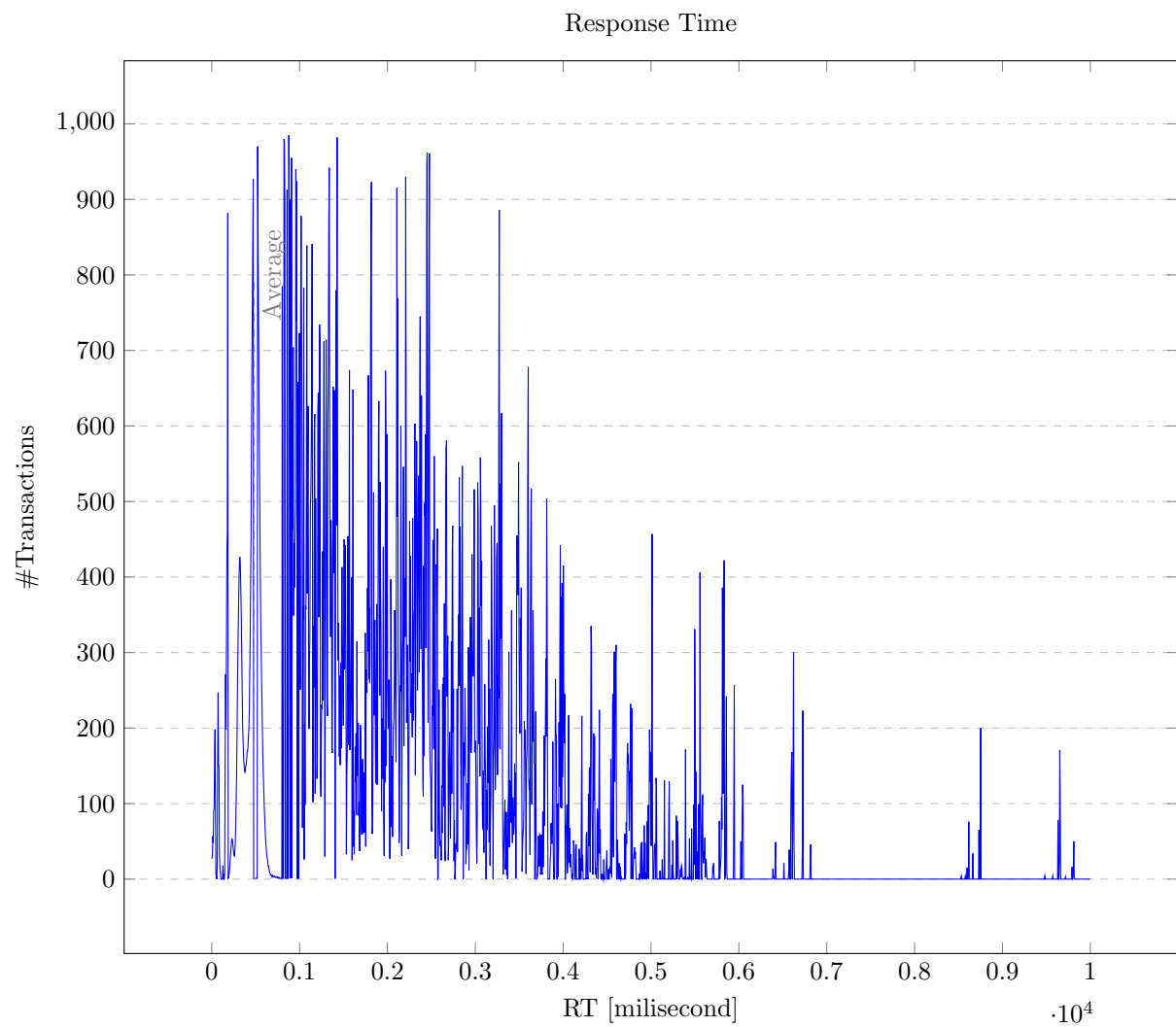
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
2.63	29417.69 MB	1.59 MB/sec	7596.00 sec	406749 milisecond	19587

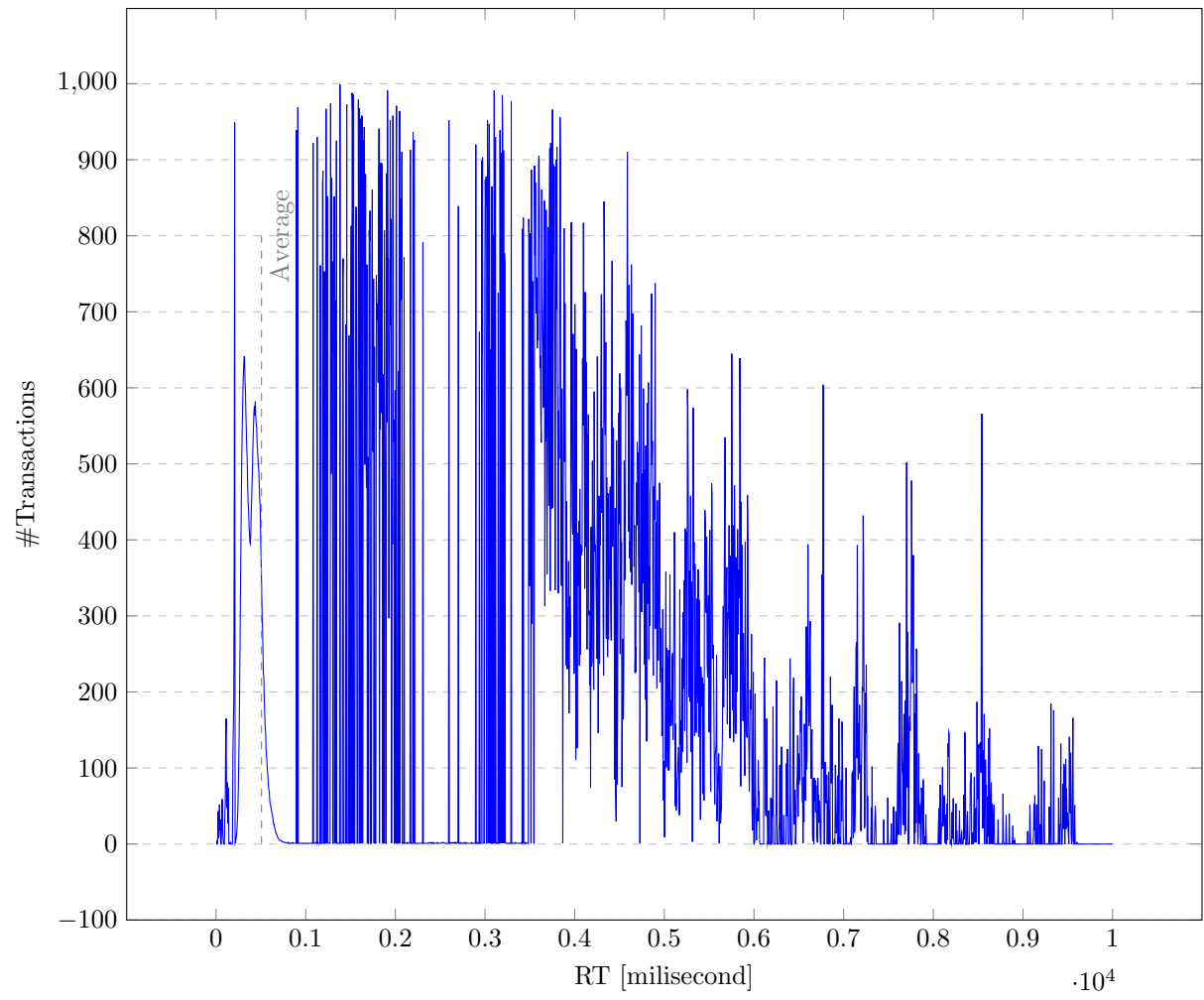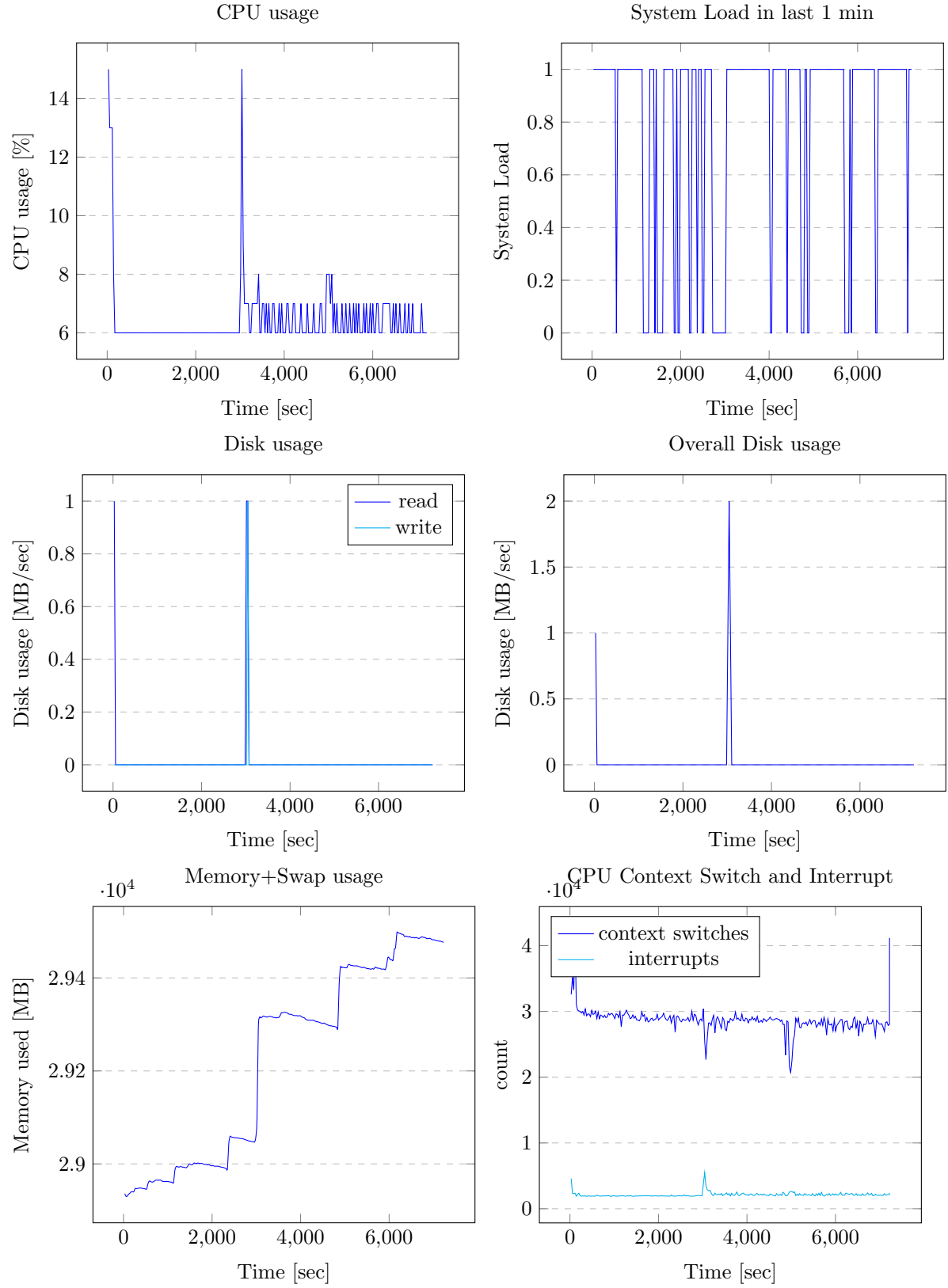Table 7: Average Parametes over Runtime in medium mode and SF equals 100

medium mode and SF equals 100

Total Throughput

Throughput for each transaction type

Average Latency
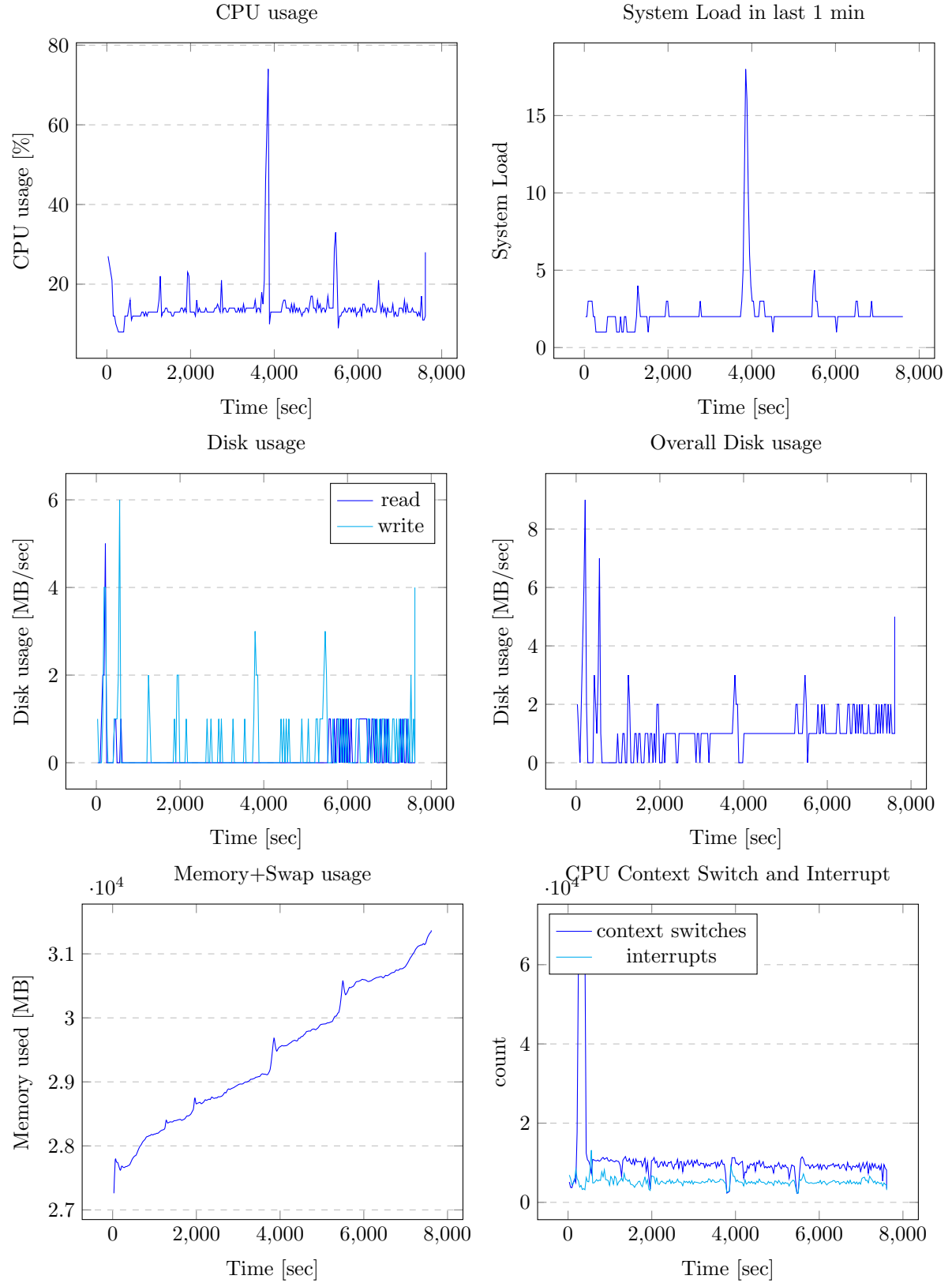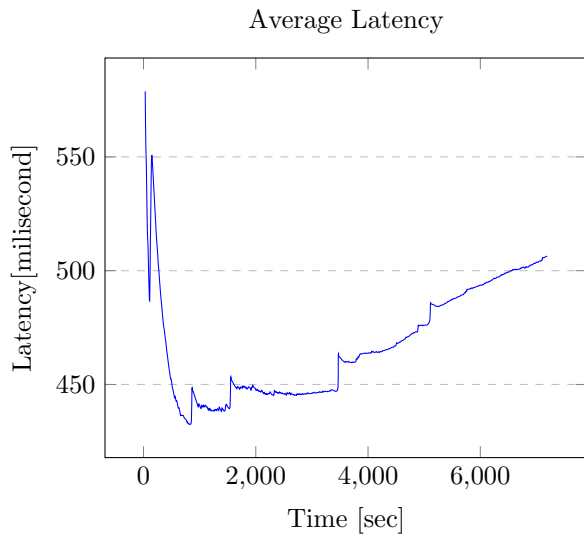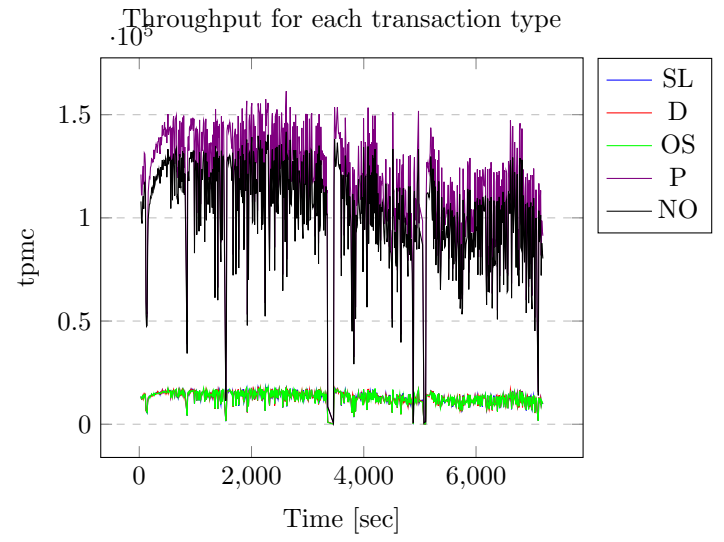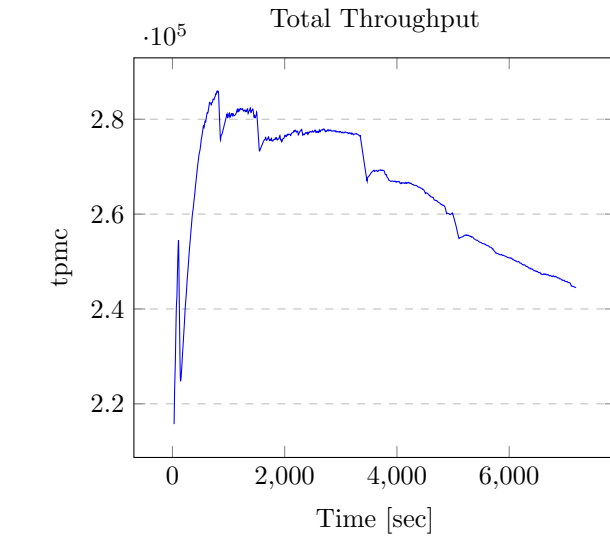
Transaction Type	Total Count	tpmc
Stock Level	1468082	12233.29
Delivery	1465303	12210.13
Order Status	1466064	12216.47
Payment	13195519	109956.10
New Order	11734536	97781.98

Response Time

System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
1.14	29225.55 MB	0.09 MB/sec	7222.00 sec	18293 milisecond	2

Table 8: Average Parametes over Runtime in high_write mode and SF equals 1
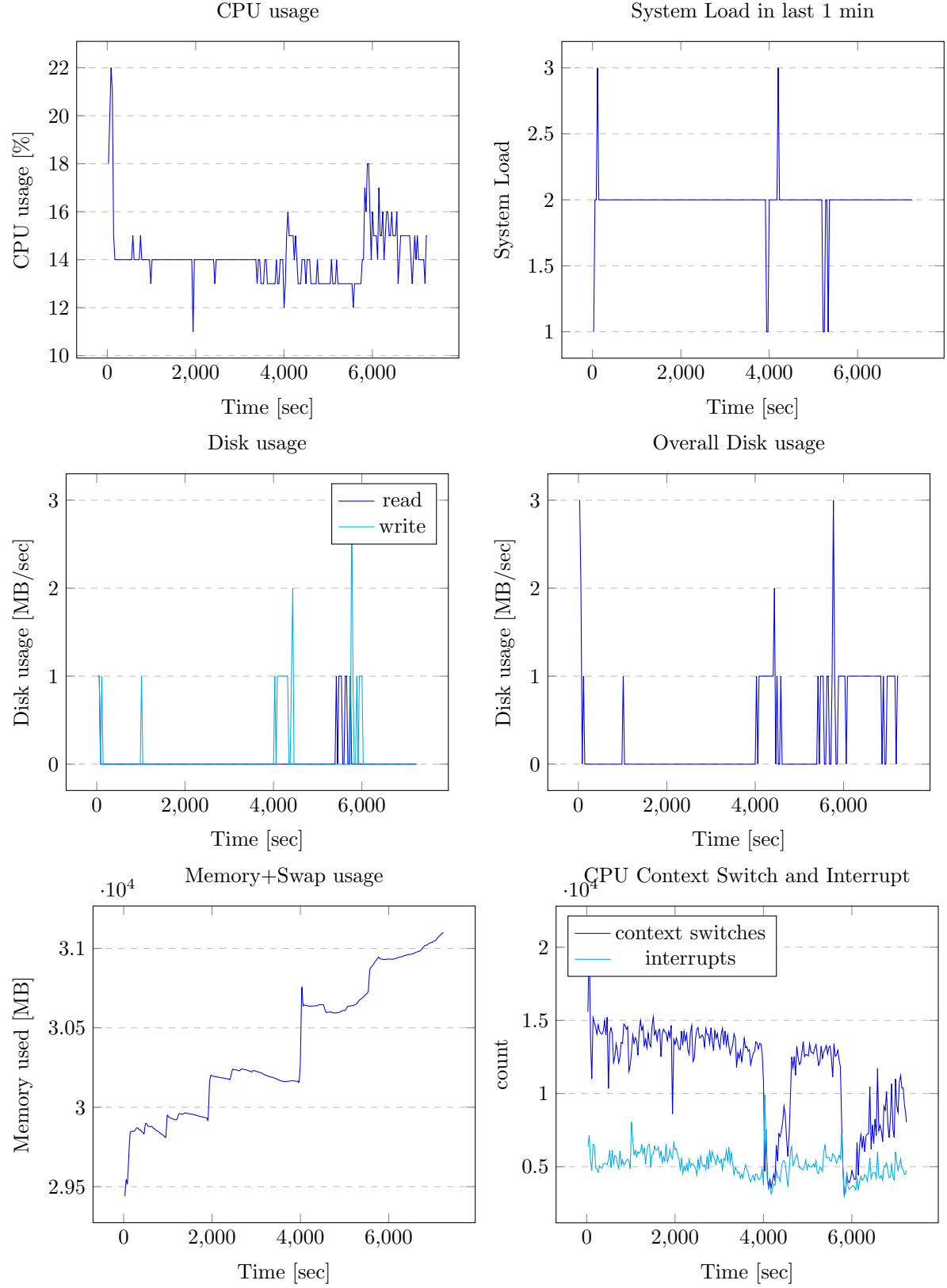
high_write mode and SF equals 1

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

Throughput for each transaction type

Average Latency
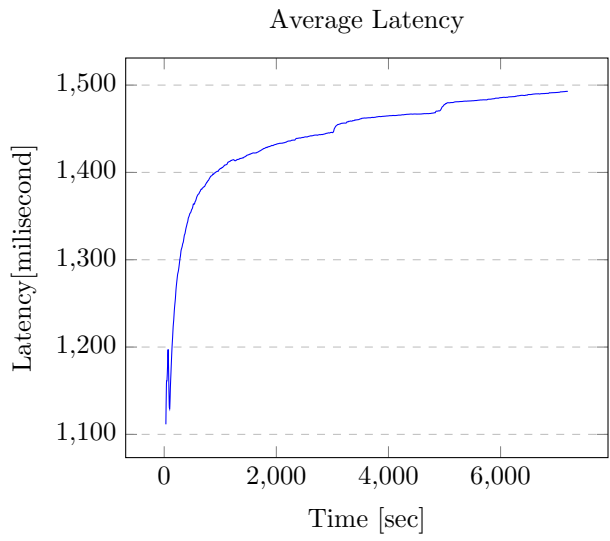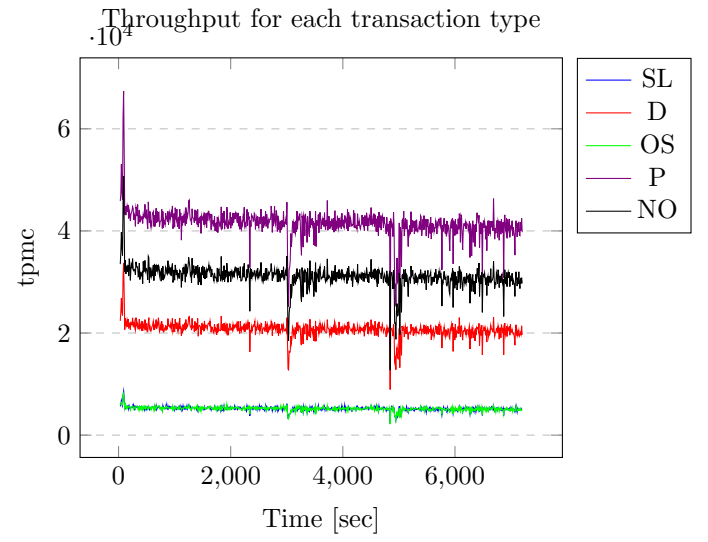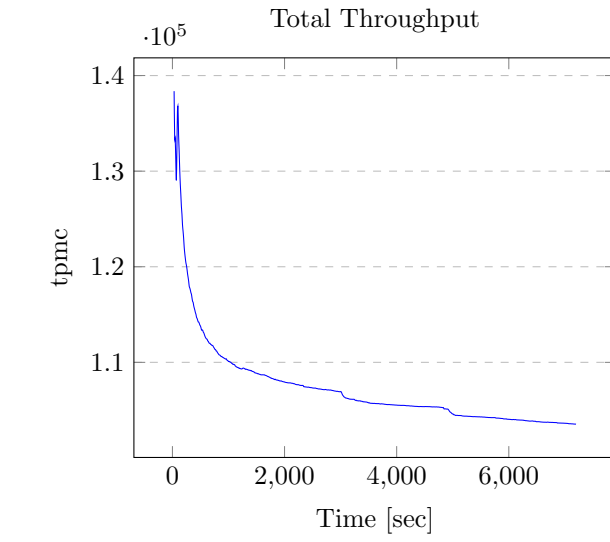
Transaction Type	Total Count	tpmc
Stock Level	621674	5178.53
Delivery	2483355	20686.29
Order Status	621709	5178.82
Payment	4967768	41381.39
New Order	3729723	31068.50

Response Time
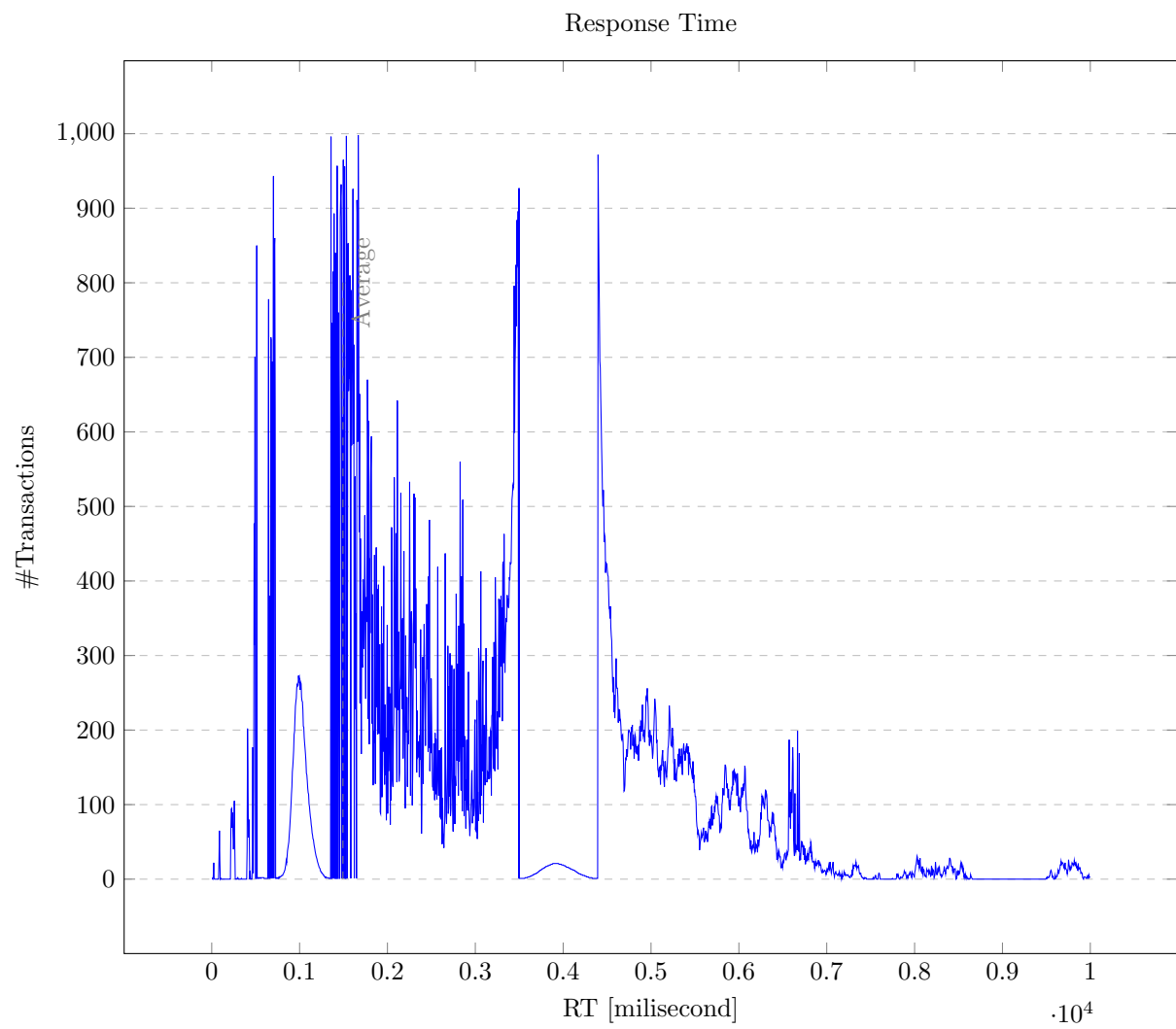
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
2.33	30390.30 MB	0.60 MB/sec	7237.00 sec	35214 milisecond	5967

Table 9: Average Parametes over Runtime in high_write mode and SF equals 2
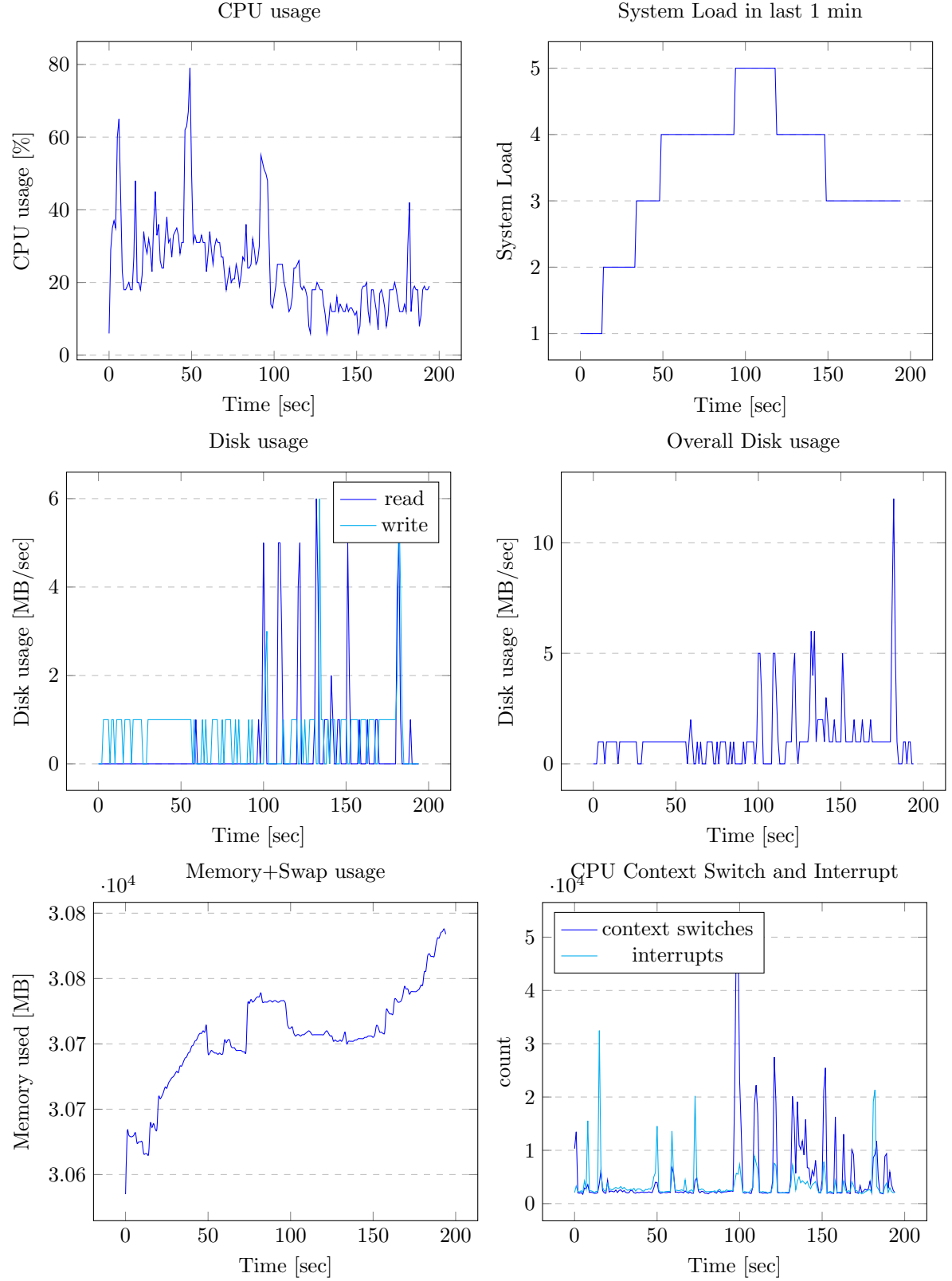
high_write mode and SF equals 2

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

Throughput for each transaction type

Average Latency
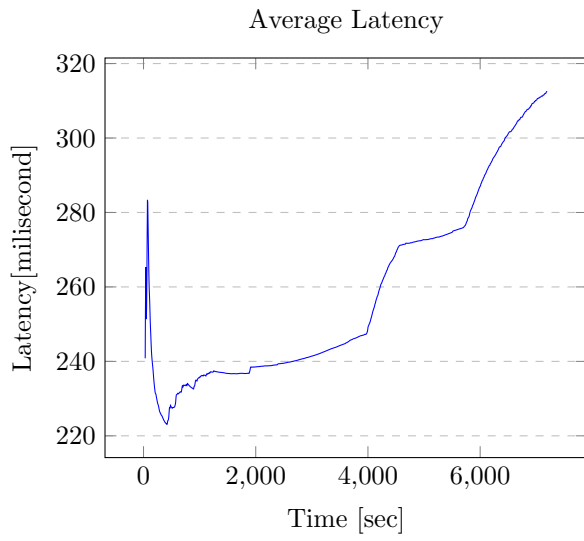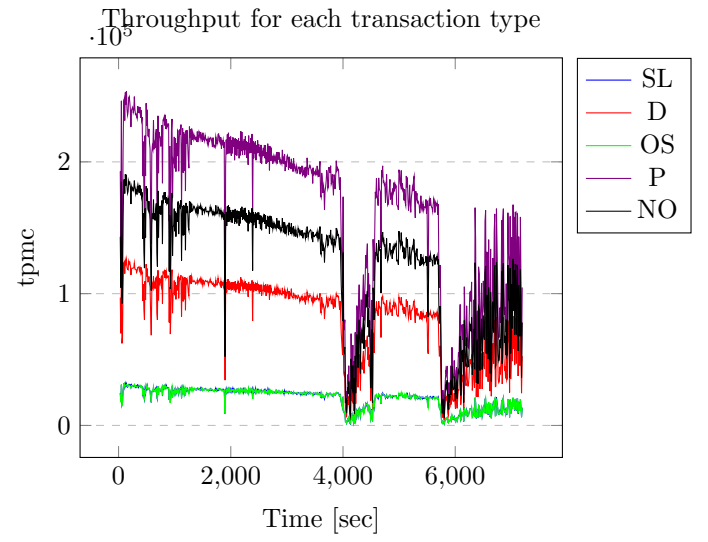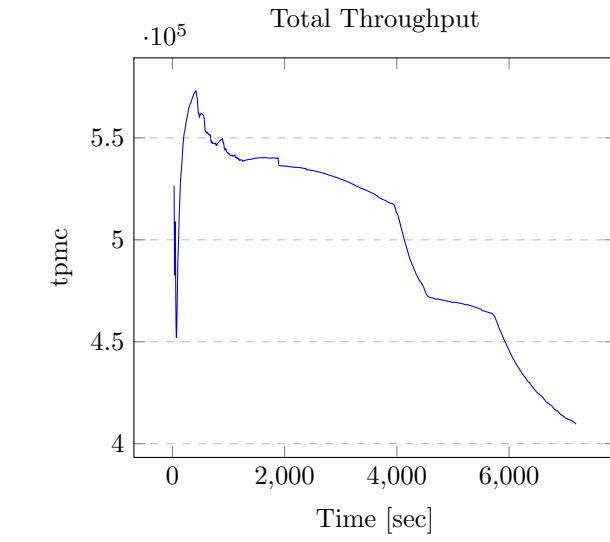
Transaction Type	Total Count	tpmc
Stock Level	2460365	20502.03
Delivery	9829435	81907.90
Order Status	2458251	20484.41
Payment	19658745	163814.73
New Order	14744031	122860.84

Response Time
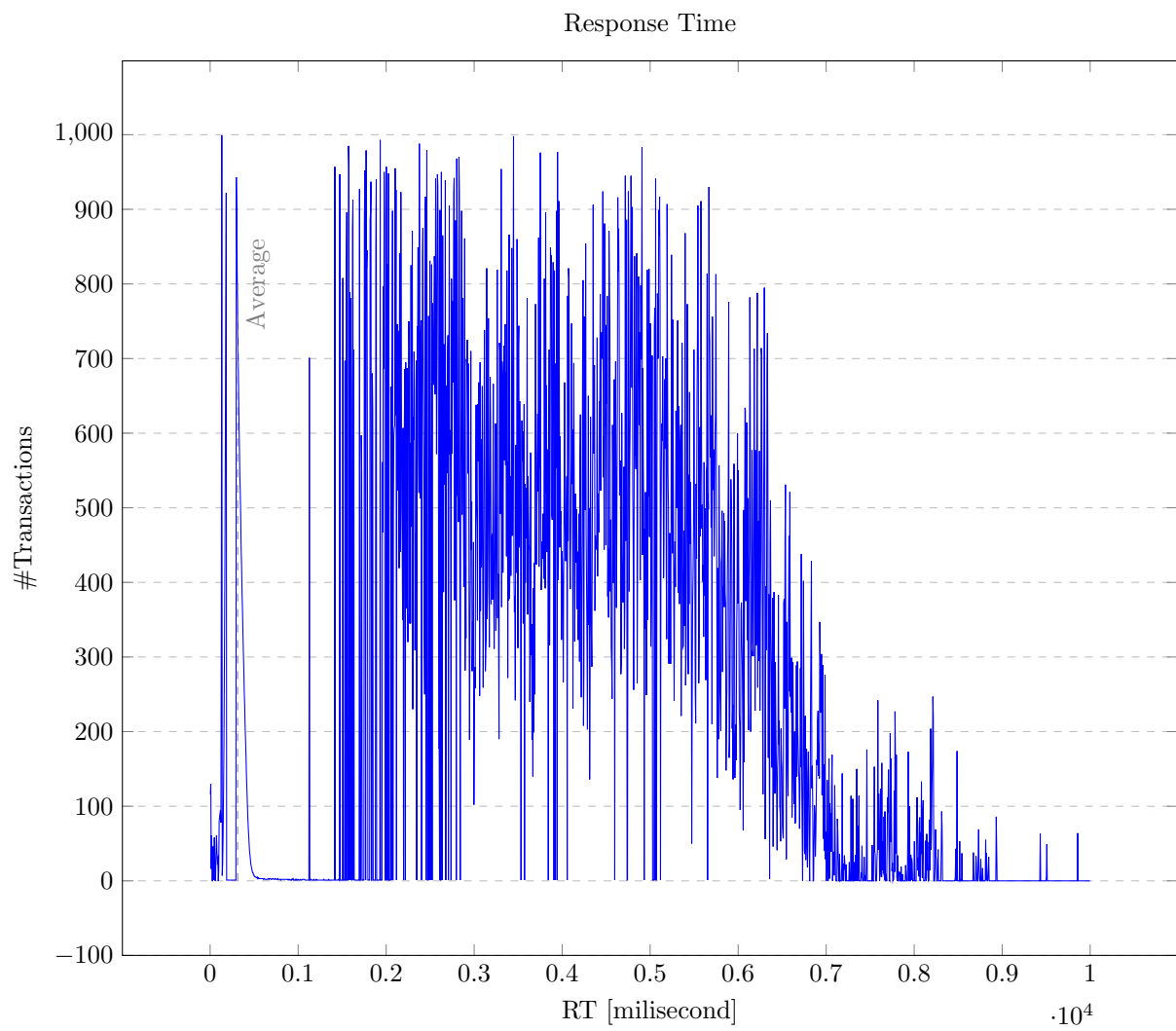
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
3.98	30755.69 MB	1.61 MB/sec	195.00 sec	not reported	not reported

Table 10: Average Parametes over Runtime in high_write mode and SF equals 3

high_write mode and SF equals 3

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
2.03	31081.02 MB	0.23 MB/sec	7307.00 sec	107787 milisecond	9666

Table 11: Average Parametes over Runtime in high_write mode and SF equals 5

Trnsactions reports are not available because TPC-C benchmarking app exited with error (Connection Lost). It seems this application has serious bug.

high_write mode and SF equals 5

Total Throughput

Throughput for each transaction type

Legend: SL, D, OS, P, NO

Average Latency
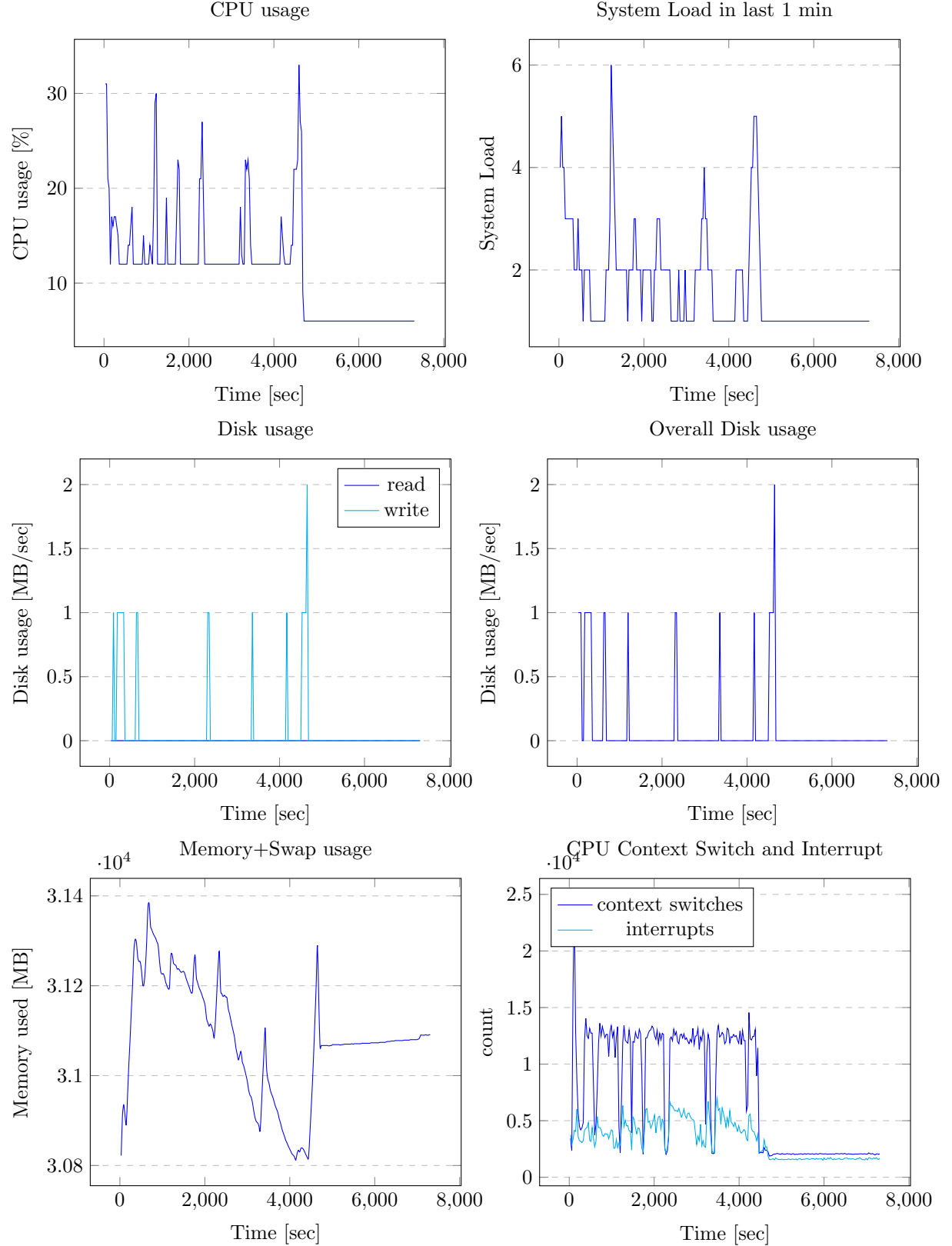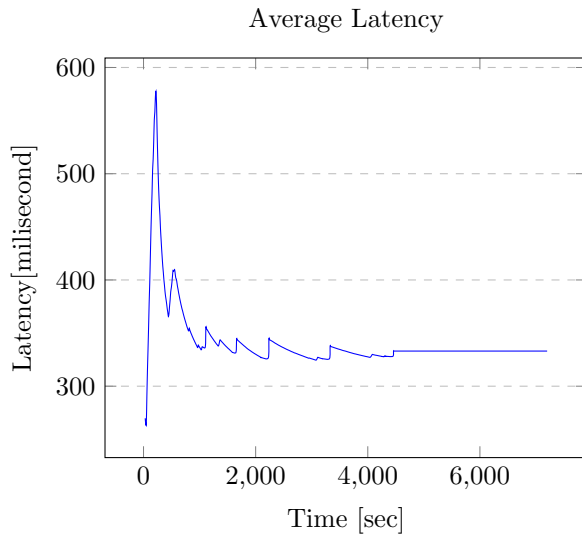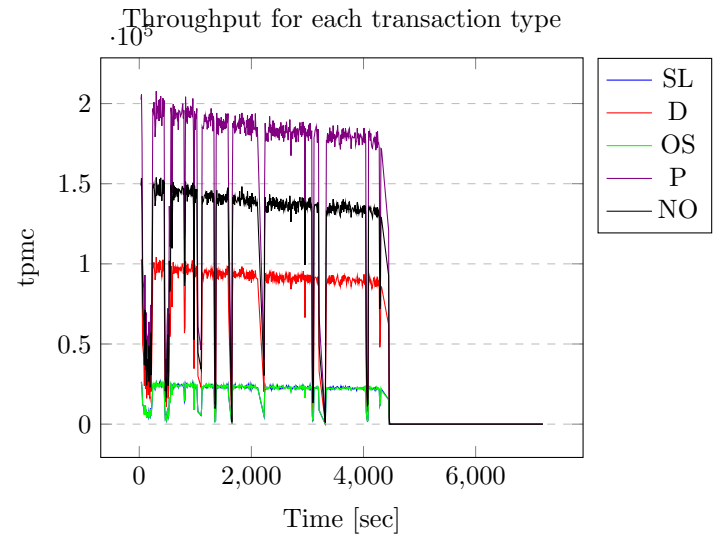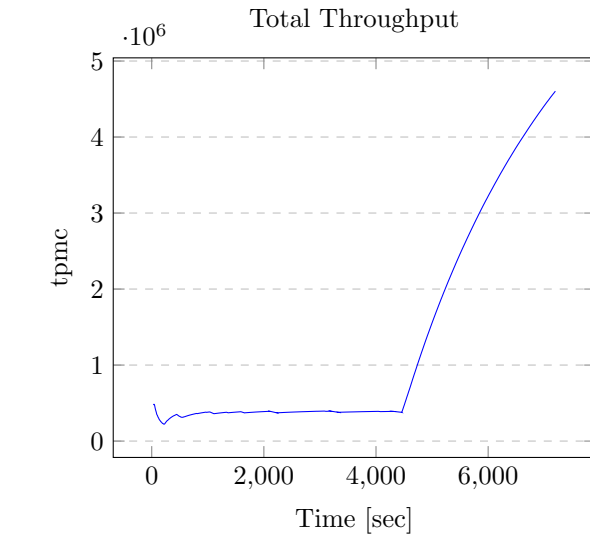
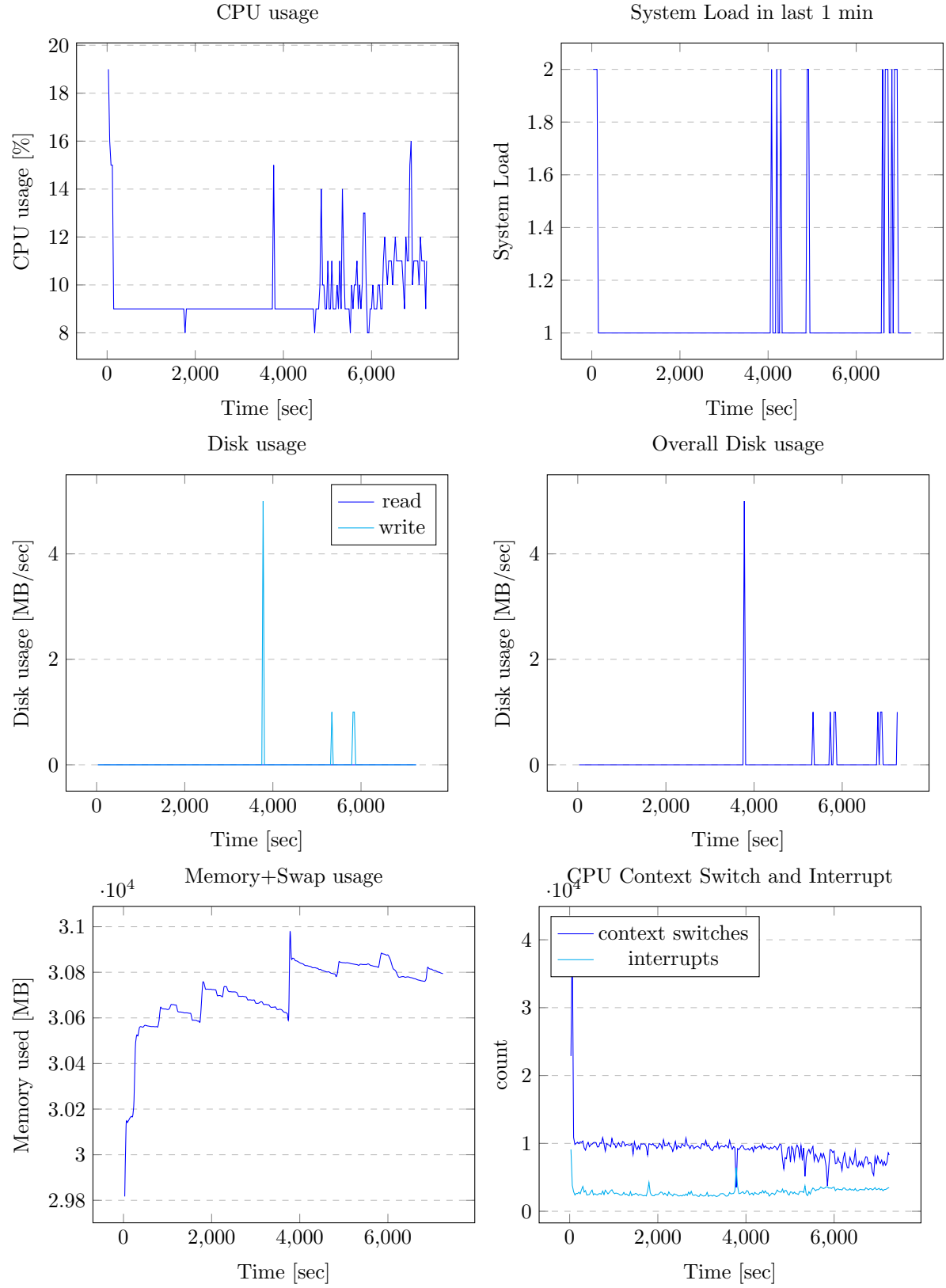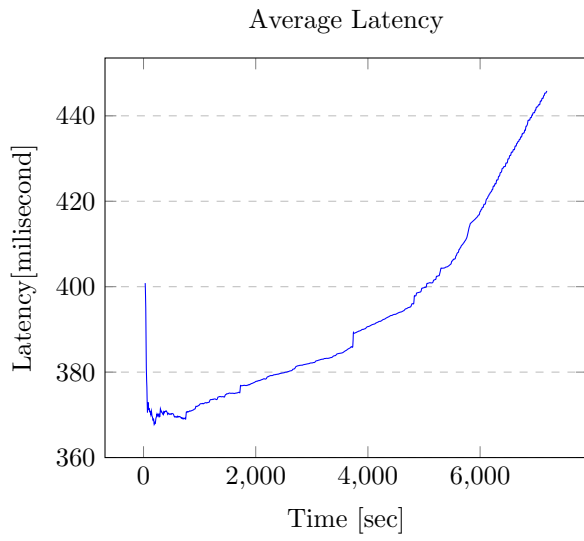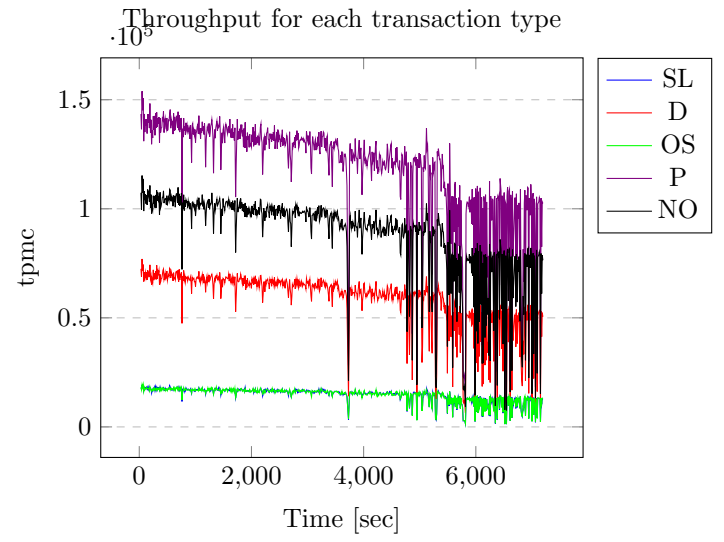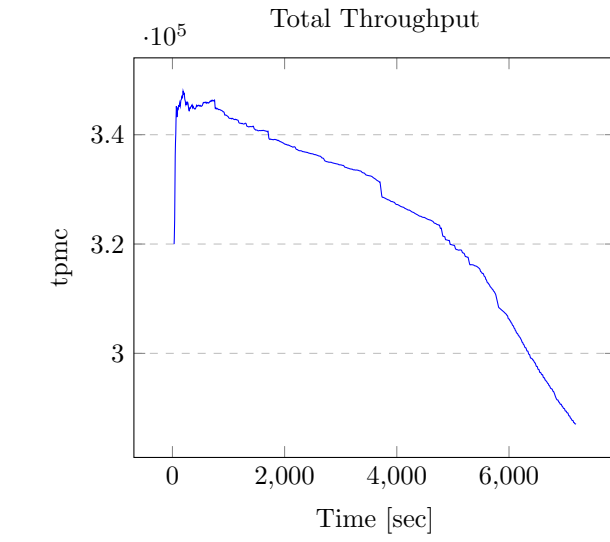| Transaction Type	Total Count	tpmc
Stock Level	1408285	11735.71
Delivery	5621904	46849.20
Order Status	1405206	11710.05
Payment	11245451	93712.09
New Order	8433543	70279.52

Response Time
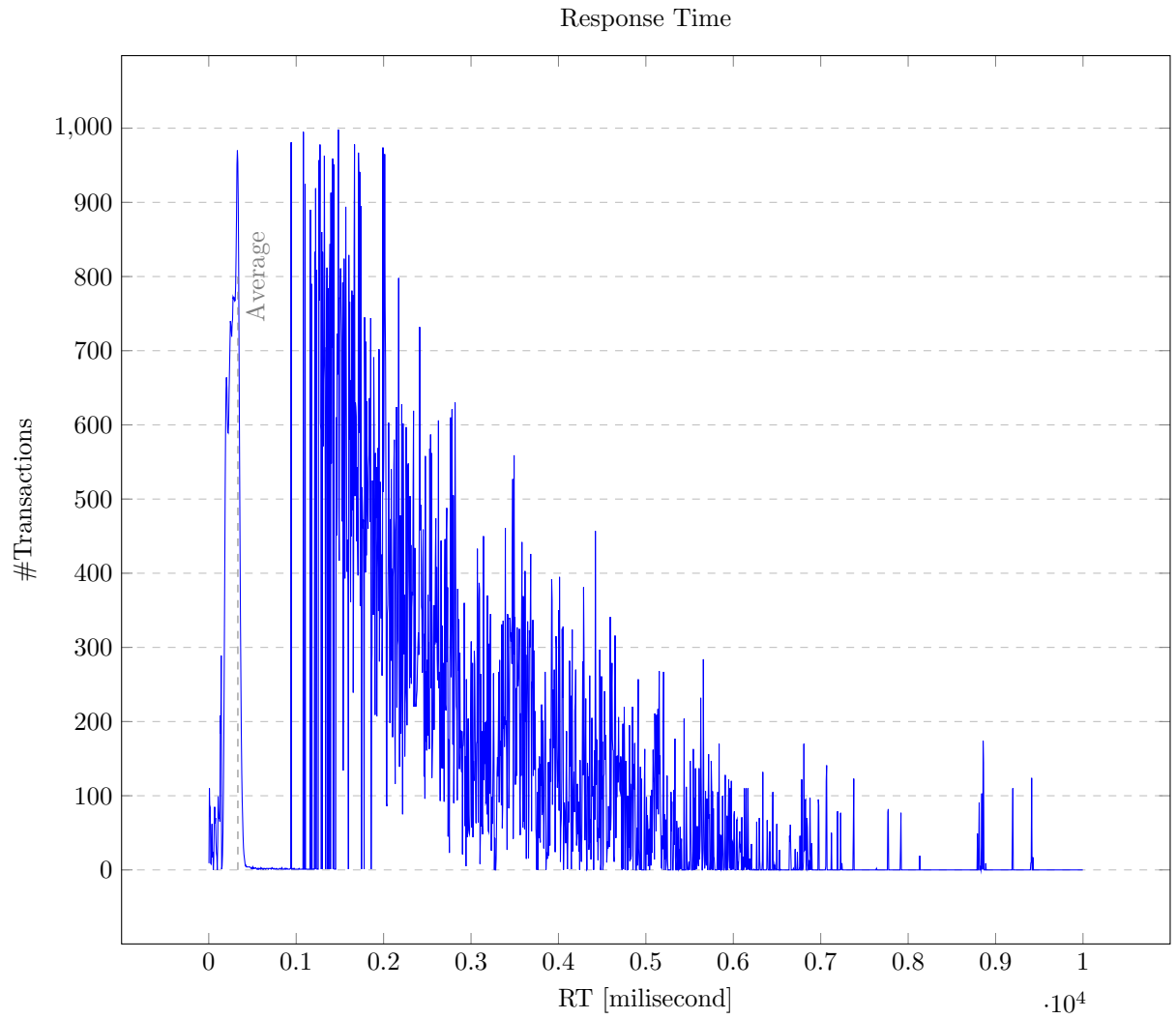
At the second half of run, Voltdb got to read only mode because it has reached memory limit, so payment and new order transaction types wont be accepted, memory will not change anymore and usage of cpu gets down. Latency of other transaction types gets up and throughput of them gets higher. The unexpected point of this test was reporting throughput of other transaction types get 0 but total throughput is reported increasing.

System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
1.60	30713.32 MB	0.30 MB/sec	7250.00 sec	44971 miliseond	26371

Table 12: Average Parametes over Runtime in high_write mode and SF equals 10
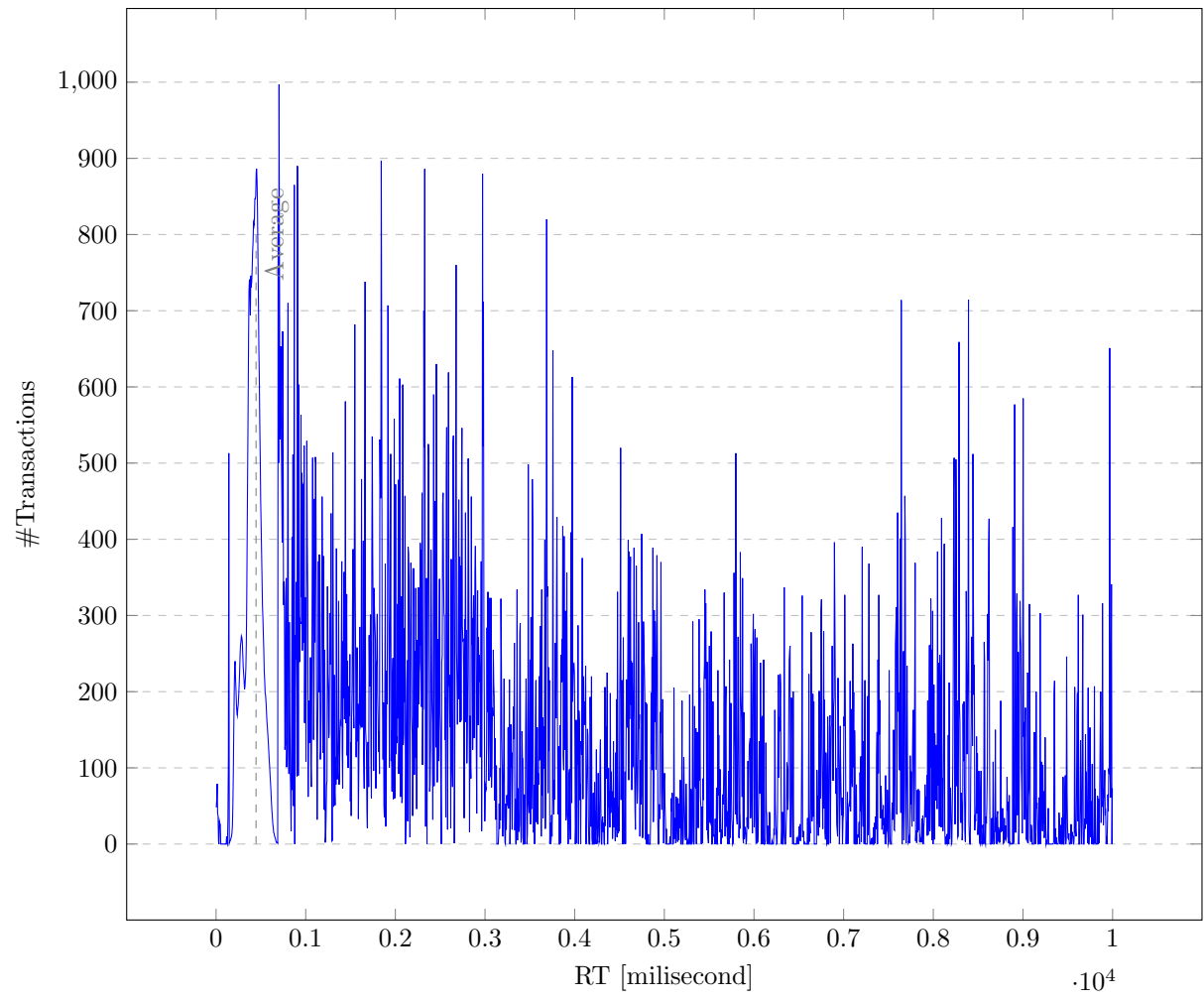
high_write mode and SF equals 10

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

Throughput for each transaction type

Average Latency

Transaction Type	Total Count	tpmc
Stock Level	1724388	14362.35
Delivery	6886760	57359.50
Order Status	1723042	14351.14
Payment	13776381	114742.84
New Order	10333223	86064.94

Response Time

System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
4.78	30581.20 MB	1.33 MB/sec	574.00 sec	not reported	not reported

Table 13: Average Parametes over Runtime in high_write mode and SF equals 100
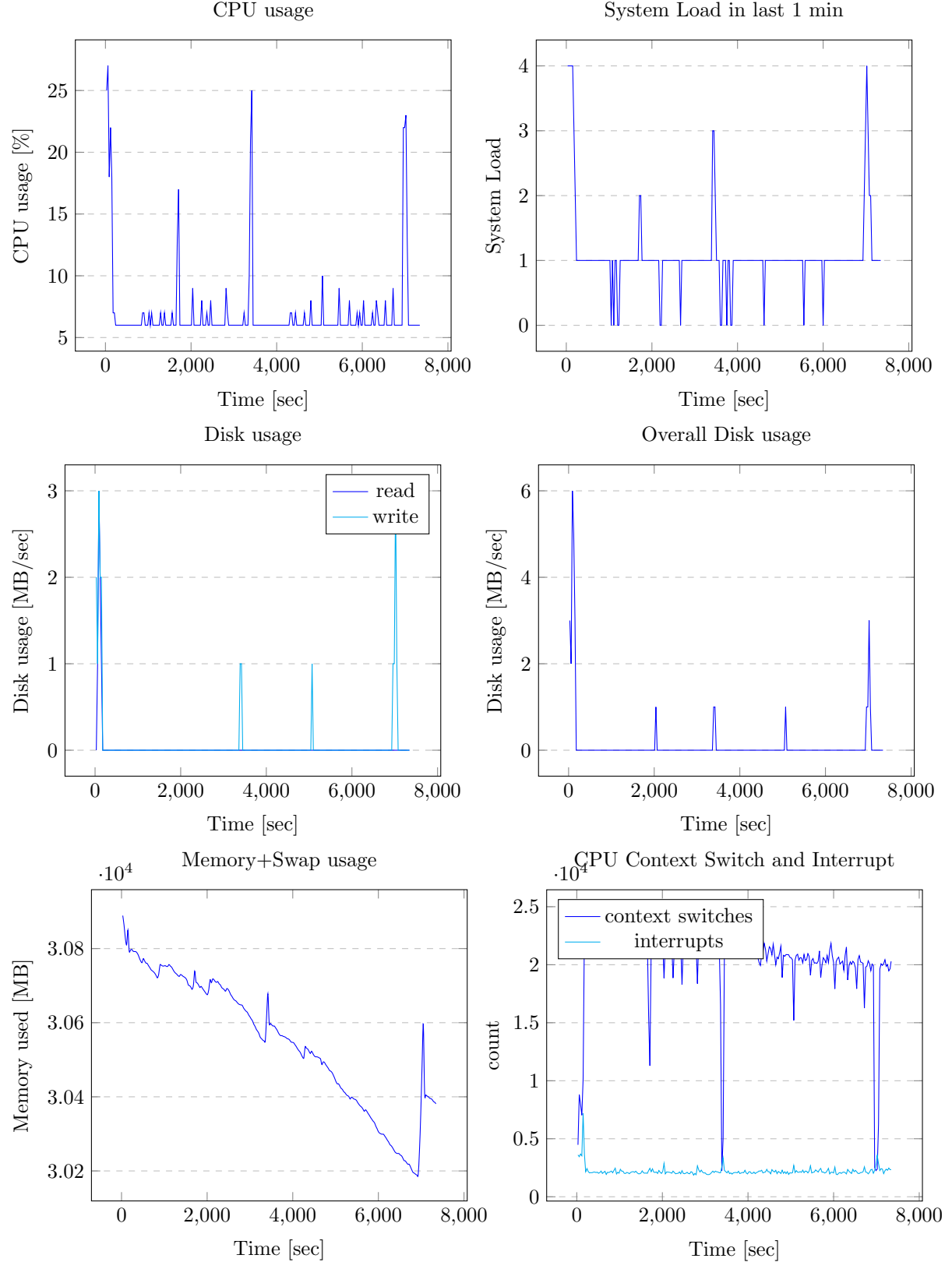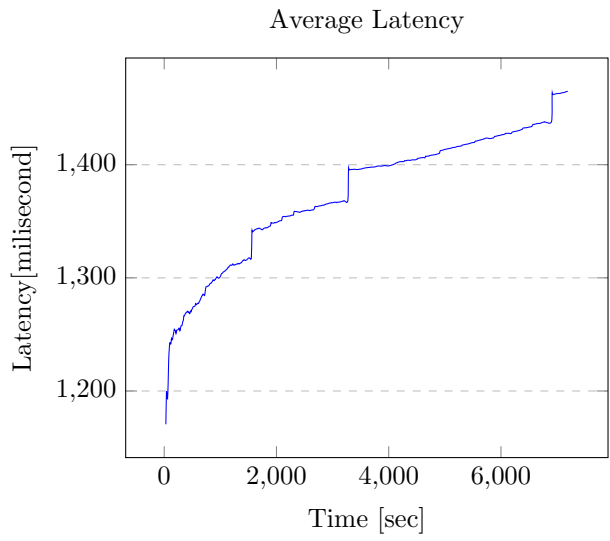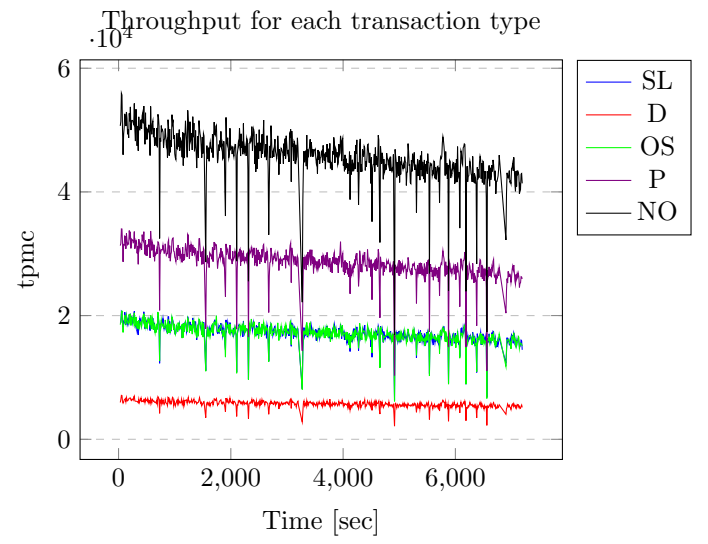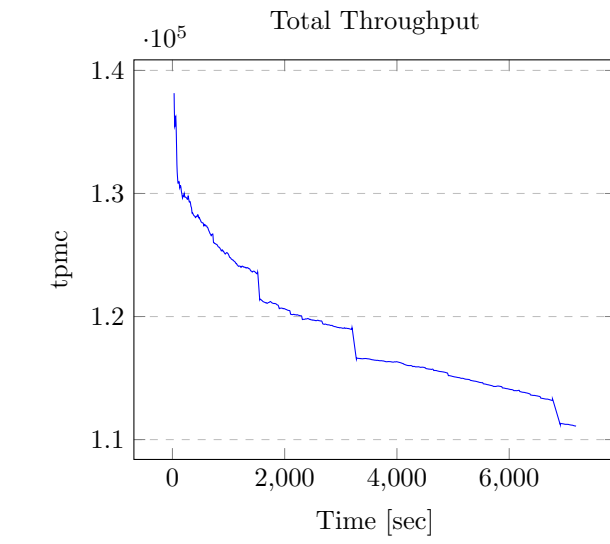
high_write mode and SF equals 100
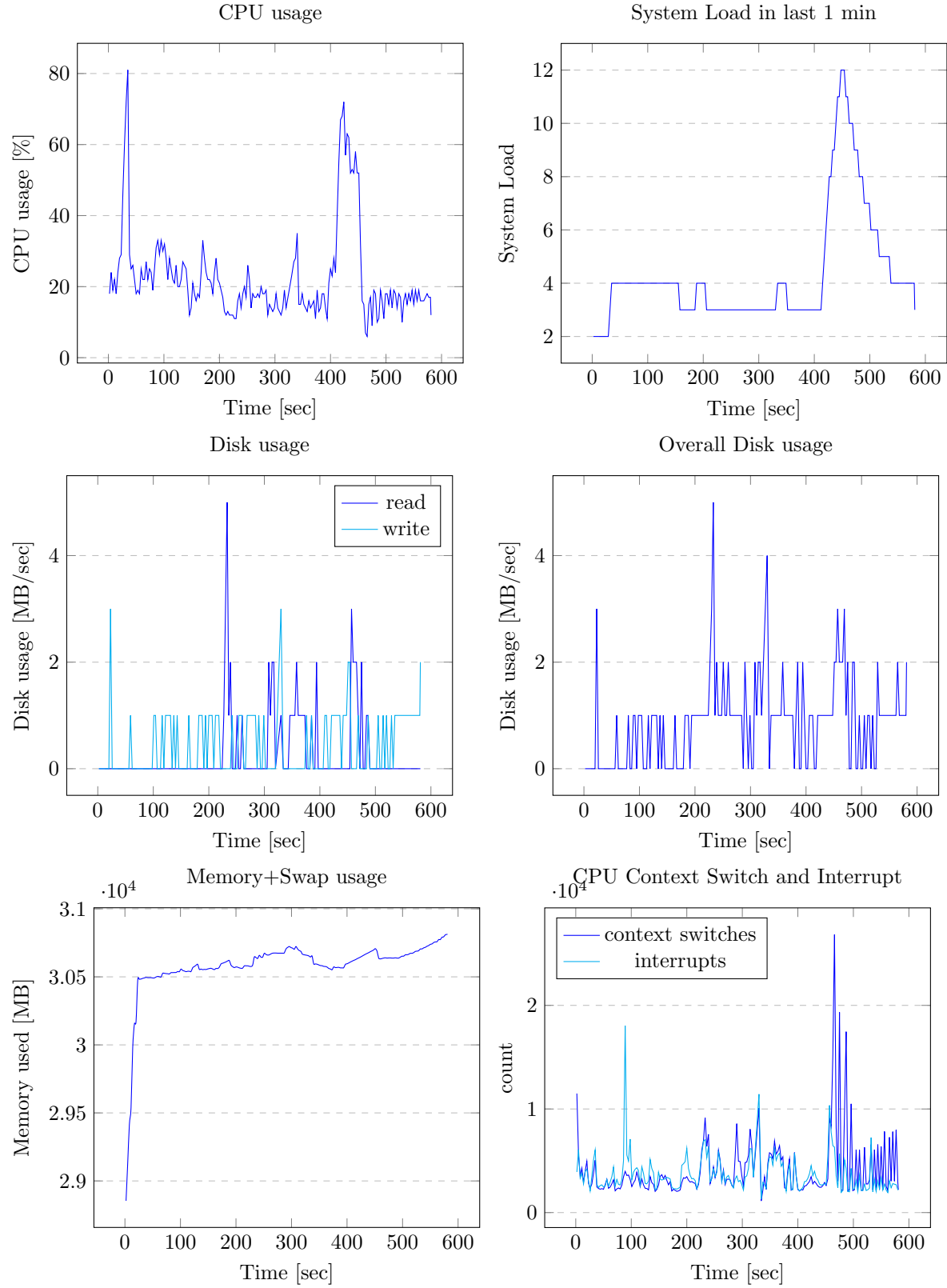
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
1.37	30548.33 MB	0.26 MB/sec	7344.00 sec	139796 milisecond	11518

Table 14: Average Parametes over Runtime in high_read mode and SF equals 1

Trnsactions reports are not available because TPC-C benchmarking app exited with error (Connection Lost). It seems this application has serious bug.

high_read mode and SF equals 1

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

Throughput for each transaction type

Average Latency

Transaction Type	Total Count	tpmc
Stock Level	1999517	16655.11
Delivery	666846	5554.54
Order Status	1998444	16646.18
Payment	3332453	27757.89
New Order	5333483	44425.61

Response Time
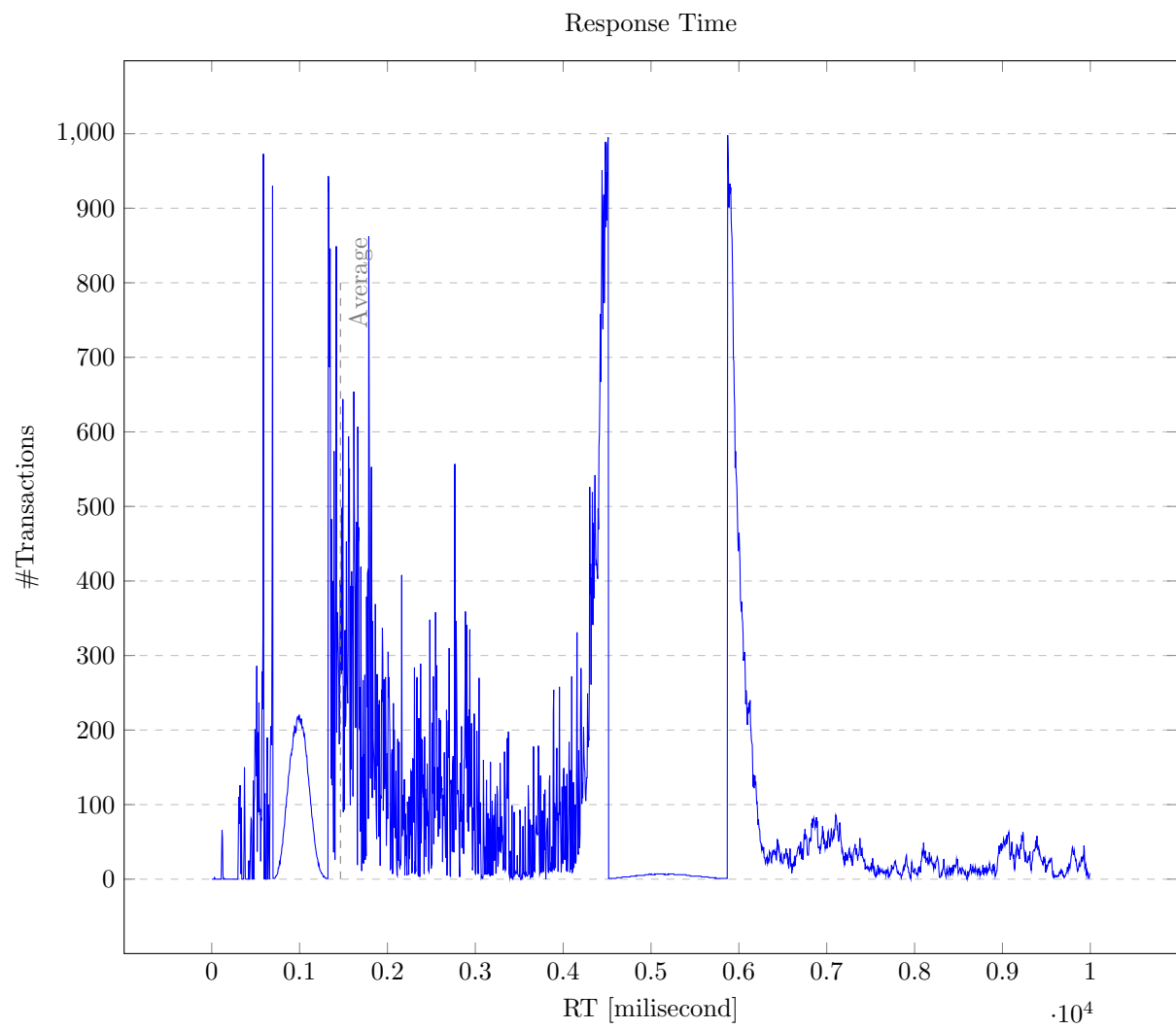
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
2.40	30335.23 MB	0.61 MB/sec	7225.00 sec	23346	52546

Table 15: Average Parametes over Runtime in high_read mode and SF equals 2
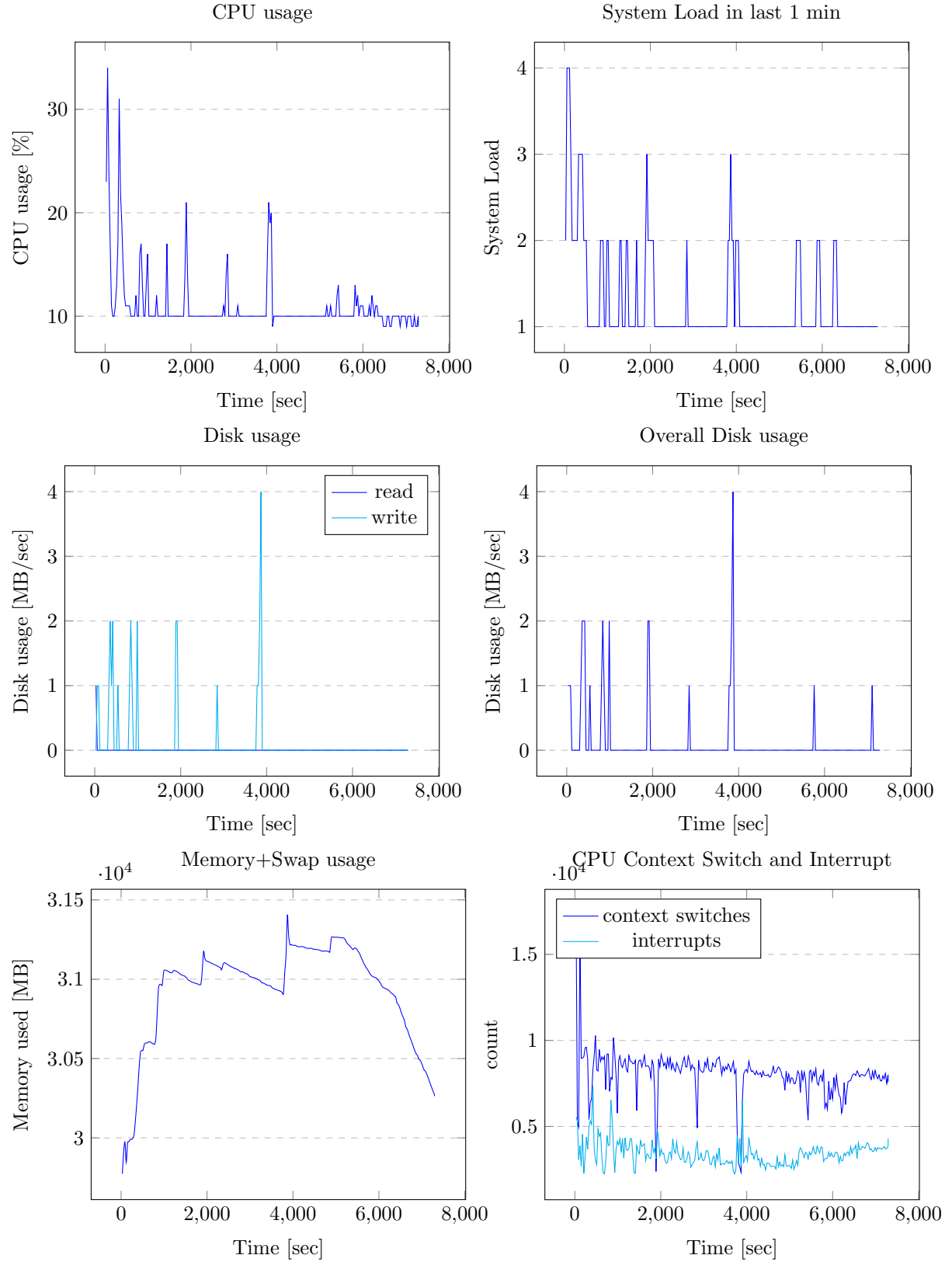
high_read mode and SF equals 2

Total Throughput

Throughput for each transaction type

Average Latency
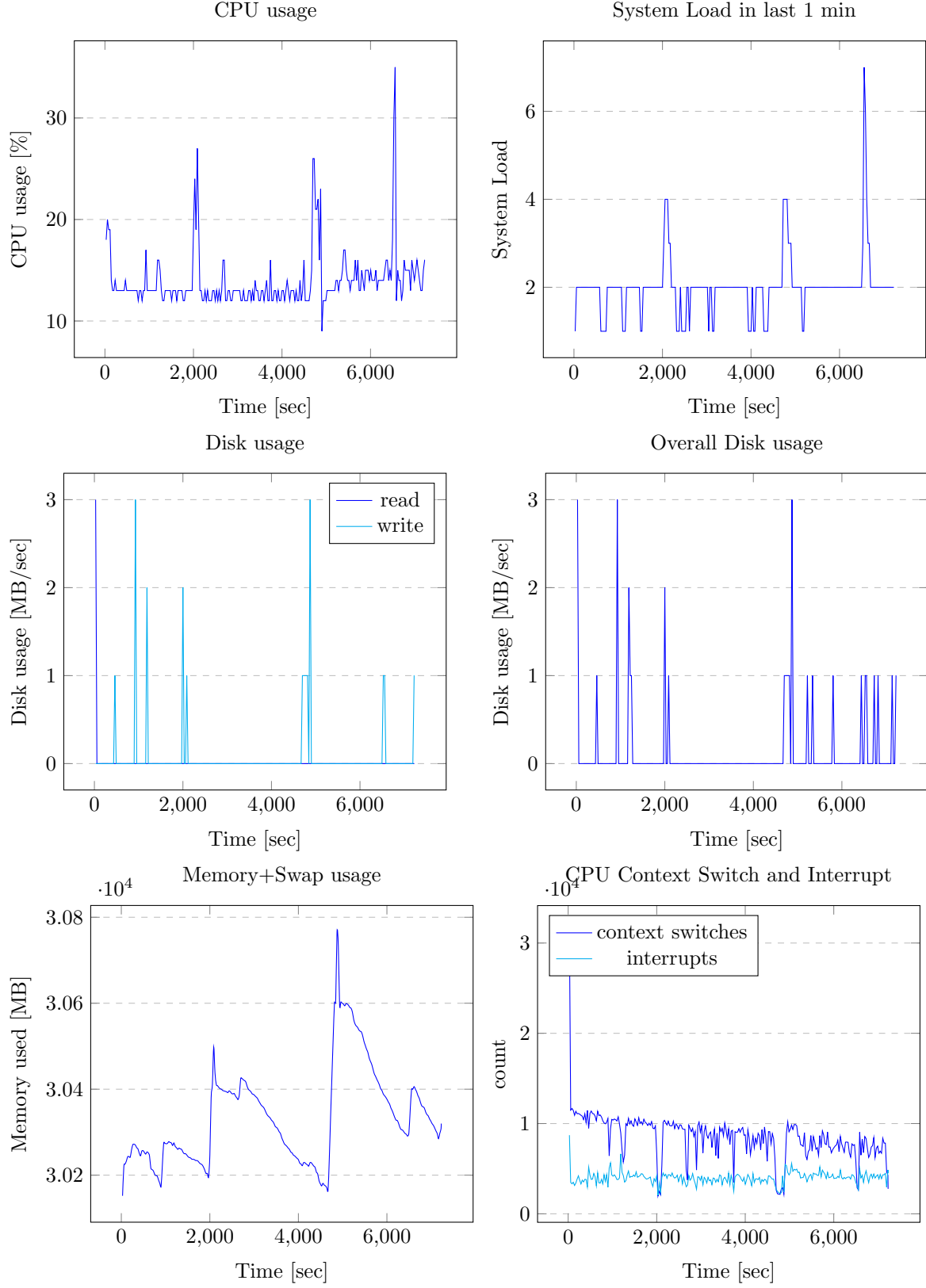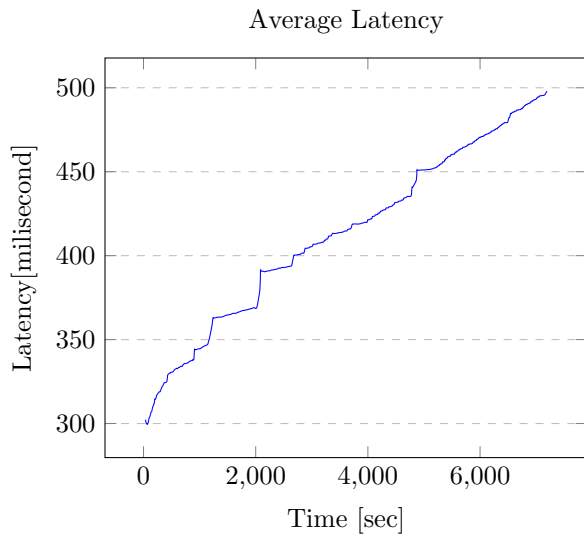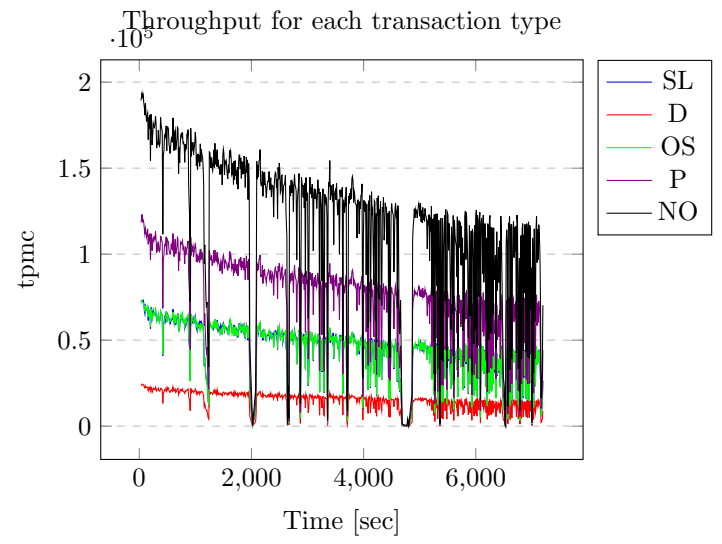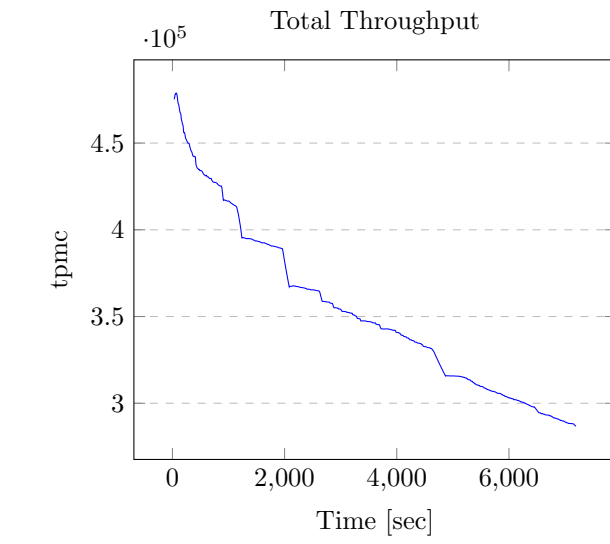
Transaction Type	Total Count	tpmc
Stock Level	5161981	42999.25
Delivery	1720231	14329.51
Order Status	5163498	43011.89
Payment	8599203	71631.28
New Order	13756471	114591.28

Response Time
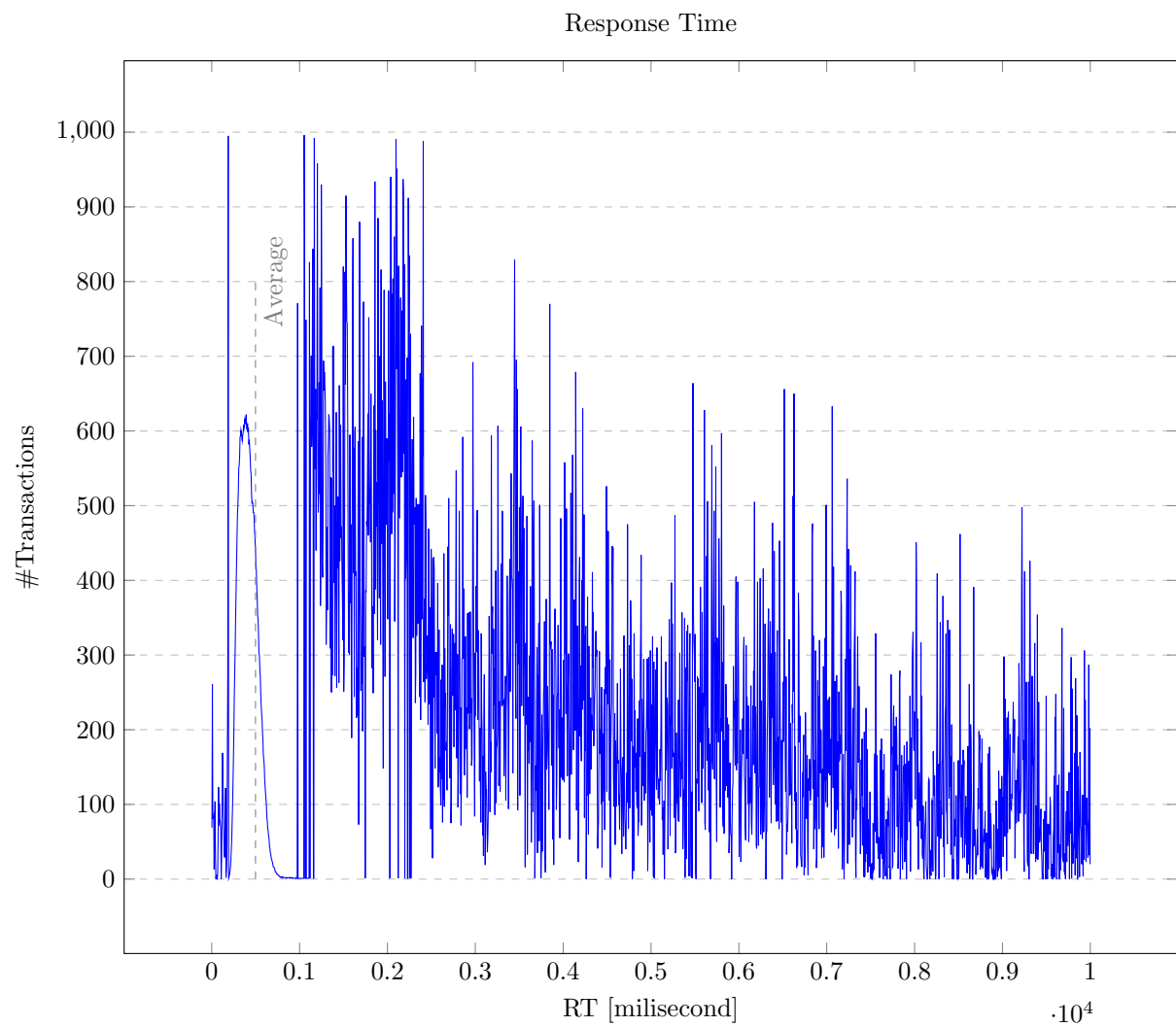
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
1.88	30927.38 MB	0.45 MB/sec	7294.00 sec	92213 milisecond	18919

Table 16: Average Parametes over Runtime in high_read mode and SF equals 3

high_read mode and SF equals 3

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

Throughput for each transaction type

Average Latency
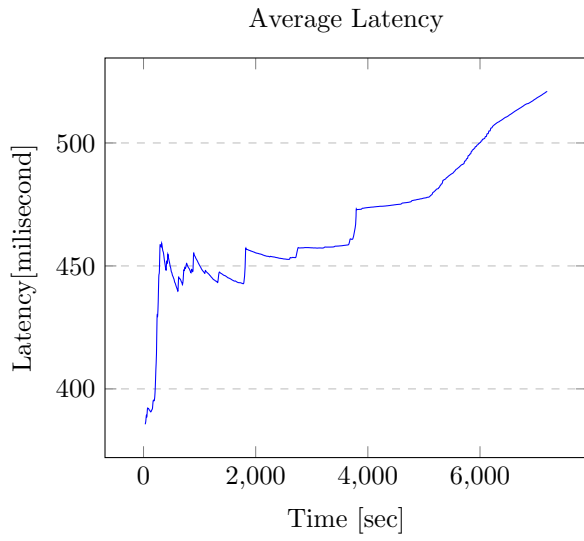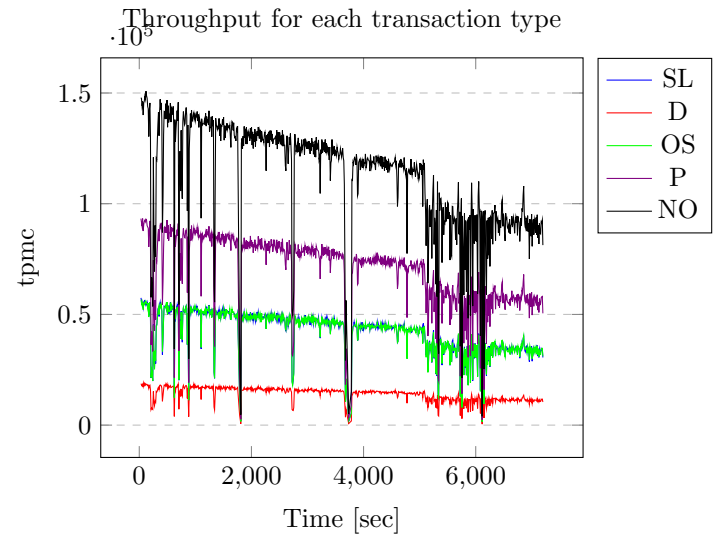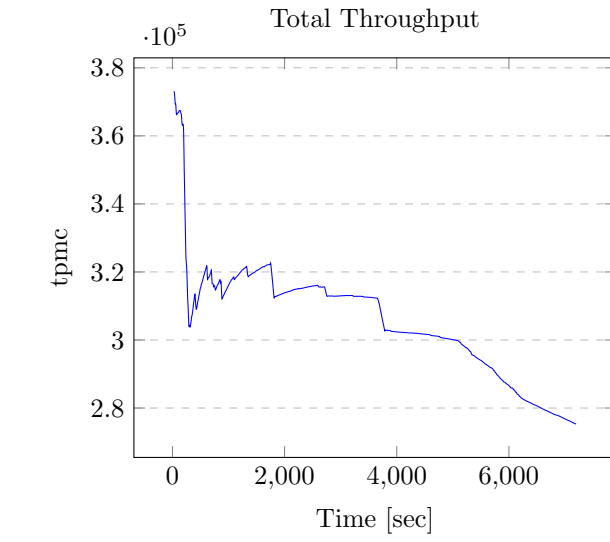
Transaction Type	Total Count	tpmc
Stock Level	4956031	41296.42
Delivery	1651760	13763.39
Order Status	4957648	41309.89
Payment	8256831	68800.53
New Order	13207086	110048.83

Response Time
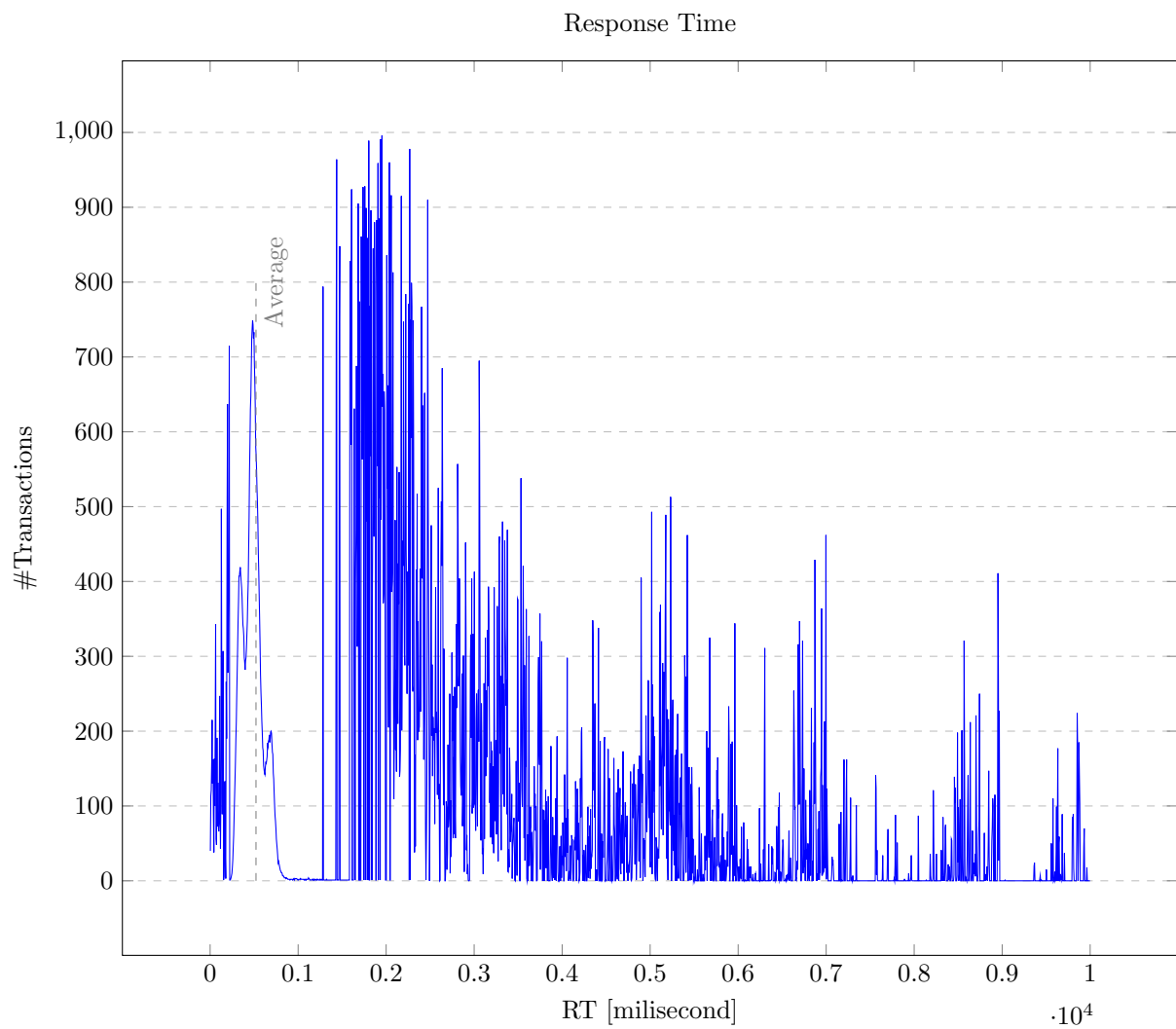
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
1.92	30071.51 MB	0.23 MB/sec	7231.00 sec	29185 milisecond	15741

Table 17: Average Parametes over Runtime in high_read mode and SF equals 5

high_read mode and SF equals 5

Total Throughput

Throughput for each transaction type

Average Latency
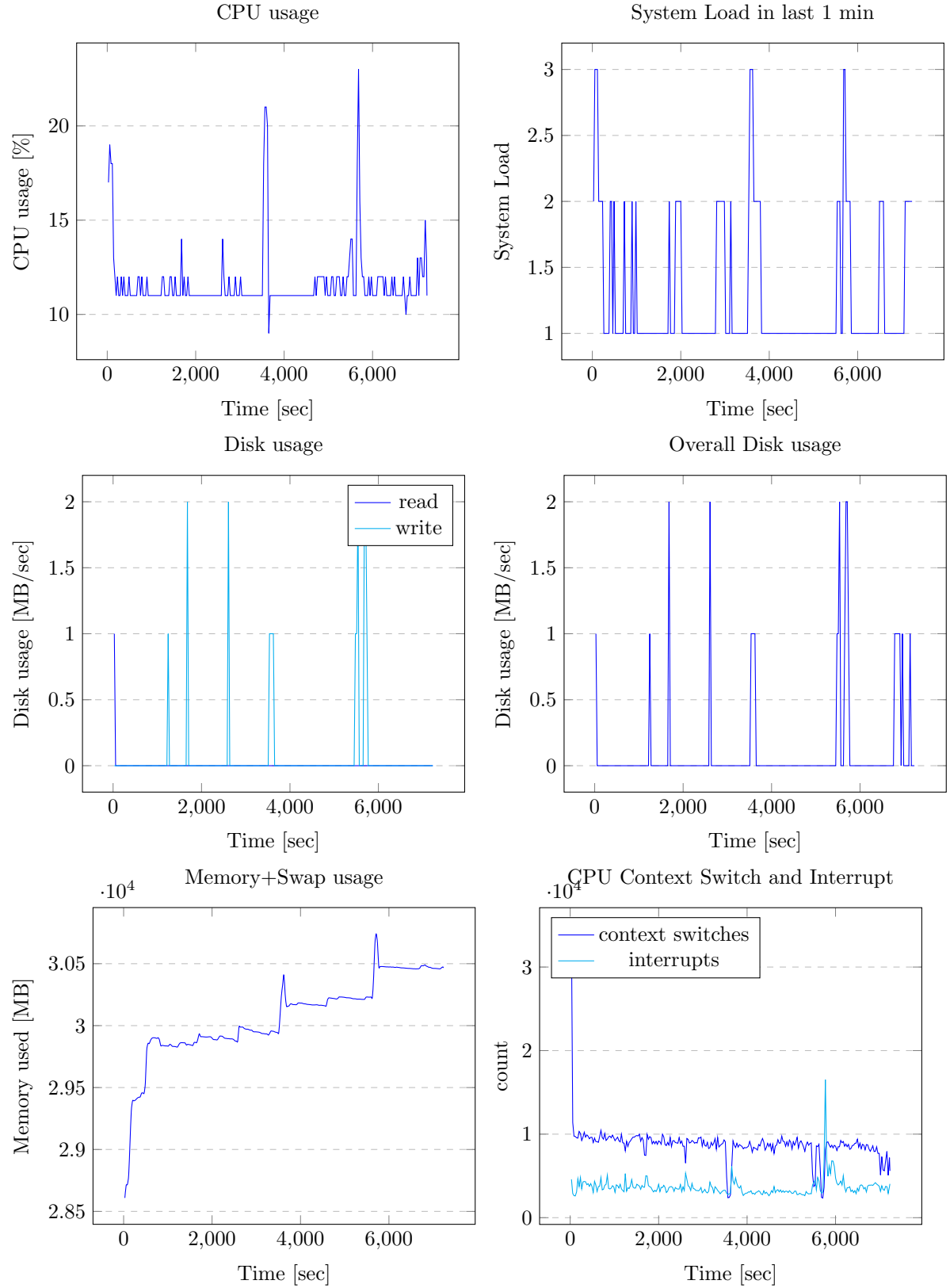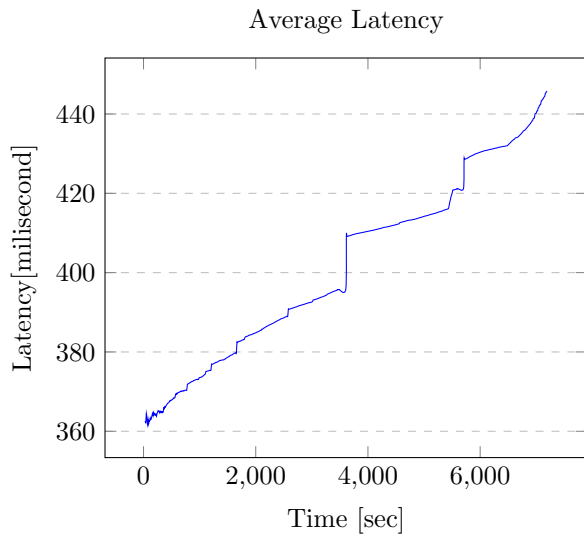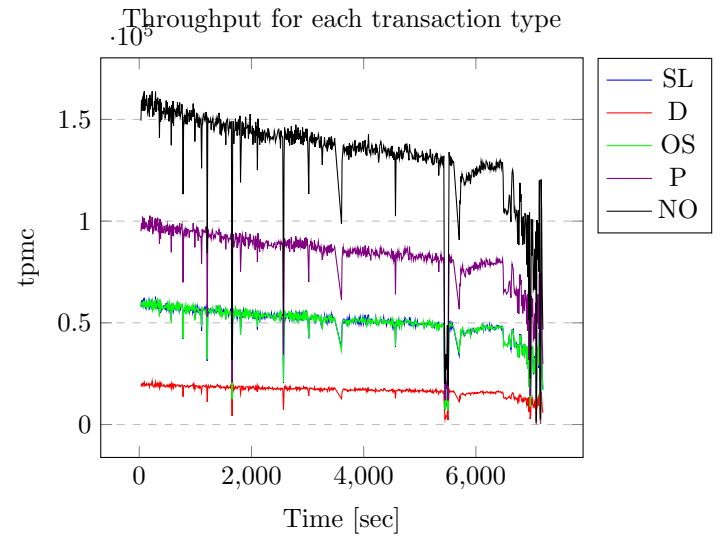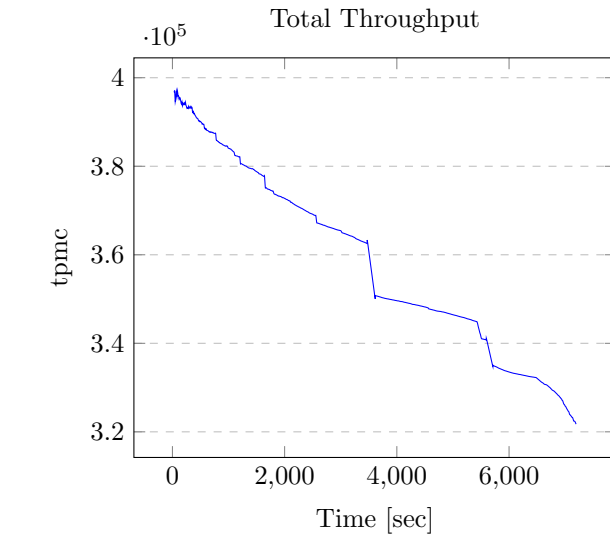
Transaction Type	Total Count	tpmc
Stock Level	5793179	48272.57
Delivery	1929595	16078.65
Order Status	5794110	48280.32
Payment	9650398	80413.44
New Order	15434848	128613.27

Response Time
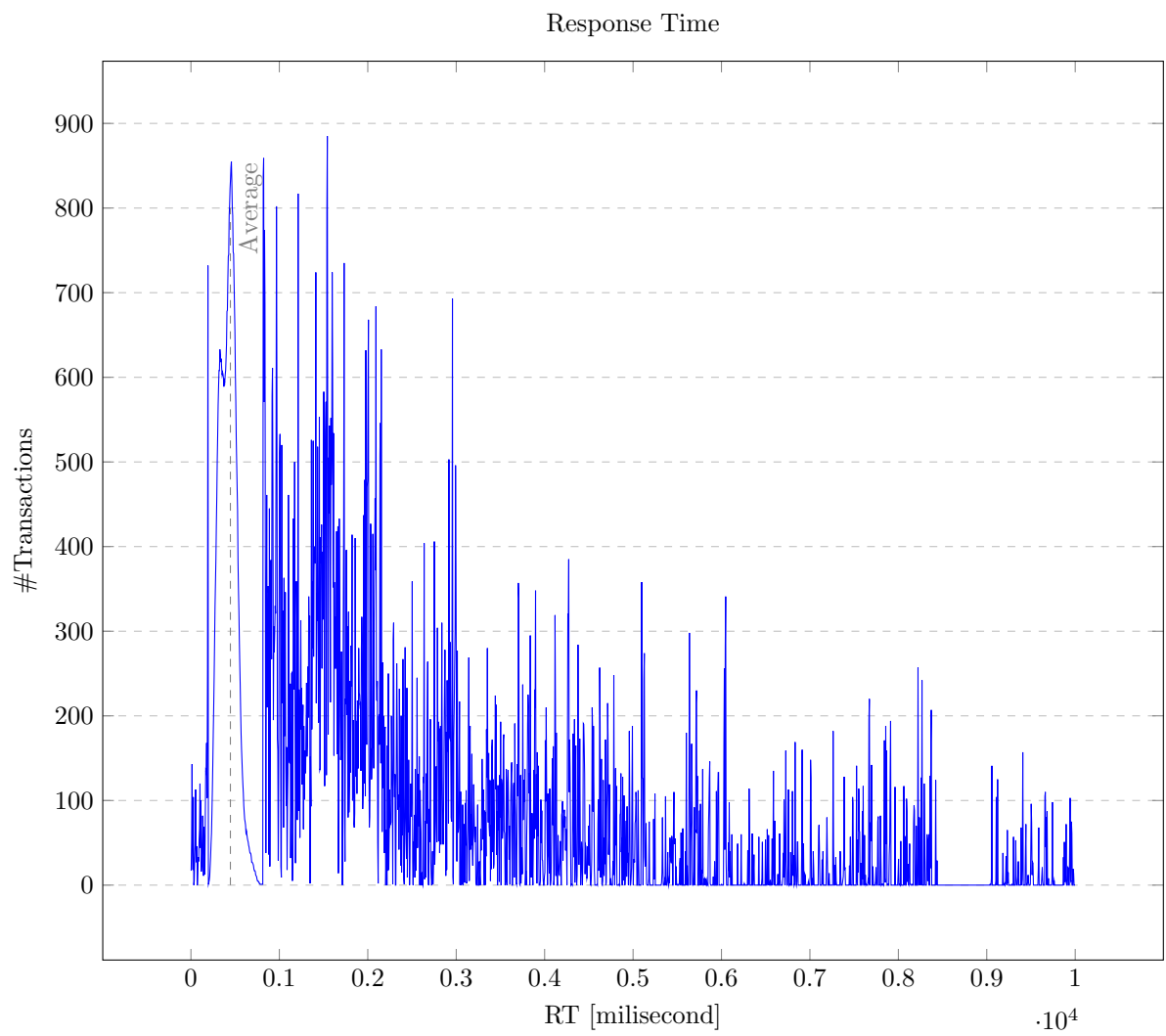
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
1.50	30815.69 MB	0.18 MB/sec	7244.00 sec	42047 milisecond	4758

Table 18: Average Parametes over Runtime in high_read mode and SF equals 10
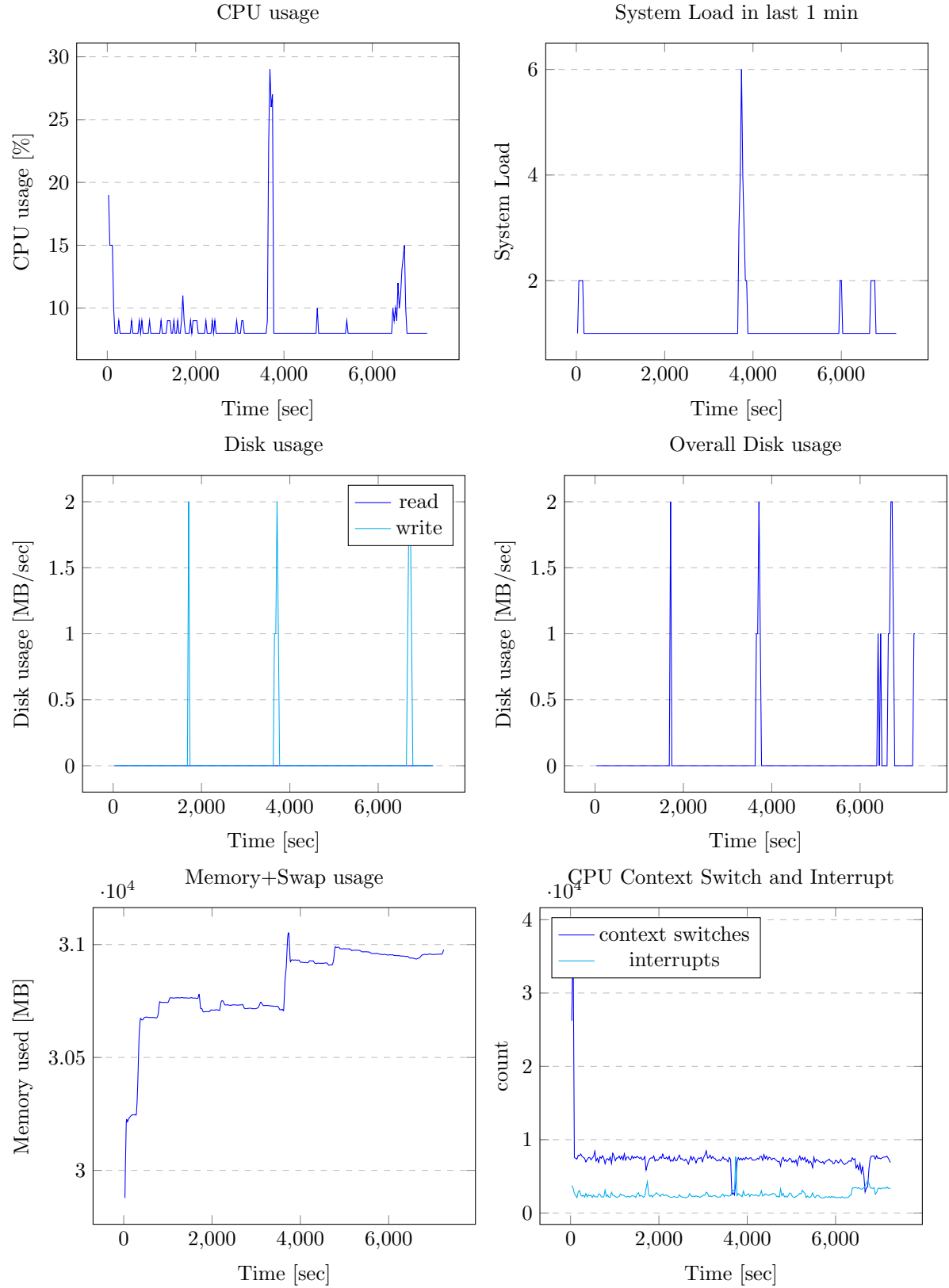
high_read mode and SF equals 10

Total Throughput

Throughput for each transaction type

Average Latency
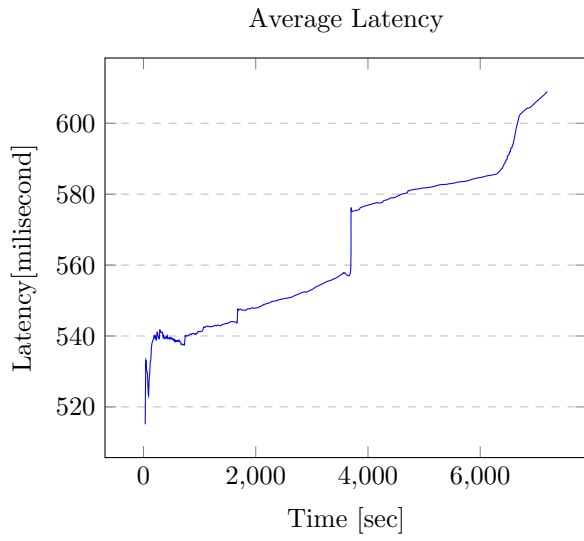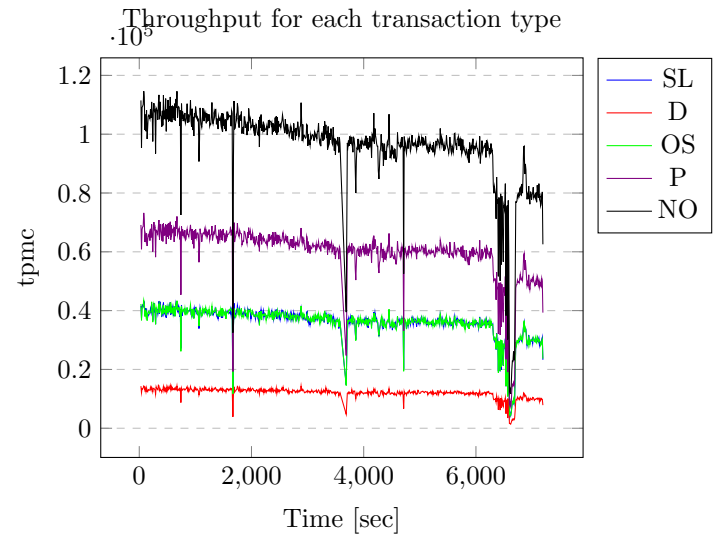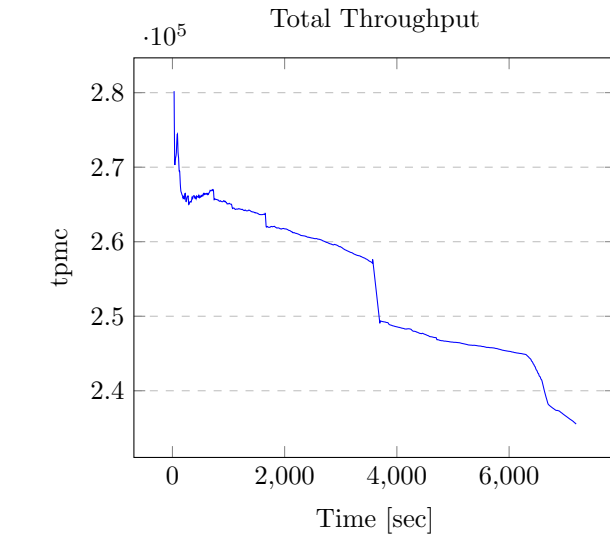
Transaction Type	Total Count	tpmc
Stock Level	4240495	35334.44
Delivery	1413433	11777.60
Order Status	4241147	35339.87
Payment	7063875	58860.60
New Order	11299264	94152.48

Response Time
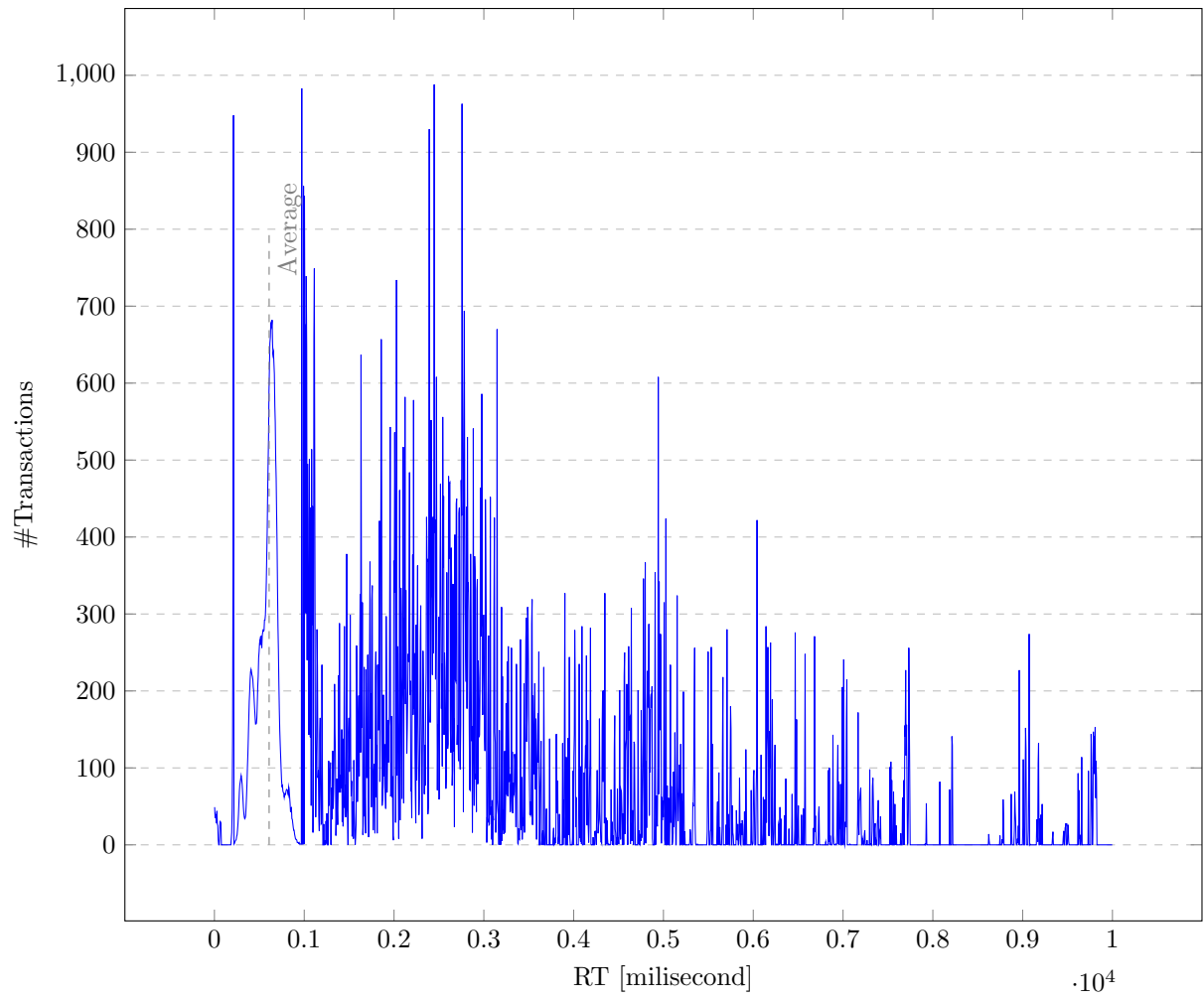
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
2.21	31163.83 MB	0.70 MB/sec	7583.00 sec	382366 milisecond	111967

Table 19: Average Parametes over Runtime in high_read mode and SF equals 100

high_read mode and SF equals 100

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

Throughput for each transaction type

Average Latency

| Transaction Type	Total Count	tpmc
Stock Level	2316387	19303.22
Delivery	771557	6429.64
Order Status	2317823	19315.19
Payment	3857336	32144.47
New Order	6174836	51456.97
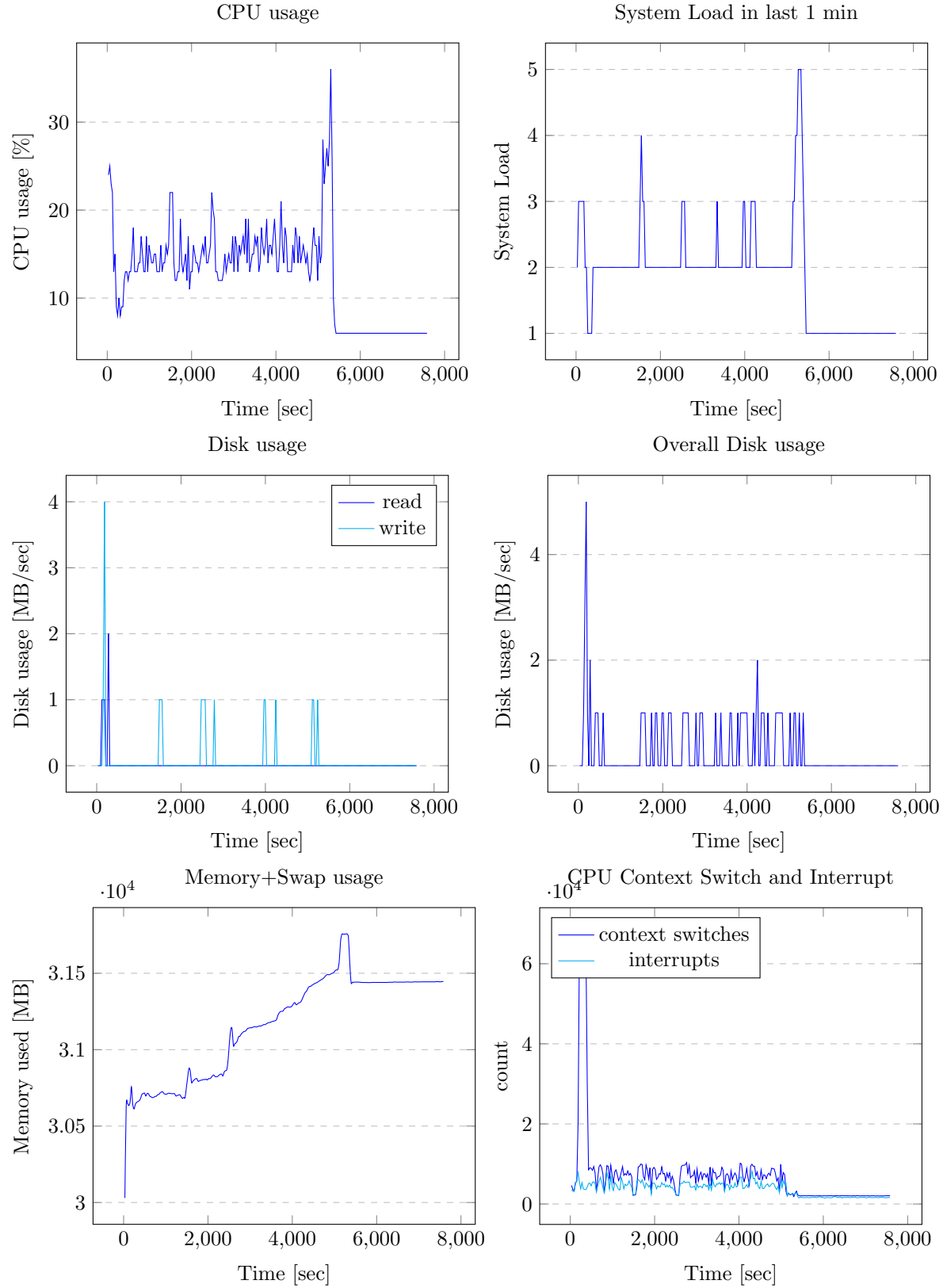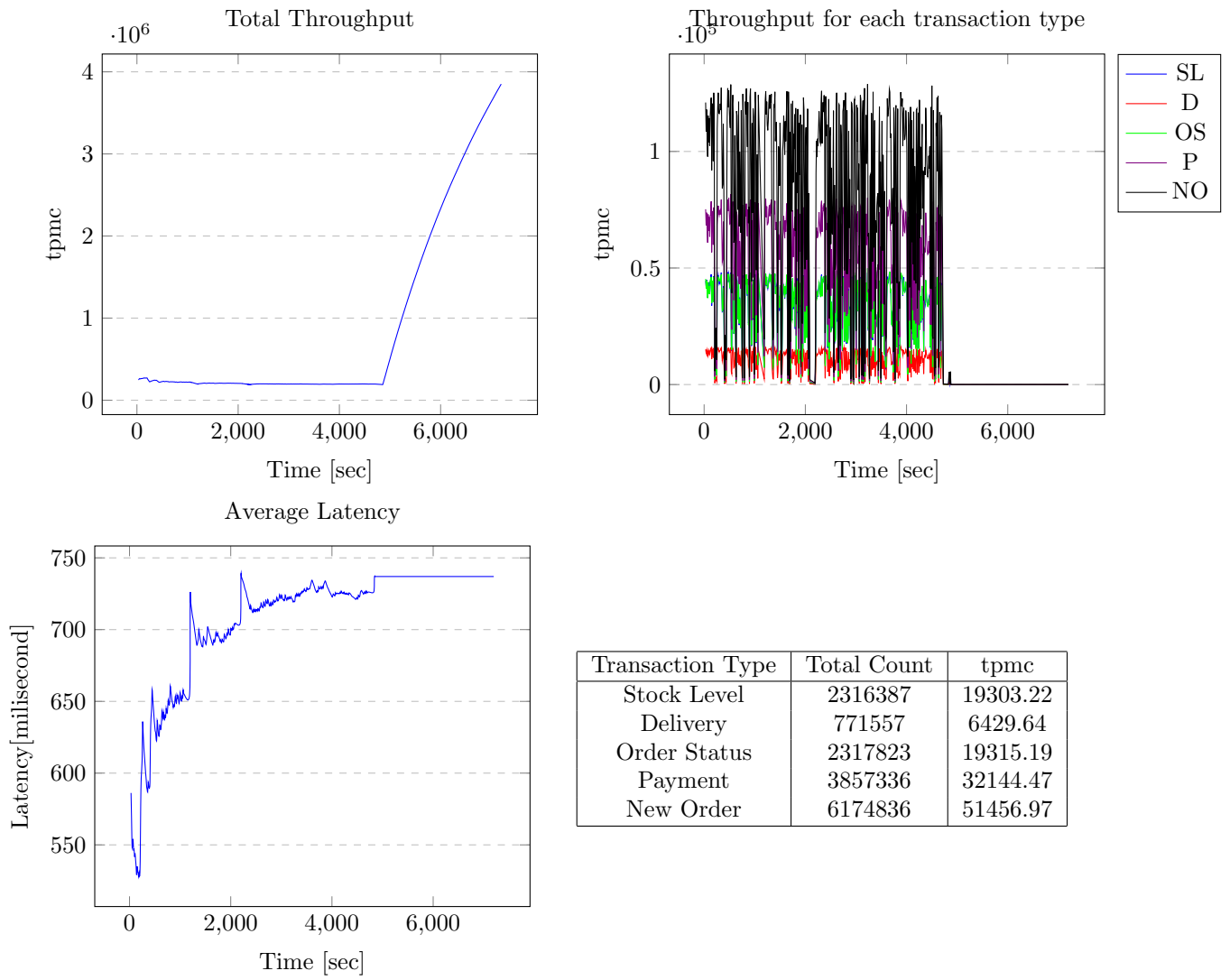
Same pattern which gets voltdb to read only mode for scale factor of 5 in high write mode happned in here.

Response Time
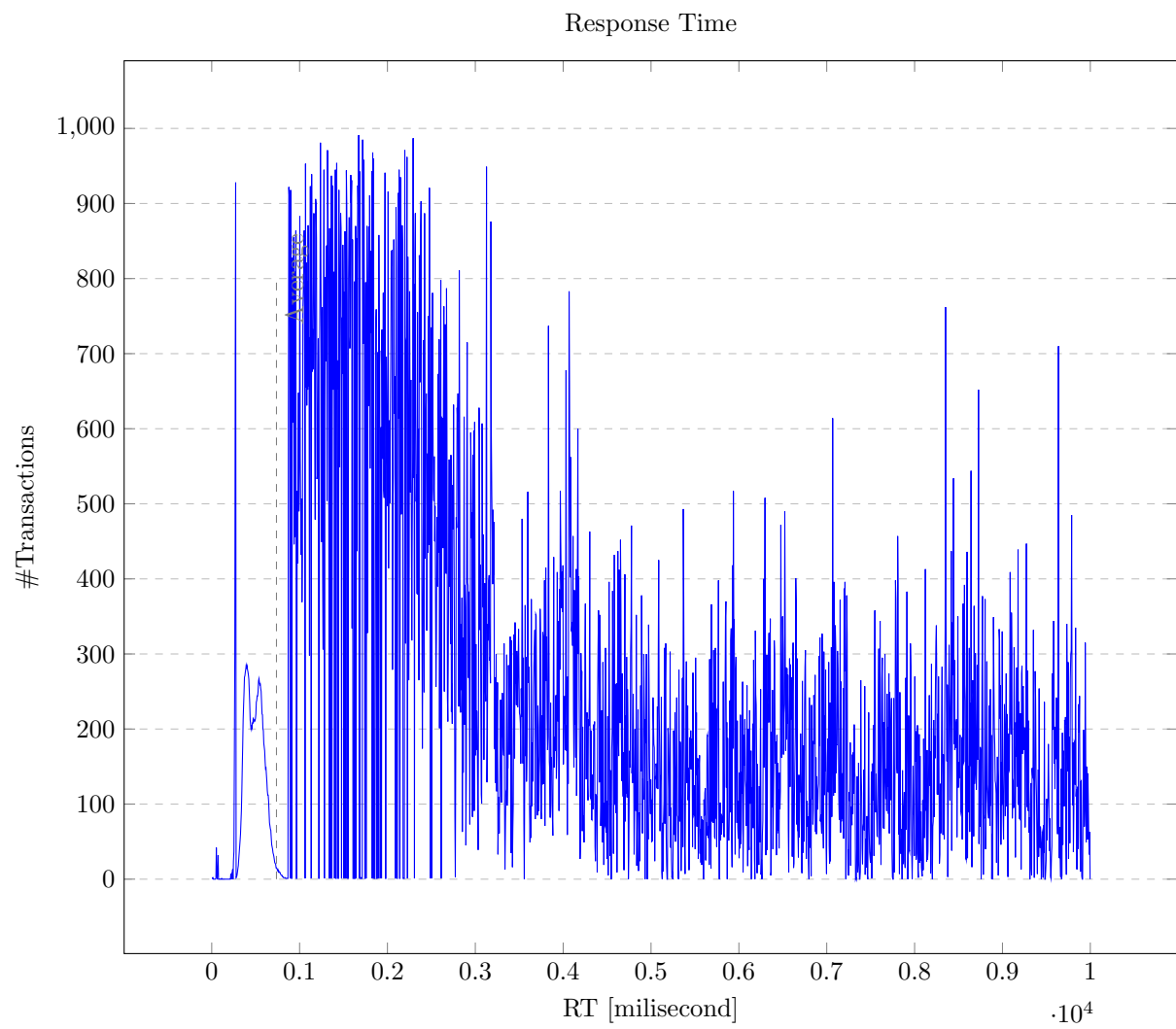
Results shows voltdb acted badly in scale factor of one. The reason is that the number of waiting transactions and locking system. Result of scale factor of 2 acts best in our test in all modes and more scale factor causes lower throughput. The more scale factor increases, the more throughput decrease rate gets low. As you can see average result of scale factor of 10 and 100 is close together. In high read and high write modes, resutls of scale factor of 5 is better than others except 2.

$\cdot 10^5$ Compare scale factors in medium mode

Compare scale factors in high read mode
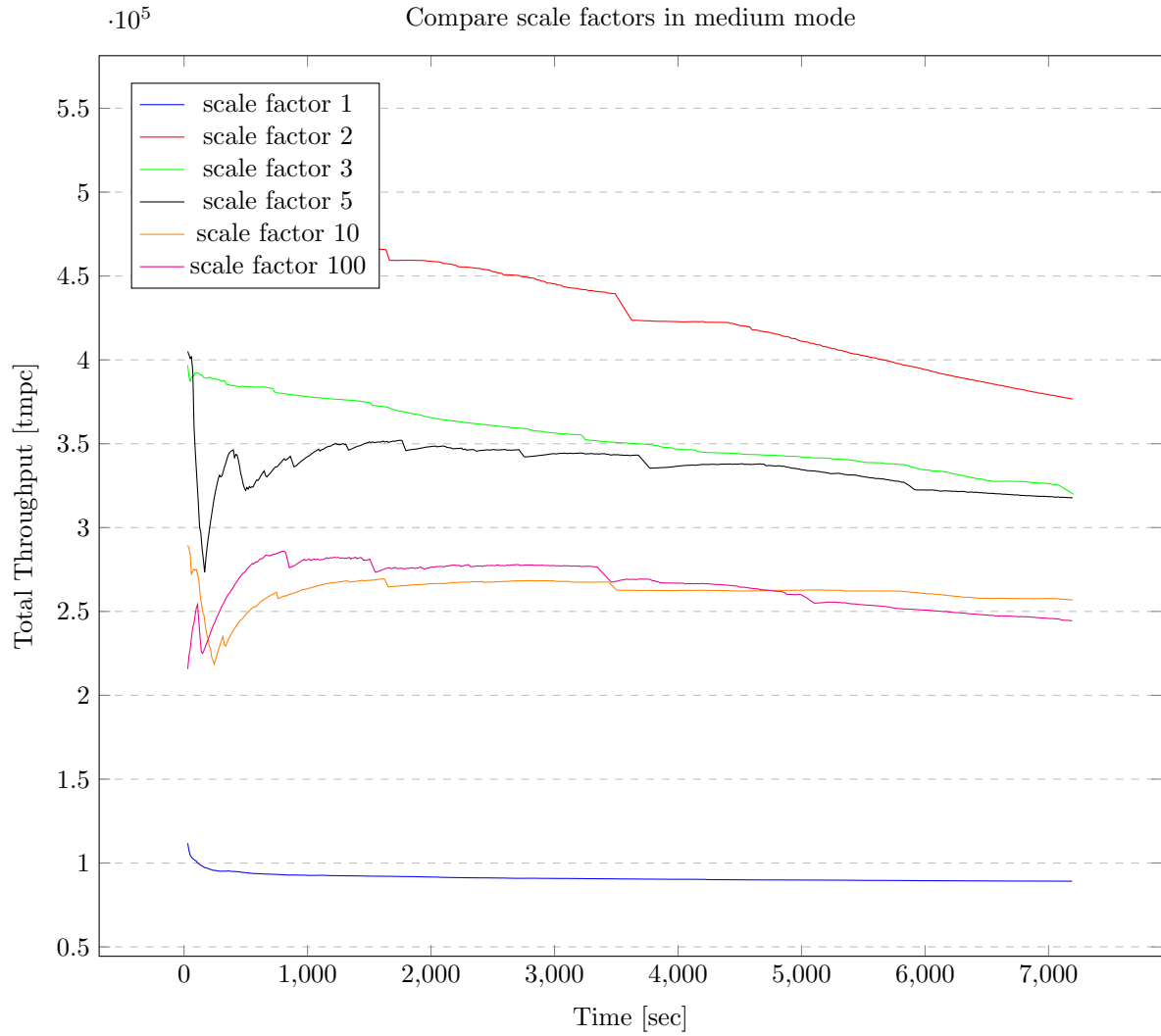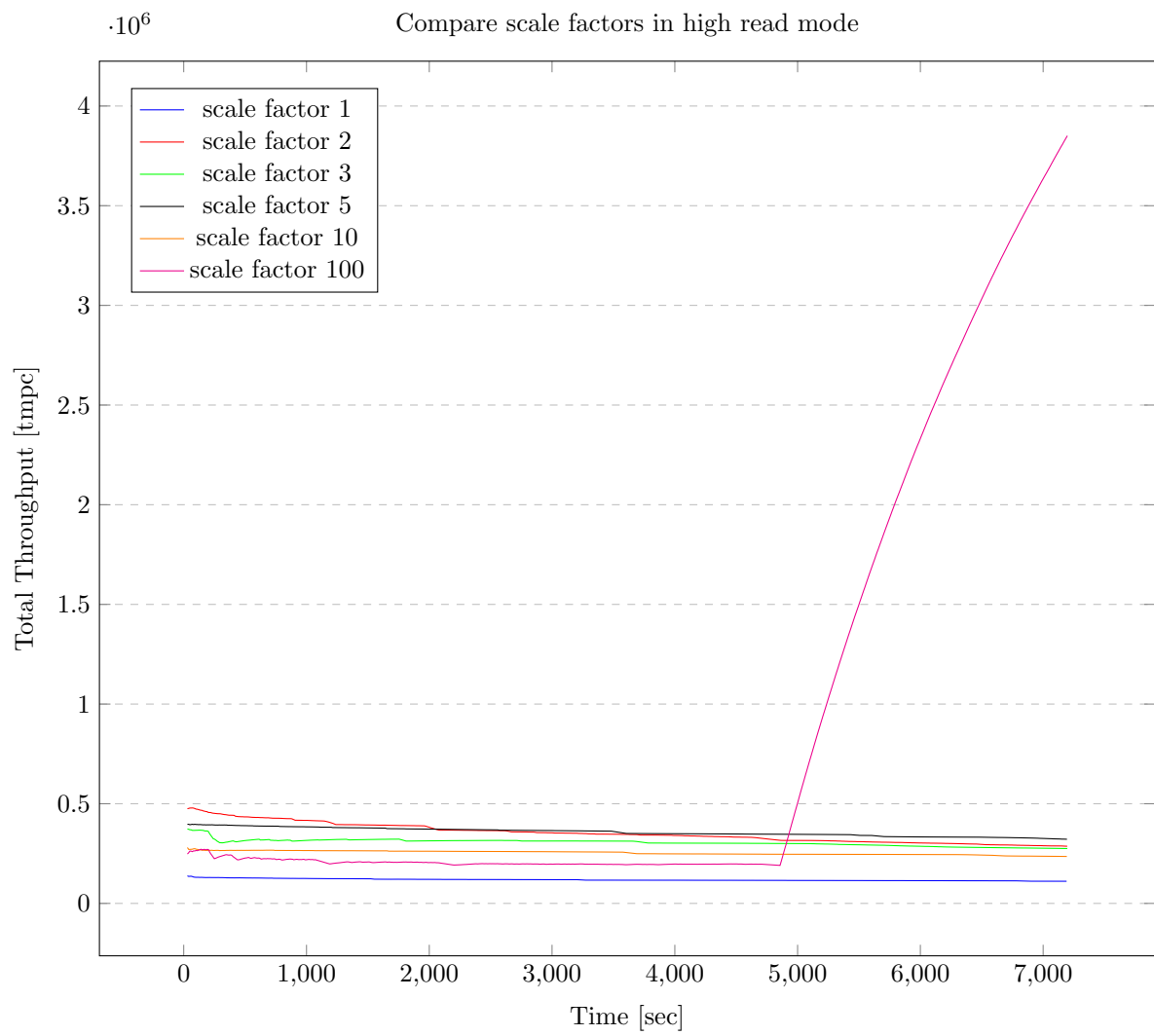
Scale Factor	Medium mode	High Read mode	High Write mode
1	89104.8	111039.6	103493.4
2	376488.0	286569	409570.2
3	319829.4	275220	not reported
5	317795.4	321660	4603719.6
10	256890	235465.2	286881
100	244398	3853688.4	not reported

Table 20: Compare Average Throughputs[tpmc] In Voltdb
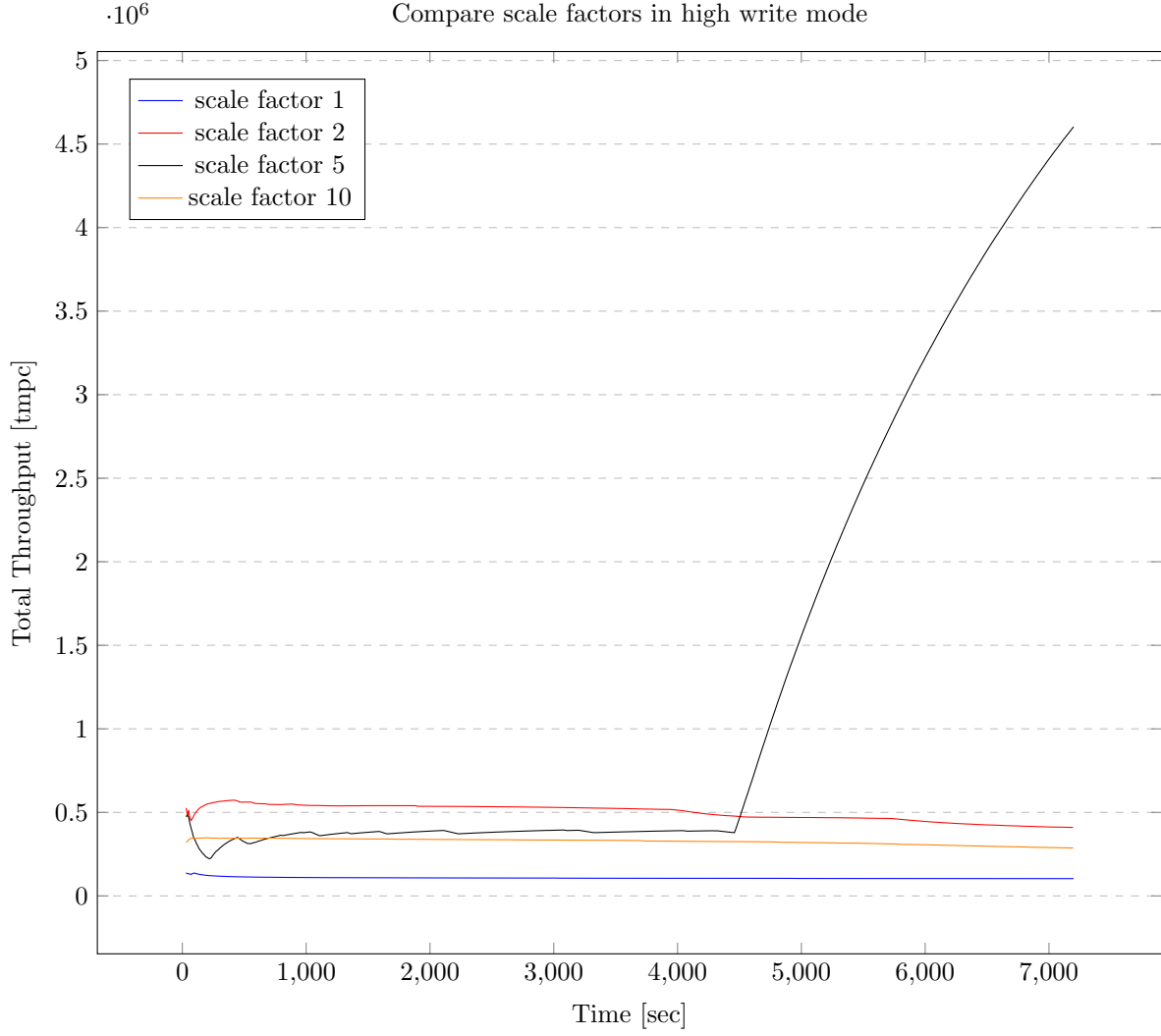
## 4 Postgres results

Postgres were ran on single node without cluster.

System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
3.32	4177.84 MB	1.00 MB/sec	7251.00 sec	77095 milisecond	222162

Table 21: Average Parametes over Runtime in medium mode and SF equals 1

medium mode and SF equals 1

Total Throughput

90th Percentile Response Time to Total Throughput

Average Latency
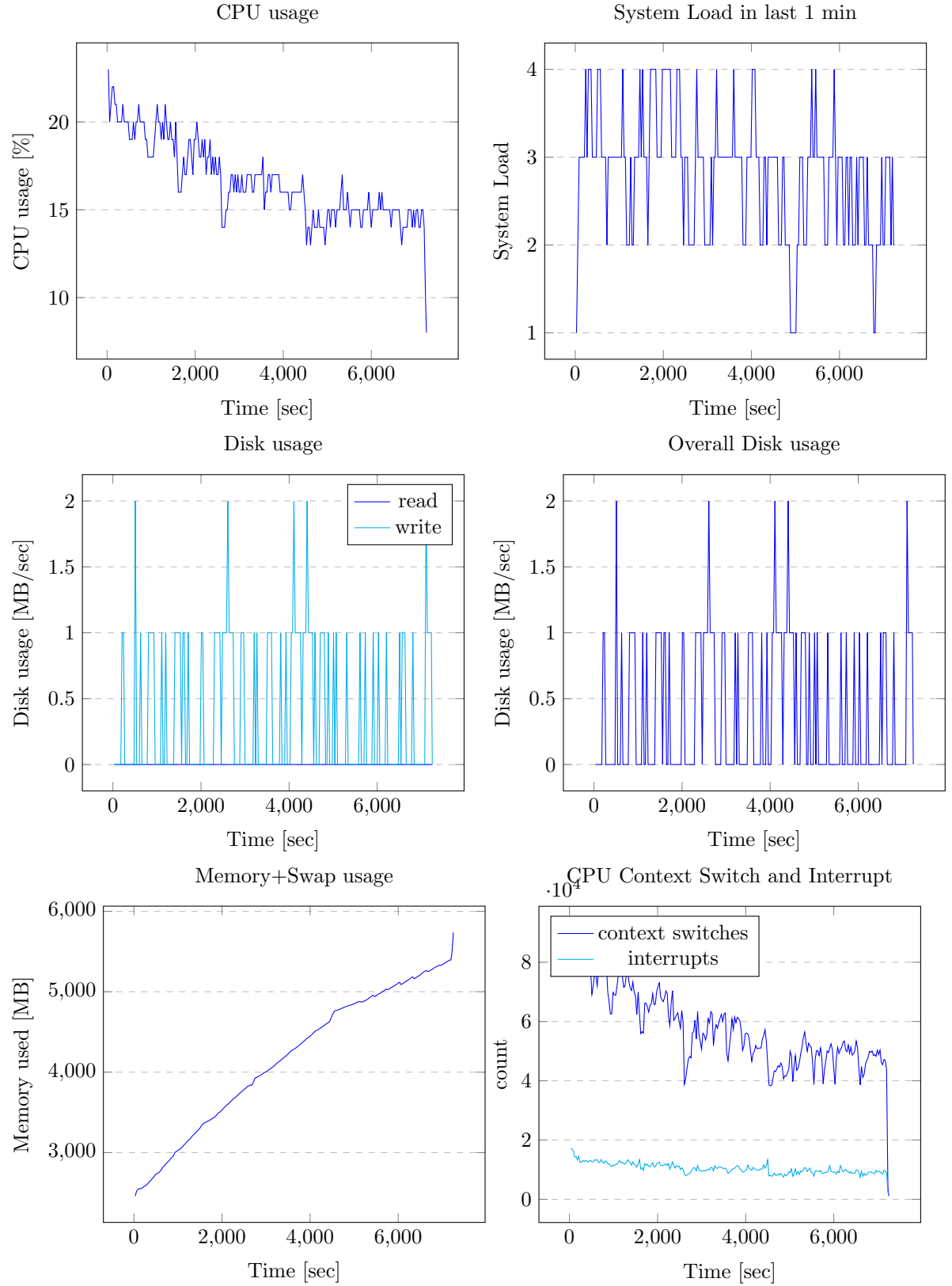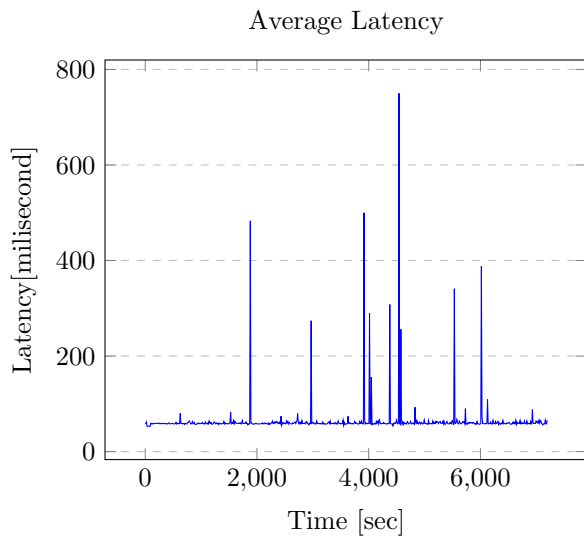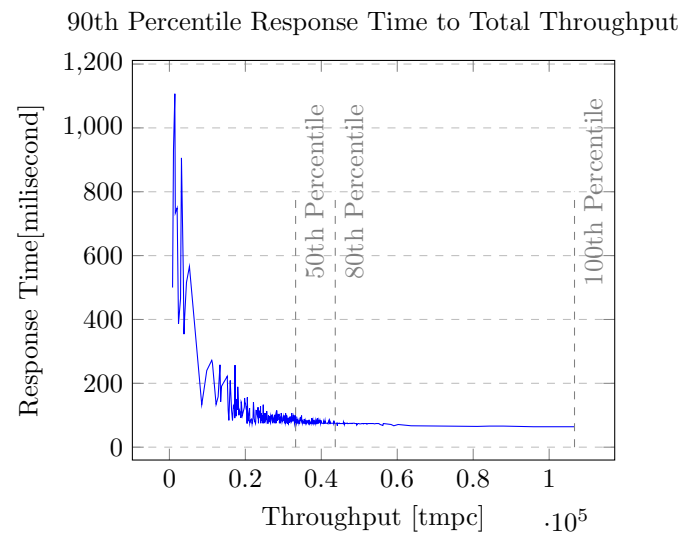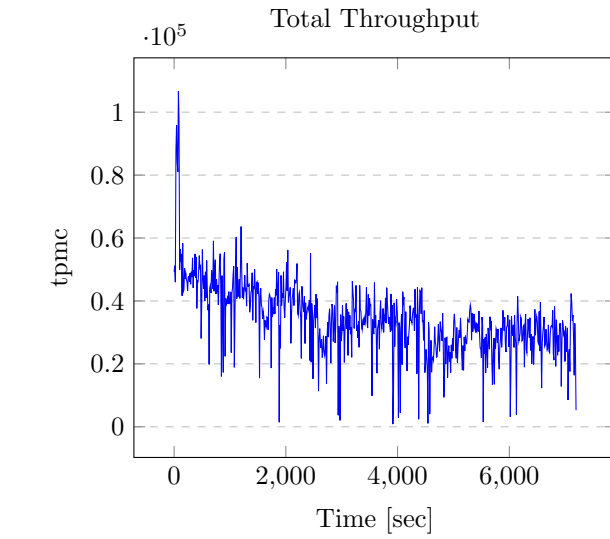
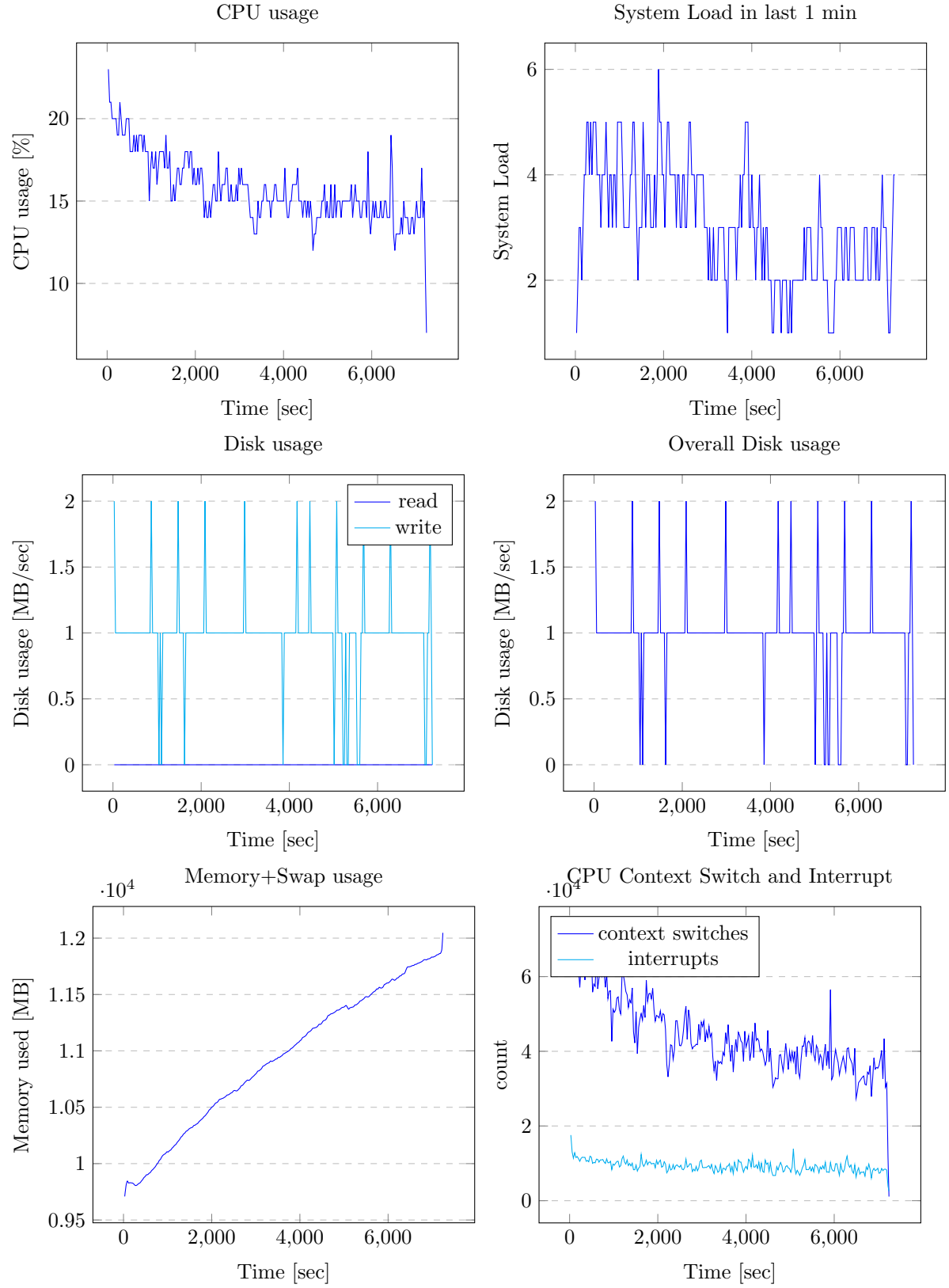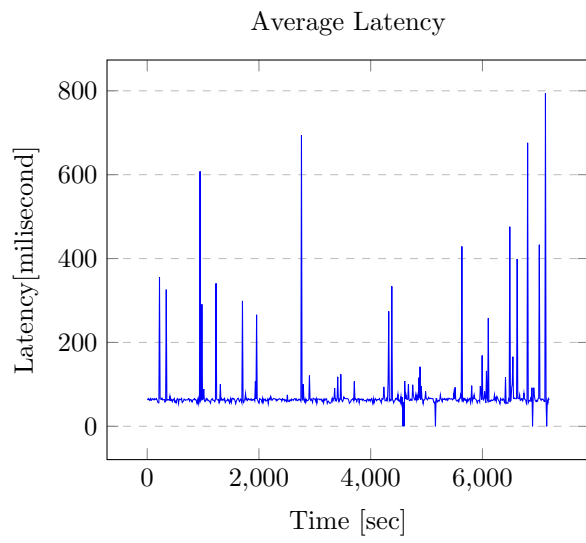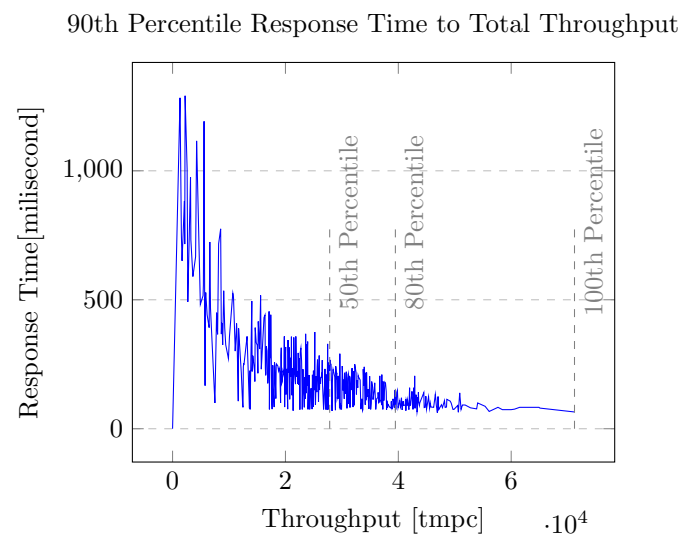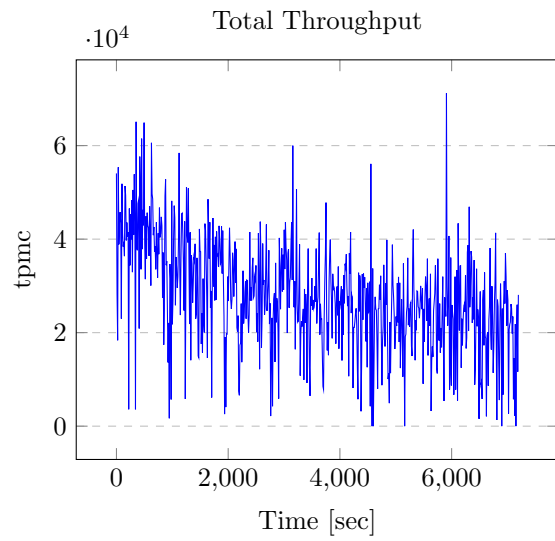| Transaction Type	Total Count	tpmc
Stock Level	206179	52816
Delivery	189345	65392
Order Status	206047	51480
Payment	1724004	63452
New Order	1572203	60535

Response Time
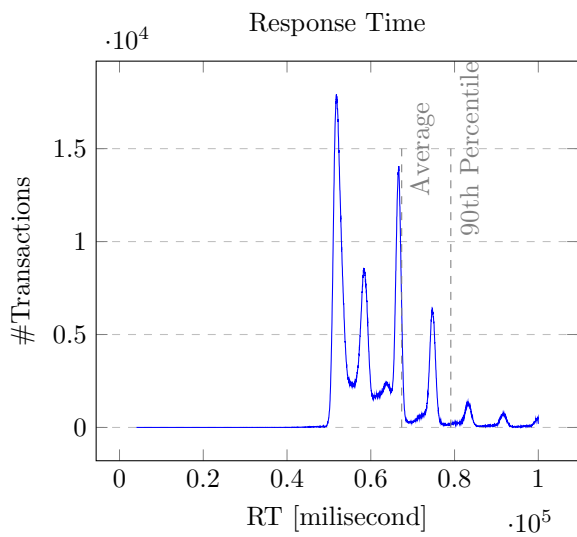
Unlike voltdb, its high write rate follows high latency and lower cpu usage. Postgres seemed to be using disk for writing more than reading in almost all transactions.

System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
3.56	10930.66 MB	1.34 MB/sec	7243.00 sec	93732 milisecond	462207

Table 22: Average Parametes over Runtime in medium mode and SF equals 2

medium mode and SF equals 2

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

90th Percentile Response Time to Total Throughput

Average Latency

Transaction Type	Total Count	tpmc
Stock Level	165202	53169
Delivery	133215	64788
Order Status	164461	51562
Payment	1189509	65930
New Order	1189621	59983

Response Time
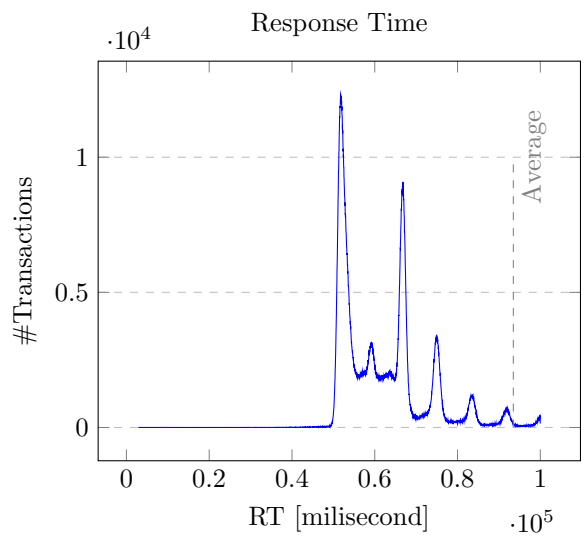
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
3.21	11972.41 MB	1.17 MB/sec	7226.00 sec	256145 milisecond	396563

Table 23: Average Parametes over Runtime in medium mode and SF equals 3

medium mode and SF equals 3

Total Throughput

90th Percentile Response Time to Total Throughput

Average Latency
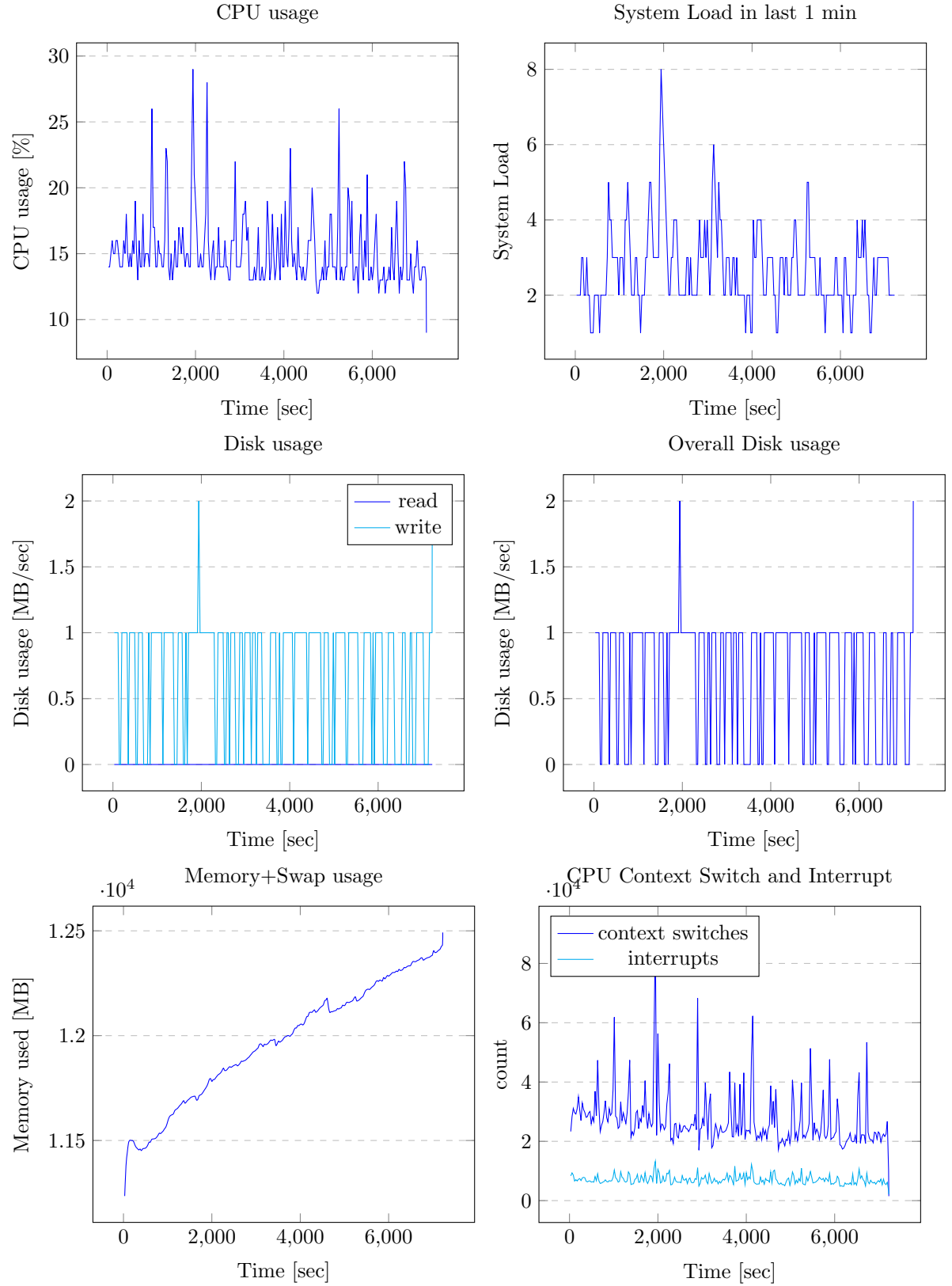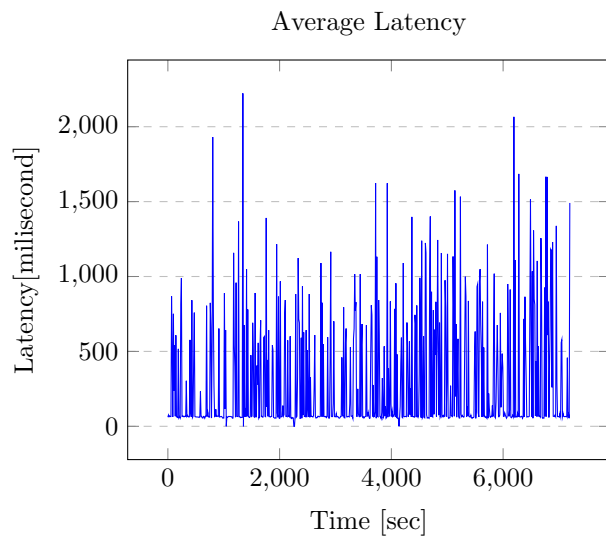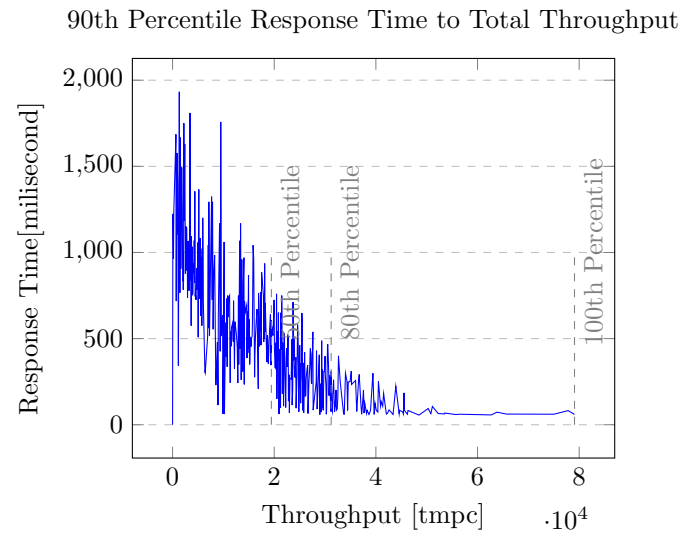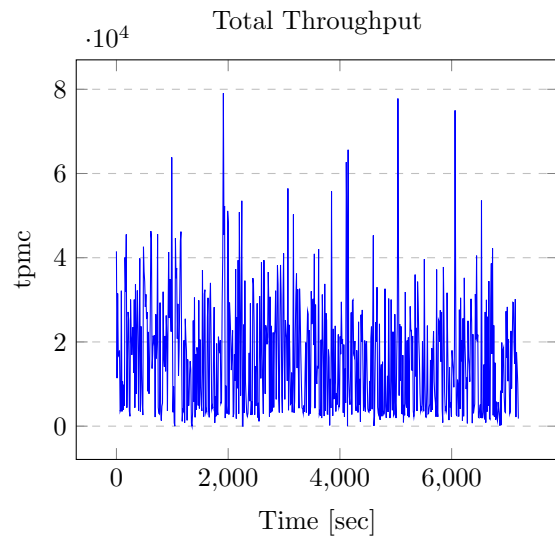
Transaction Type	Total Count	tpmc
Stock Level	93986	53480
Delivery	64097	62742
Order Status	93638	51864
Payment	590754	63714
New Order	642116	59573

Response Time
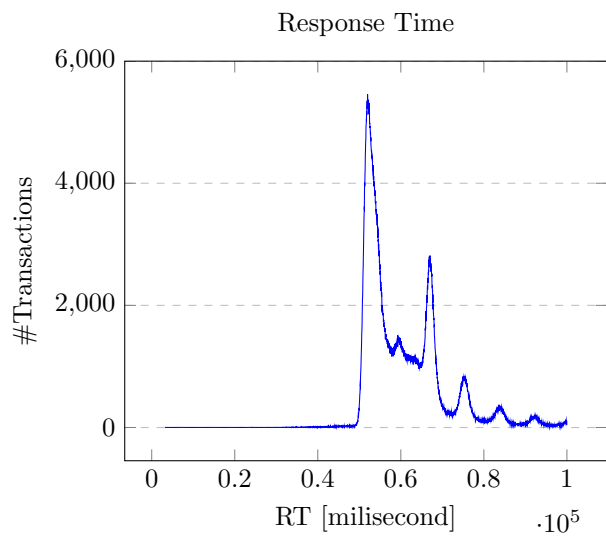
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
4.28	13015.25 MB	1.27 MB/sec	7219.00 sec	519745 milisecond	455632

Table 24: Average Parametes over Runtime in medium mode and SF equals 5
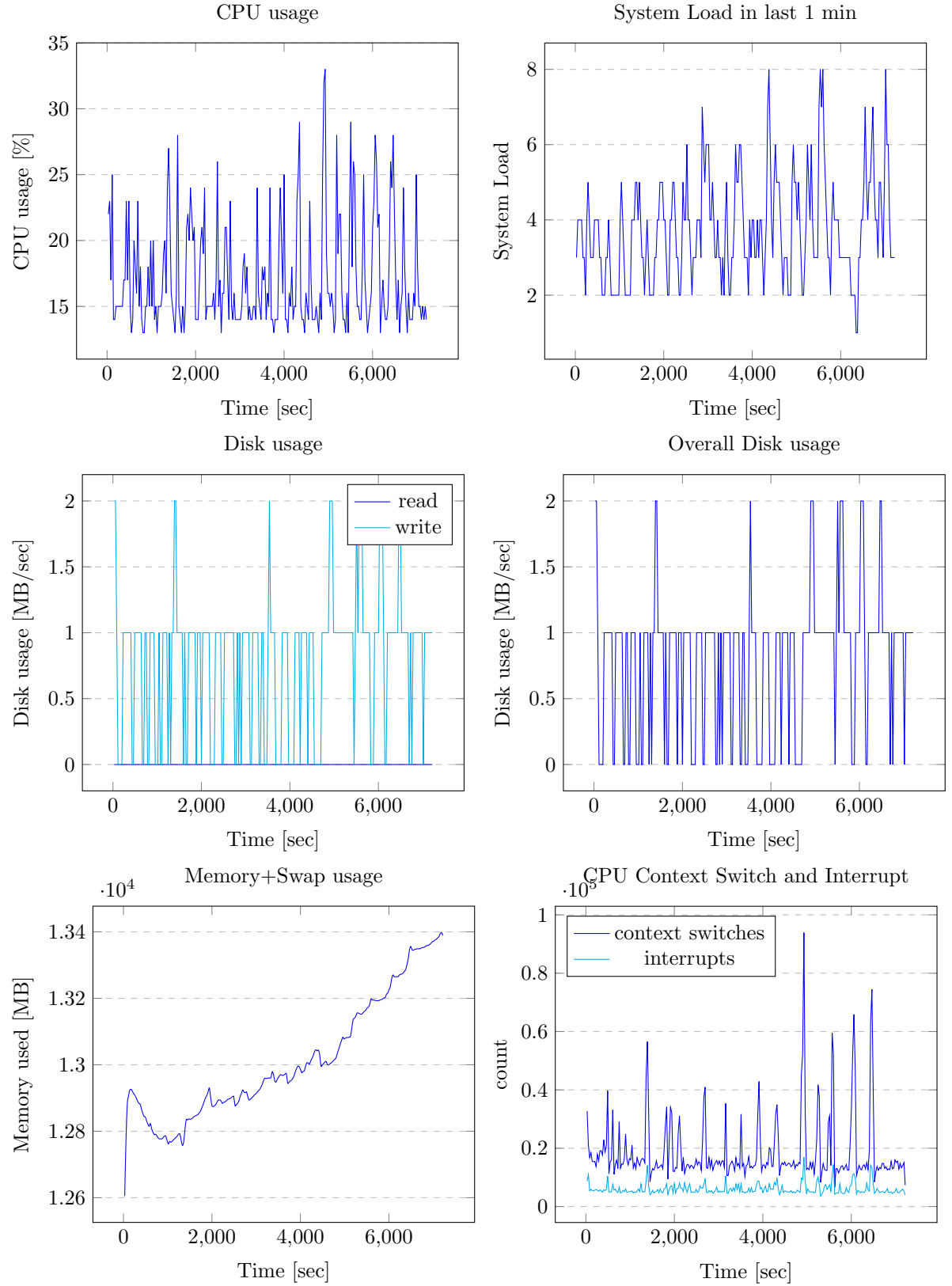
medium mode and SF equals 5

Total Throughput

90th Percentile Response Time to Total Throughput

Average Latency
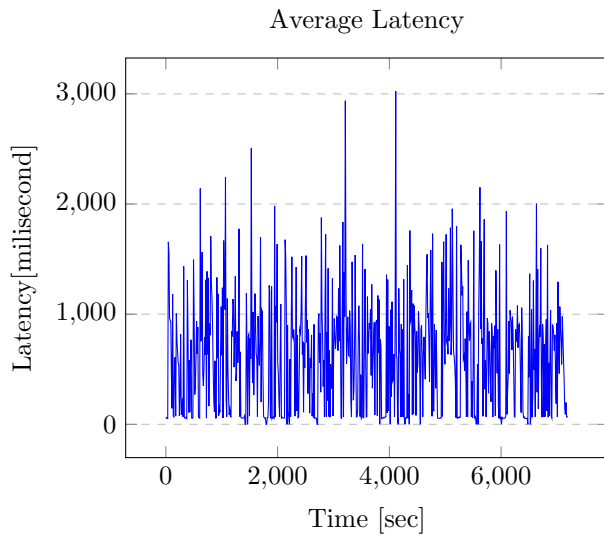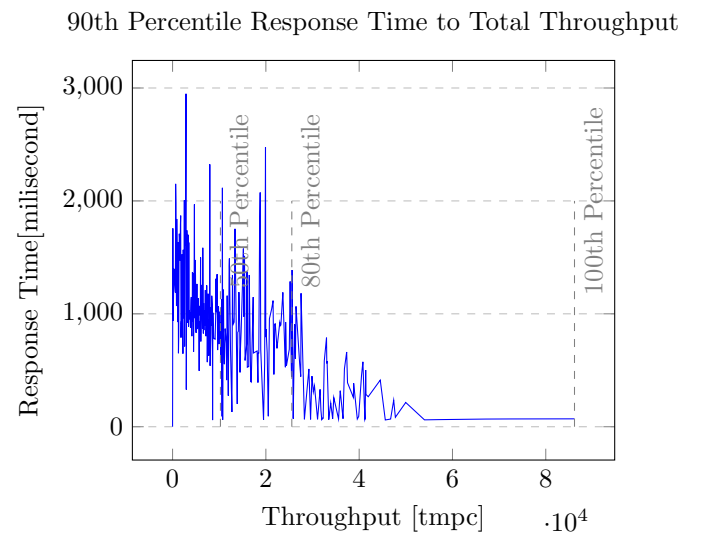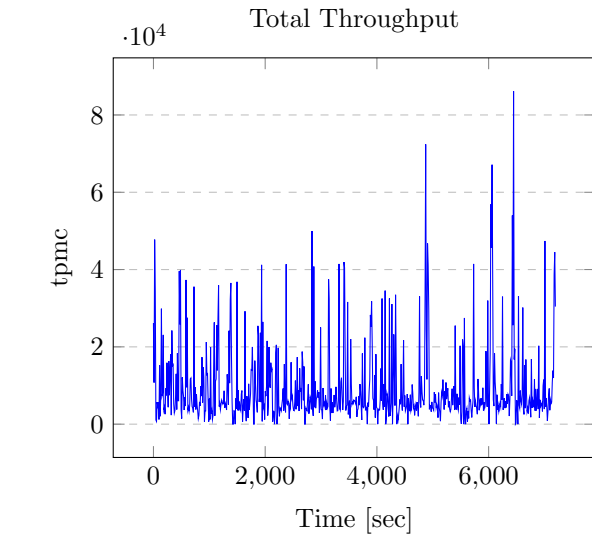
Transaction Type	Total Count	tpmc
Stock Level	56970	54301
Delivery	20101	58542
Order Status	54908	52539
Payment	232953	61567
New Order	328265	60243

Response Time
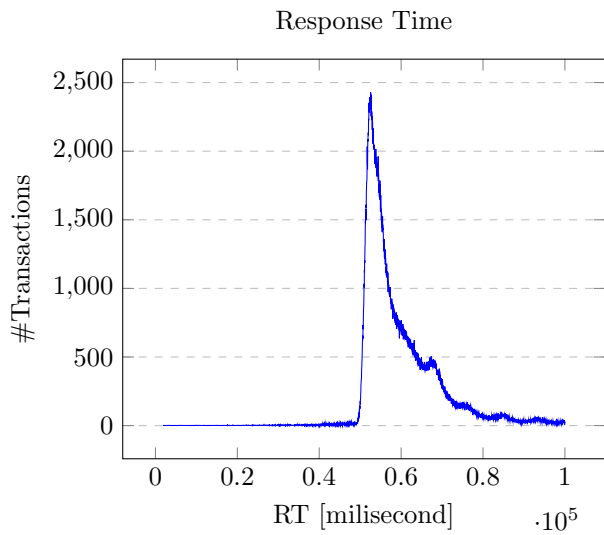
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
7.88	15685.81 MB	1.96 MB/sec	7225.00 sec	838882 milisecond	655900

Table 25: Average Parametes over Runtime in medium mode and SF equals 10

medium mode and SF equals 10

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

90th Percentile Response Time to Total Throughput

Average Latency
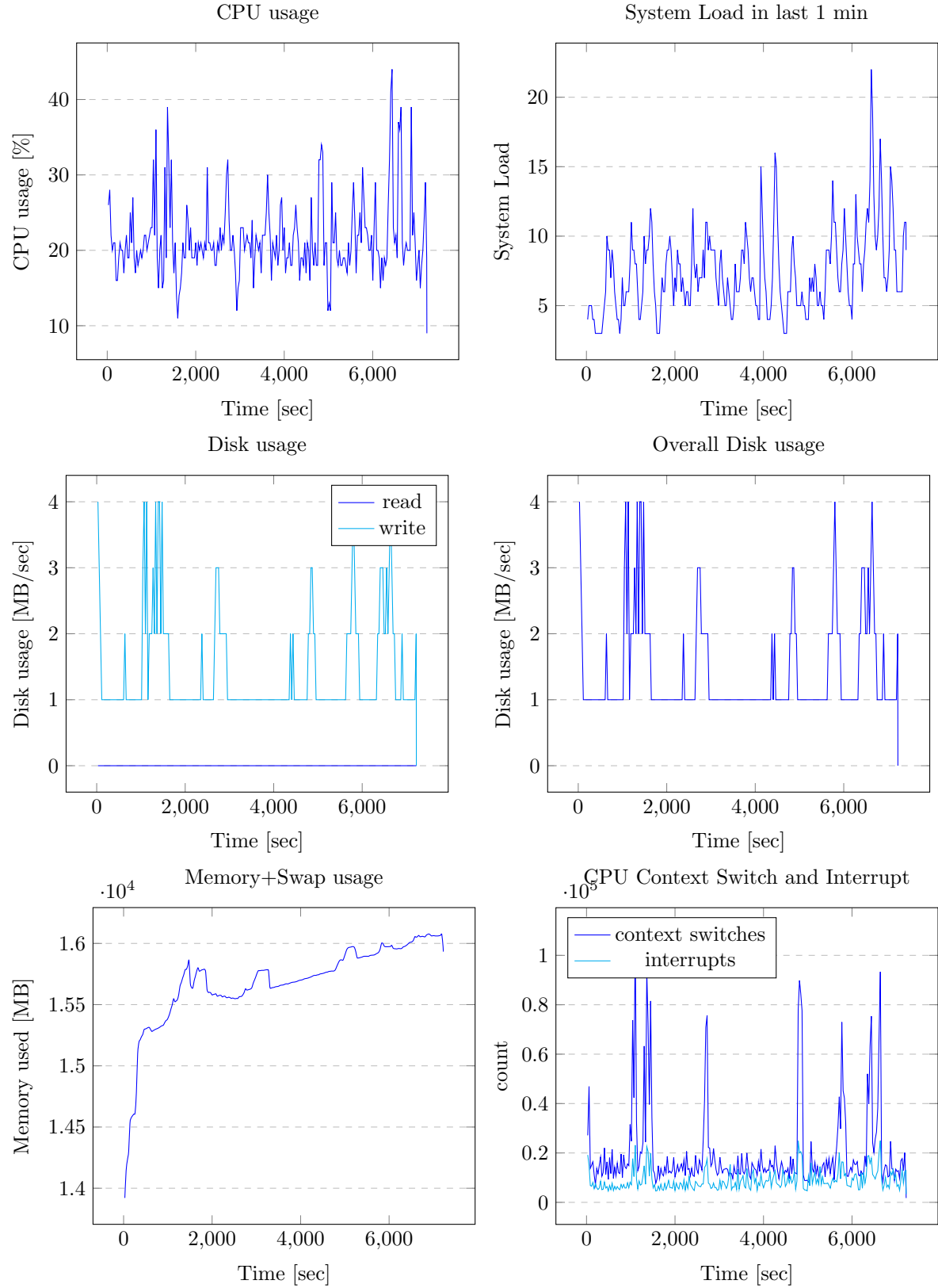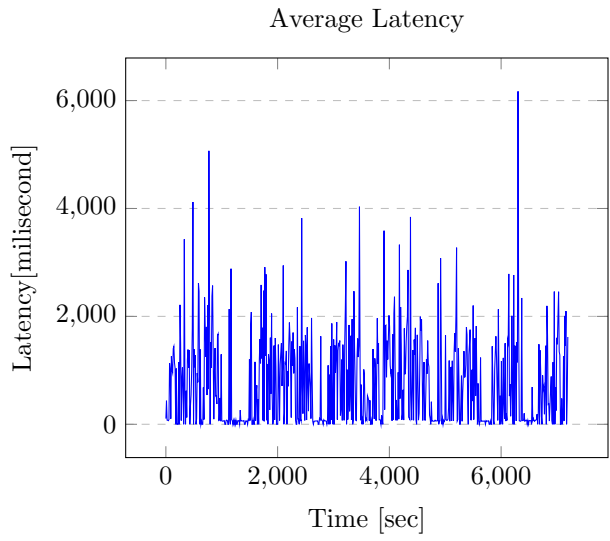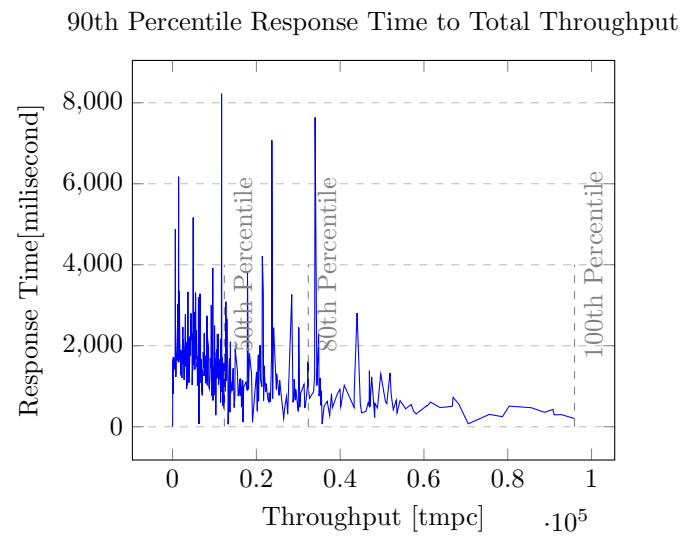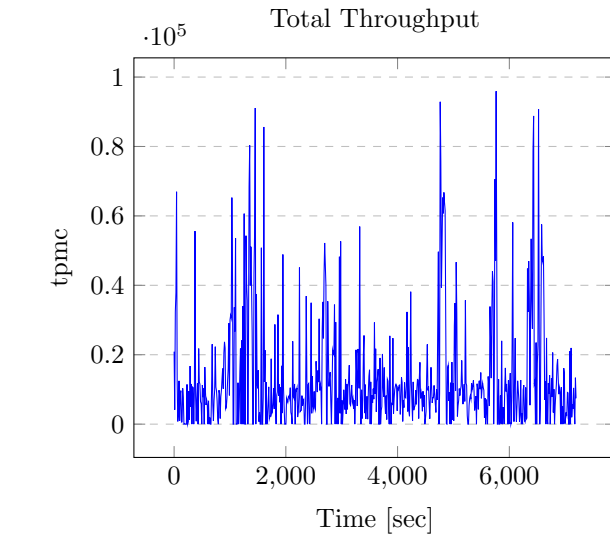
Transaction Type	Total Count	tpmc
Stock Level	70813	58126
Delivery	24475	55321
Order Status	76080	54483
Payment	262644	68059
New Order	503357	63576

Response Time
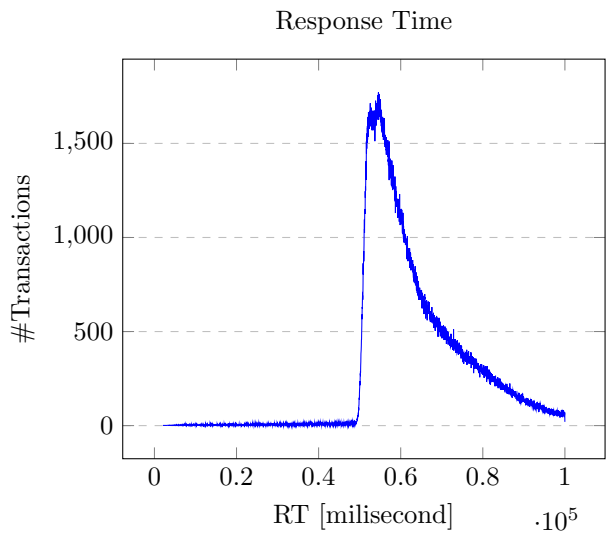
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
0.17	13197.02 MB	0.01 MB/sec	7202.00 sec	not reported	not reported

Table 26: Average Parametes over Runtime in medium mode and SF equals 100

medium mode and SF equals 100
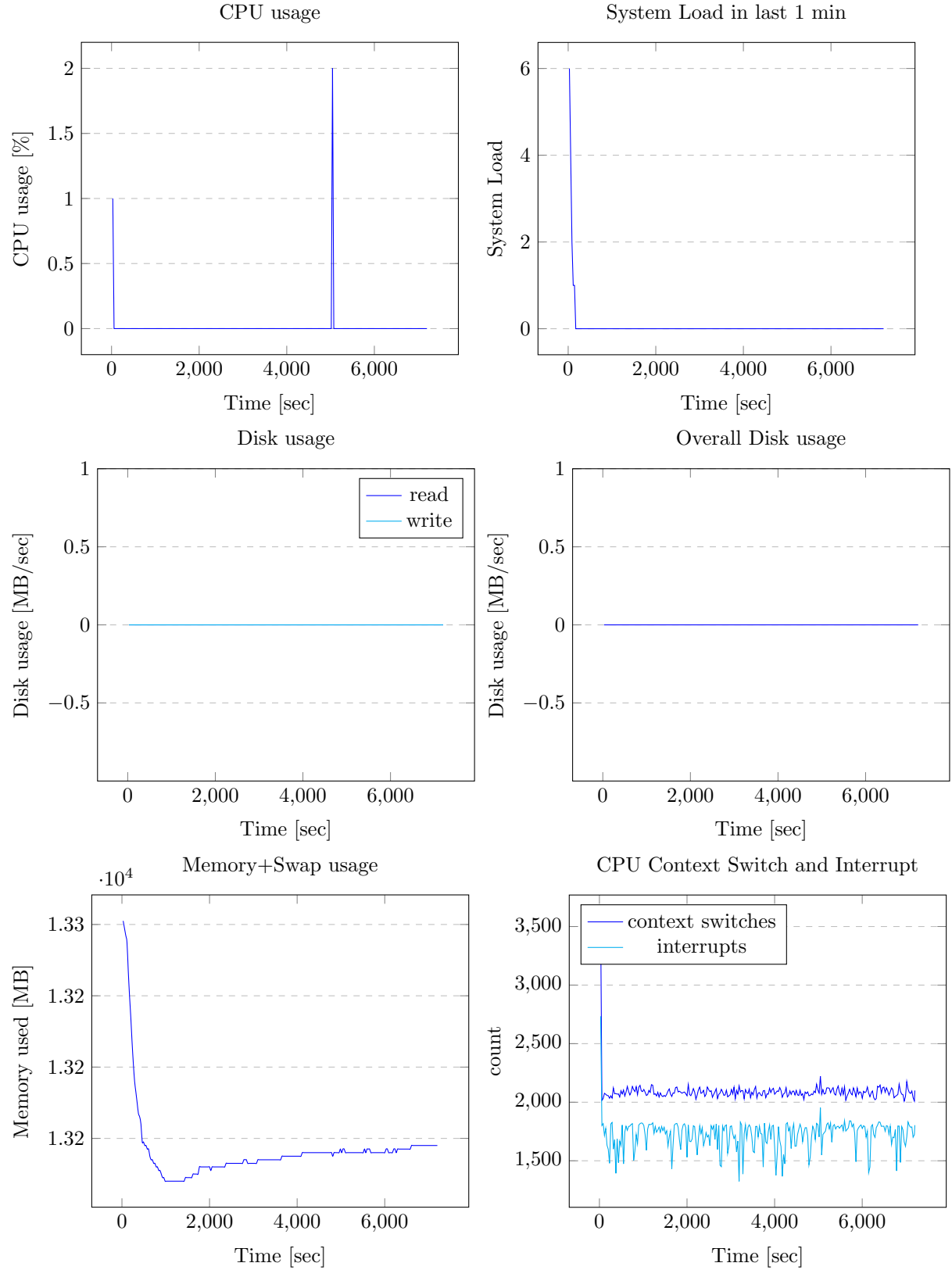
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
3.73	6056.27 MB	0.90 MB/sec	7293.00 sec	78325 milisecond	112884

Table 27: Average Parametes over Runtime in high_write mode and SF equals 1

Trnsactions reports are not available because TPC-C benchmarking app exited with error (Failed to connect to database). It seems this application has serious bug.

high_write mode and SF equals 1

Total Throughput

90th Percentile Response Time to Total Throughput

Average Latency

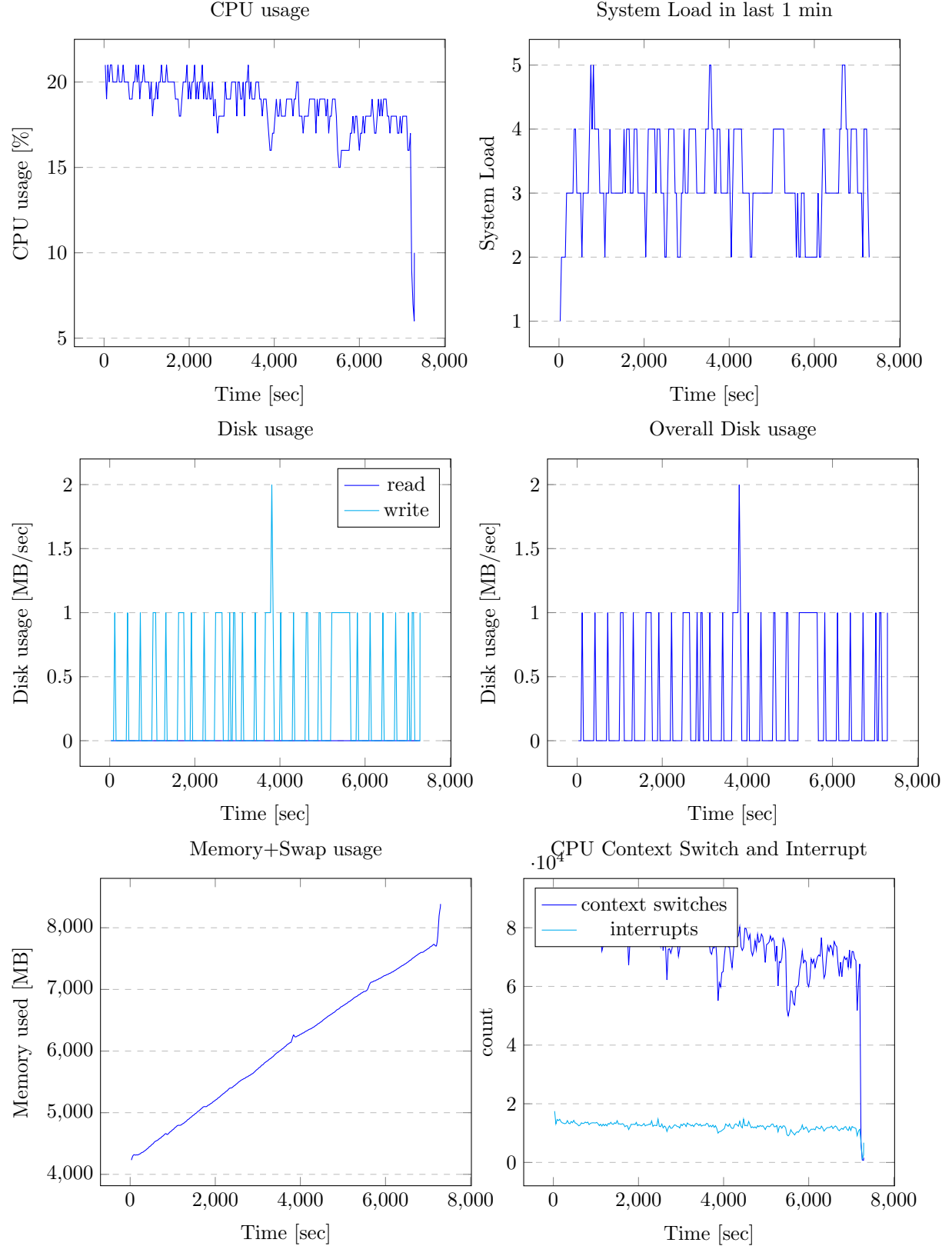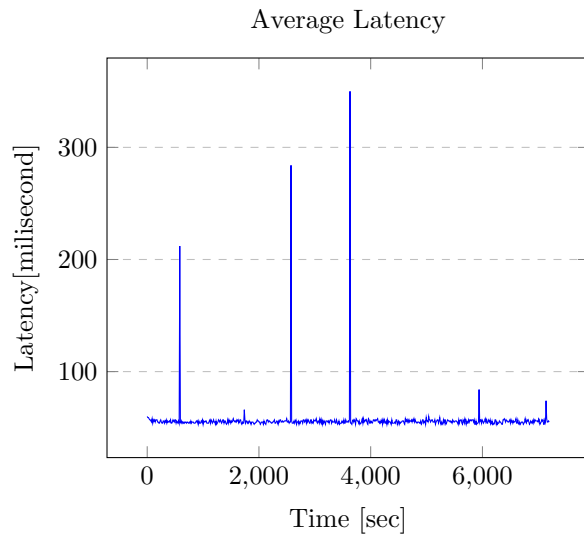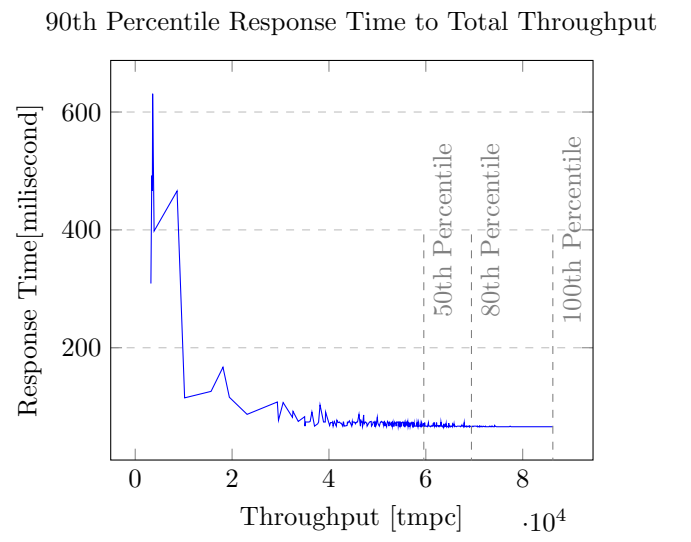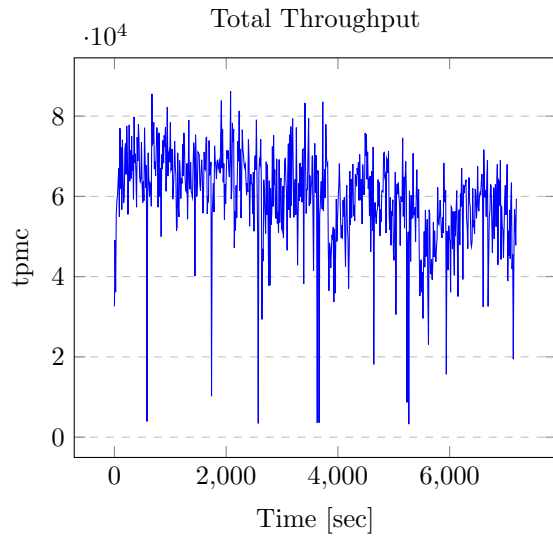| Transaction Type	Total Count	tpmc
Stock Level	358871	52753
Delivery	1419293	55443
Order Status	357774	51334
Payment	2792046	62295
New Order	2131213	56943

Response Time
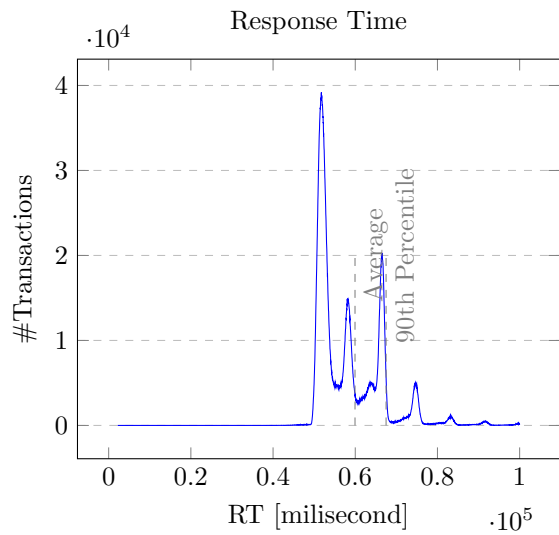
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
3.54	14659.82 MB	1.00 MB/sec	7266.00 sec	109569 milisecond	366356

Table 28: Average Parametes over Runtime in high_write mode and SF equals 2

high_write mode and SF equals 2

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

90th Percentile Response Time to Total Throughput

Average Latency
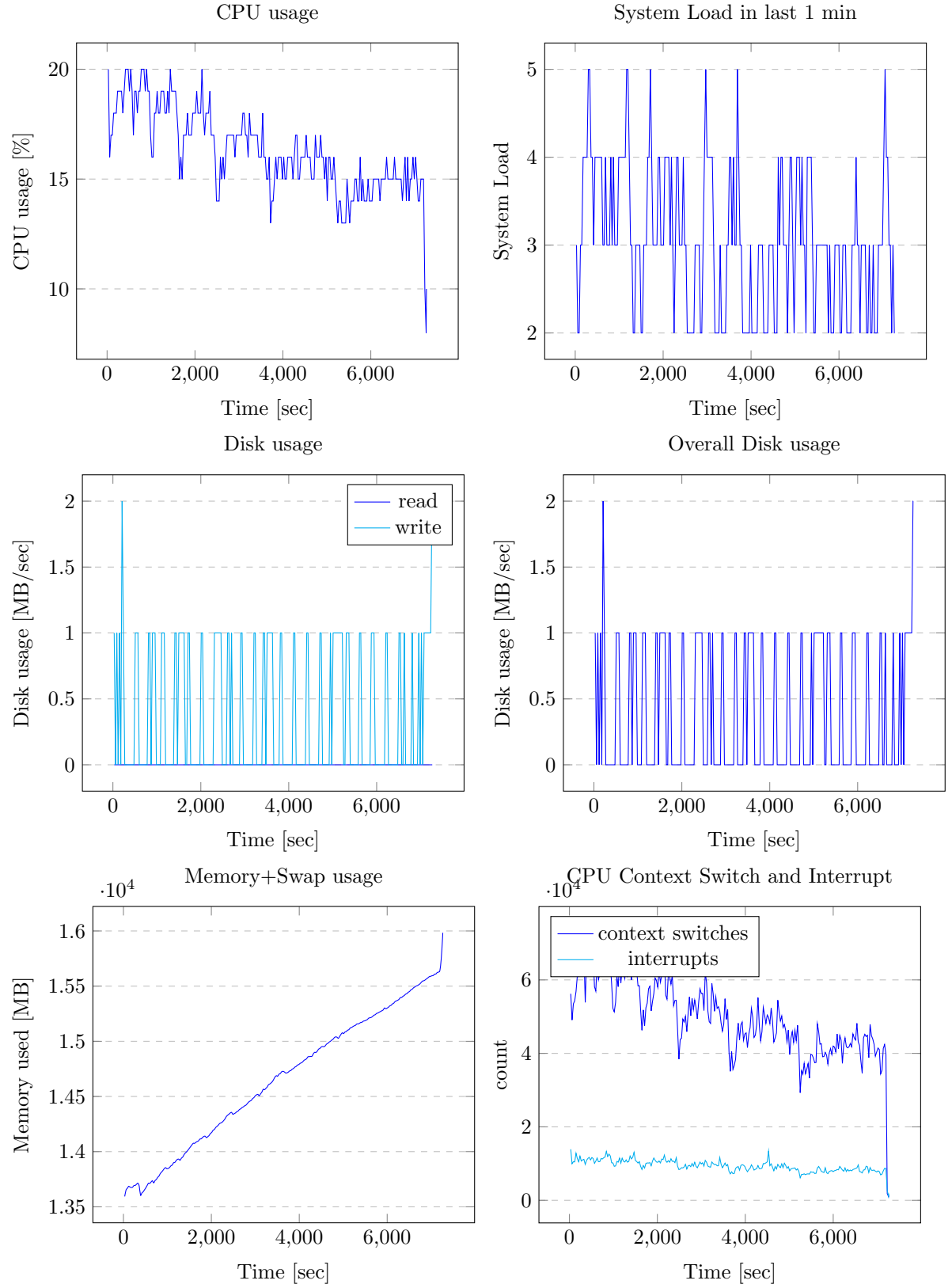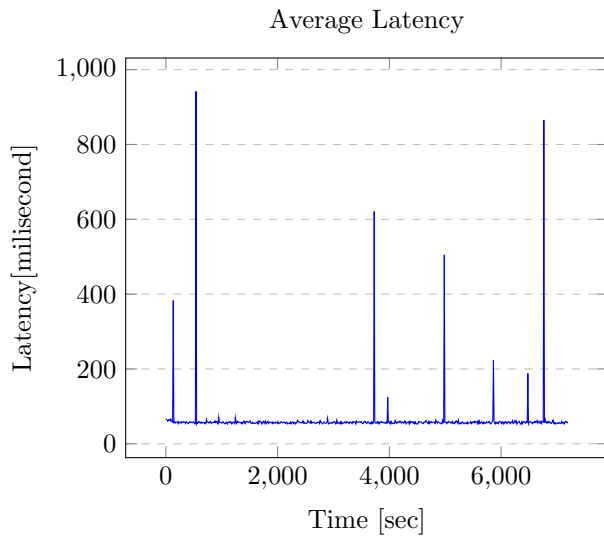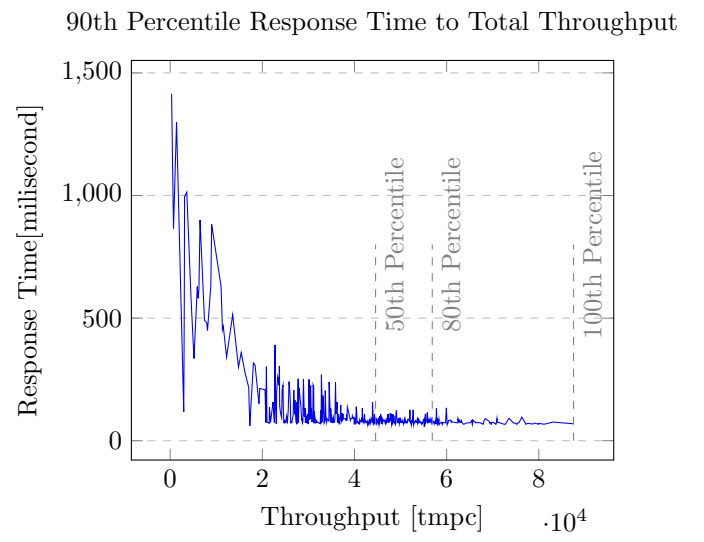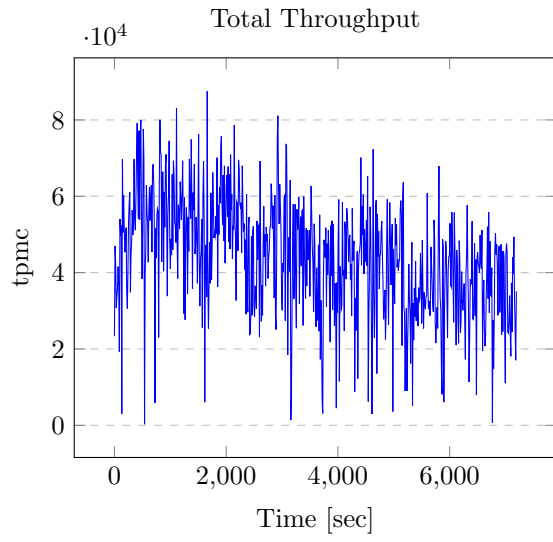
Transaction Type	Total Count	tpmc
Stock Level	259141	53021
Delivery	994642	55640
Order Status	258460	51519
Payment	1811187	65298
New Order	1503864	56509

Response Time
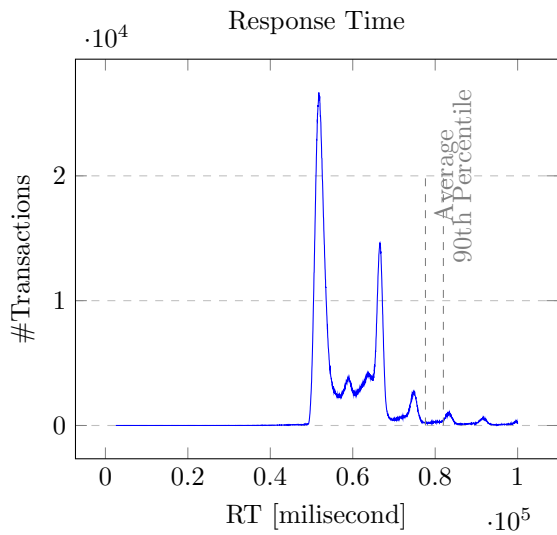
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
3.46	23885.28 MB	2.17 MB/sec	7245.00 sec	269263 milisecond	479722

Table 29: Average Parametes over Runtime in high_write mode and SF equals 3

high_write mode and SF equals 3

Total Throughput

90th Percentile Response Time to Total Throughput

Average Latency
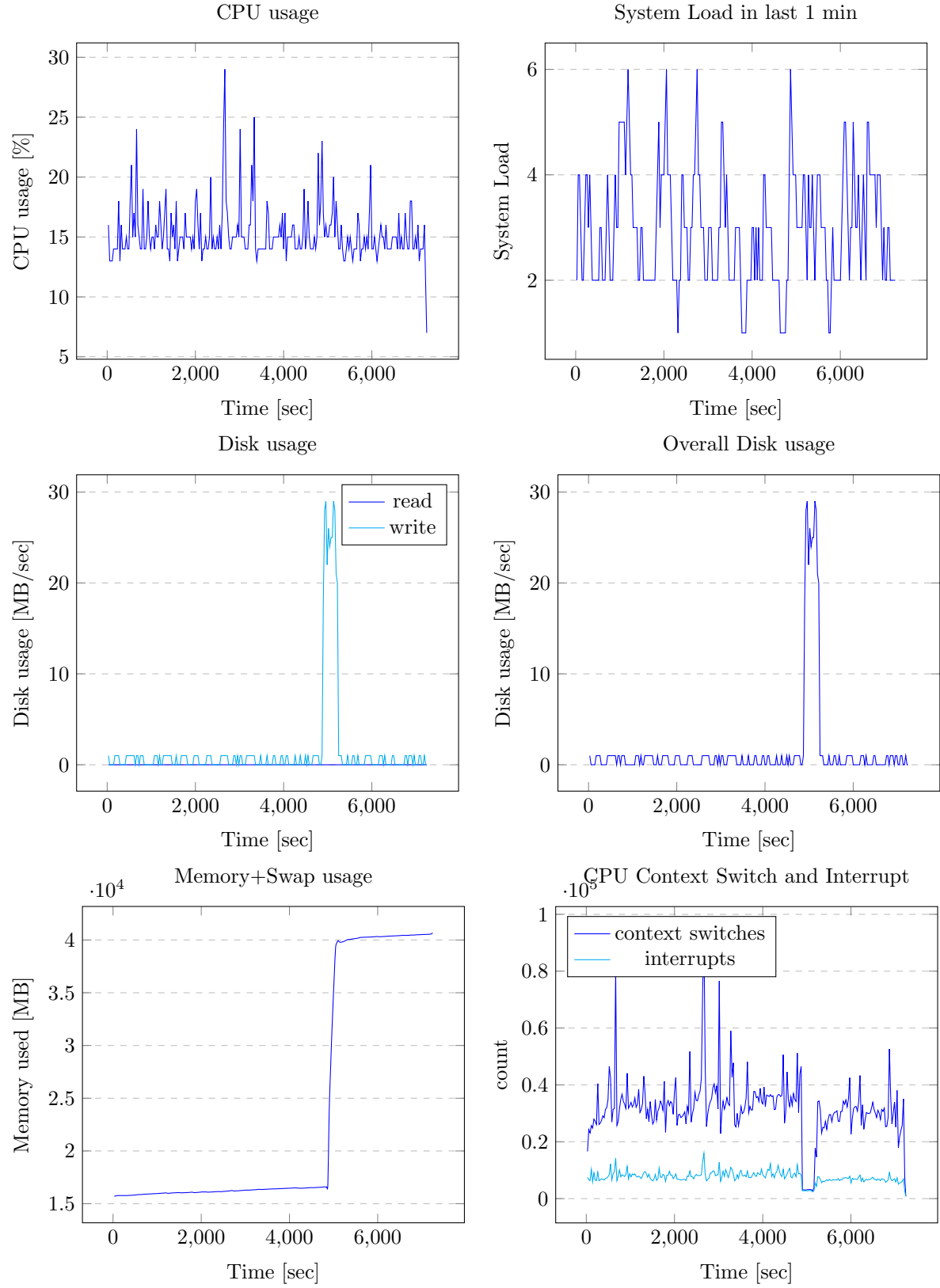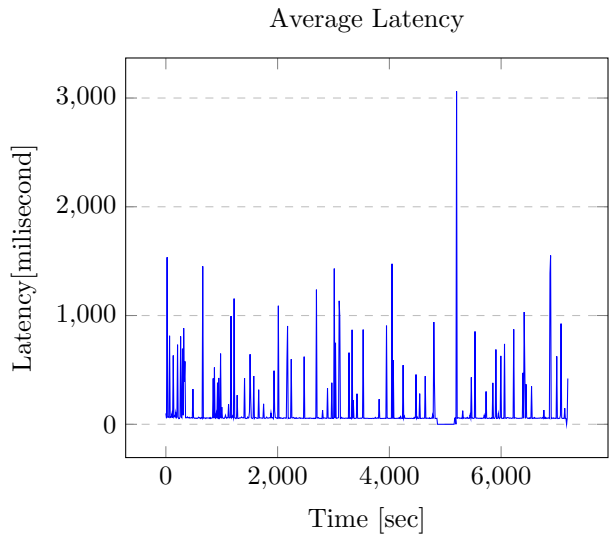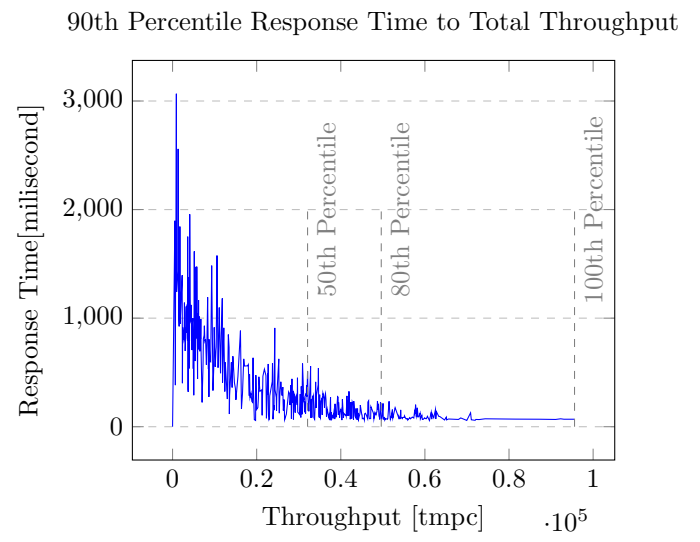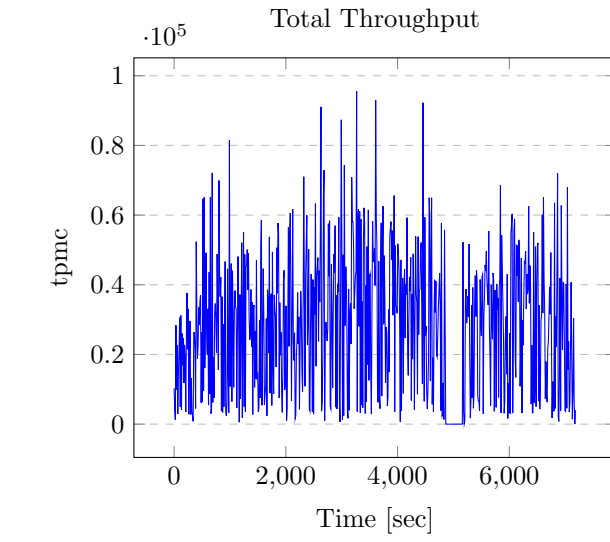
Transaction Type	Total Count	tpmc
Stock Level	167622	53295
Delivery	614730	54460
Order Status	166235	51667
Payment	968450	65745
New Order	950698	55831

Response Time
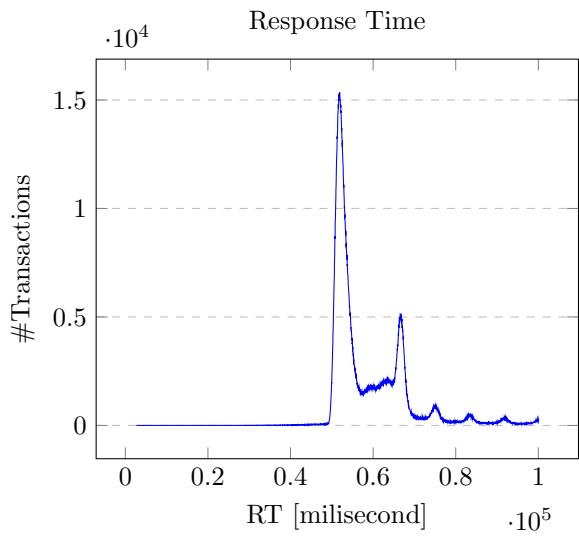
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
4.86	27948.64 MB	2.94 MB/sec	5911.00 sec	not reported	not reported

Table 30: Average Parametes over Runtime in high_write mode and SF equals 5

high_write mode and SF equals 5
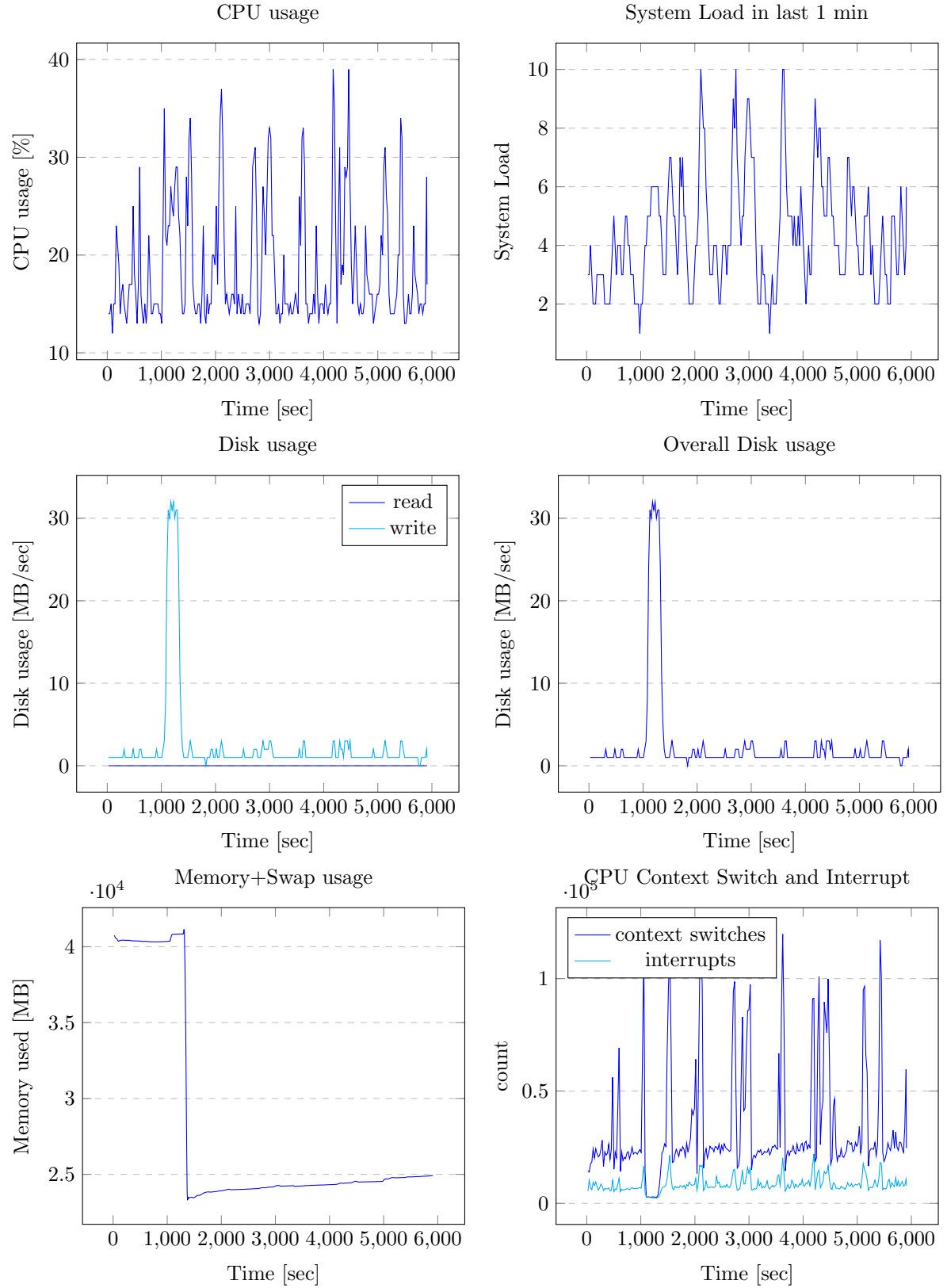
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
6.29	26974.77 MB	1.71 MB/sec	4854.00 sec	not reported	not reported

Table 31: Average Parametes over Runtime in high_write mode and SF equals 10

Trnsactions reports are not available because TPC-C benchmarking app exited with error.

high_write mode and SF equals 10

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt
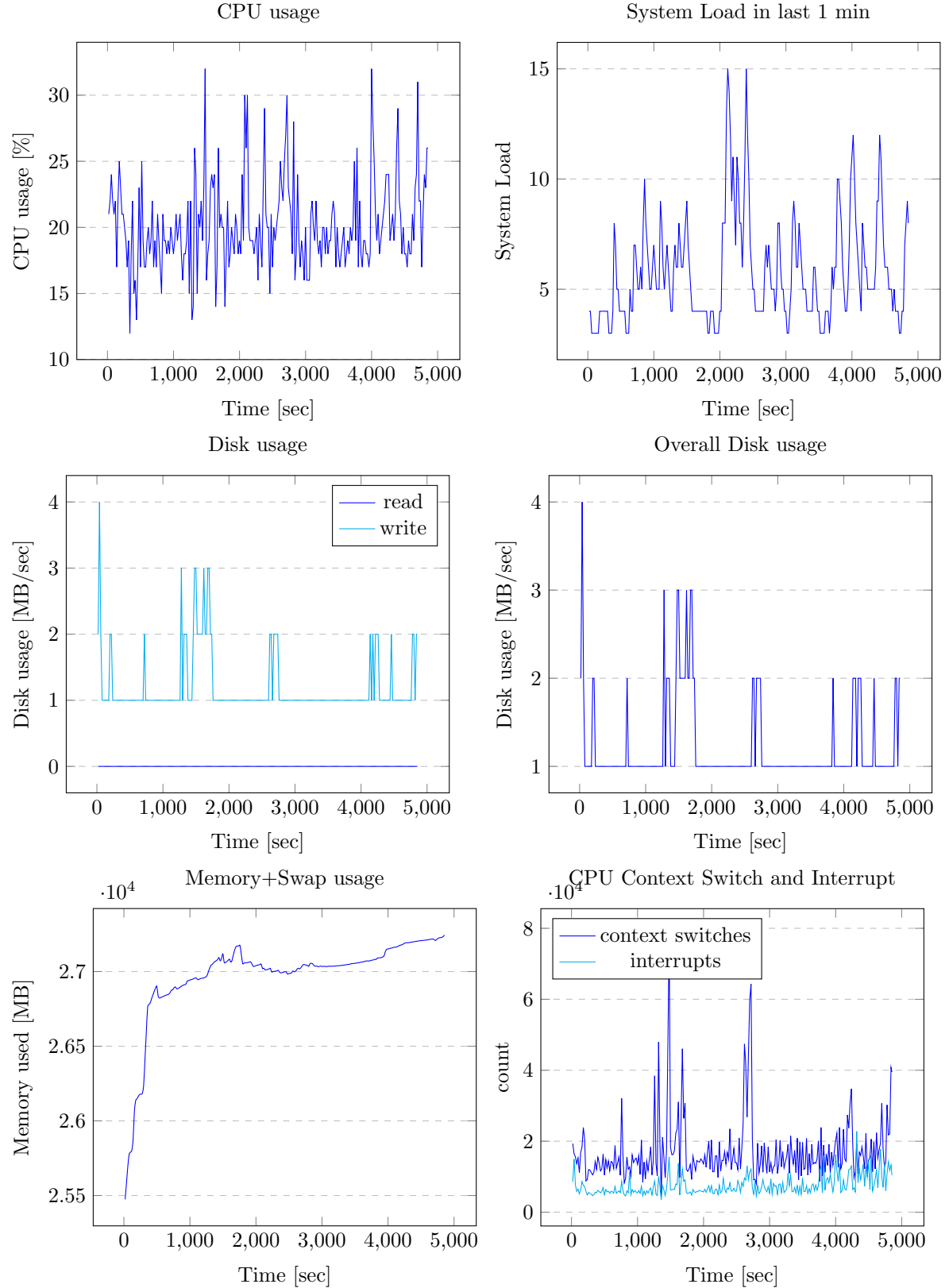
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
0.17	24345.34 MB	0.00 MB/sec	7202.00 sec	not reported	not reported

Table 32: Average Parametes over Runtime in high_write mode and SF equals 100

Trnsactions reports are not available because TPC-C benchmarking app exited with error. (out of shared memory)

high_write mode and SF equals 100

System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
4.24	8841.95 MB	1.19 MB/sec	7276.00 sec	84295 milisecond	198258

Table 33: Average Parametes over Runtime in high_read mode and SF equals 1

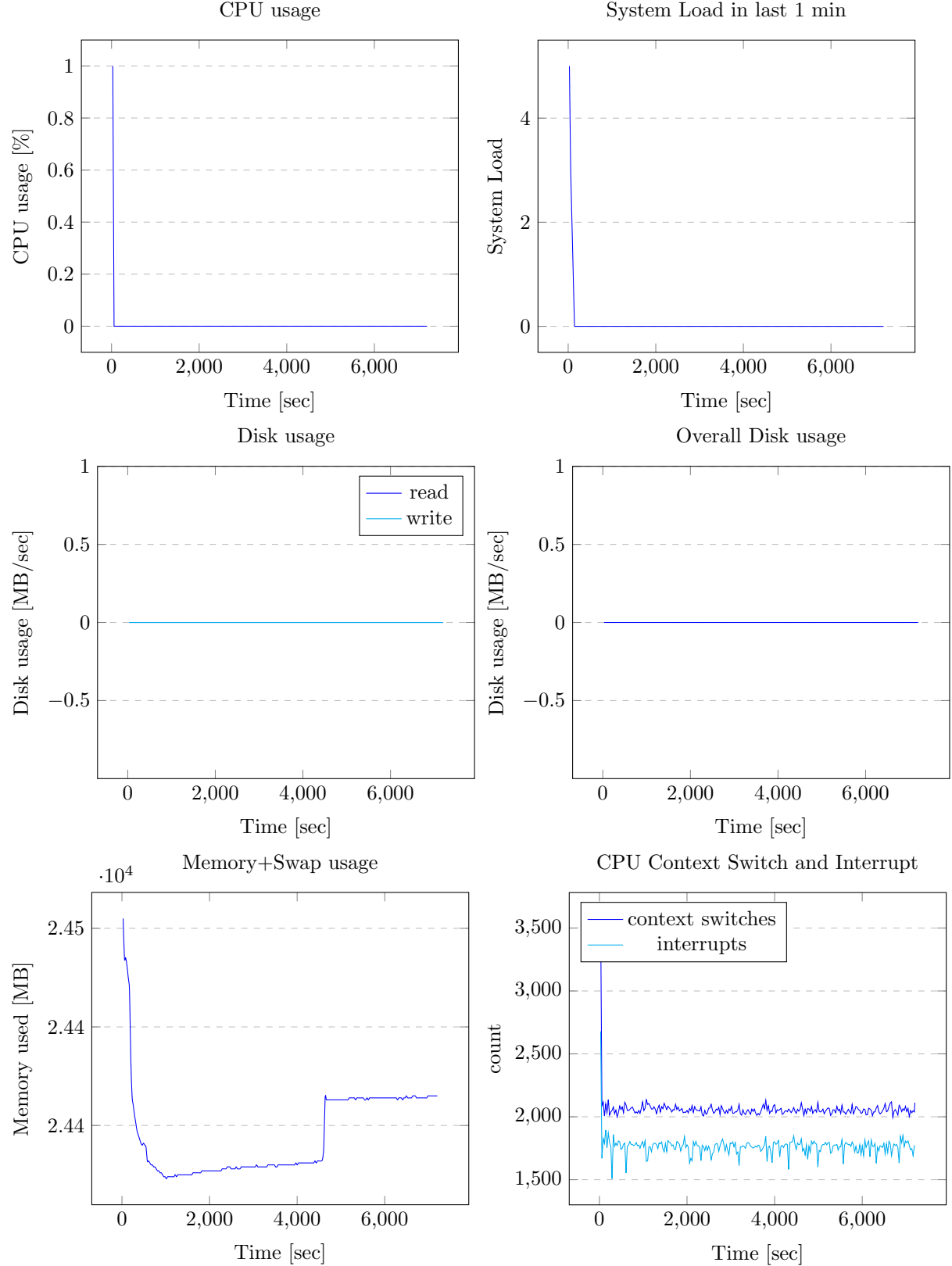Trnsactions reports are not available because TPC-C benchmarking app exited with error (Failed to connect to database). It seems this application has serious bug.

high_read mode and SF equals 1

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

90th Percentile Response Time to Total Throughput

Average Latency

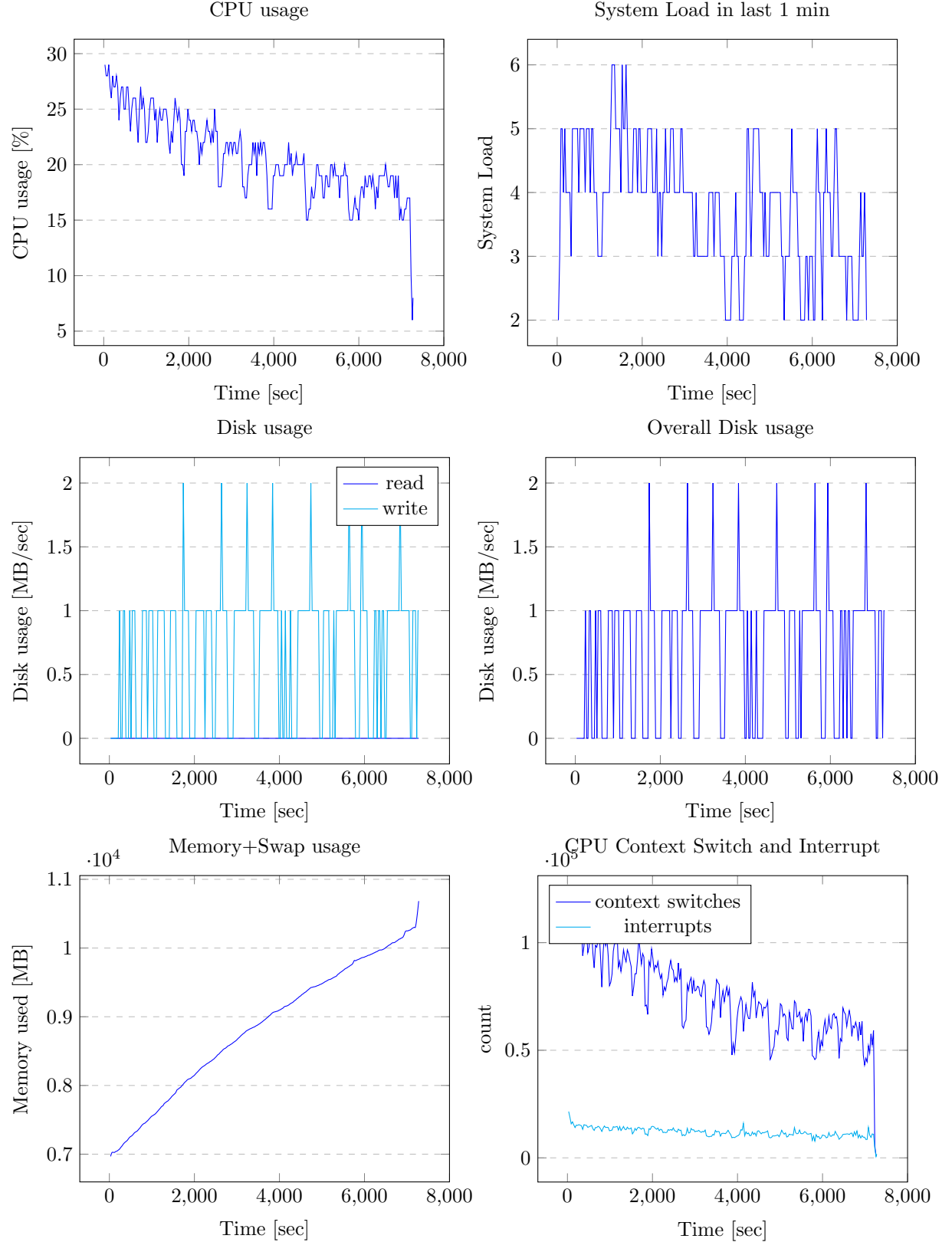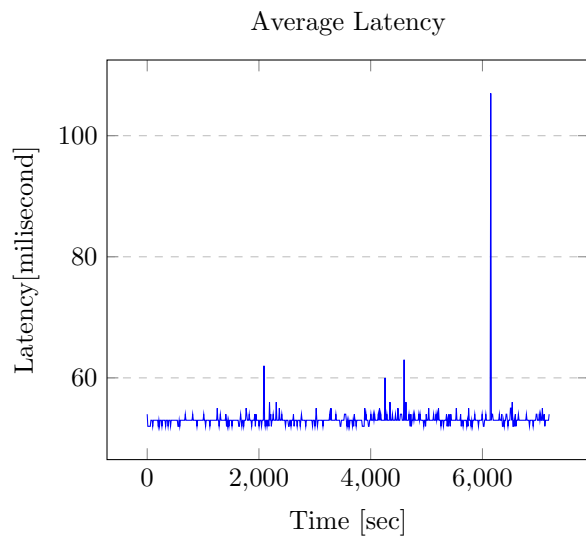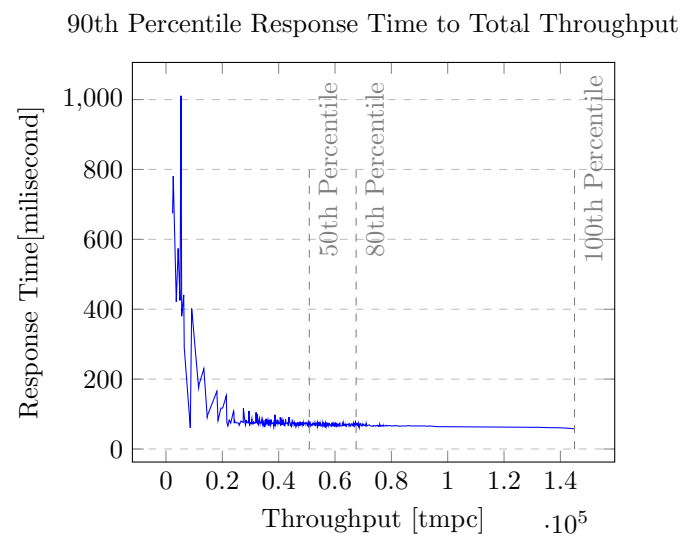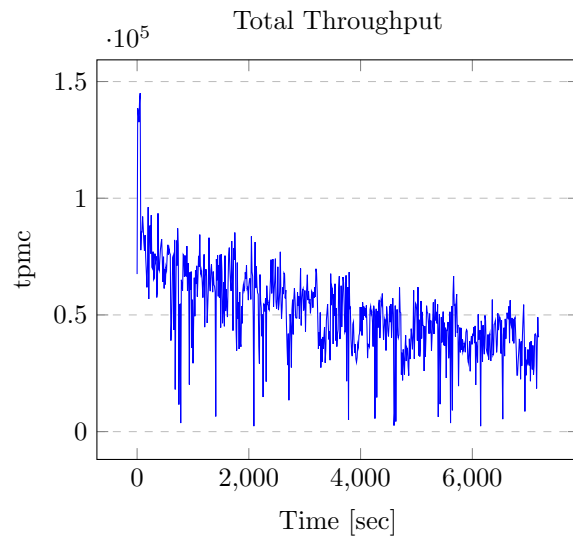| Transaction Type	Total Count	tpmc
Stock Level	914837	52665
Delivery	283782	61253
Order Status	912806	51299
Payment	1404918	61571
New Order	2380514	57731

Response Time
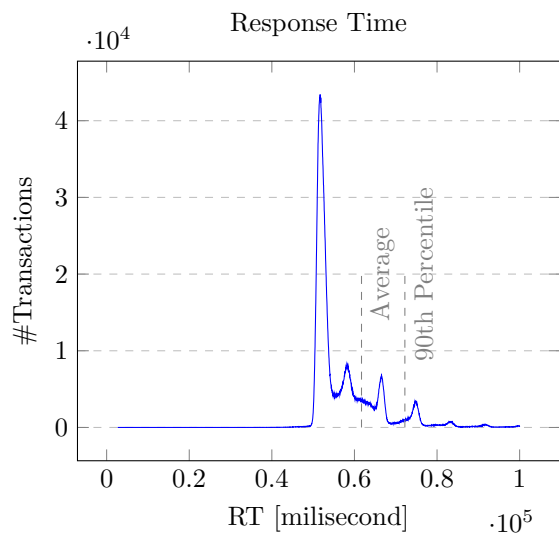
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
4.39	25828.49 MB	1.33 MB/sec	7260.00 sec	93682 milisecond	480253

Table 34: Average Parametes over Runtime in high_read mode and SF equals 2

high_read mode and SF equals 2

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Total Throughput

90th Percentile Response Time to Total Throughput

Average Latency
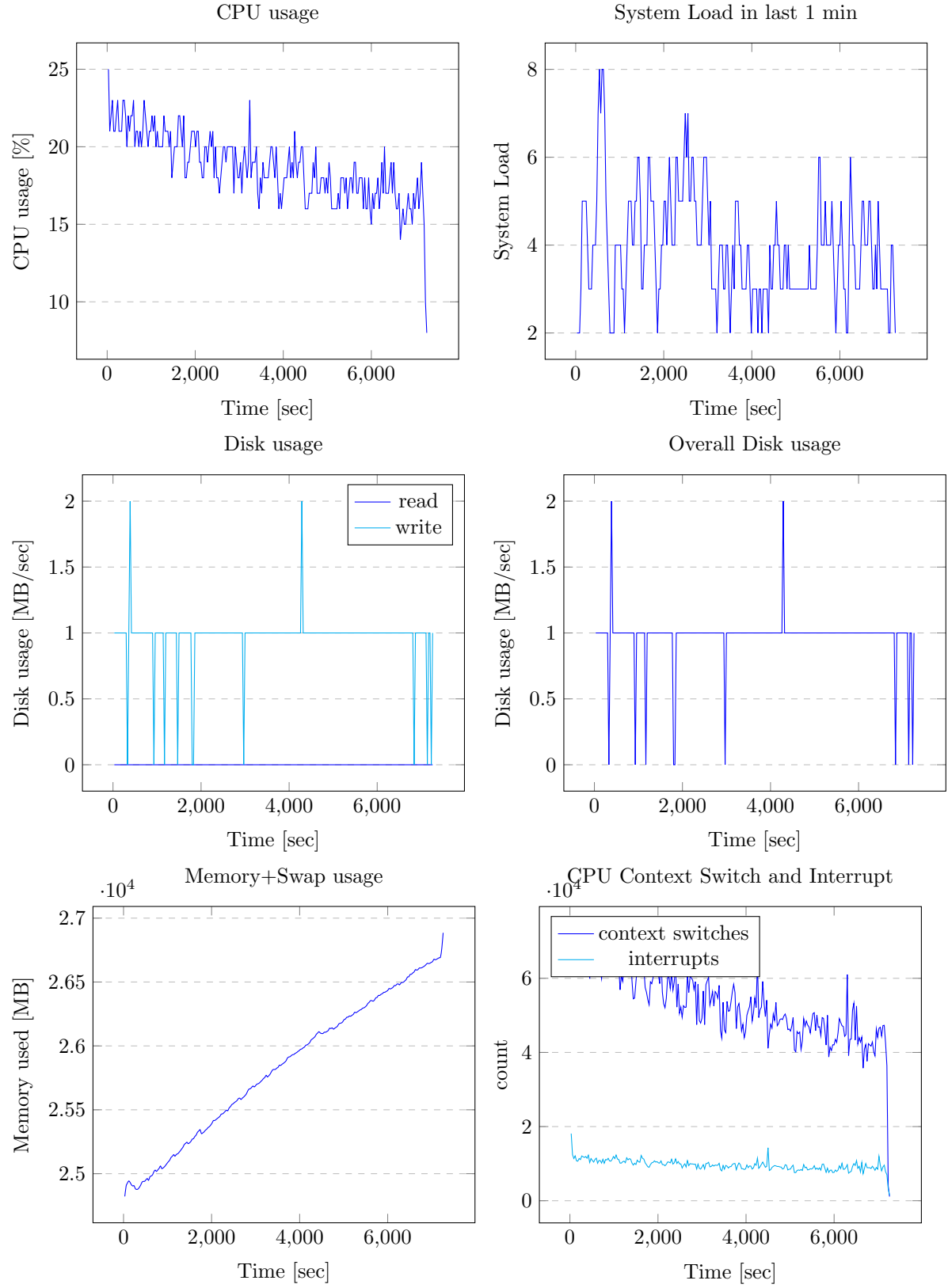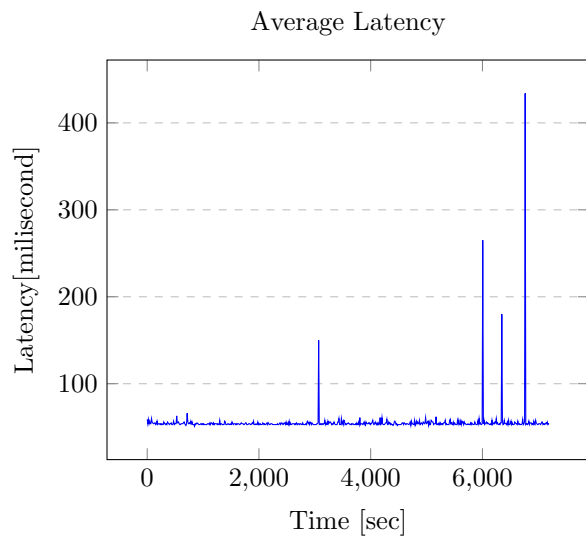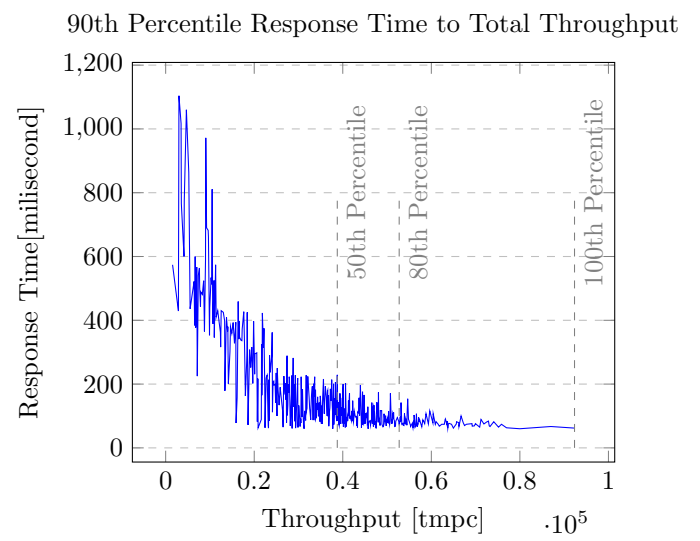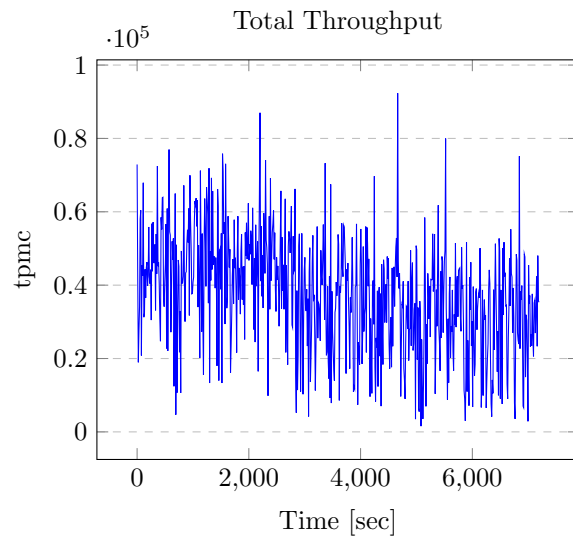
Transaction Type	Total Count	tpmc
Stock Level	686545	53089
Delivery	184770	59347
Order Status	685435	51584
Payment	799130	65047
New Order	1739863	57318

Response Time
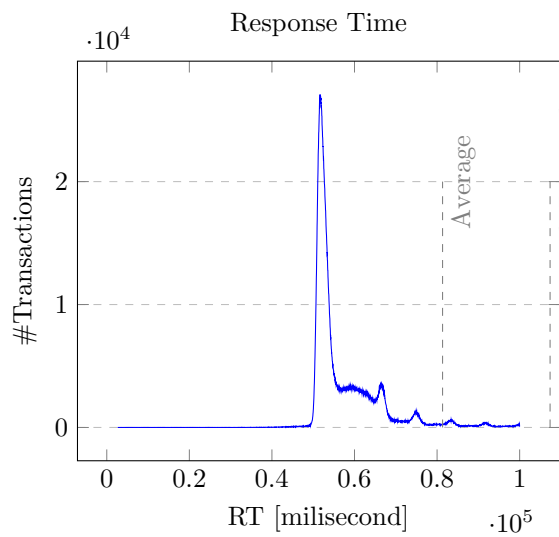
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
4.30	26831.25 MB	1.24 MB/sec	1221.00 sec	not reported	not reported

Table 35: Average Parametes over Runtime in high_read mode and SF equals 3

high_read mode and SF equals 3

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt
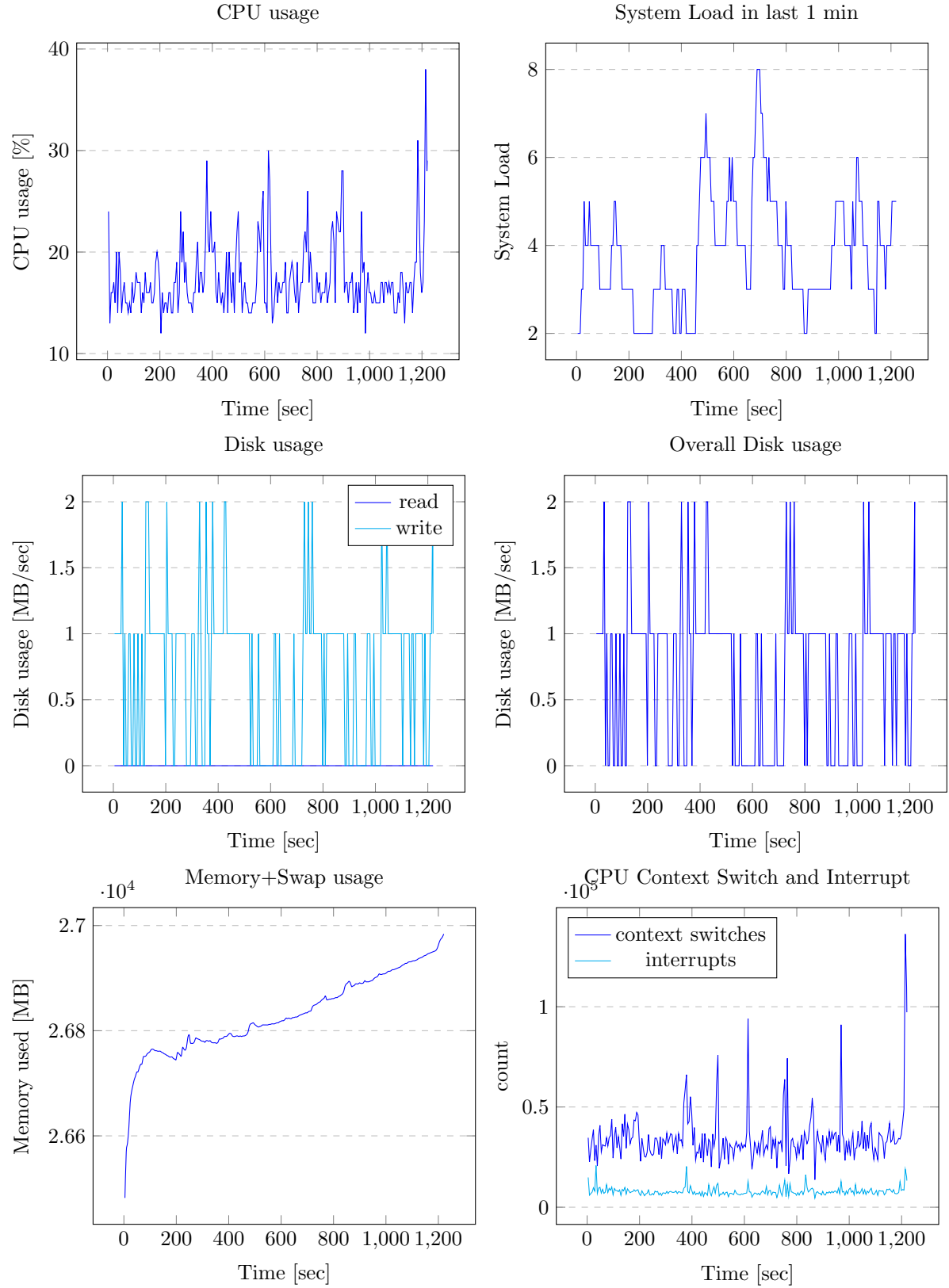
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
4.74	27484.73 MB	1.12 MB/sec	1667.00 sec	not reported	not reported

Table 36: Average Parametes over Runtime in high_read mode and SF equals 5

Trnsactions reports are not available because TPC-C benchmarking app exited with error (out of shared memory).

high_read mode and SF equals 5

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt
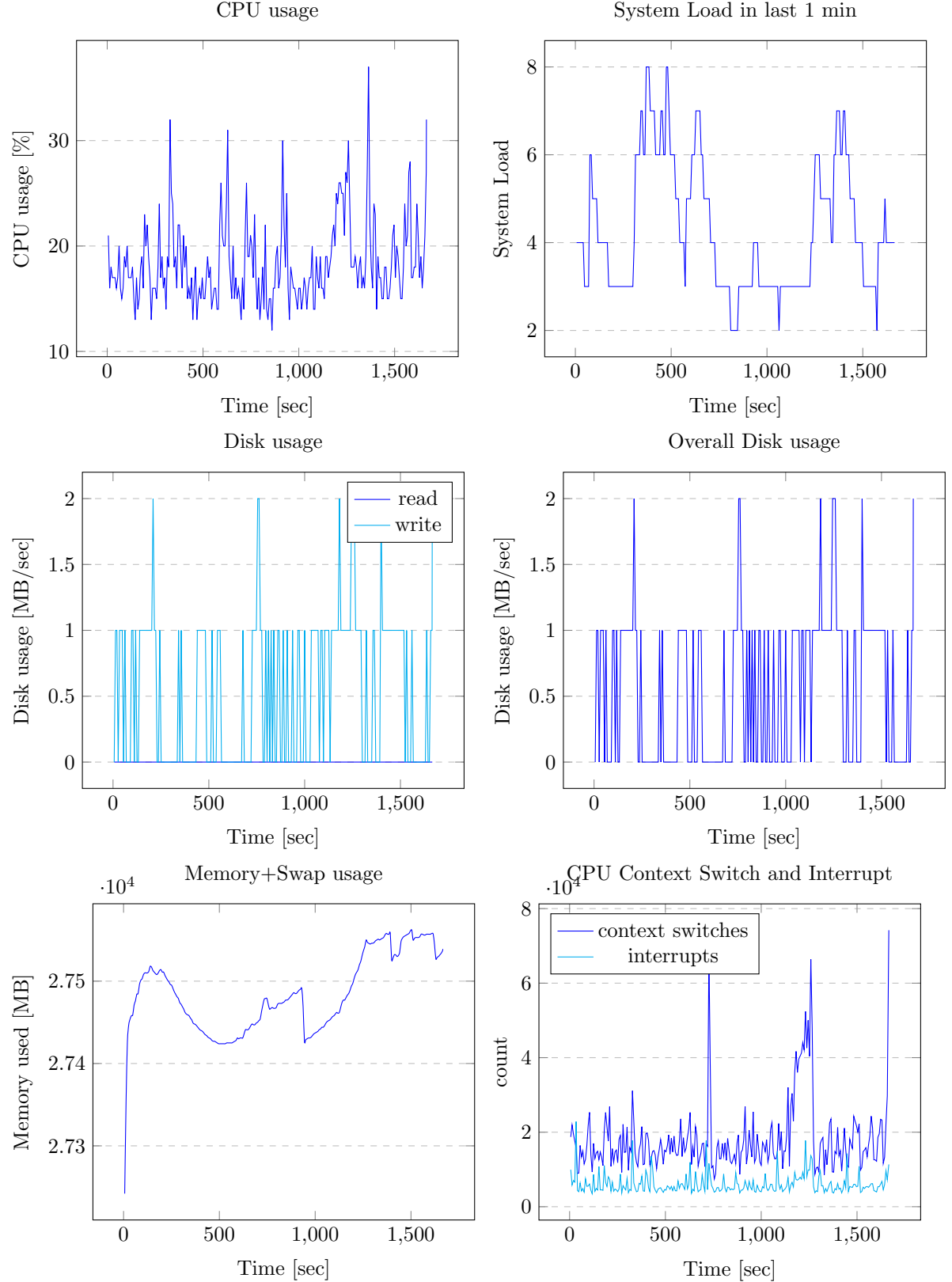
System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
7.23	28482.75 MB	2.54 MB/sec	94.00 sec	not reported	not reported

Table 37: Average Parametes over Runtime in high_read mode and SF equals 10

Trnsactions reports are not available because TPC-C benchmarking app exited with error (out of shared memory).
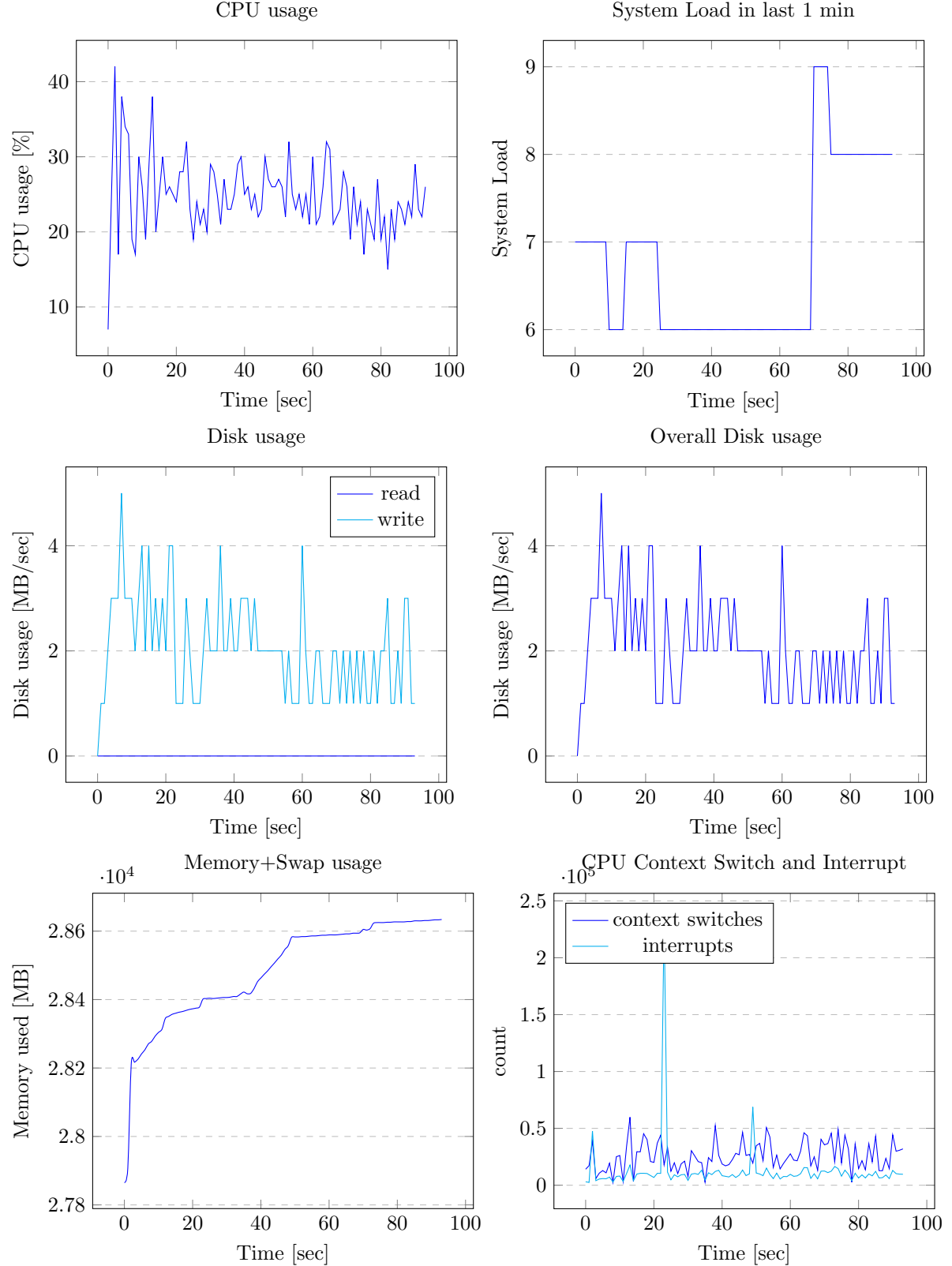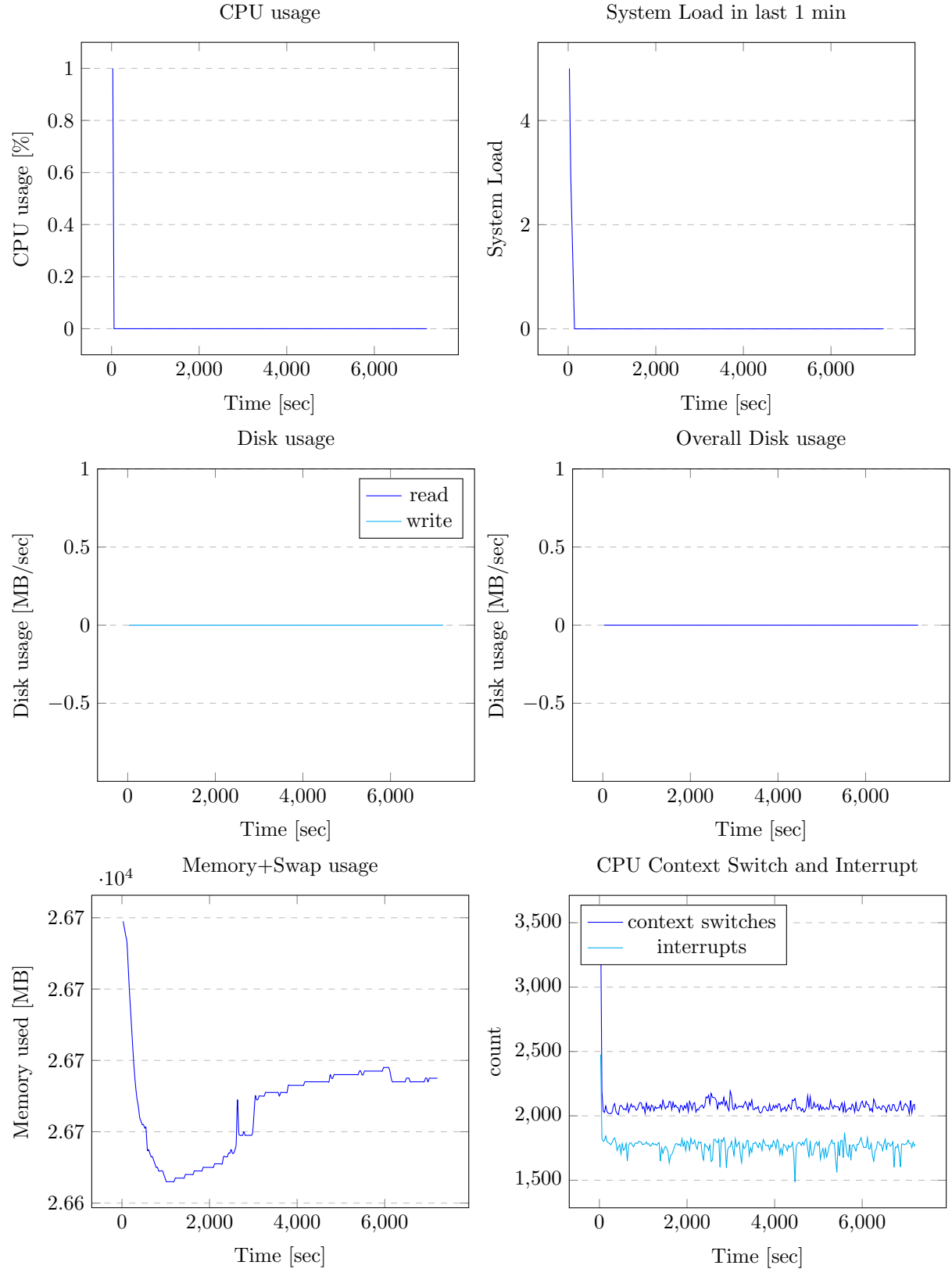
high_read mode and SF equals 10

| System Load	Memory	Disk IO	Execution Time	Load Time	# Long Transactions
0.17	26667.72 MB	0.00 MB/sec	7202.00 sec	not reported	not reported

Table 38: Average Parametes over Runtime in high_read mode and SF equals 100

Trnsactions reports are not available because TPC-C benchmarking app exited with error. It seems this application has serious bug.

high_read mode and SF equals 100

CPU usage

System Load in last 1 min

Disk usage

Overall Disk usage

Memory+Swap usage

CPU Context Switch and Interrupt

Trnsactions reports are not available because TPC-C benchmarking app exited with error (Failed to connect to database). It seems this application has serious bug.

Compare scale factors in medium mode

Compare scale factors in high read mode
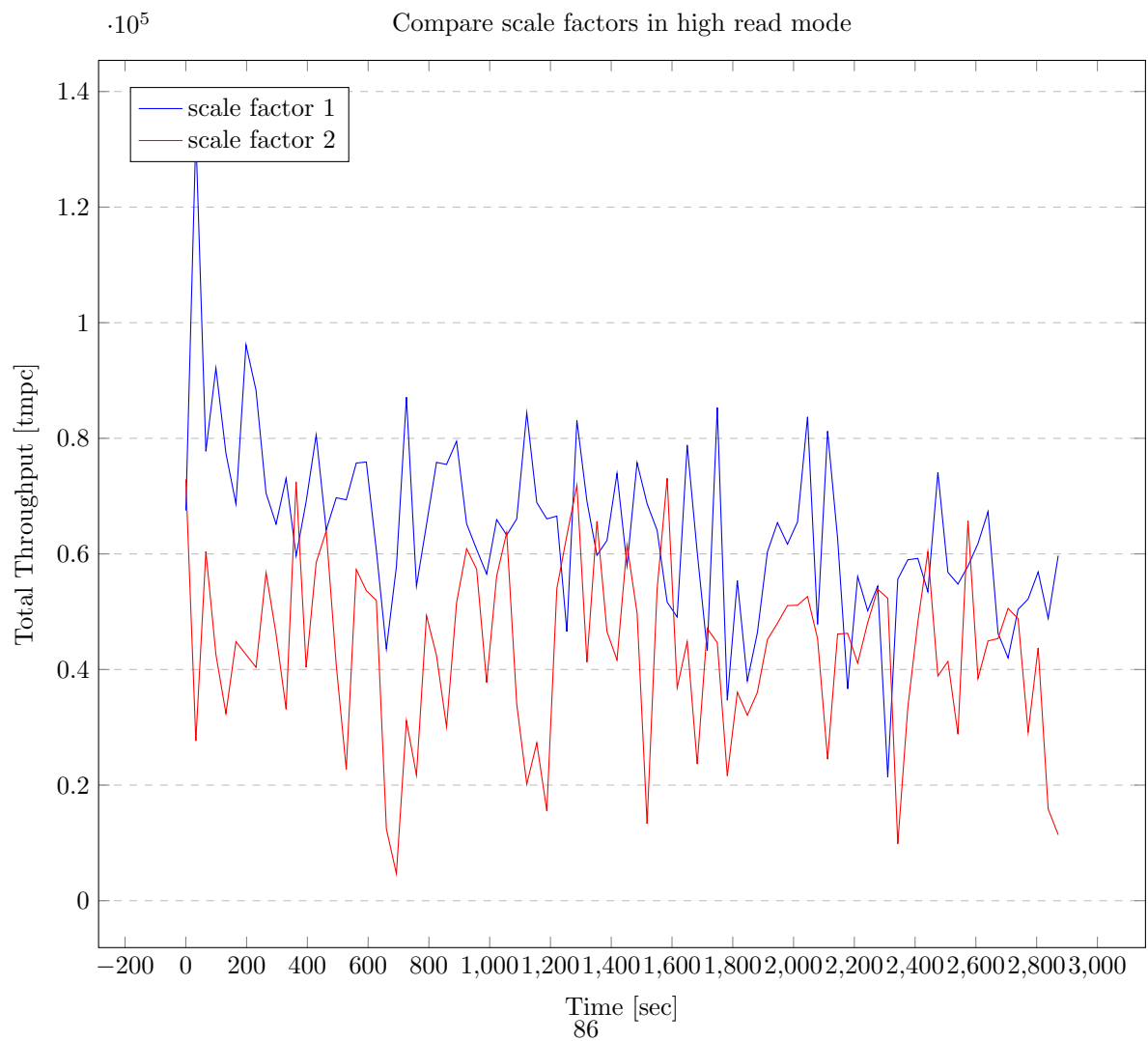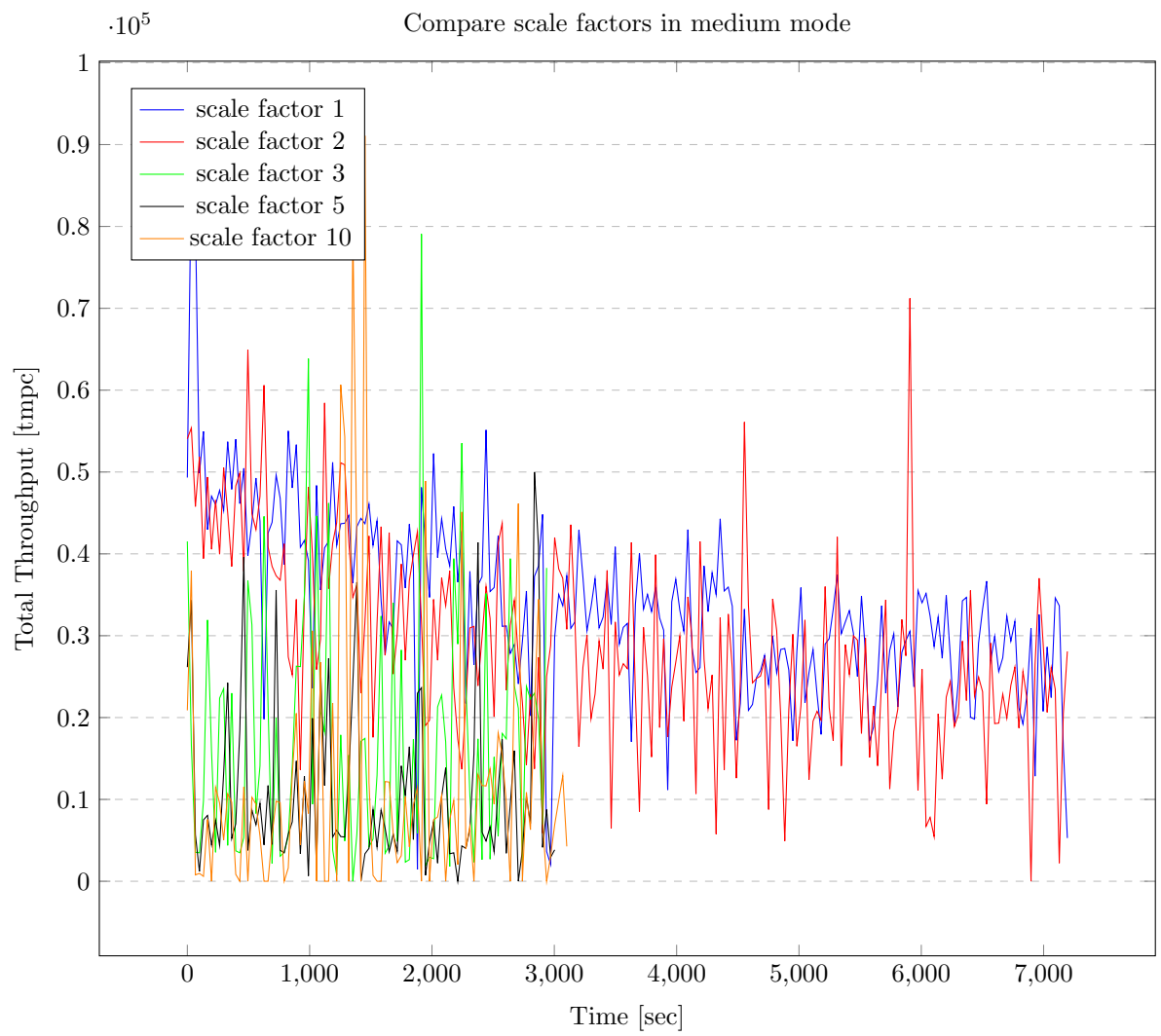
Scale Factor	Medium mode	High Read mode	High Write mode
1	34332.6	50792.4	59767.32
2	27534.6	796608	43280.4
3	15676.28	not reported	27900
5	9573.57	not reported	not reported
10	13276.8	not reported	not reported

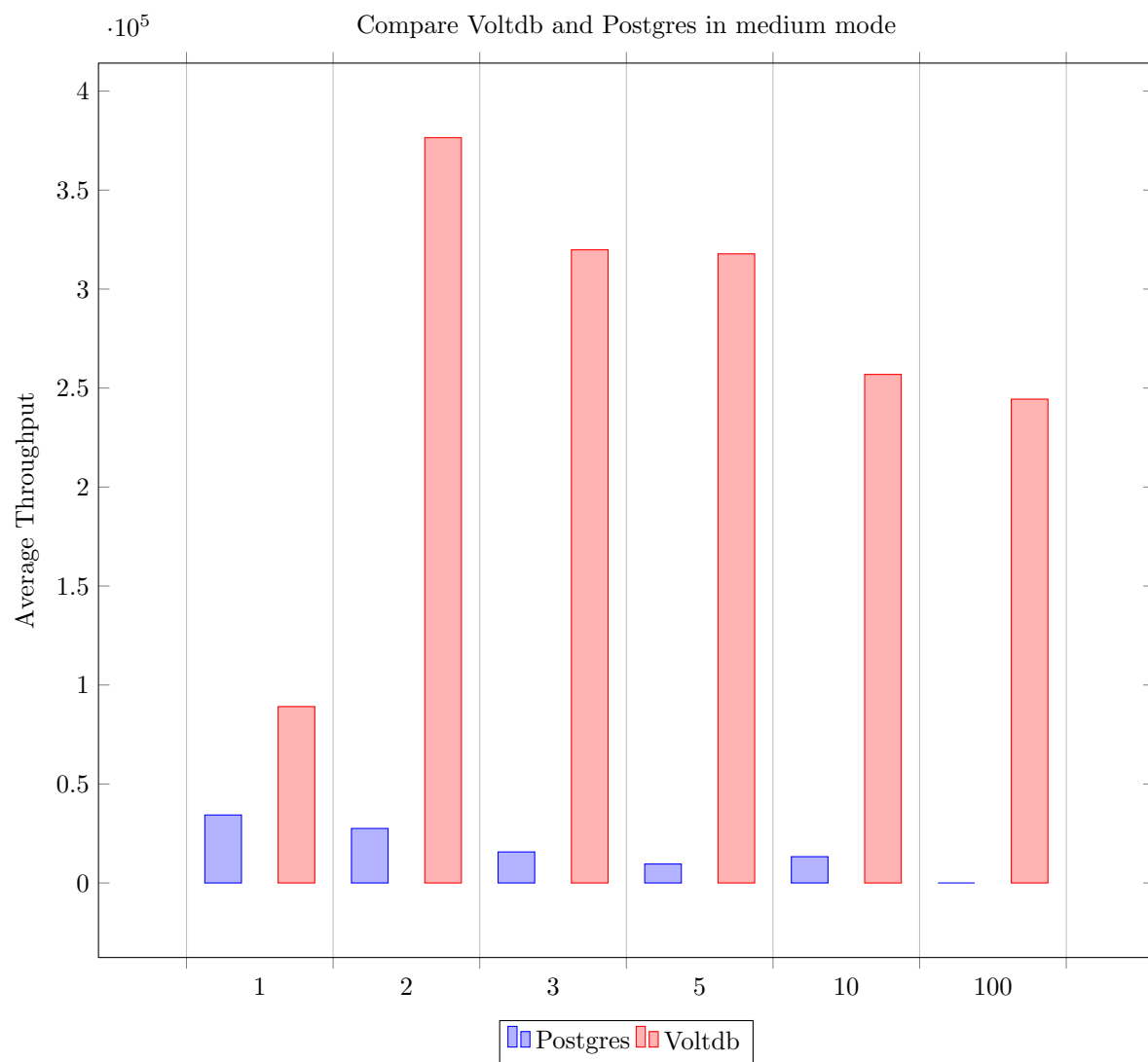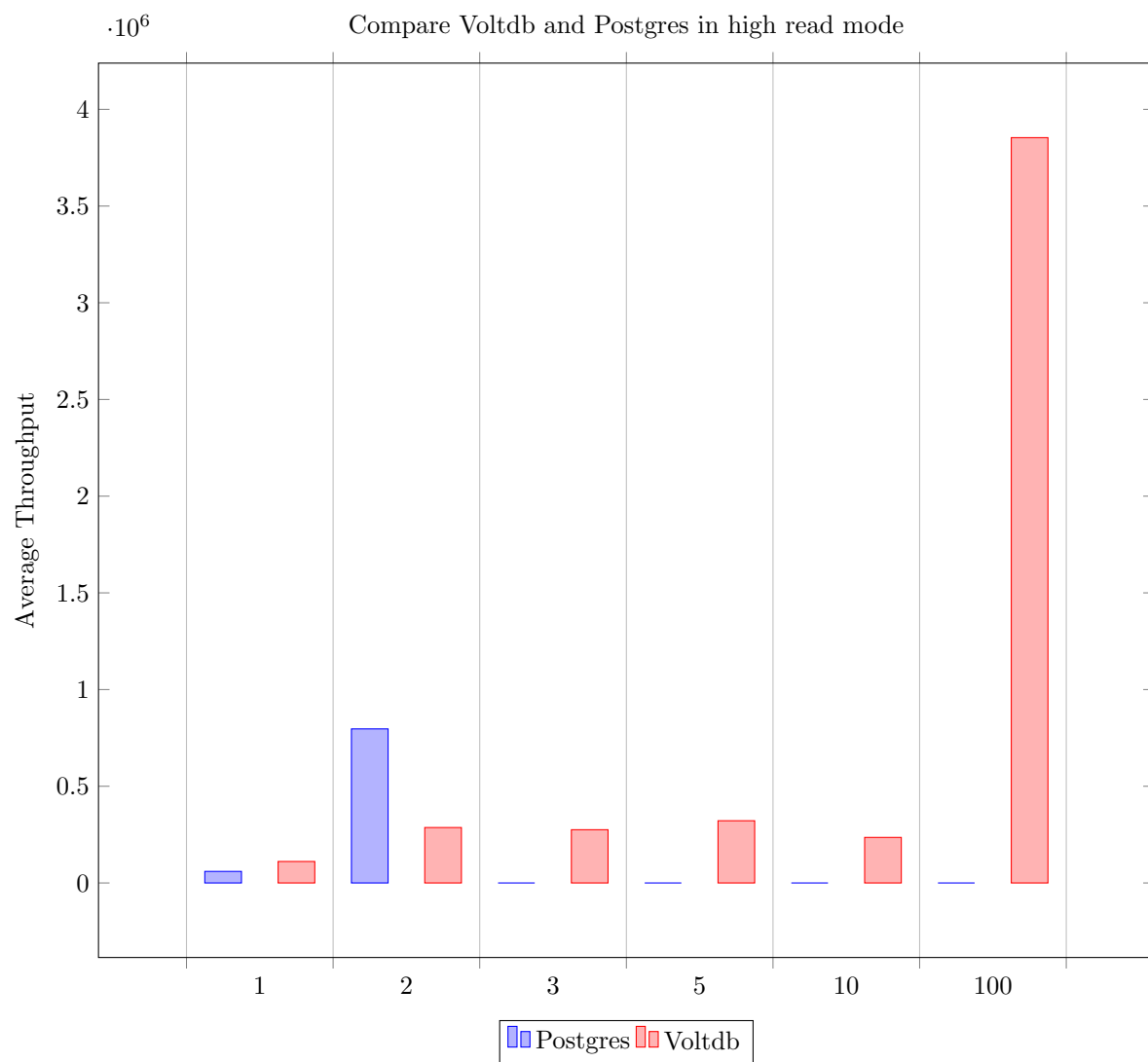Table 39: Compare Average Throughputs[tpmc] In Postgres
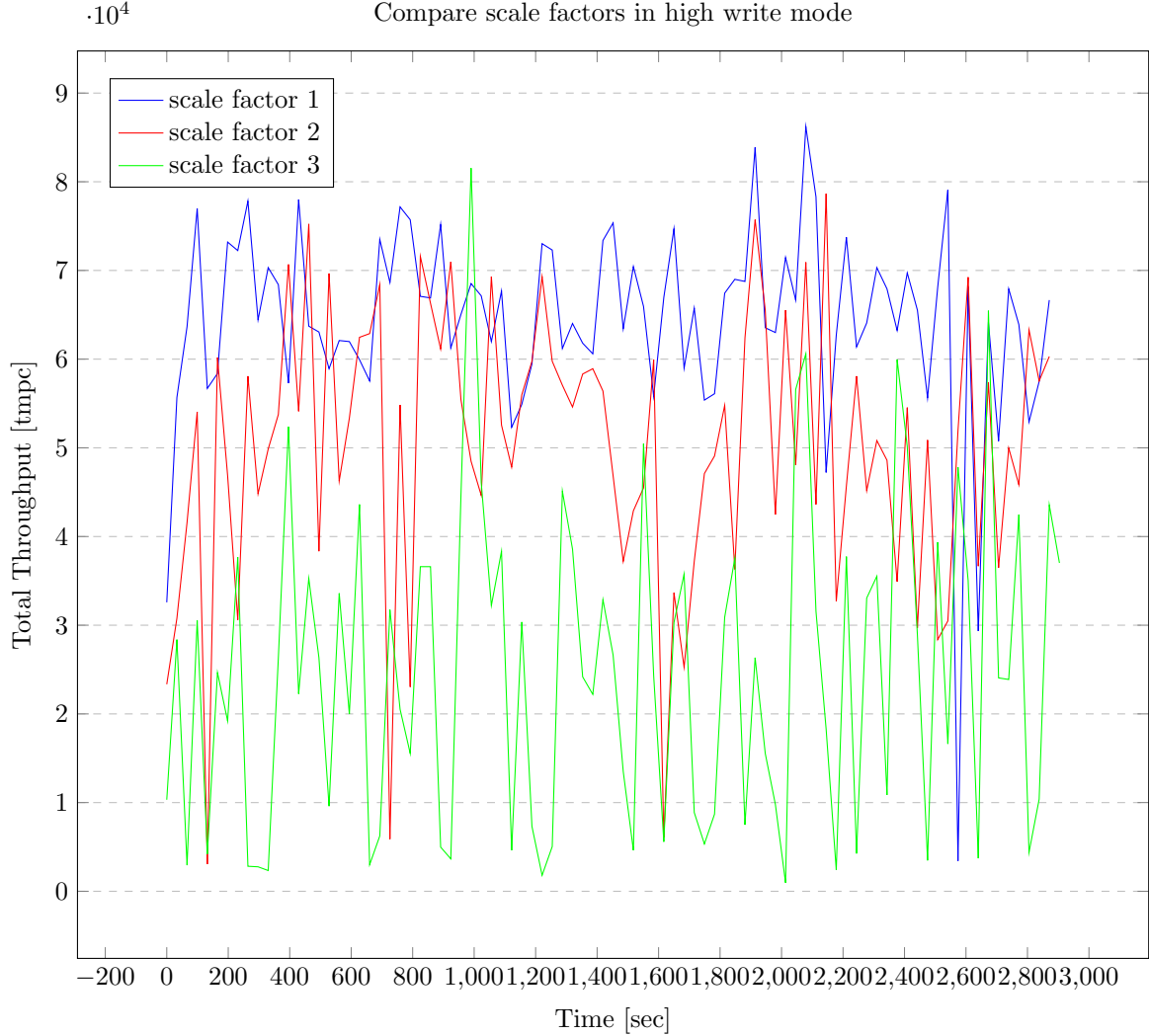
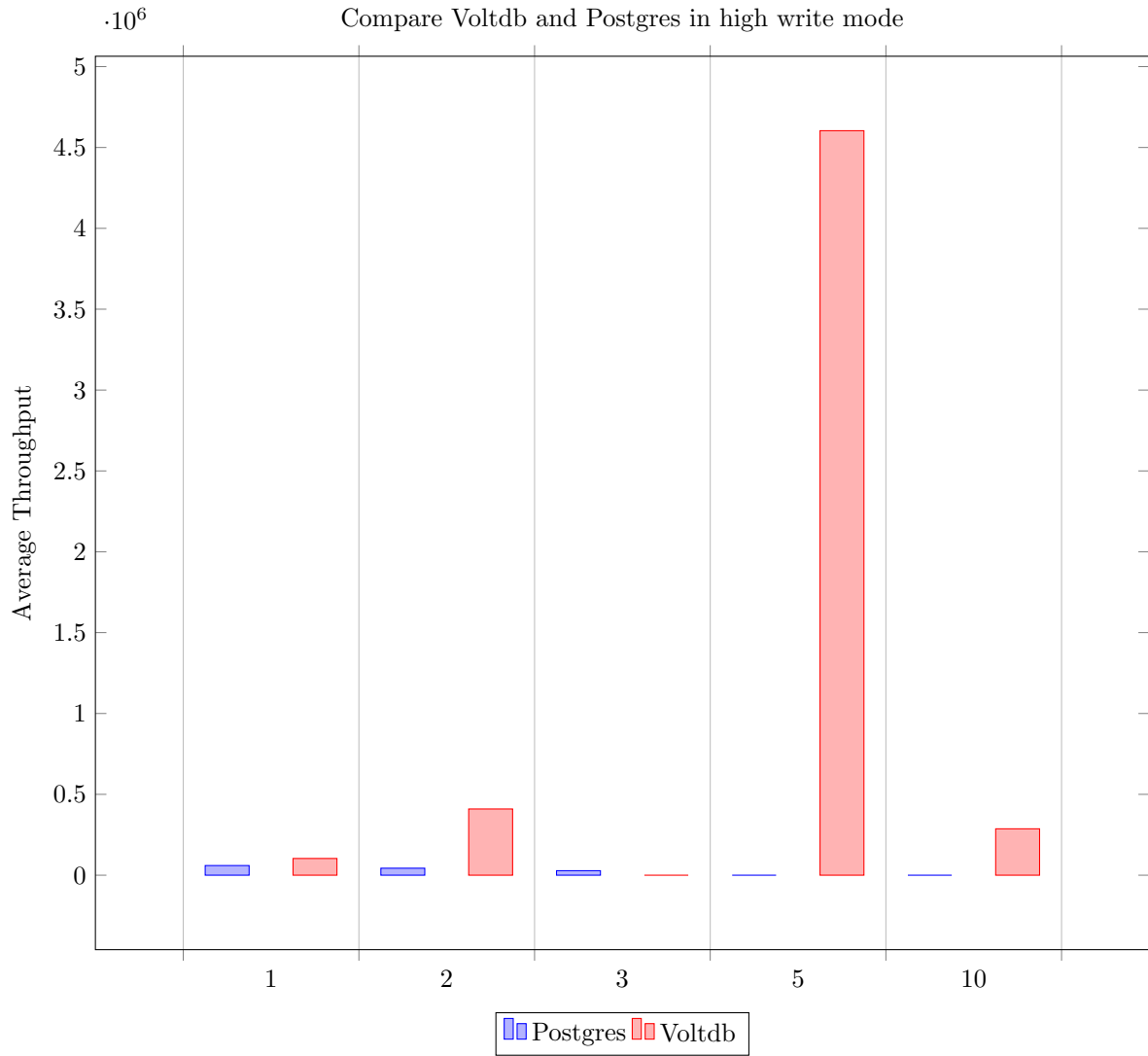By increasing scale factor, total throughput gets lower overally.

5 Compare DMBSs

Voltdb runs perfeclty in all modes and scale factors. But benchmarking app has a bug and cant gather final data for scale factor of 3 and 100 in write mode. oltpbenchmark cant connect properly to Postgres in scale facotor if 100 in all modes and, 5 and 10 for write mode, 3 and 5 and 10 for high read mode. It seemed that the main reason is that oltpbenchmark wants to create high connections and Postgres rejects them. Also in some cases Postgres gets to its lock limits and in some cases high frequency of dead locks makes databse less effective.In all cases except high read mode in scale factor of 2, Voltdb acts better than Postgres. The main reason is Voltdb is first-based-memory dbms and intracts only a little with disk.

Postgres transaction latencies were close together and this shows stable and equal treatment with all terminals and requests.

Compare Voltdb and Postgres in medium mode

Compare Voltdb and Postgres in high read mode

Compare Voltdb and Postgres in high write mode

6 Test Technical Details

6.1 Benchmark Apps

benchmark app used for testing Voltdb was developed by Voltdb official institution(*****) but had several bugs and missing feature. Some features like reporting more details about latency added and some bugs like stocking in load time solved but some others need huge refactor so we skipped it and this situation caused some missing report parameters.

6.2 Measurment Tools

we used Dstat for log system status. Dstat is a light system resource statistics recorder. After these data were collected, they were aggregated to generate proper plots and statistics to analyze them.

All codes including benchmarking apps and analysis scripts are pushed to corresponded repository.

Cafebazar company allowed some of their servers to be used for free in order to run these tests. Therefore no price has been reported in this report.