

Introduction

Performance tests will be able to answer how big one needs to dimension the operating environment, whether bottlenecks that can lead to errors, whether there is resource leakage so the system must be restarted periodically, which errors will come when something unexpected happens in the environment etc.

During the performance test, the system has been subjected to a certain load, triggered special situations, and then observed what happens in relation to end users and use of resources.

In order for performance tests to provide reproducible, secure measurements, performance tests should be conducted in a stable environment where all components are unchanged and continuously running, during each run of the performance tests.

Performance test on Nets VA and VAPugin component has been runned through the test tool coitest which is made to test the overall performance of BankID COI. This tool has when testing Validator patch in H2 2018, shown a bottleneck in NetsVA. The bottleneck took form as a congestion when there are longer period of high load, as for instance happens during Tax Return day in Norway.

The goal of these tests has been to meet the performance parameter set by BU/NNI in Nets, which are related to the performance numbers required to meet the Taxday type of load.

Endurance testing as a robustness test looks at how the system lasts for a long time. This includes:

1. BIMOTP
2. BankID on mobile
3. Netcentric with standard OTP

Requirement

Nets has not received any direct requirement on the performance. We have used recommendations and parameter from NNI based on adjusted performance numbers from load during Taxday 2018.

Numbers used in as a requirement for 2018 in the table below. The level of ambition was somewhat high and is reduced in terms of requirements.

Name	Percentage	Number of authentications pr. seconds (TPS)
Total	100 %	120
Netcentric	56 %	67
BankID on Mobile	44 %	53

The table below shows the type of load during Taxday 2018 and shows the least number of transactions per second the system needs to be able to handle for 2019. This number is divided over 4 nodes so the equivalent for one node is given in the last column.

The percentage of Netcentric traffic versus BankID on mobile traffic, has changed during 2018. The table is adjusted to reflect this behavioral pattern change expected for 2019. In addition the table shows the actual load we have seen during performance test of this deliver.

Operation	Total transactions	Percentage	TPS 4 nodes	TPS 1 node	TPS 1 node Test result
Netcentric	2 420 767	43,05 %	28,92	7,01	24.77
BIMOTP	109 496	1,95 %	1,27	0,31	6.00
BankID on mobile	3 092 543	55 %	35,79	8,91	11.29
SUM	5 622 806	100,00 %			42,06

Another requirement has been that COI needs to handle 100 TPS (equivalent to 8 640 000 tr/ tax day). With the percentage distribution of transactions above, the test results are 42,06 TPS on one node, which indicates that we should be able to deliver more than 100TPS on four nodes.

The tests has been runned with varying pressures, where the throughput, response and resource usage has been measured. A long-time stability (48h endurance) tests has also been executed.

Testresult and conclusion

The performance tests performed show that new functionality has had a good impact on performance.

The test has shown that bottleneck of NetsVA has been reduced and the amount of error percentage from last Taxday has been reduced. See detailed test result below.

Type of test	Result	Comment
Baseline test	APPROVED	
Stress test	APPROVED	
Normal test	APPROVED	
Endurance test	APPROVED	

Detailed test result

As a general rule, one must be very careful about translating the figures into production figures. It is not a 1:4 ratio between one and four branches, as we do not run tests on exactly the same test environment that we have in production. We use the requirements of a branch and run tests on this with some margin. We have therefore estimated that we should also be able to cover the requirements per. branch in production. That is, we can walk with four, but it will be inaccurate.

Baseline test

BankID on mobile, Netcentric standard OTP and Netcentric BIMOTP are all within the response time requirements. This job runs every night via Jenkins and has low load on the system. Baseline runs the tests one after the other.

The tables do not show any relevant info, but the log of driving can tell something.

```
Performance: File runTests_TEST_BIM_Async_BASELINE_30min.csv reported 0.0% of errors [SUCCESS].
Build status is: SUCCESS
Performance: File runTests_TEST_Netcentric_BIMOTP_BASELINE_30min.csv reported 0.0% of errors
[SUCCESS]. Build status is: SUCCESS
Performance: File runTests_TEST_Netcentric_OTP_BASELINE_30min.csv reported 0.0% of errors
[SUCCESS]. Build status is: SUCCESS
Performance: File runTests_TEST_ODSRTLITE_BASELINE_30min.csv reported 0.0% of errors [SUCCESS].
Build status is: SUCCESS
```

Result baseline test: **APPROVED**

Stress test

The test is run half an hour and adjusted to the error rate is at a sufficiently low level, but maximum performance is achieved. This test is run in a few moments to find the correct balance point. We could have reduced Netcentric and increased BankID on mobile, but the numbers were sufficient to reach the goal. It was important to bring down the error rate increasing BankID on mobile past the requirement, that we can increase BankID on mobile further and reduce Netcentric is only positive.

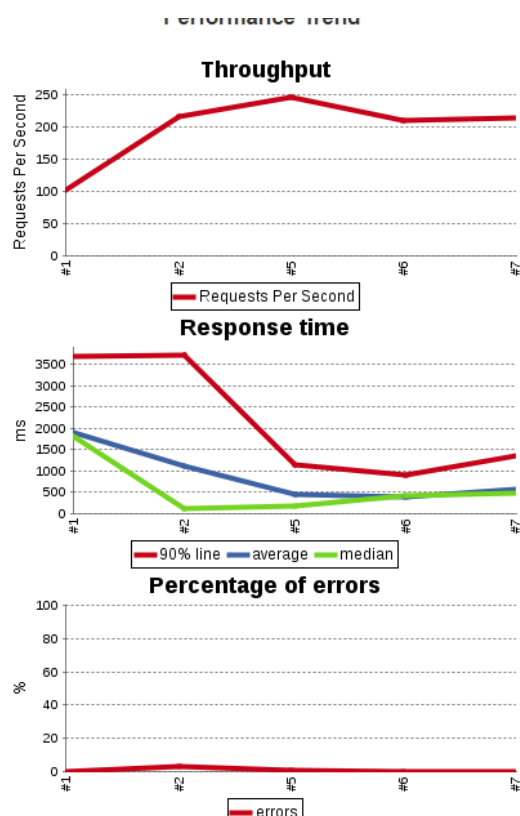
Name	Requirement (TPS)	Test result (TPS)
BankID on mobile	8,91	11,29
Netcentric OTP	7,01	24,77
Netcentric BIMOTP	0,31	6

Both requirement and number of transactions pr. seconds and response time is met.

Percentage of errors in Taxday 2018 was between 1 and 2% and is in this release down to 0.04% on the last stress test execution.

Requests	Executions			Response Times (ms)							Network (KB/sec)	
Label	#Samples	KO	Error %	Average	Min	Max	90th pct	95th pct	99th pct	Throughput	Received	Sent
Total	290929	113	0.04%	436.96	0	4610	846.00	943.00	1258.98	161.41	63.62	14.21
BIM - 01 - Open Client	20346	0	0.00%	1.71	0	184	2.00	3.00	5.00	11.31	16.06	1.85
BIM - 02 - Log in	20346	26	0.13%	158.70	35	2638	282.00	335.00	582.00	11.31	13.76	3.00
BIM - 03 - Poll Loop	20305	10	0.05%	51.23	17	2251	52.00	55.00	106.00	11.29	7.38	6.62
BIM - 04 - Polling	40814	10	0.02%	25.57	0	2251	48.00	50.00	96.00	22.68	7.39	6.62
BIM - 05 - Continue - Done	20190	40	0.20%	48.54	45	2685	49.00	51.00	77.00	11.29	10.83	2.77
Netcentric_BIMOTP_getOTPAuthenticateResponse	10789	0	0.00%	943.50	447	4610	1160.00	1432.50	2769.50	6.00	3.33	0.00
Netcentric_BIMOTP_getOTPChallengeResponse	10795	0	0.00%	493.78	185	2987	567.00	595.00	676.04	6.00	0.07	0.00
Netcentric_getOTPAuthenticateResponse	33811	0	0.00%	781.08	334	4440	966.00	1236.95	2323.93	18.79	10.50	0.00
Netcentric_getSignResponse	44583	37	0.08%	824.07	329	3461	1018.00	1121.95	1480.00	24.77	0.29	0.00
Netcentric_getTid	44635	0	0.00%	433.78	176	3444	491.00	531.00	735.99	24.77	0.68	0.00
Netcentric_getUserInfoResponse	44620	0	0.00%	533.75	201	3234	618.00	672.95	919.99	24.77	0.87	0.00

Improvement stress test



Most important here is to have reduced the Response time in this release. The throughput in #2 (in des 23 2018) was reached with an error rate of 3%. This was an acceptable throughput, with an unacceptable error-rate. #5-#7 are different runs of the stress test done as a part of this test. (The failed tests #3 and #4 are not included.)

Result stress test: **APPROVED**

Normal

The test runs for half an hour with half the load of stress test. This test forms the basis for endurance that has been run for both 6 and 48 hours.

Requests	Executions			Response Times (ms)							Network (KB/sec)	
Label	#Samples	NOK #Error	Error %	Average	Min	Max	90th pct	95th pct	99th pct	Throughput	Received	Sent
Total	286450	180	0.06%	382.87	0	6643	733.00	789.00	952.99	158.92	63.71	14.23
BIM - 01 - Open Client	20423	0	0.00%	1.74	0	179	2.00	3.00	6.00	11.35	16.12	1.86
BIM - 02 - Log in	20423	64	0.31%	156.22	30	6643	263.00	309.00	577.00	11.35	13.81	3.01
BIM - 03 - Poll Loop	20349	4	0.02%	50.58	8	2333	52.00	55.00	107.00	11.31	7.38	6.61
BIM - 04 - Polling	40778	4	0.01%	25.29	0	2332	48.00	50.00	87.00	22.66	7.38	6.62
BIM - 05 - Continue - Done	20235	105	0.52%	48.12	45	2343	49.00	51.00	73.00	11.31	10.84	2.77
Netcentric_BIMOTP_getOTPAuthenticateResponse	6135	0	0.00%	803.98	447	3293	961.00	1064.00	1352.12	3.41	1.89	0.00
Netcentric_BIMOTP_getOTPChallengeResponse	6136	0	0.00%	443.59	184	2702	505.00	524.00	579.63	3.41	0.04	0.00
Netcentric_getOTPAuthenticateResponse	38476	0	0.00%	666.99	334	3229	787.00	852.95	1205.00	21.39	11.95	0.00
Netcentric_getSignResponse	44591	7	0.02%	716.09	321	3659	849.00	910.00	1123.00	24.78	0.29	0.00
Netcentric_getTid	44632	0	0.00%	406.27	176	3243	456.00	483.00	710.00	24.77	0.68	0.00
Netcentric_getUserInfoResponse	44621	0	0.00%	471.99	201	2857	539.00	564.00	648.00	24.78	0.87	0.00

Result normal test: **APPROVED**

Robustness test

The endurance test that ran for 48 hours had a failure rate of 0.67%. Endurance of 6 hours was 0.11%.

The errors that we see, gives some opportunities of improvement.

Results from Nov 2018 (the load in 2018 was different to 2019, so it's hard to compare directly):

Requests	Executions			Response Times (ms)							Network (KB/sec)	
Label	#Samples	KO	Error %	Average	Min	Max	90th pct	95th pct	99th pct	Throughput	Received	Sent
Total	3085189	3341	0.11%	935.54	0	50019	3096.70	5039.95	6374.00	142.80	77.50	20.18
BIM - 01 - Open Client	345284	0	0.00%	1.51	0	3806	2.00	2.00	13.00	15.99	22.71	2.62
BIM - 02 - Log in	345284	1460	0.42%	759.53	5	50019	2725.00	3715.00	7656.97	15.99	19.43	4.25
BIM - 03 - Poll Loop	343783	519	0.15%	56.43	42	4272	92.00	95.00	180.00	15.92	10.51	9.42
BIM - 04 - Polling	696885	519	0.07%	27.84	0	3810	47.00	49.00	143.99	32.27	10.51	9.42
BIM - 05 - Continue - Done	343130	1362	0.40%	47.15	41	2862	48.00	49.00	111.00	15.89	15.24	3.90
Netcentric_BIMOTP_getOTPAuthenticateResponse	46157	0	0.00%	2222.08	411	9940	2872.00	3423.00	4611.98	2.14	1.19	0.00
Netcentric_BIMOTP_getOTPChallengeResponse	46158	0	0.00%	1326.16	181	7365	1662.90	2132.95	3232.99	2.14	0.03	0.00
Netcentric_getOTPAuthenticateResponse	280962	0	0.00%	2145.13	274	11990	1880.00	2103.00	3125.93	13.01	7.29	0.00
Netcentric_getSignResponse	327059	0	0.00%	3886.50	334	39885	6893.90	7402.00	10071.40	15.14	0.18	0.00
Netcentric_getTid	327137	0	0.00%	291.05	170	4037	504.00	591.00	954.00	15.14	0.41	0.00
Netcentric_getUserInfoResponse	327133	0	0.00%	1391.30	186	12298	1236.00	1353.00	1824.00	15.14	0.53	0.00

Extraction from 6 hours execution

Requests	Executions			Response Times (ms)							Network (KB/sec)	
Label	#Samples	KO	Error %	Average	Min	Max	90th pct	95th pct	99th pct	Throughput	Received	Sent
Total	3410576	3652	0.11%	521.28	0	45813	912.00	1015.00	1246.00	157.88	52.76	10.89
BIM - 01 - Open Client	183868	0	0.00%	1.37	0	2895	2.00	3.00	7.00	8.51	12.10	1.40
BIM - 02 - Log in	183868	264	0.14%	192.35	6	27206	261.00	315.00	530.99	8.51	10.35	2.26
BIM - 03 - Poll Loop	183598	802	0.44%	52.24	3	3563	50.00	55.00	148.99	8.50	5.76	5.16
BIM - 04 - Polling	381586	802	0.21%	25.14	0	3095	47.00	49.00	86.00	17.67	5.76	5.16
BIM - 05 - Continue - Done	182713	429	0.23%	46.61	42	3133	48.00	50.00	78.00	8.46	8.12	2.07
Netcentric_BIMOTP_getOTPAuthenticateResponse	246272	52	0.02%	1014.16	191	45813	1228.00	1366.00	1805.00	11.40	6.34	0.00
Netcentric_BIMOTP_getOTPChallengeResponse	246298	22	0.01%	548.83	183	13027	631.00	687.00	827.98	11.40	0.13	0.00
Netcentric_getOTPAuthenticateResponse	311323	40	0.01%	842.76	184	34919	1009.00	1106.00	1399.98	14.41	8.05	0.00
Netcentric_getSignResponse	557486	287	0.05%	863.16	205	32121	1022.00	1114.00	1374.99	25.81	0.30	0.00
Netcentric_getTid	559403	1630	0.29%	482.27	170	10326	548.00	601.00	784.00	25.90	0.72	0.00
Netcentric_getUserInfoResponse	557759	126	0.02%	584.23	177	28107	669.00	728.00	912.00	25.82	0.91	0.00

Result robustness test: **APPROVED**