Compatibility and performance

OfficeBOX SC1500

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Chapter 1: Introduction

Goals

This document represents Bicom Systems Lab test results for officeBOX appliance, measuring performance and PSTN compatibality under various workloads.

Testing is done in two parts:

- First set of tests is comprised only of SIP calls with different codecs being used and this testing imposed additional stress on the machine because of the transcoding process
- Second set of tests was done to determine the machines compatibilty with various PSTN PCI cards and its workload with different calls being placed, whether they are analog or ISDN, or their combination

First set of tests are done to determine how many concurrent calls can be made without calls being broken. We took 80% CPU usage as a allowed maximum, but for our requirements CPU usage should not go over 40-50% in production. In the following chapters we will discuss given results.

These tests consisted of eight similar test, which were:

- Test 1 – calls are made using g711 codec
- Test 2 – calls are made using g711 codec with Call Recording enabled
- Test 3 – calls are made with callers using g711 and calls were transcoded to g729
- Test 4 – calls are made with callers using g711 and calls were transcoded to g729 with Call Recording enabled
- Test 5 – calls are made with callers using g711 and calls were transcoded to iLBC
- Test 6 – calls are made with callers using g711 and calls were transcoded to iLBC with Call Recording enabled
- Test 7 – calls are made with callers using g711 and calls were transcoded to GSM
- Test 8 – calls are made with callers using g711 and calls were transcoded to GSM with Call Recording enabled

The second set of tests is done in similar way as the first one, but we have also taken compatibilty issues in concern. This set had an overall of 23 tests, and that means that we have tried 23 combination of PCI cards in the officeBOX, which are:

- Test 1 – Two Digium TDM800P analog cards
- Test 2 – Digium TDM800P and Two Trust MD-2100P USB ISDN
- Test 3 – Digium TDM800P and Digium B410P ISDN card
- Test 4 – Digium TE110P E1 mode and Digium TDM800P
- Test 5 – Digium TE110P T1 mode and Digium TDM800P
- Test 6 – Digium TE110P E1 mode, Digium TDM800P and Trust MD-2100P
- Test 7 – Digium TE110P T1 mode, Digium TDM800P and Trust MD-2100P
- Test 8 – Digium TE110P E1 mode and Trust MD-2100P
- Test 9 – Digium TE110P T1 mode and Trust MD-2100P
- Test 10 – Digium TE110P E1 mode and Digium B410P
- Test 11 – Digium TE100P T1 mode and Digium B410P
- Test 12 – Digium TDM04B and Digium TDM800P
- Test 13 – Digium TDM04B and Trust MD-2100P
- Test 14 – Digium TDM04B, Digium TDM800P and Trust MD-2100P
- Test 15 – Digium TDM04B and Digium TE110P E1 mode
- Test 16 – Digium TDM04B and Digium TE110P T1 mode
- Test 17 – Digium TDM04B, Digium TE110P E1 mode and Trust MD-2100P
- Test 18 – Digium TDM04B, Digium TE110P T1 mode and Trust MD-2100P
- Test 19 – BiPAC PCI V.3.0 ISDN Card
- Test 20 – BiPAC PCI V.3.0 and Digium TE110P E1 mode
- Test 21 – BiPAC PCI V.3.0 and Digium TE110P T1 mode
- Test 22 – BiPAC PCI V.3.0 and Digium TDM04B
- Test 23 – BiPAC PCI V.3.0 and Digium TDM800P

Tests include measuring CPU usage, memory usage and CPU/DoM performance where:

- CPU usage is a number in % which shows user, system and total usage of the CPU time. For simplified understanding, we will discuss total usage given.
- Memory usage shows how much of the machines memory is taken during the test.
- CPU/DoM performance shows how many blocks were writen to and read from a DoM storage device per second. In our case 1 Block equals 1 KB

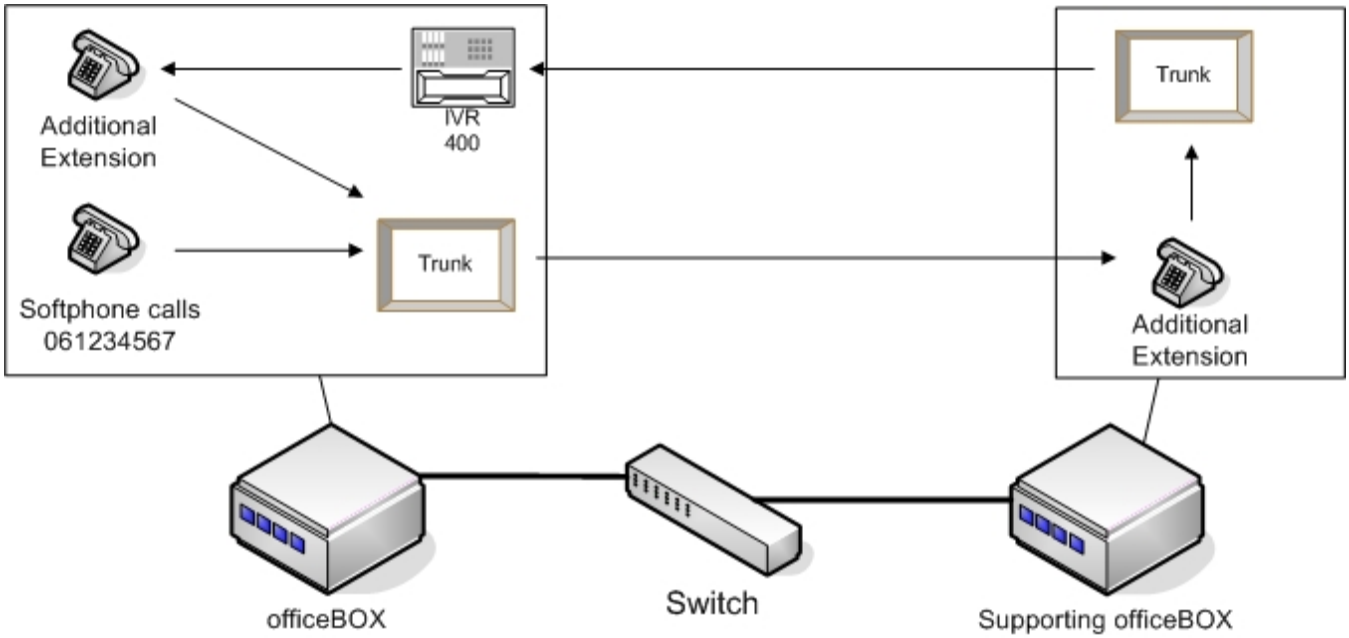
Tested officeBOX configuration is:

- VIA Esther processor C7 1500MHz
- 512MB of RAM
- 1GB DoM drive
- Dual Gigabit LAN

Chapter 2:
SIP testing

Setup

For this testing we devised a method which provides us with the ability to make as many calls as we need using below configuration.



Picture A.

On the machine which is tested we set up a trunk which is used to direct our calls to a supporting officeBOX. On supporting box additional extension is actually registered trunk from the first officeBOX, so when the call is passed to this machine it is treated like that extension is making a call. When the call arrives to the supporting box it is then redirected again through the trunk on it, to our testing box and into the IVR.

When call reaches IVR, we have the option to stay at current number of calls or call additional extension which has call forwarding to the same number from the begining, thus creating another call.

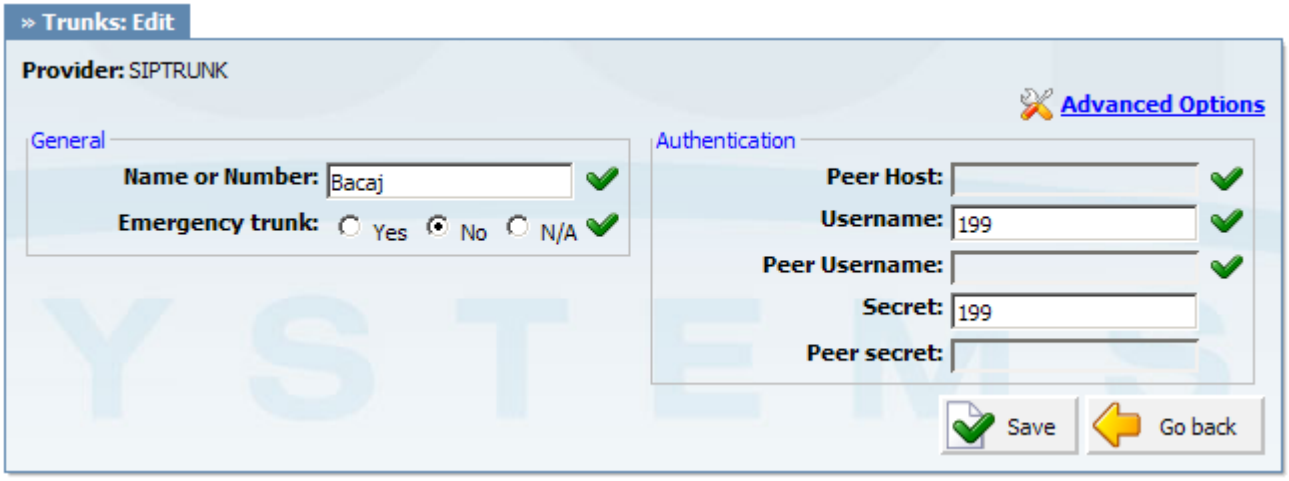
Like stated before this "loop method" allows us to make as many calls as we want to, and it is used because it is not very convenient to use large number of phone devices for testing purposes, whether they are softphones or hardware devices. At same time this method produces real life audio strems and signalling emulating real life call.

Also we have placed a call to Music On Hold from an IP Phone in order to monitor the quality of audio when making all these concurrent calls.

Extension which starts this test is

Picture B.

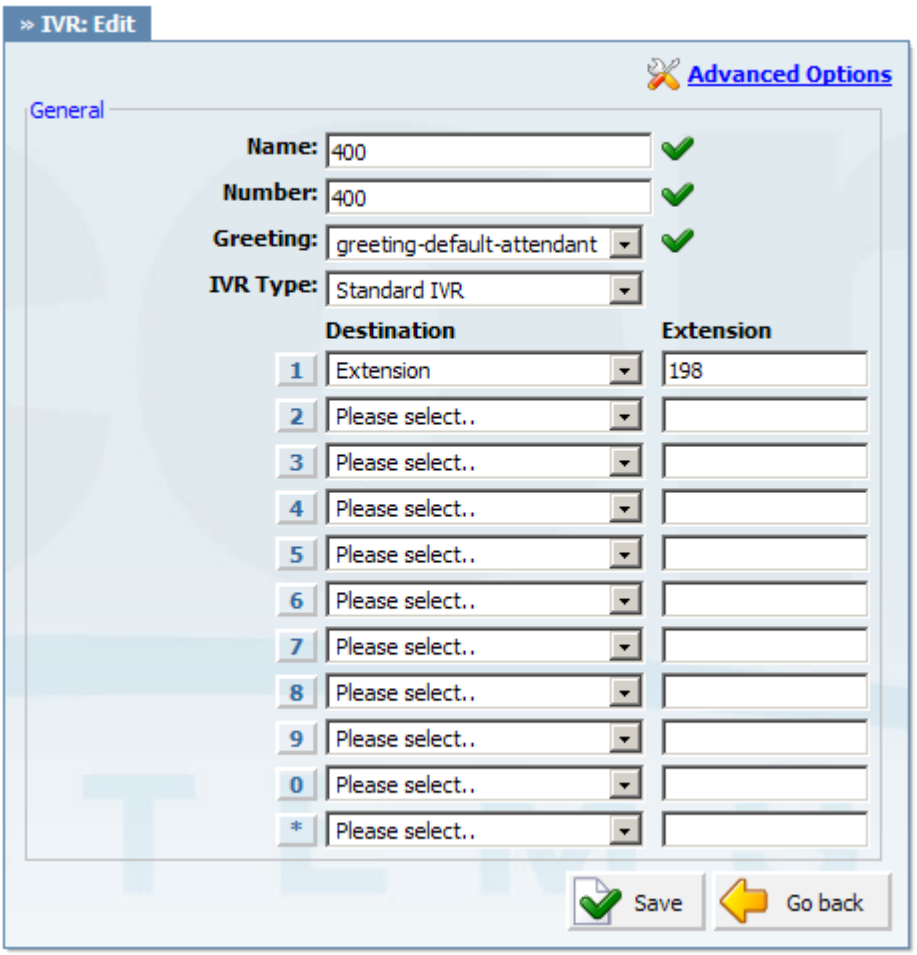
and the trunk which passes the calls to another box is



Picture C.

Username on the picture is an extension on the supporting box which accepts the calls and dials them there, and then they are taken by a trunk, back to our tested box.

Call which is returned back, is then entering the IVR which is on the following picture:



Picture C.

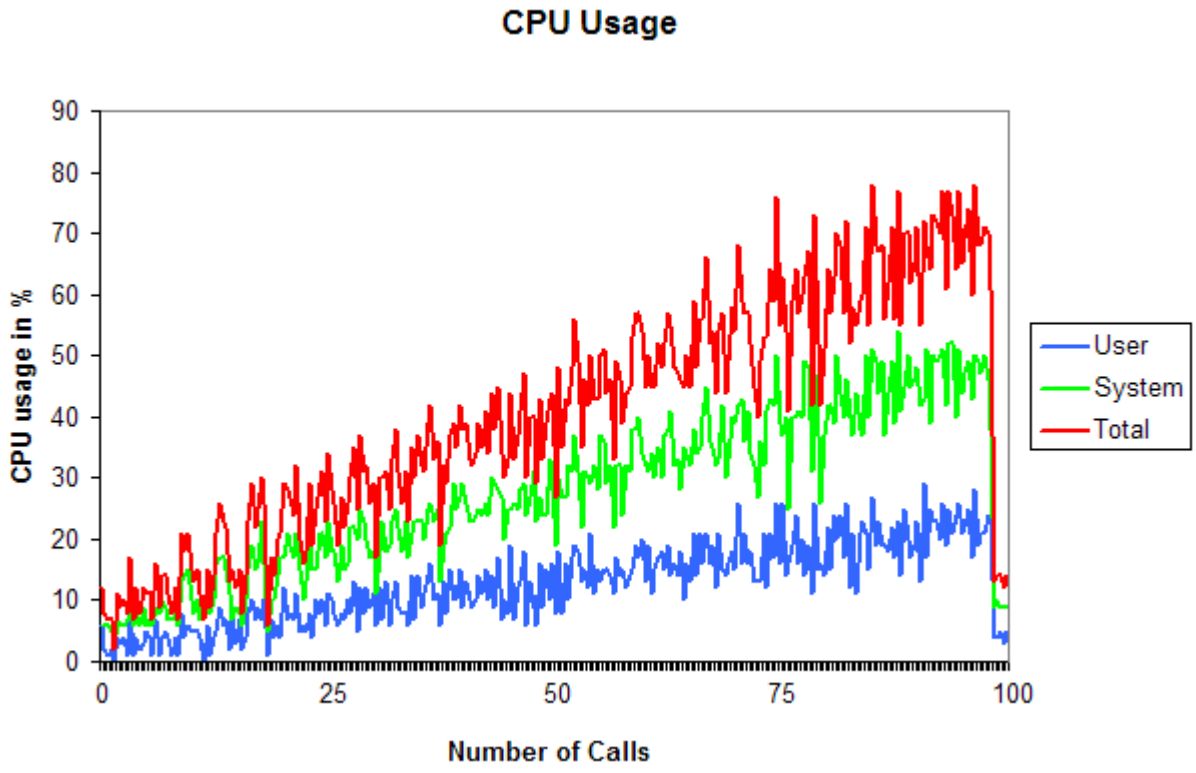
Extension number 198 is additional extension which then forwards the call to the trunk, and makes another call.

Test 1: g711 calls

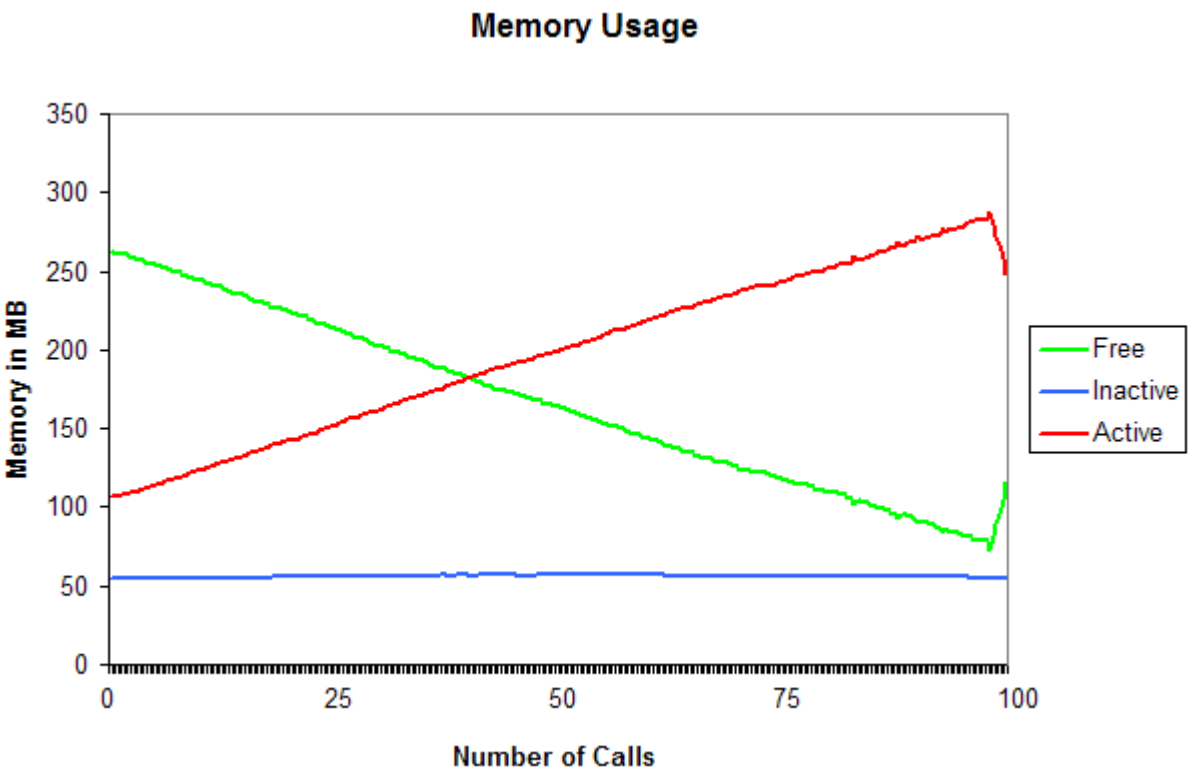
First thing that needs to be mentioned is that all tests use the same setup except they use different codecs and every test is repeated with Call Recording feature turned on.

Test 1 is simple and it uses this setup and all calls use g711 codec which requires less CPU time, and taking in account our 80% allowed maximum, we made one hundred calls.

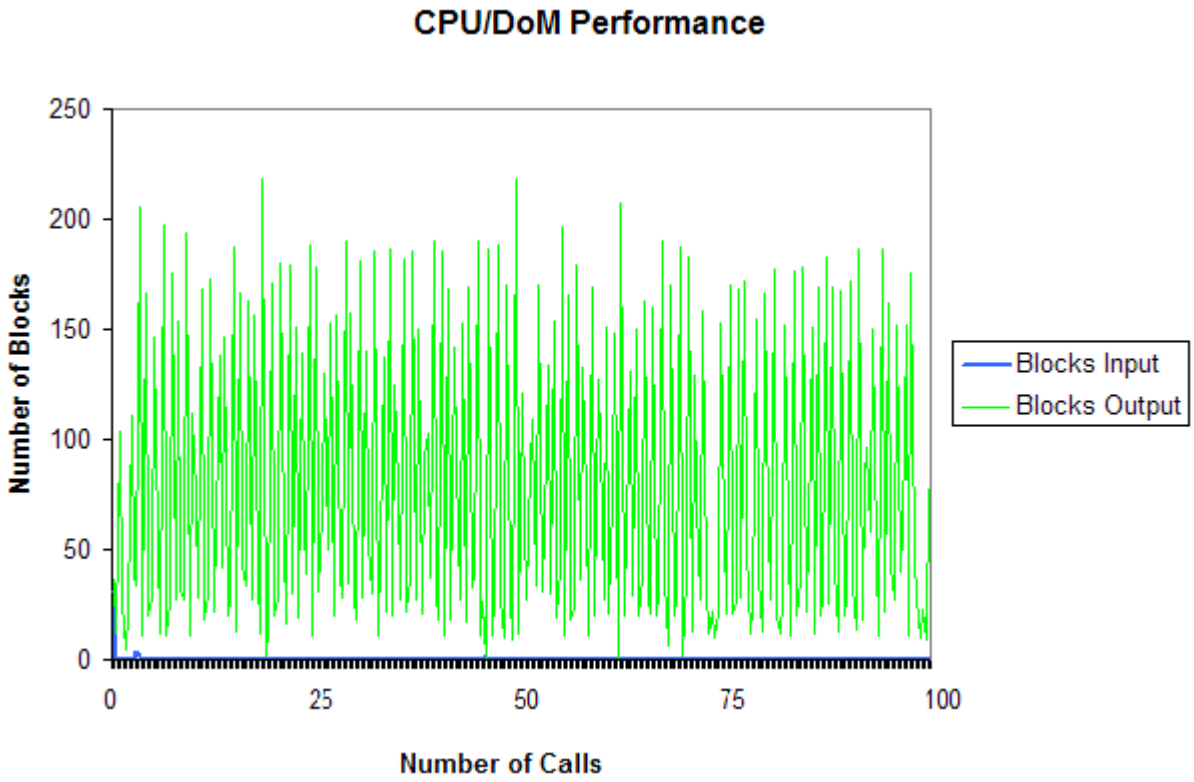
So the resulting diagrams are as follows:



Picture 1.1



Picture 1.2



Picture 1.3

Test 1: Conclusion

When analysing all the aquired data, which is presented as diagrams, we come to conclusion that with one hundred concurrent calls CPU usage is around 80%, and the officeBOX is still responsive. All the calls are still normal, meaning one can hear audio without noise or constant crackle, although with so many calls, CPU usage sometimes spikes a bit and clicks the calls.

Memory usage is 280 MB with 100 calls, and when analysing data one can see that the usage grows proportionally with number of calls.

With 50 concurrent calls, we have a 40% usage of CPU and 170MB of memory taken, and that of course means that there is still a lot of free memory so we could say that with 50 calls we have achieved a safe margin.

It is important to say that number of blocks read from DoM is minimal, and the number of blocks written to oscillates between 25 and 200. We see that during a call very little number of blocks is written, but when making a new call or destroying a current one, **bo** spikes which means that the data is being written to the DoM. That is normal considering that PBXware is logging every call being made.

100 calls statistics:

- 75 – 85 % CPU usage
- 270 – 285 MB of memory used
- Almost none of data is read from the DoM
- 25 – 200 blocks written to DoM
- With 100 calls there are sometimes clicks in audio

50 calls statistics:

- 36 – 44 % CPU usage
- 165 – 175 MB of memory used
- Almost none of data is read from the DoM
- 25 – 200 blocks written to DoM
- Audio is perfect

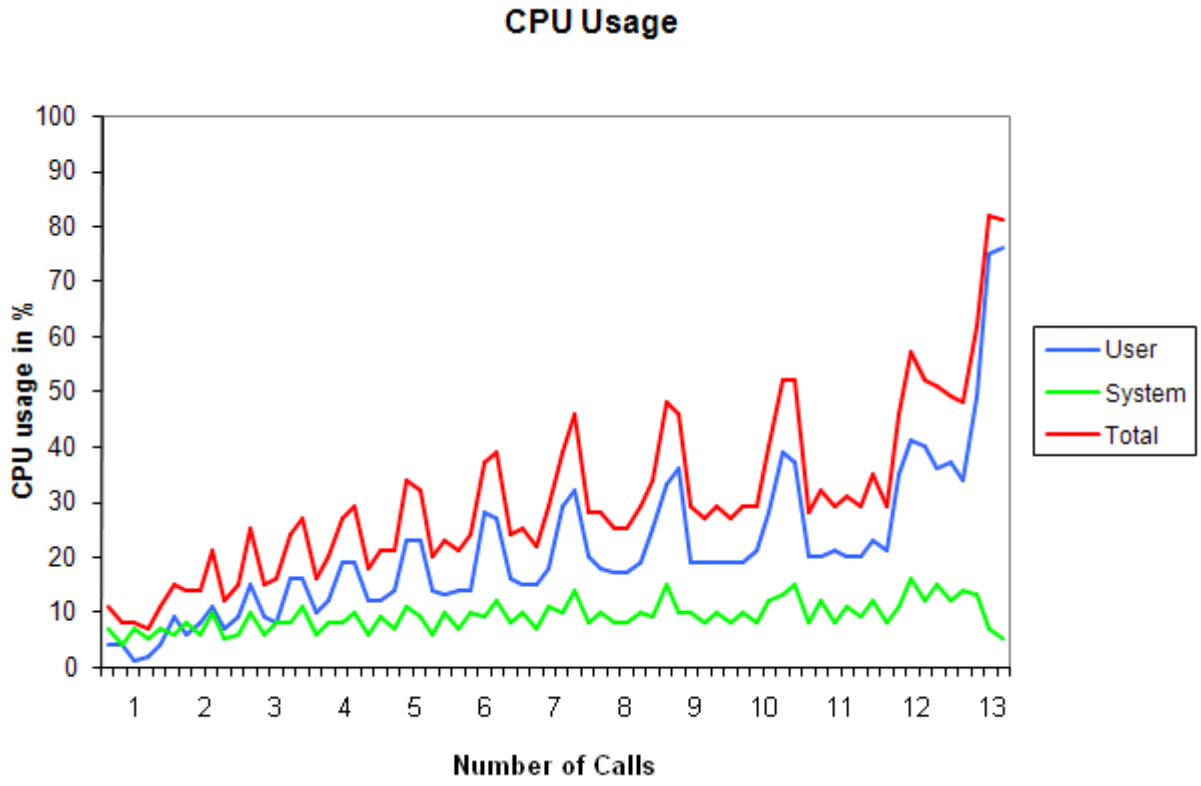
Test 2: g711 calls with Call Recording

Test 2 is the same test as the Test 1 but with very different results which is a direct consequence of Call Recording feature being turned on.

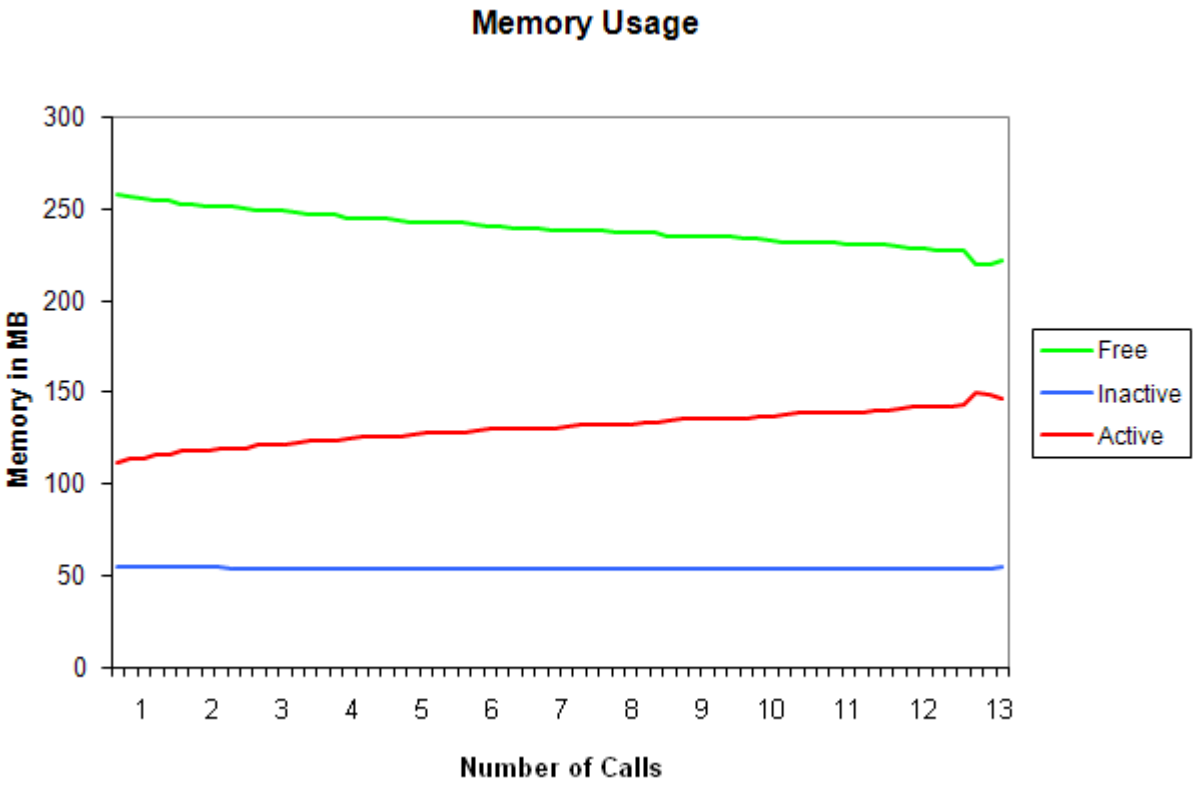
Call Recording, as it name suggests, is a PBXware feature which enables recording of all calls to or from an extension..

It is important to mention that recording every call is a very stressful for CPU. That is why we have such results.

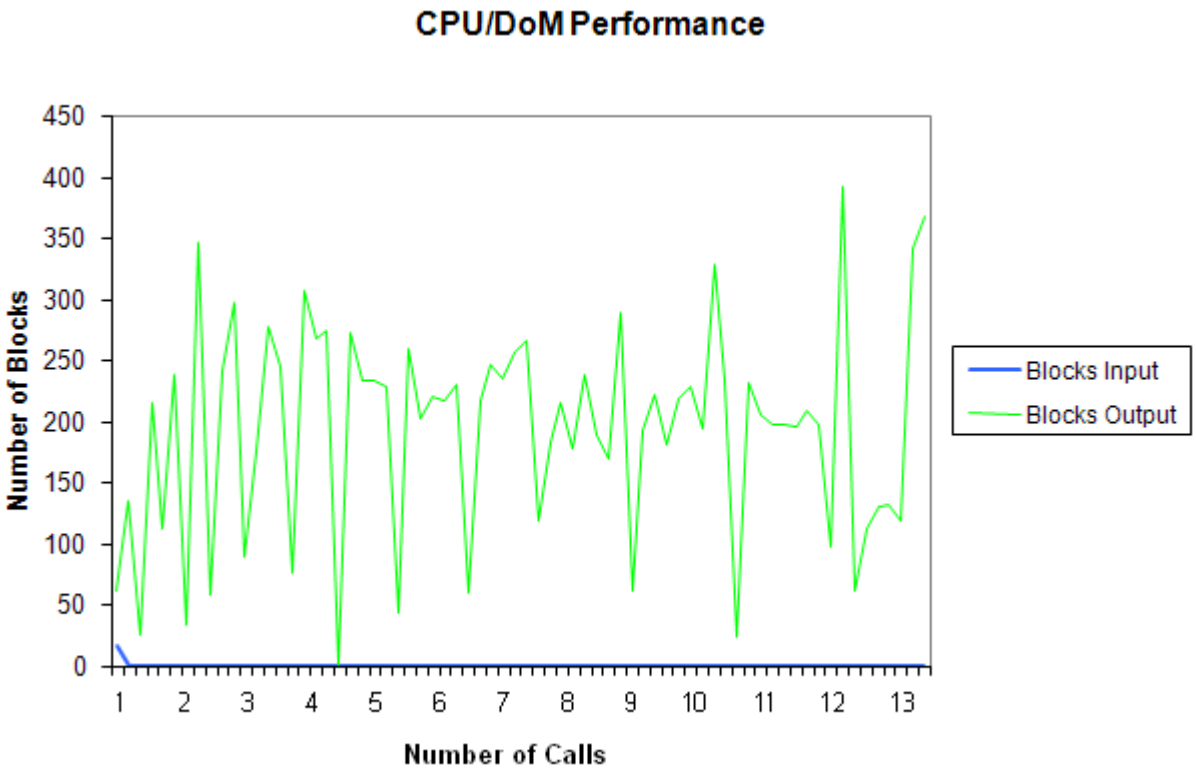
Resulting diagrams are as follows:



Picture 2.1



Picture 2.2



Picture 2.3

Test 2: Conclusion

Analysis of the gathered data have shown that the Call Recording option is very stressful for the machine because it is consuming CPU time very fast when making additional calls.

Machine was able to make 13 calls with 80% to 85% CPU usage and the memory usage was 145MB to 150 MB.

For 6 calls we had 38% to 42% CPU usage and memory usage was 120MB to 125 MB.

Also, number of blocks written to DoM are higher because we have Call Recording turned on and it is writting data to the DoM.

Results are proportional to the number of calls, so as number of call is rising linearly so are the CPU and memory usage rising too.

13 calls statistics:

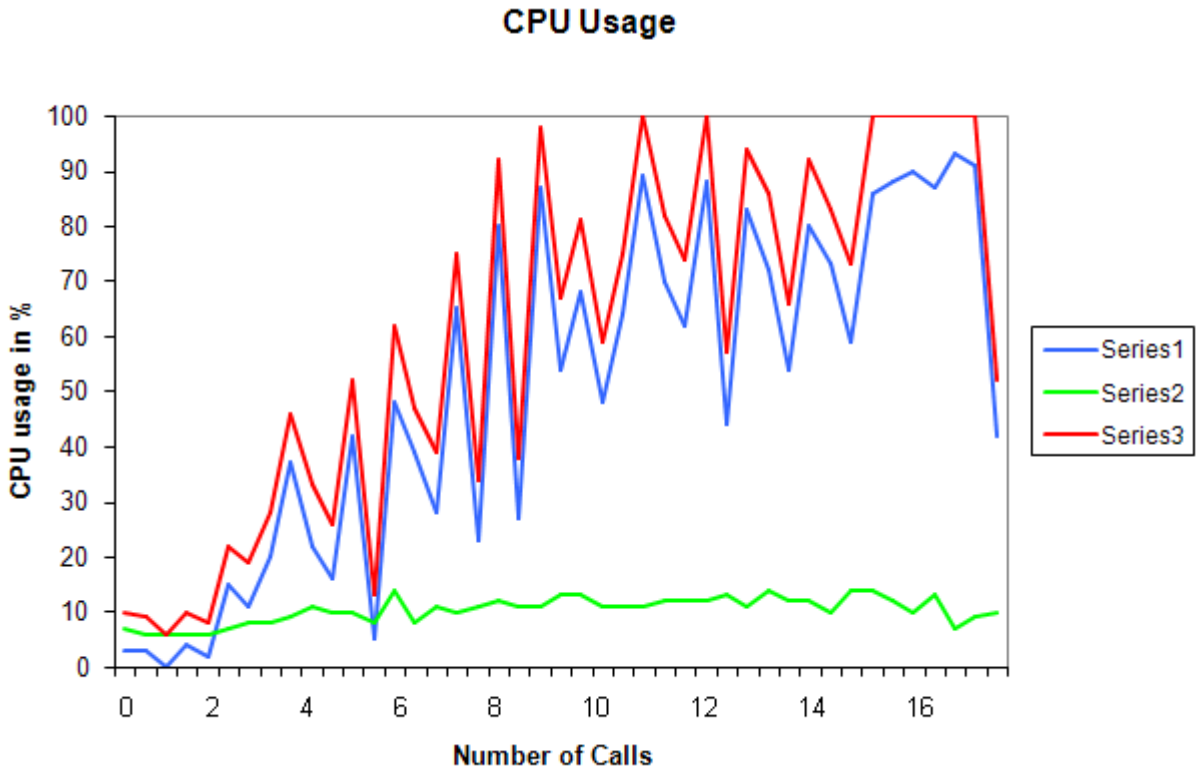
- 80 – 85 % CPU usage
- 145 – 150 MB of memory used
- Almost none of data is read from the DoM
- 50 – 350 blocks written to DoM
- With 13 calls there are clicks in audio

6 calls statistics:

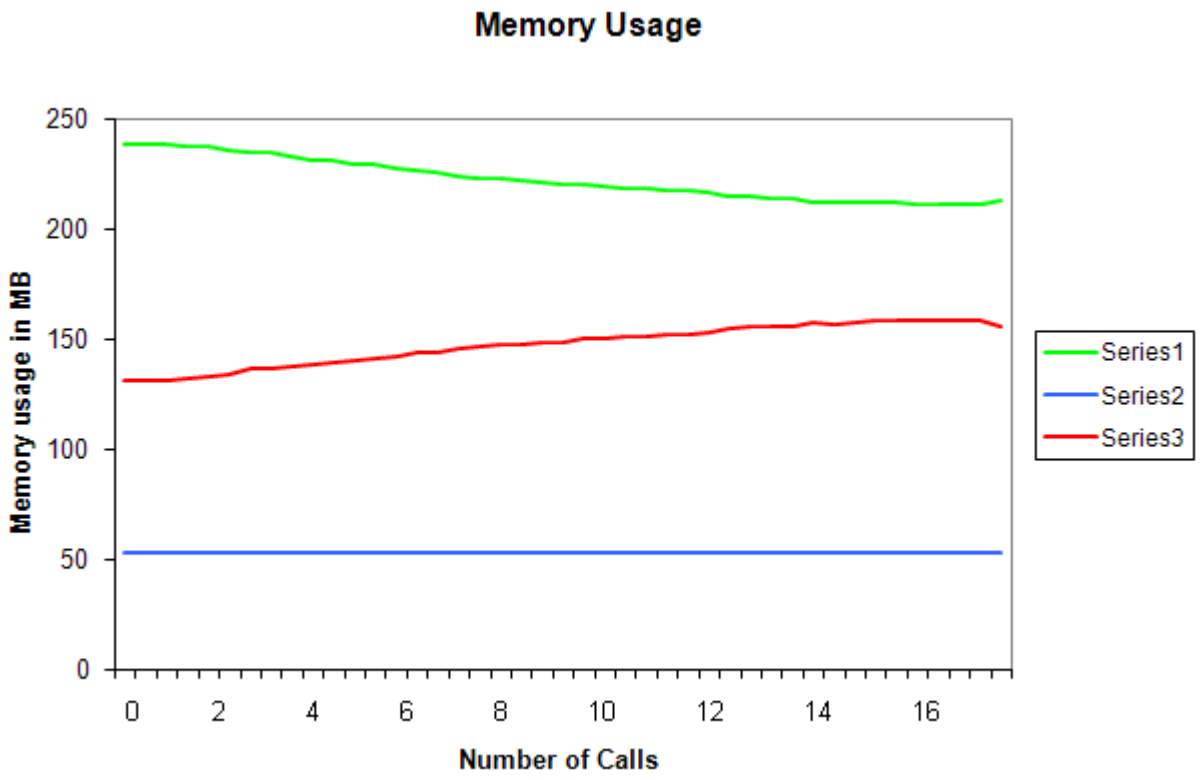
- 38 – 42 % CPU usage
- 120 – 125 MB of memory used
- Almost none of data is read from the DoM
- 50 – 350 blocks written to DoM
- Audio is perfect

Test 3: g711 transcoded to g729

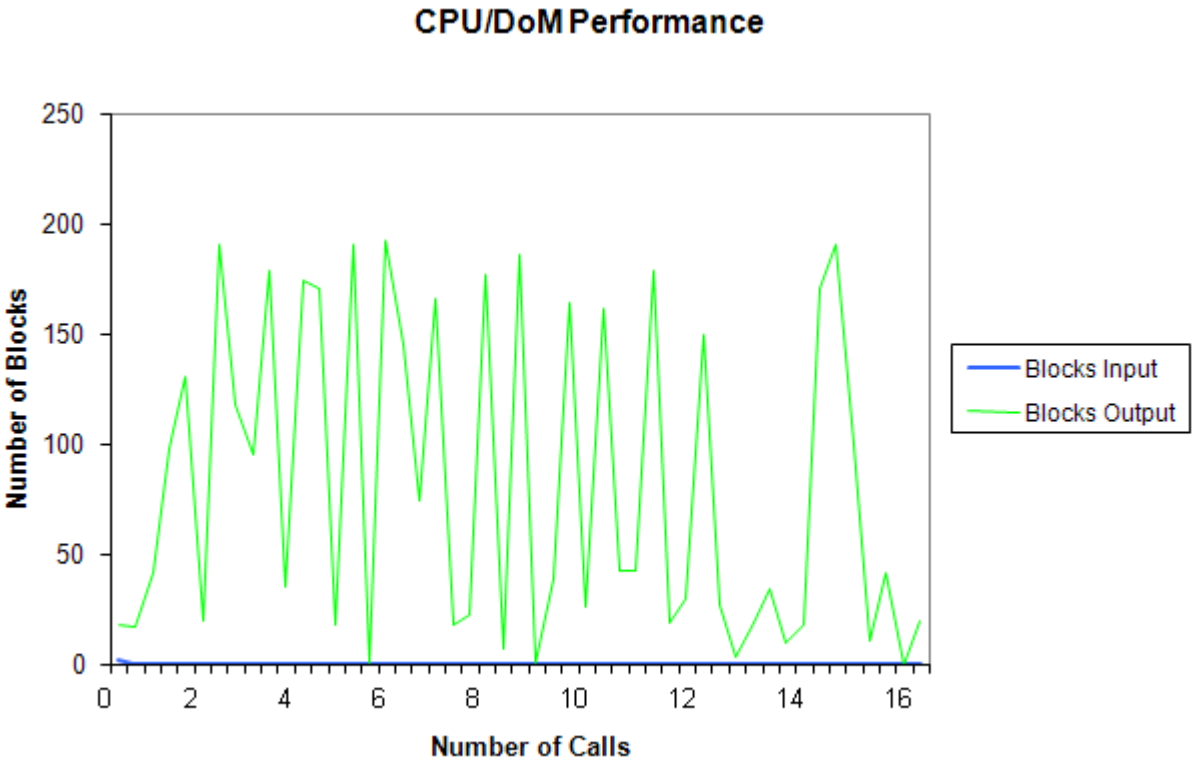
This test required calls to be g711 coded, but before they can go out through the trunk they were transcoded to g729 codec. So, besides the regular calls being made, they were transcoded which was very CPU intensive for the machine, and the results are following.



Picture 3.1



Picture 3.2



Picture 3.3

Test 3: Conclusion

When using transcoding of the calls CPU usage goes to 100% very fast. In fact with 16 calls, the machine became unresponsive in a way that no additional calls could be made.

So, with 14 calls machine is working, but barely and the 16 calls blocks it from functioning normaly. Memory is not heavily used because of the small number of calls, and DoM performance is in the normal range.

With 7 calls we have 40% CPU usage and 140 MB of memory usage.

This test shows that OfficeBOX should not transcode more then 7 calls otherwise there is a risk of blocking the machine which then would need to be fixed (ie. restarting PBX).

14 calls statistics:

- 80 – 88 % CPU usage
- 150 MB of memory used
- Almost none of data is read from the DoM
- 25 – 200 blocks written to DoM
- With 14 calls machine is working, but is close to blocking

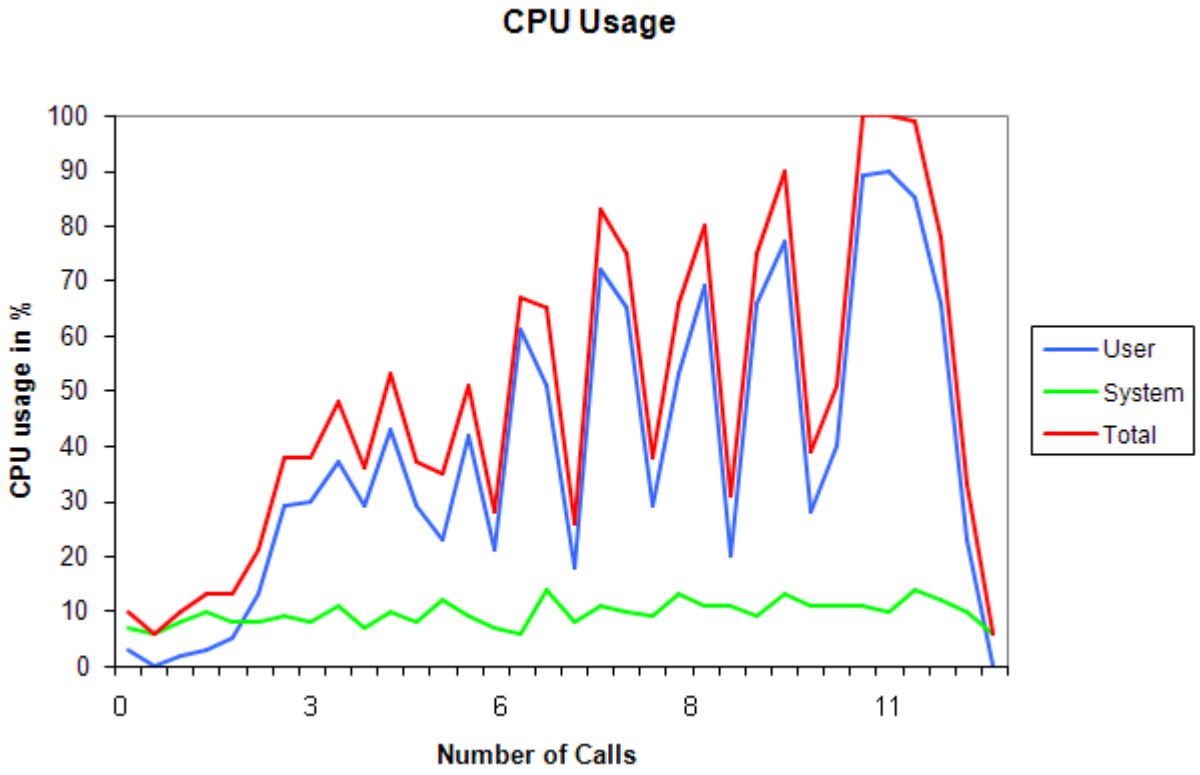
7 calls statistics:

- 40 % CPU usage
- 140 MB of memory used
- Almost none of data is read from the DoM
- 25 – 200 blocks written to DoM
- Machine is working as expected

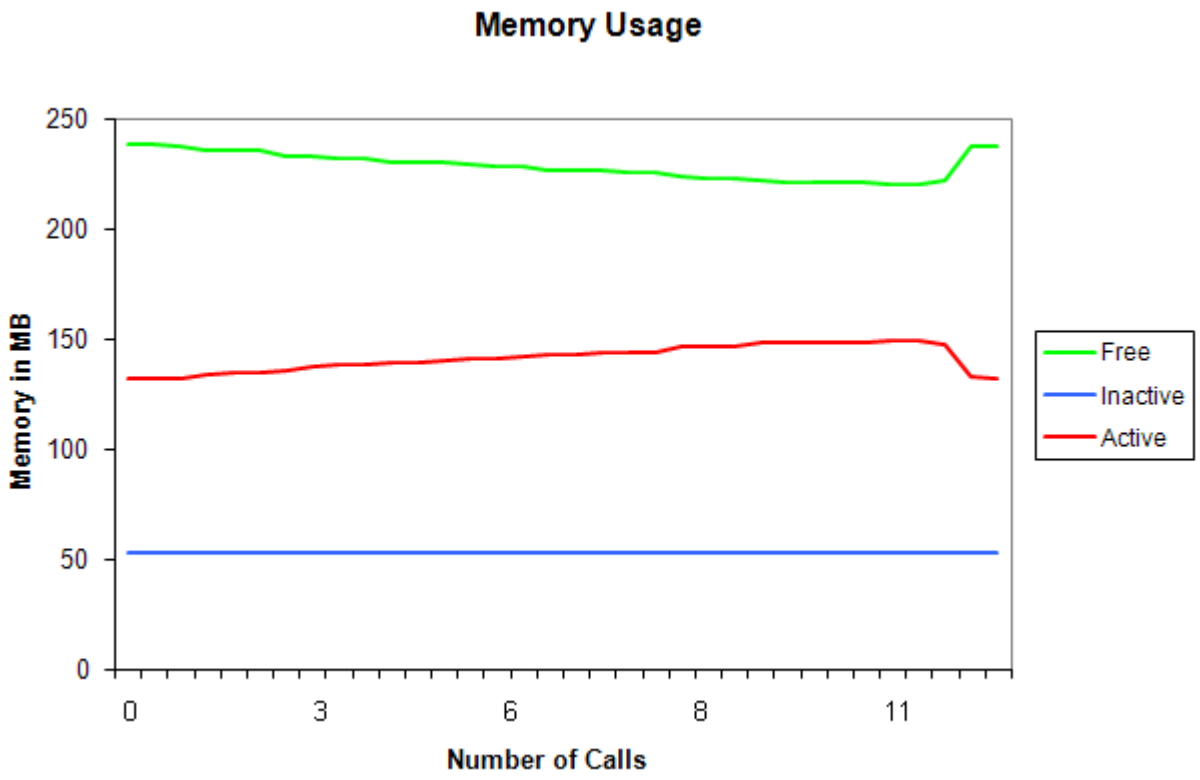
Test 4: g711 transcoded to g729 with Call Recording

This test is essentially same as previous with exception that we added Call Recording to each call. This means that this test is most stressful for the machine because of transcoding and call recording done at the same time.

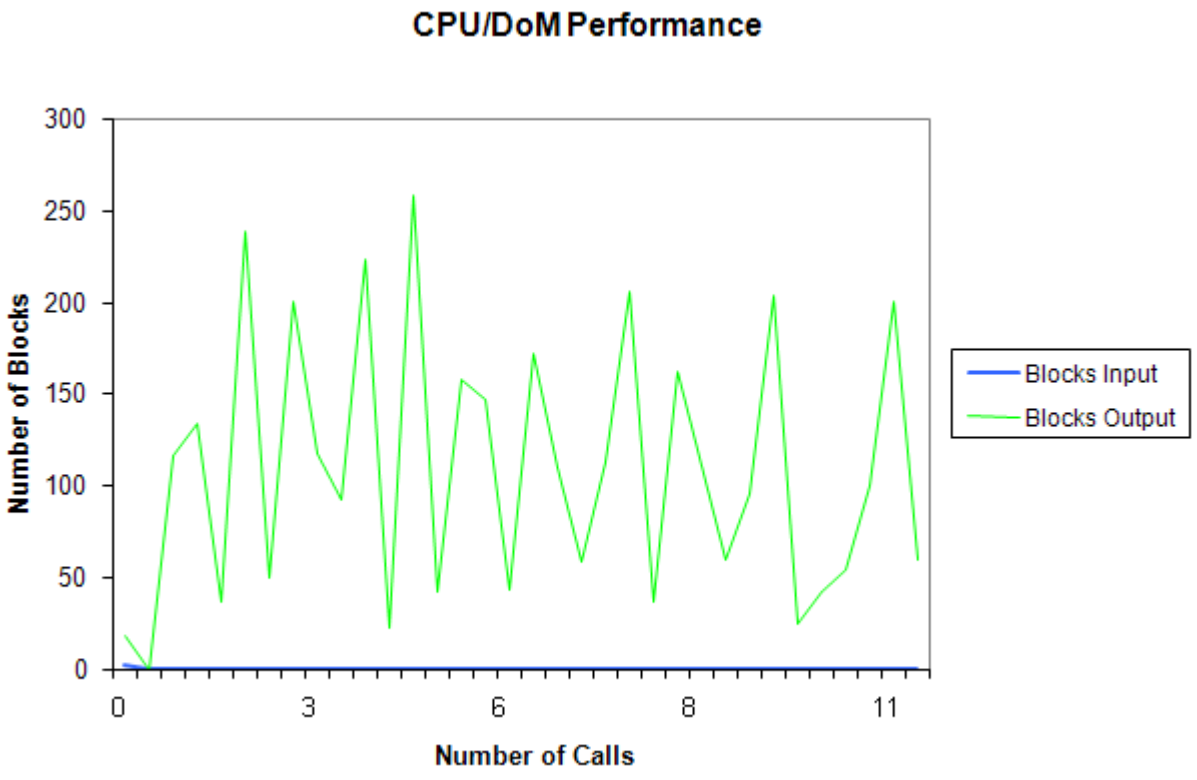
Results have shown that OficeBOX becomes unresponsive with 11 calls and barely works with 9. Resulting diagrams are as follows:



Picture 4.1



Picture 4.2



Picture 4.3

Test 4: Conclusion

As it was expected, this test was most stressful for the machine. We had transcoding from g711 to g729 and Call Recording feature turned on. We saw in previous test that the CPU load was very high but now it is more critical. That means that with this type of configuration we managed to get 11 calls and then the system blocks, ie becomes unresponsive.

With 9 calls it is barely working and with 5 calls we got 40% CPU usage.

When analyzing this situation we come to conclusion that officeBOX should not be used for more then 5 concurrent calls with this setup.

9 calls statistics:

- 84 – 89 % CPU usage
- 145 MB of memory used
- Almost none of data is read from the DoM
- 50 – 250 blocks written to DoM because of the Call Recording
- Machine is unresponsive

5 calls statistics:

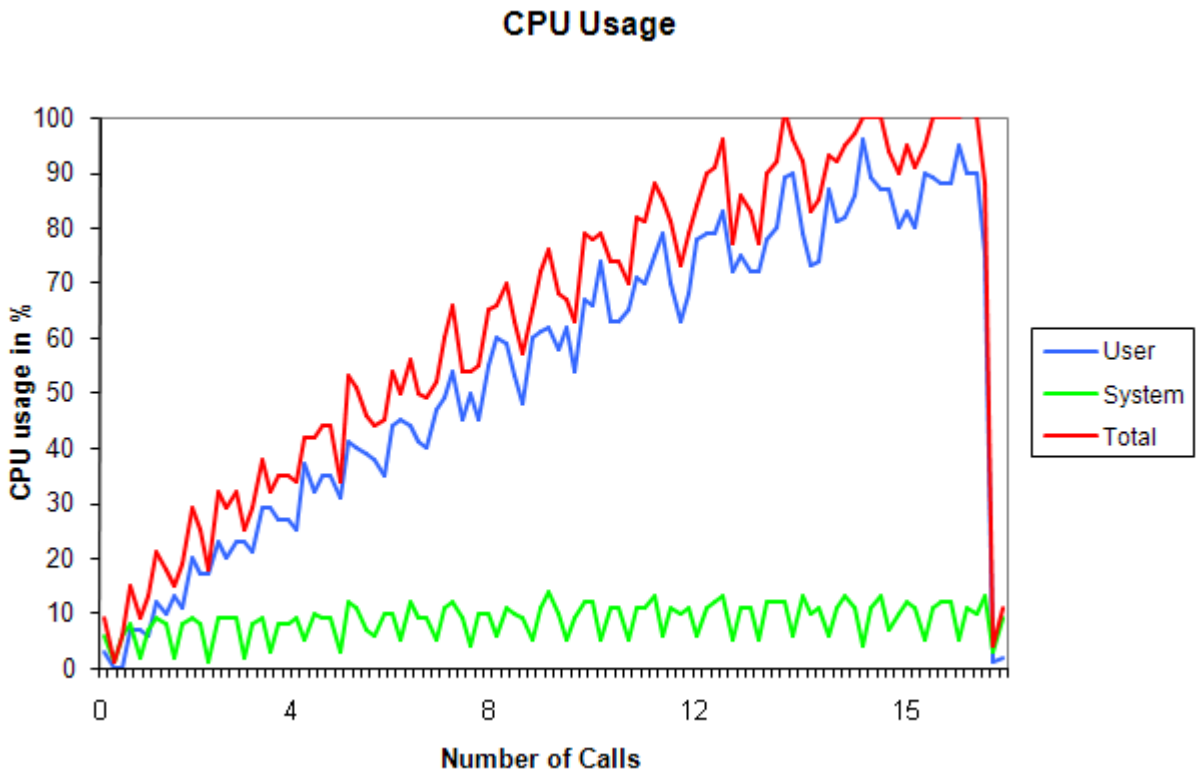
- 40 – 44 % CPU usage
- 140 MB of memory used
- Almost none of data is read from the DoM
- 50 – 250 blocks written to DoM because of the Call Recording
- Working

Test 5: g711 transcoded to iLBC

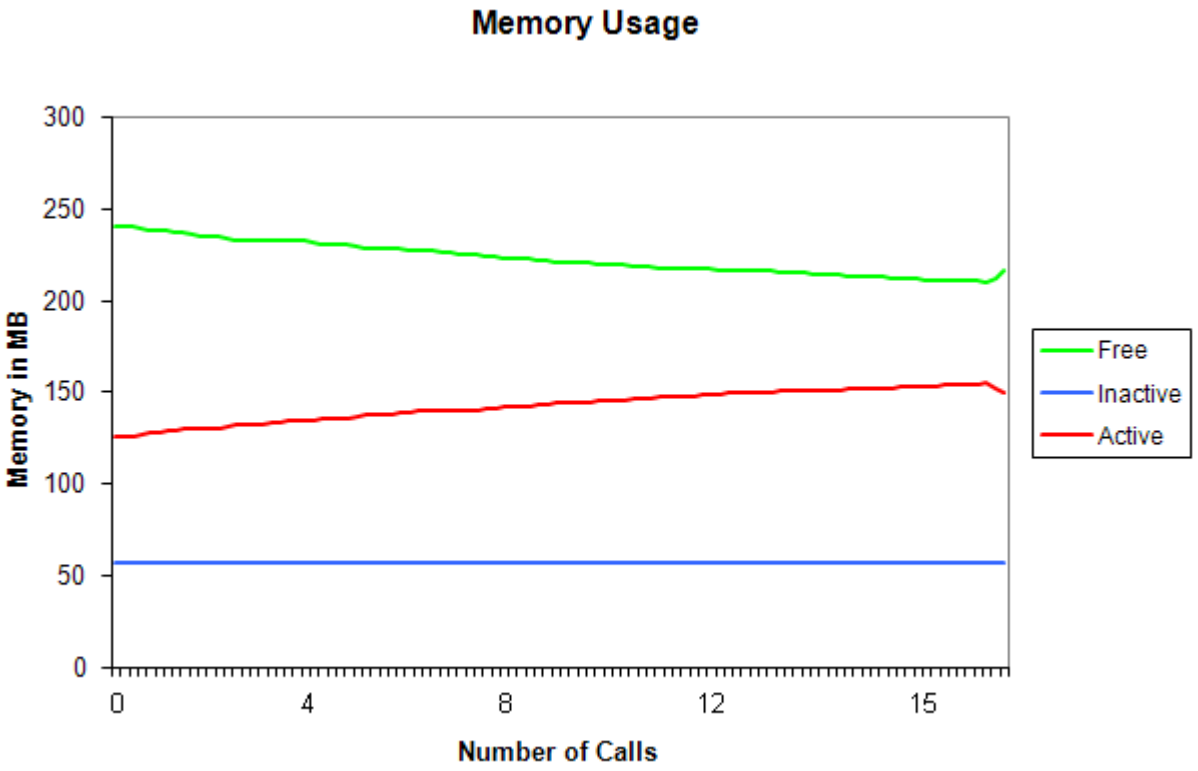
g711 transcoding to iLBC test is very similar to the previous test except the fact that the transcoding to iLBC codec is sligthly less demanding than is the g729.

Transcoding process is still very stresful although machine was able to do several calls more.

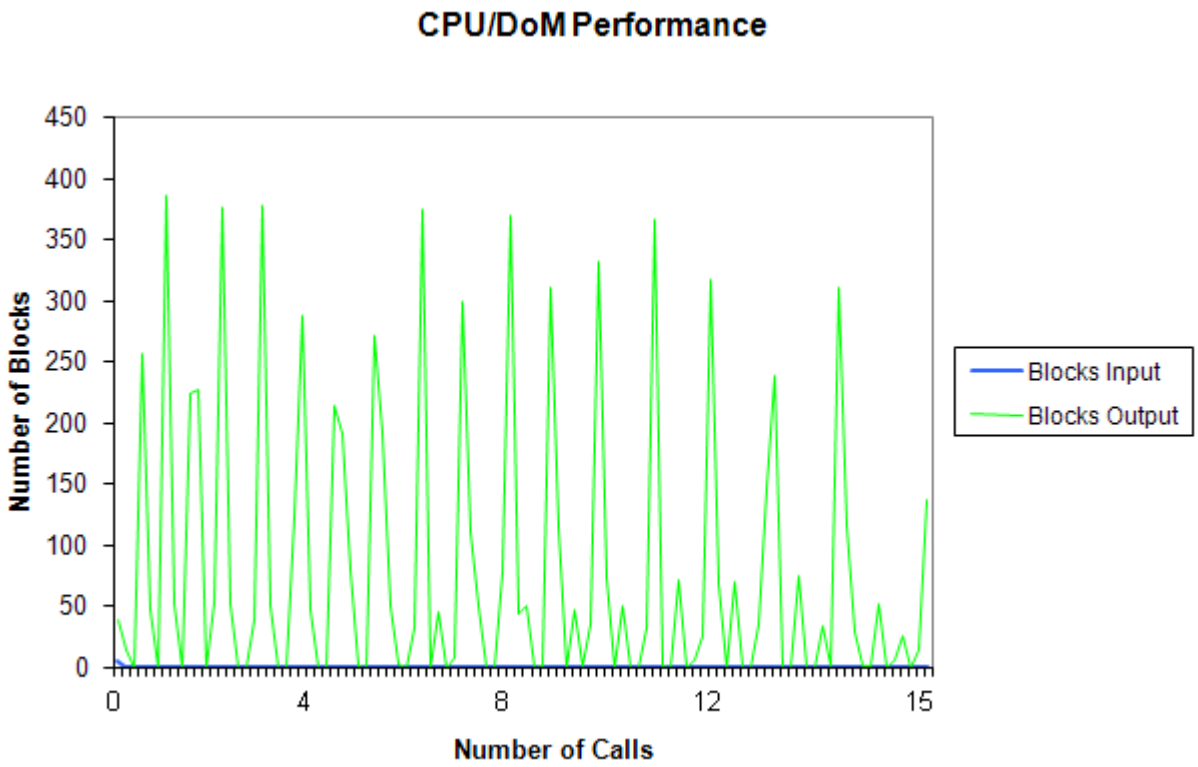
Resulting diagrams are as follows:



Picture 5.1



Picture 5.2



Picture 5.3

Test 5: Conclusion

Like previous test with transcoding, this one proved stressful for the machine too. Although we managed to make several calls more, this is still the least recommended way of officeBOX usage. It can lead to a machines blocking which would require restarting the PBXware and in worst case rebooting the machine.

With 15 calls we have 100% CPU usage, and we get 80% recommended with 12 calls. Also 12 calls are using 140MB of memory.

With 6 calls we have our designated 40% usage and 130MB of memory usage. We must say that with this transcoding writting to the DoM has increased.

12 calls statistics:

- 80 – 84 % CPU usage
- 140 MB of memory used
- Almost none of data is read from the DoM
- 100 – 350 blocks written to DoM
- Machine is working but additional calls are not recommended

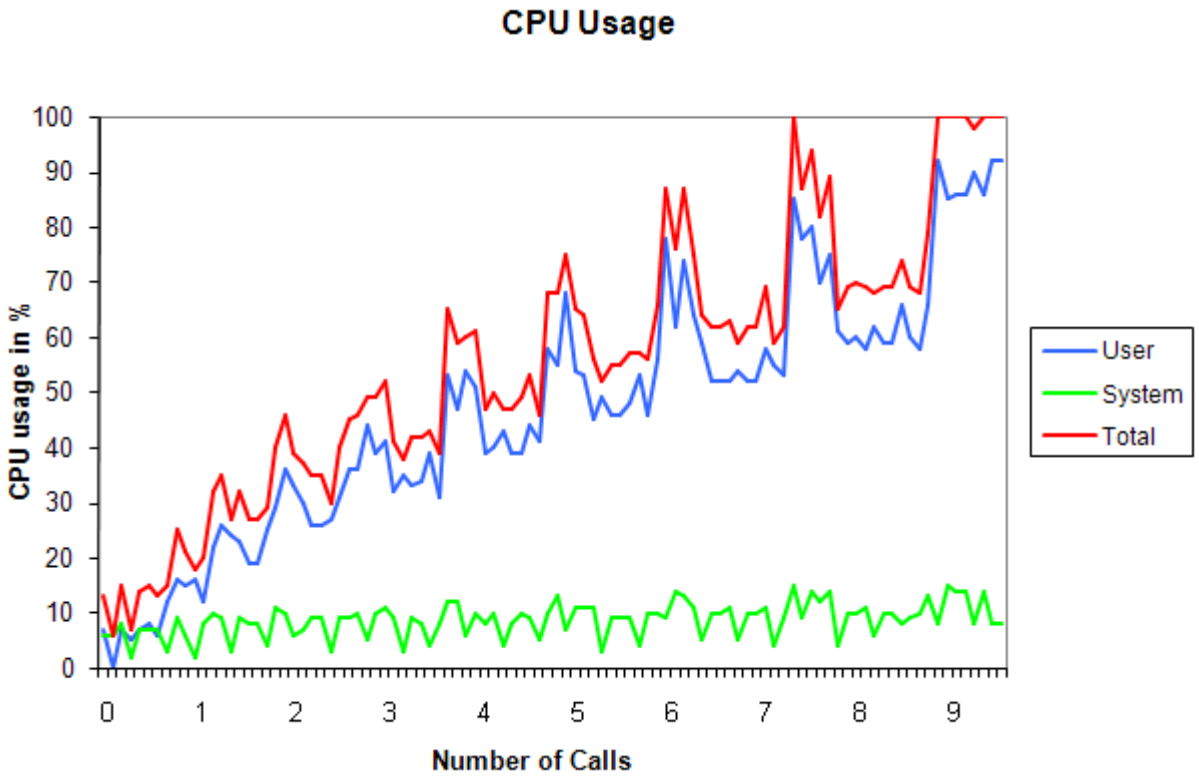
5 calls statistics:

- 40 – 45 % CPU usage
- 130 MB of memory used
- Almost none of data is read from the DoM
- 100 – 350 blocks written to DoM
- Working

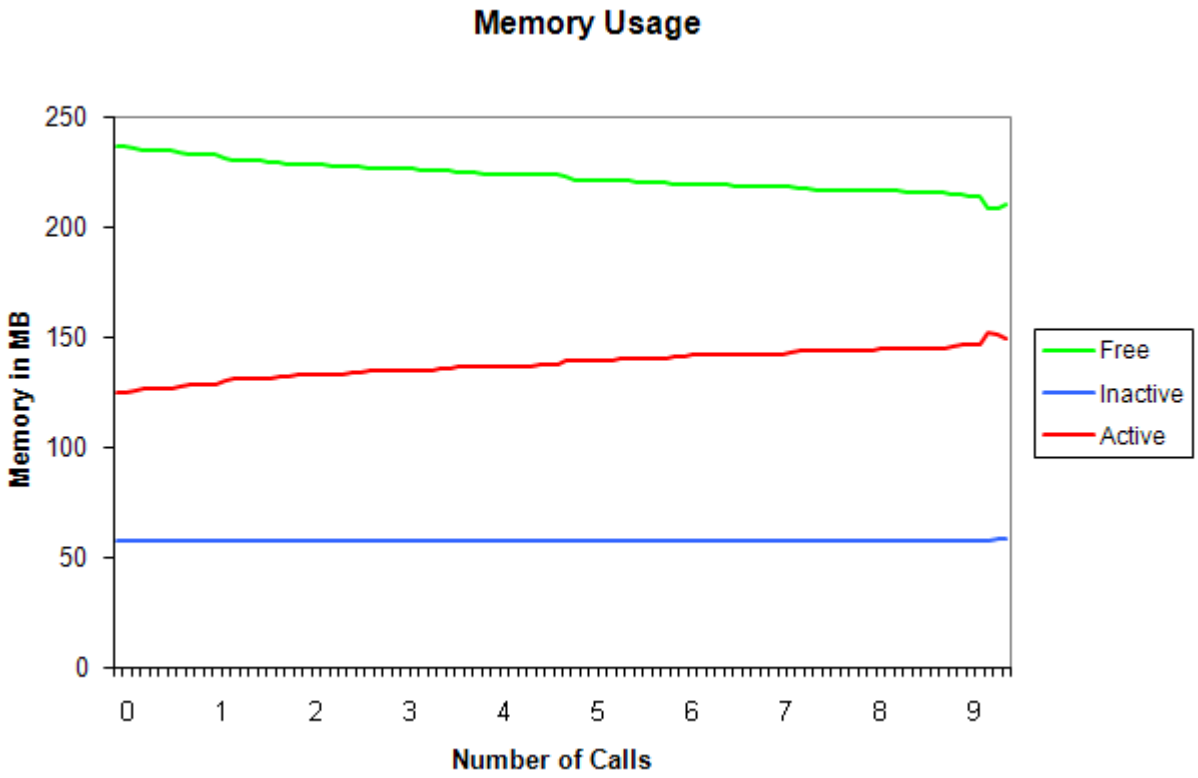
Test 6: g711 transcoded to iLBC with Call Recording

This test proved as a difficult task for the machine too. Like g711 to g729 with Call Recording we got a small number of calls due to the heavy CPU usage.

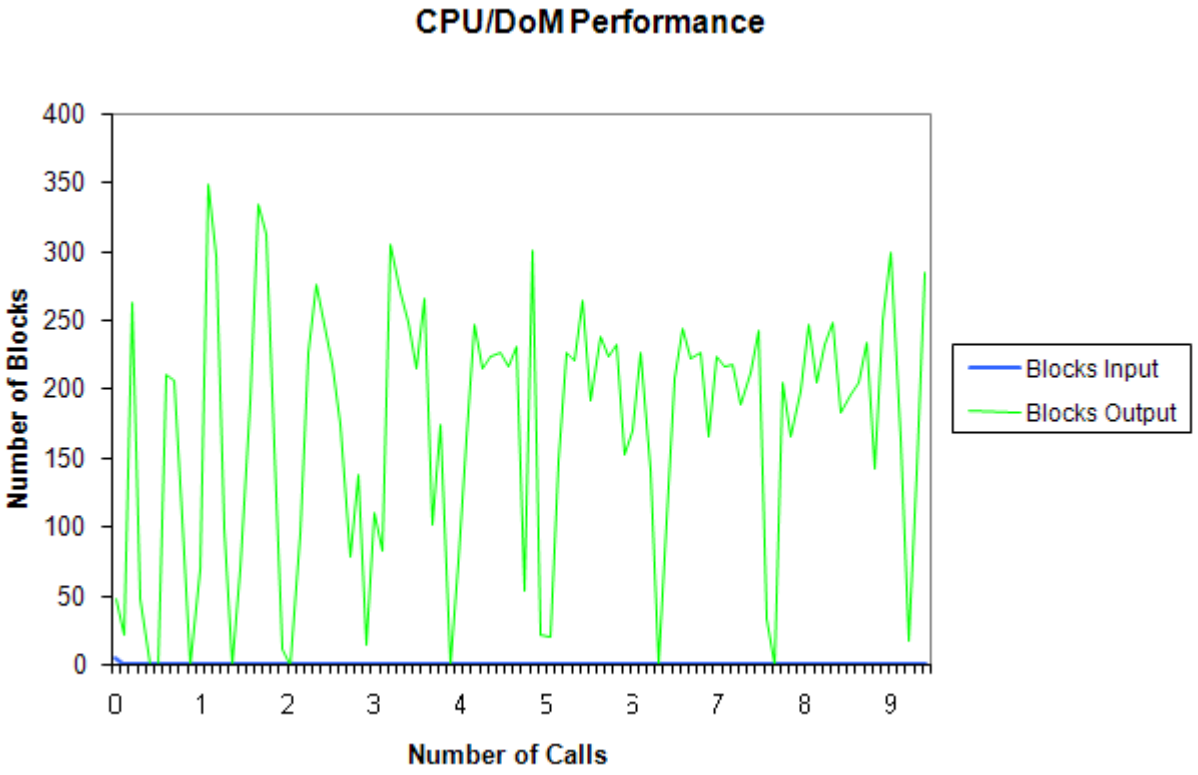
Resulting diagrams are as follows:



Picture 6.1



Picture 6.2



Picture 6.3

Test 6: Conclusion

Like previous test with transcoding, this one proved stressful for the machine too. Although we managed to make several calls more, this is still the least recommended way of officeBOX usage. It can lead to a machine blocking which would require restarting the PBXware and in worst case rebooting the machine.

With 9 calls we have 100% CPU usage, and we get 80% recommended with 7 calls. Also 7 calls are using 135MB of memory.

With 3 calls we have our designated 40% usage and 130MB of memory usage.

7 calls statistics:

- 78 – 83 % CPU usage
- 135 MB of memory used
- Almost none of data is read from the DoM
- 100 – 350 blocks written to DoM
- Machine is working but additional calls are not recommended

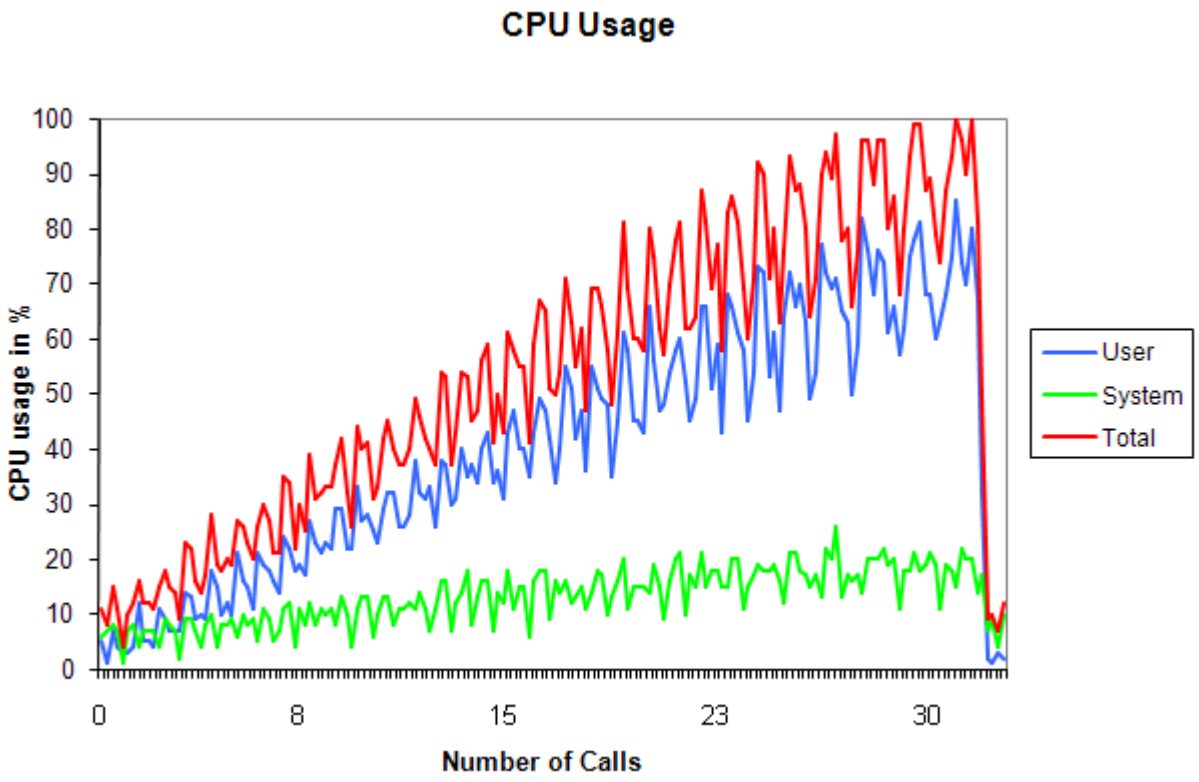
3 calls statistics:

- 40 – 44 % CPU usage
- 130 MB of memory used
- Almost none of data is read from the DoM
- 100 – 350 blocks written to DoM
- Working

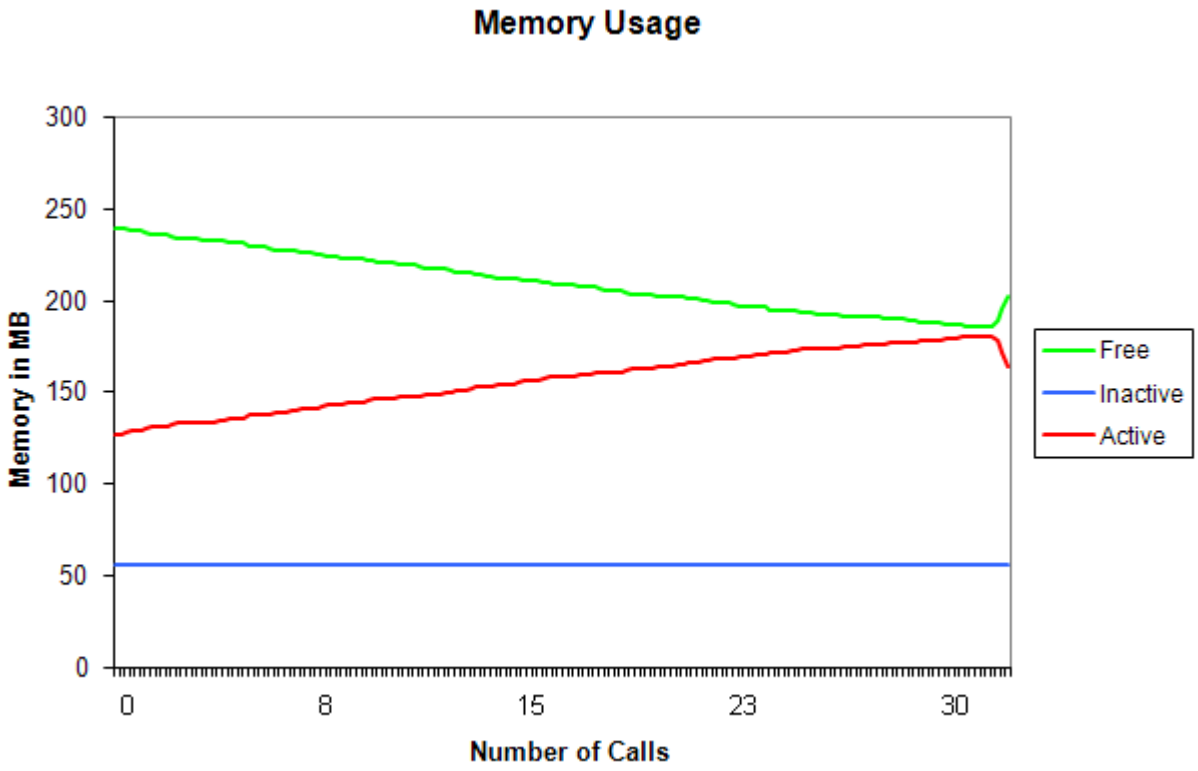
Test 7: g711 transcoded to GSM

g711 transcoding to GSM test is similar to the previous transcoding tests but with this test we got better performance which is confirmed with 30 calls that we made.

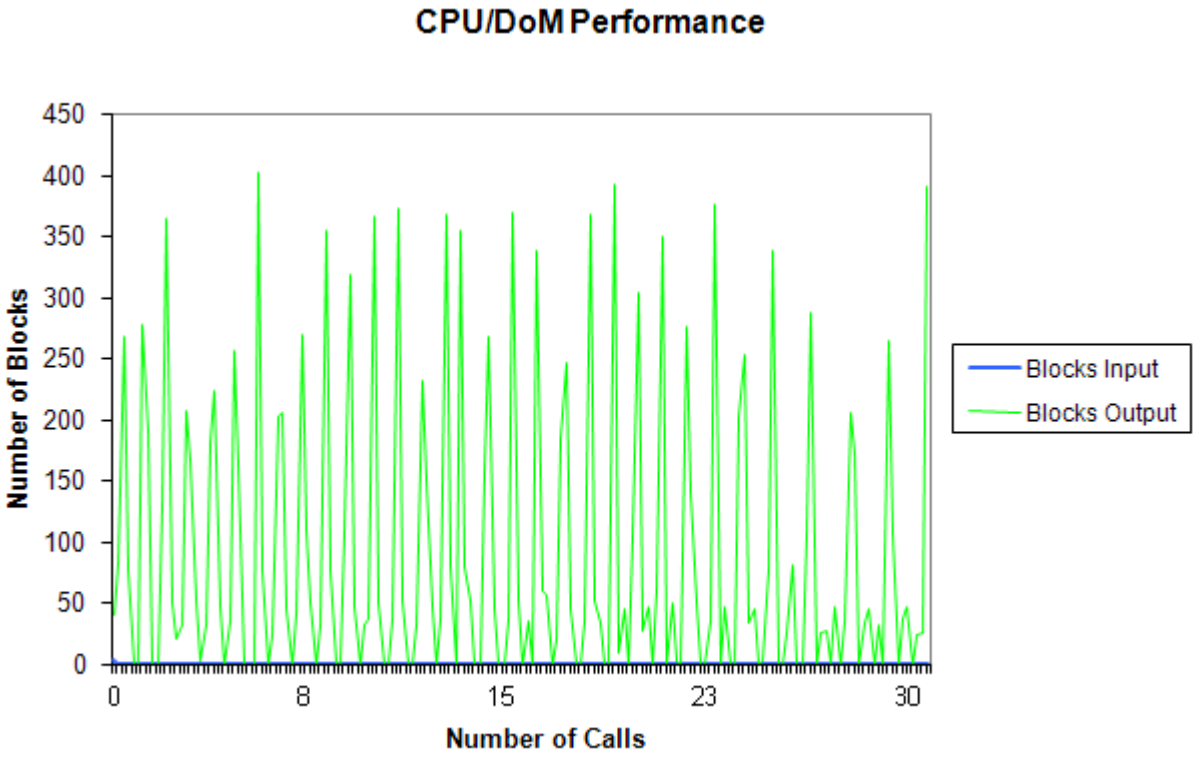
Resulting diagrams are as follows:



Picture 7.1



Picture 7.2



Picture 7.3

Test 7: Conclusion

When comparing this test to the previous ones we see that transcoding from g711 to GSM is a little less CPU consuming and we see that we managed to make 30 calls, although not recommended.

With 30 calls we have 100% CPU usage, and we get 80% recommended with 23 calls. Also 23 calls are using 160MB of memory.

With 12 calls we have our designated 40% usage and 140MB of memory usage.

We see that if there is a need for a transcoding, this is the most suitable combination.

23 calls statistics:

- 80 – 85 % CPU usage
- 160 MB of memory used
- Almost none of data is read from the DoM
- 50 – 400 blocks written to DoM
- Machine is working but additional calls are not recommended

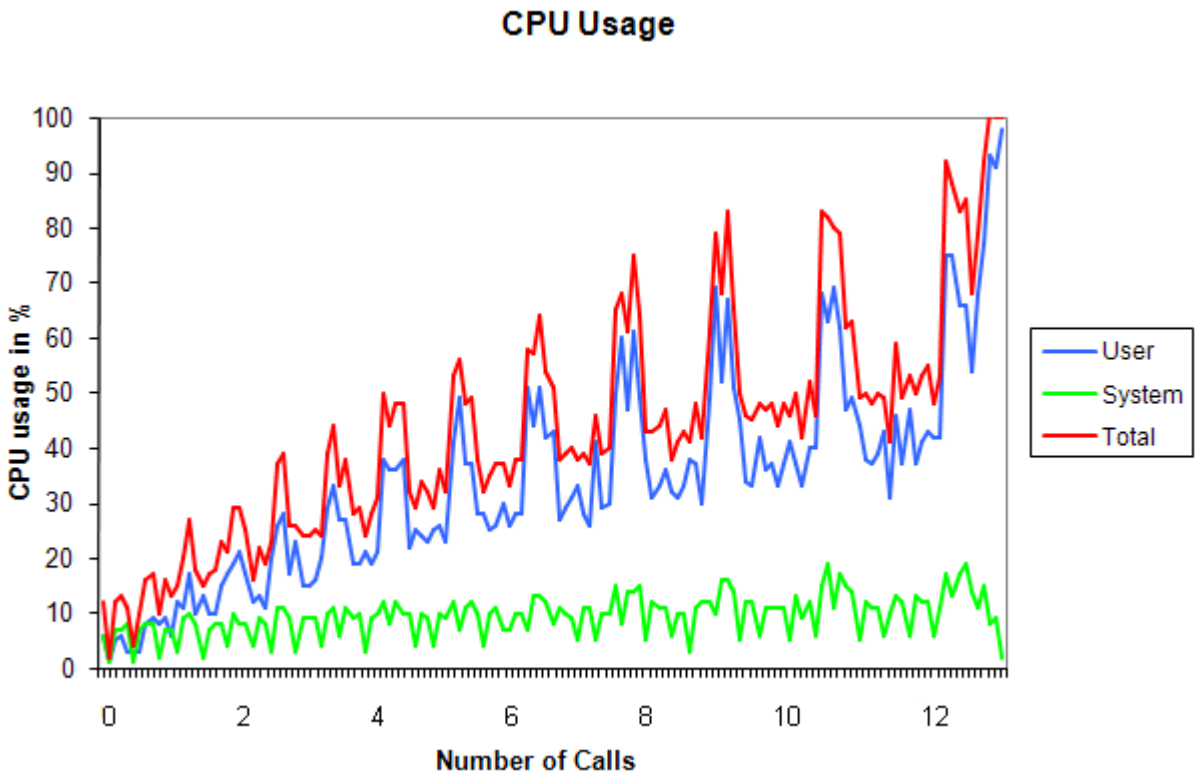
12 calls statistics:

- 40 – 45 % CPU usage
- 140 MB of memory used
- Almost none of data is read from the DoM
- 50 – 400 blocks written to DoM
- Working

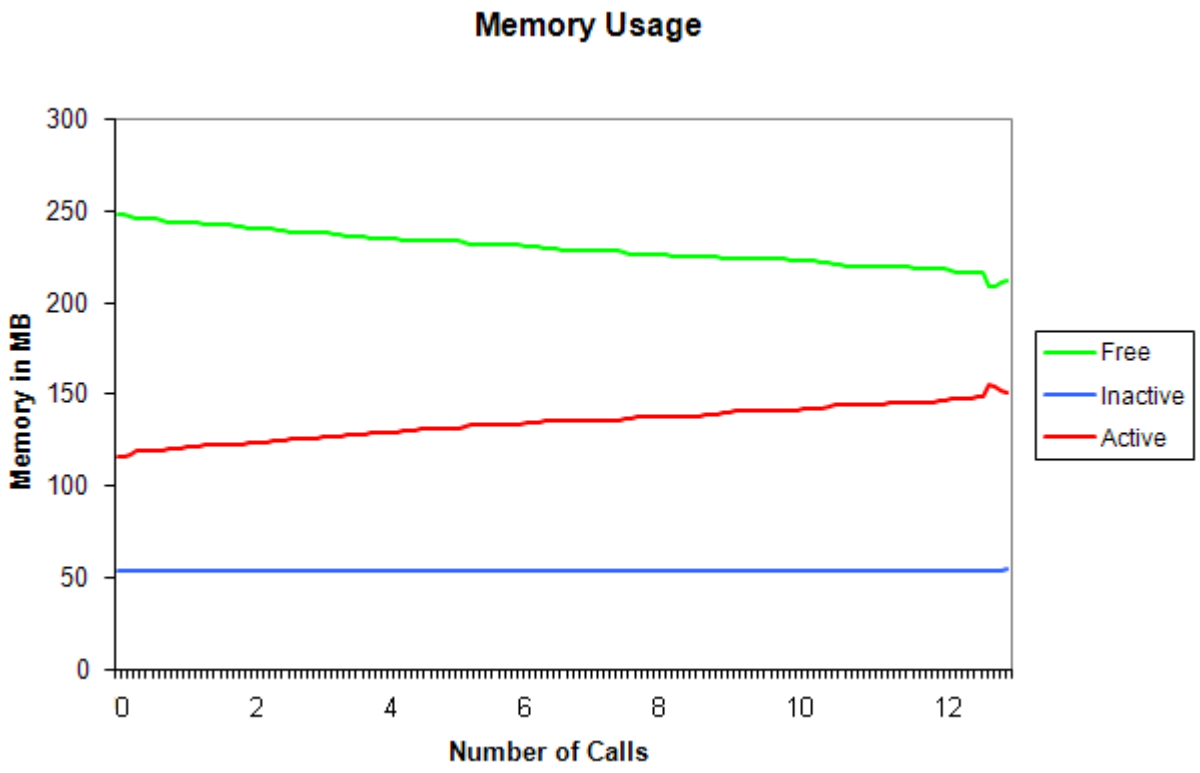
Test 8: g711 transcoded to GSM with Call Recording

Like the previous test, this one uses transcoding from g711 to GSM but with Call Recording turned on and results are similar to previous ones.

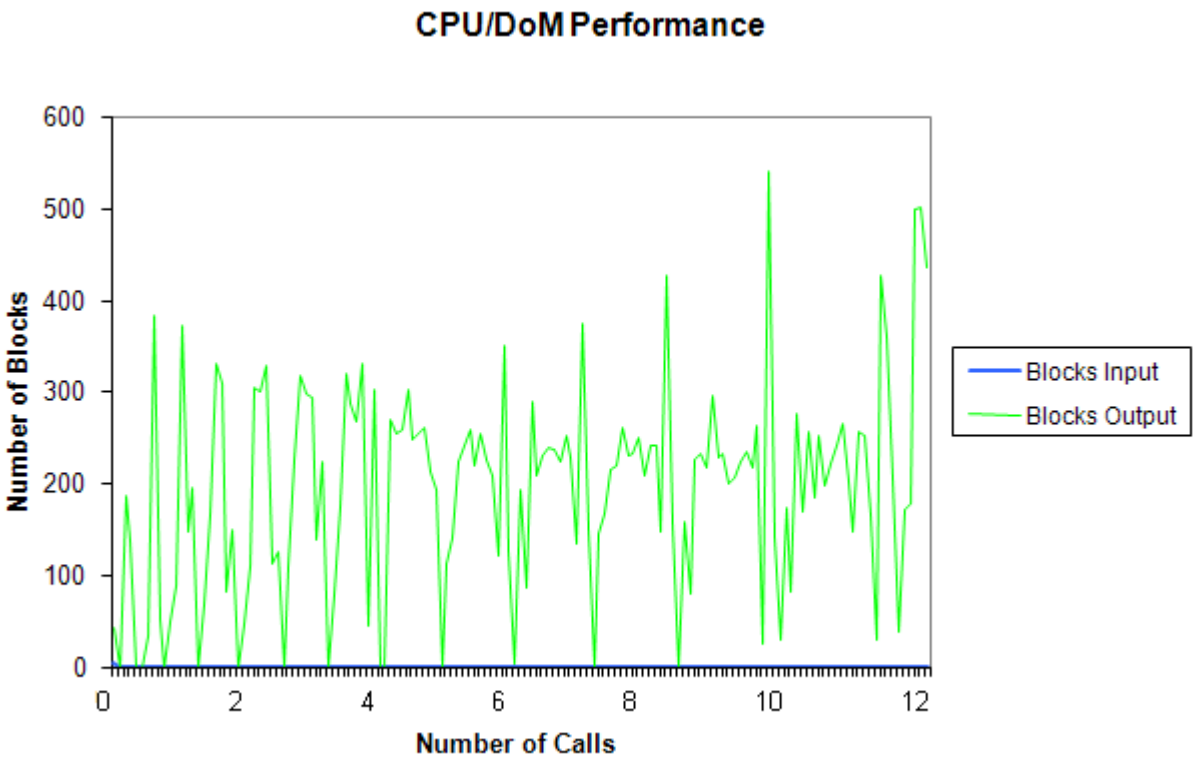
Resulting diagrams are as follows:



Picture 8.1



Picture 8.2



Picture 8.3

Test 8: Conclusion

This test like all transcoding tests with Call Recording, shows that this kind of usage is not recommended. Although this transcoding test showed improved performance, with Call Recording it is still very CPU intensive and dangerous for normal day usage.

With 12 calls we have 100% CPU usage, and we get 80% recommended with 10 calls. Also 10 calls are using 135MB of memory.

With 5 calls we have our designated 40% usage and 120MB of memory usage.

This test also was using DoM more then all others.

10 calls statistics:

- 80 – 84 % CPU usage
- 135 MB of memory used
- Almost none of data is read from the DoM
- 100 – 500 blocks written to DoM
- Machine is working but additional calls are not recommended

5 calls statistics:

- 40 – 45 % CPU usage
- 120 MB of memory used
- Almost none of data is read from the DoM
- 100 – 500 blocks written to DoM
- Working

SIP Testing Comparison

	CPU Usage		Memory Usage		DoM Performance (blocks written)
	40%	80%	40% calls	80% calls	
Test 1	50 calls	100 calls	170 MB	280 MB	25 – 200 blocks
Test 2	6 calls	13 calls	125 MB	150 MB	50 – 350 blocks
Test 3	7 calls	14 calls	140 MB	150 MB	25 – 200 blocks
Test 4	5 calls	9 calls	140 MB	145 MB	50 – 250 blocks
Test 5	5 calls	12 calls	130 MB	140 MB	100 – 350 blocks
Test 6	3 calls	7 calls	130 MB	135 MB	100 – 350 blocks
Test 7	12 calls	23 calls	140 MB	160 MB	50 – 400 blocks
Test 8	5 calls	10 calls	120 MB	135 MB	100 – 500 blocks

Results Comparison

Analysing all the gathered data we can state several conclusions.

First of all, when making SIP calls on the officeBOX the best and recommended codec for usage is g711. It is not CPU intesive and one can make up to 100 calls without any problems. Also it is the default one used.

When the transcoding from one codec to another is needed, then we are really stressing the machine because the transcoding process is very CPU demanding, and when the Call Recording feature is turned on, we really have a problem.

Comparing the three codecs used in the transcoding tests, we see that the last one, g711 to GSM transcoding is the least demanding one and can give up to 23 calls with 80% CPU usageand 12 calls with 40%. But it is writting more to the DoM then the rest are.

When Call Recording is turned on we have real problem for the CPU. Even with only g711 calls it is on 100% usage with 16 calls. 13 calls are 80% and 6 calls are 40%, and when this feature is combined with transcoding we see that this is the least recommended method for usage. CPU hits 100% usage very fast and after that it is blocking PBXware which must be restarted.

Overall conclusion is that the transcoding shouldn't be used on the officeBOX machine, and that the Call Recording feature shouldn't be used on all calls too.

Chapter 3:
Testing with various cards

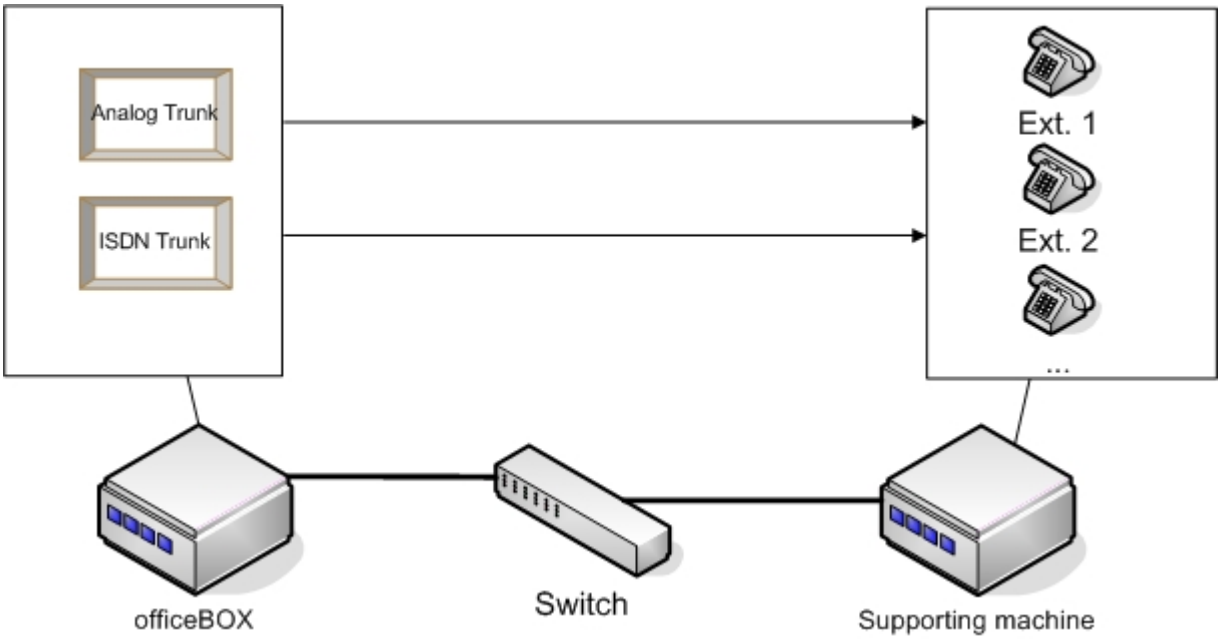
Setup

Second set of tests was done in order to determine the possible compatibility issues of the officeBOX machine with various additional cards connected, which were used for analog, ISDN and T1/E1 calls. Also we wanted to test machines performance when utilising this additional features.

For this testing we used additional supporting machine which would serve as a "sink" for the calls that we make on our tested machine. On the tested machine we were making SIP calls to two numbers which were then directed through two trunks, one using analog channels of some additional device and the other one using ISDN channels of some additional device. On the supporting box we created as much extensions as it would be needed to accept all the incoming calls, which were then directed to the IVR.

In order for the calls to be dialed from the tested machine, analog cards had to be setup with FXO channels and the ISDN cards had to be setup with TE channels. On the supporting machine analog cards were setup with FXS channels and ISDN cards were setup with NT channels.

Simplified setup is presented on the following picture.

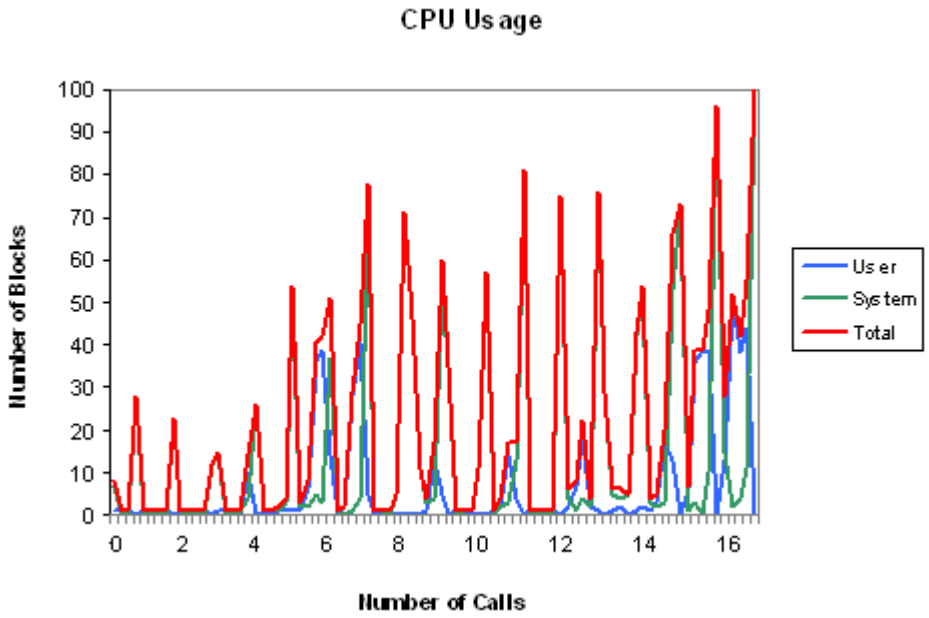


Picture D.

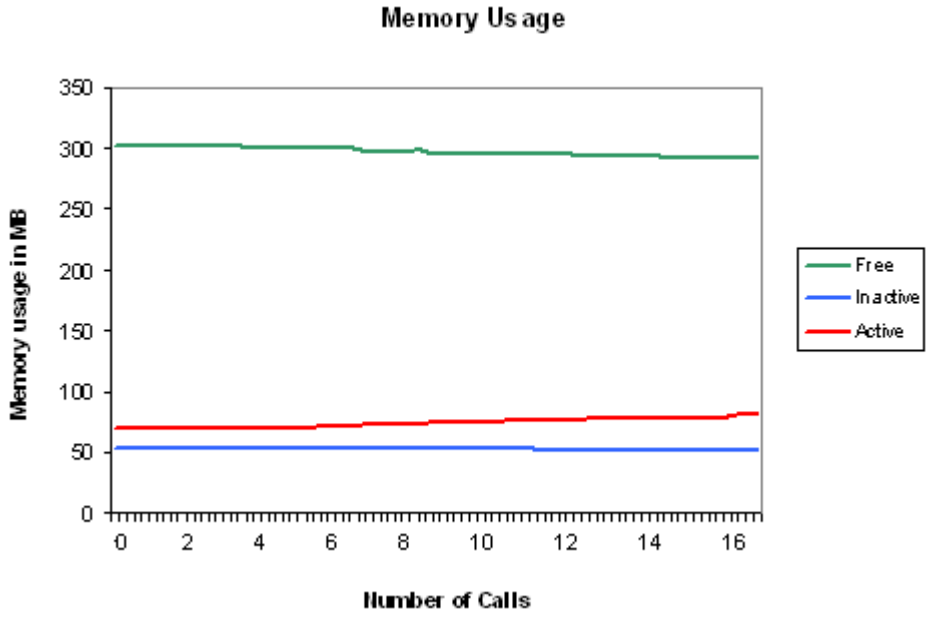
Test 1: Two Digium TDM800P cards

Digium TDM800P analog card has 8 lines thus can be used to create up to 8 calls. Because we inserted two of these in officeBOX we had total of 16 analog lines.

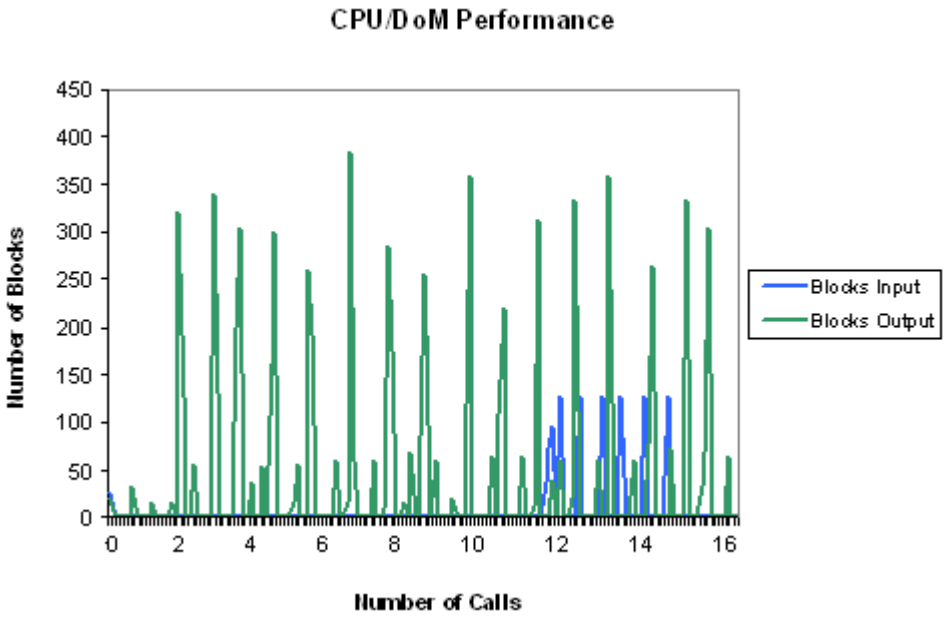
Resulting diagrams are as follows:



Picture 1.1



Picture 1.2



Picture 1.3

Test 1: Conclusion

First test, like stated, was done with two Digium TDM800P analog cards which have 8 channels each, and that means that we had made 16 analog calls, but because we started every call as a SIP call that is trunked through the analog (or later ISDN) line, total number of calls is double of that value. Also, all the tests in this set are like this one, meaning that the total number of calls is always double of the starting figure, which is a good thing because it is closer to a real life situation, and it is better for testing for posible compatibility issues.

TDM800P cards are working perfectly. There are no compatibility problems and they are automaticaly detected when the machine boots up. PBXware detects them and configures them properly. It is up to the end user to configure them for their own purpose.

32 calls statistics:

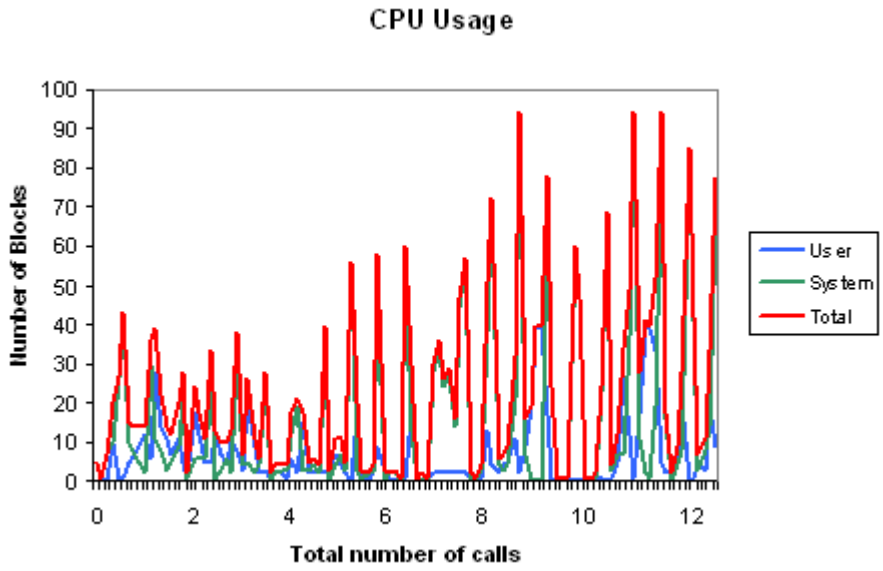
- 40% average CPU usage
- 90% peak CPU usage
- 75 MB of memory used
- Up to 100 blocks read from the DoM
- 50 – 350 blocks written to DoM
- Machine is working without any problem

Test 2: Digium TDM800P and two Trust MD-2100P

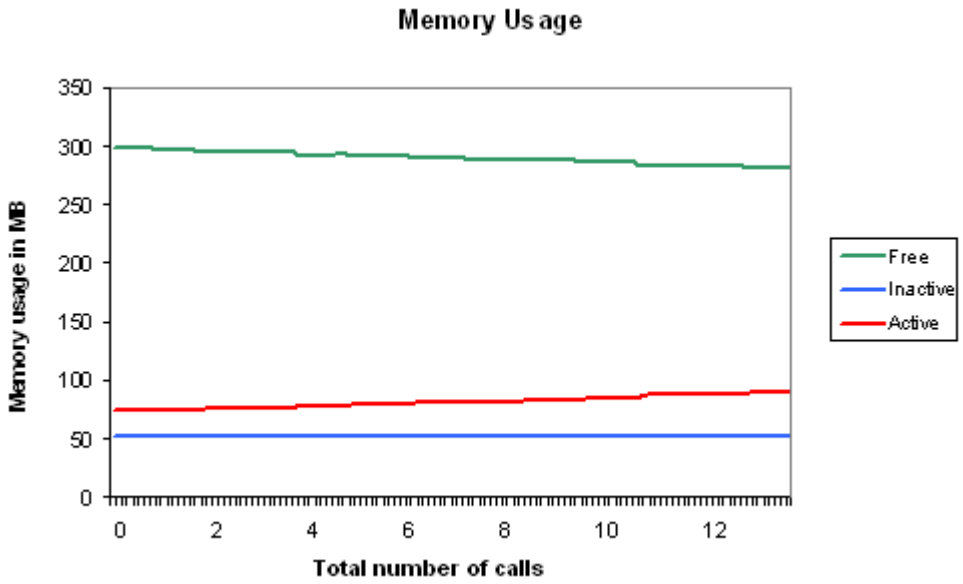
Digium TDM800P analog card has 8 lines thus can be used to create up to 8 calls.

Trust MD-2100P USB ISDN is a device which connects to the USB port and has one BRI channel which means that it can pass through 2 calls. In this testing we used two of these which means that we created 4 ISDN calls total.

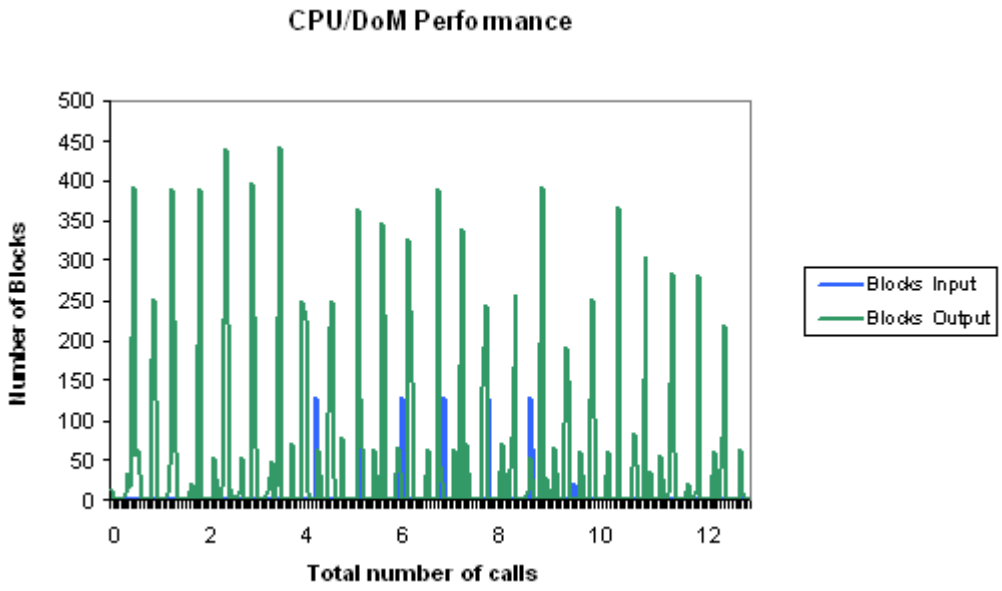
Resulting diagrams are as follows:



Picture 2.1



Picture 2.2



Picture 2.3

Test 2: Conclusion

With TDM800P we made 8 analog calls, and with two MD-2100P we made 4 ISDN calls. Like stated before, we were making SIP calls that got through analog and ISDN trunks. That means that we have total of 24 calls on our test machine.

This combination worked perfectly, after powering on the machine we only needed to cofigure the trunks which will be used and set the MD-2100P to TE mode.

24 calls statistics:

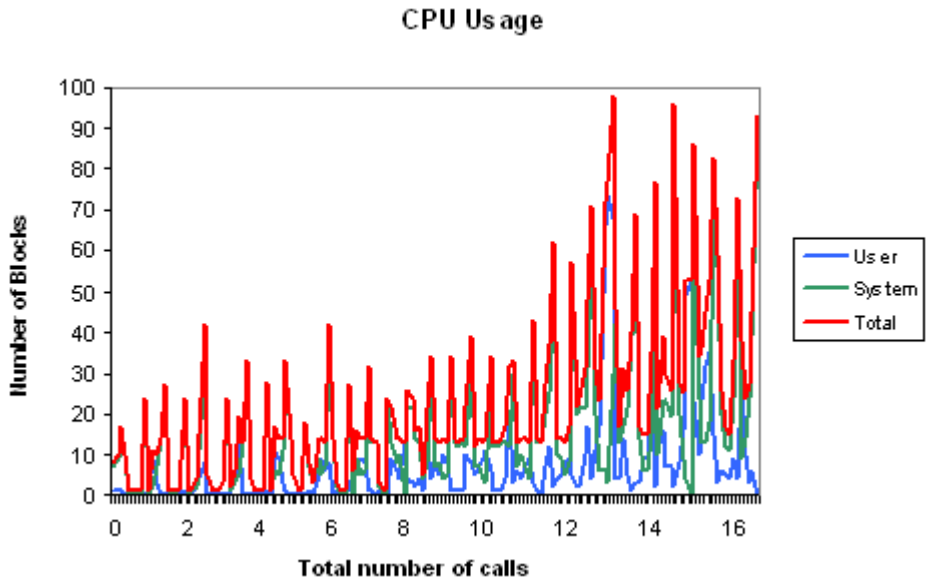
- Average 30 – 35 % CPU usage
- Peak 90 % CPU usage
- 75 MB of memory used
- Up to 100 blocks read from the DoM
- 50 – 400 blocks written to DoM
- Machine is working without any problem

Test 3: Digium TDM800P and Digium B410P

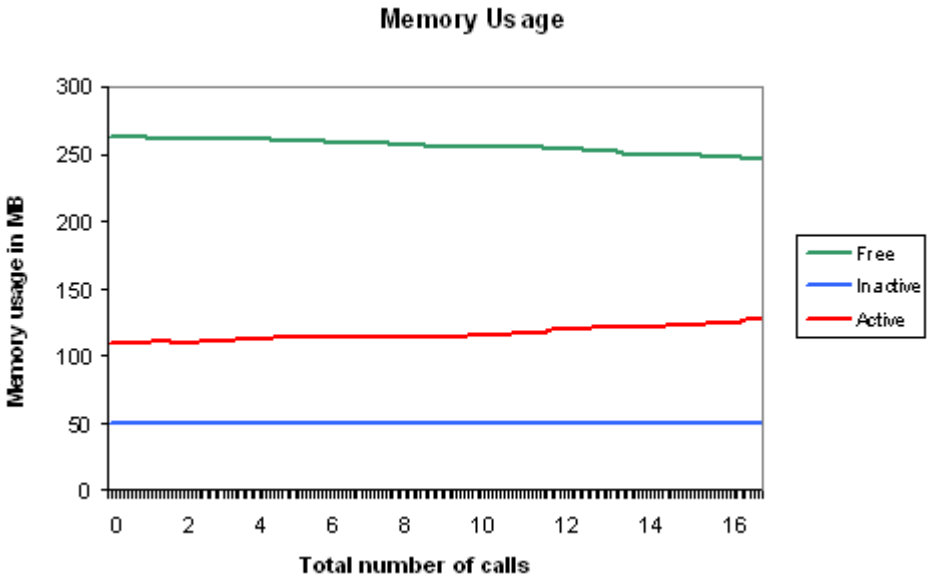
Digium TDM800P analog card has 8 lines thus can be used to create up to 8 calls.

Digium B410P ISDN card has 4 BRI channels which means that we are able to make 8 calls, and this means that we were able to make 16 calls in this test.

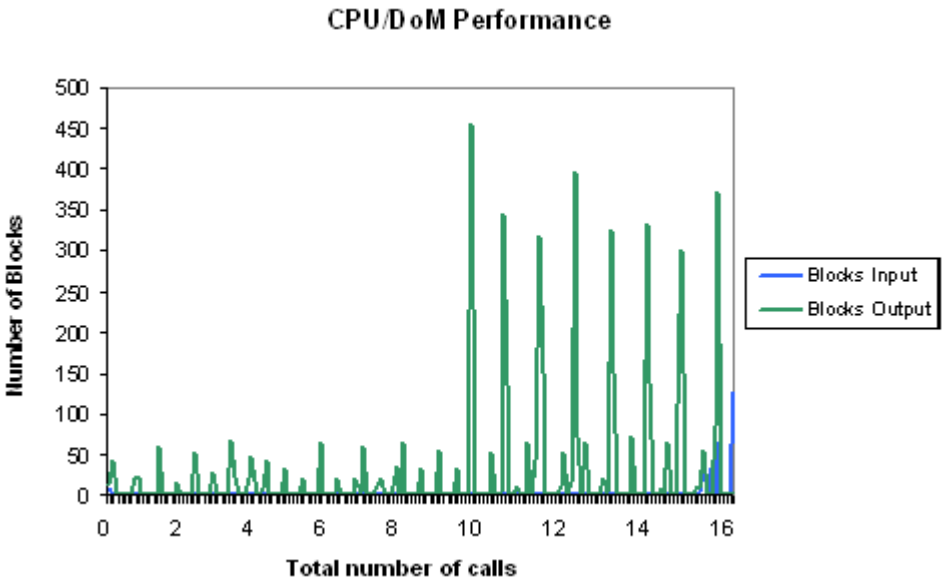
Resulting diagrams are as follows:



Picture 3.1



Picture 3.2



Picture 3.3

Test 3: Conclusion

This is a similar test like the previous one but instead two MD-2100P we used Digiums B410P ISDN card which has 4 ports and allows maximum of 8 calls. This means we had 16 calls, and counting in the starting SIP calls that is a total of 32 calls.

There are no compatibility problems, but it is important to check the jumpers on the B410P card. Before you insert it inside officeBOX, decision must be made on wheter the calls will go out through the trunks in which case you must set up the jumpers to TE mode, or the card will receive calls through extensions in which case you must set the jumpers to NT mode, and set the additional NT termination jumpers to on. If you fail to do this properly this configuration will not work, although the TDM800P will work without problems.

32 calls statistics:

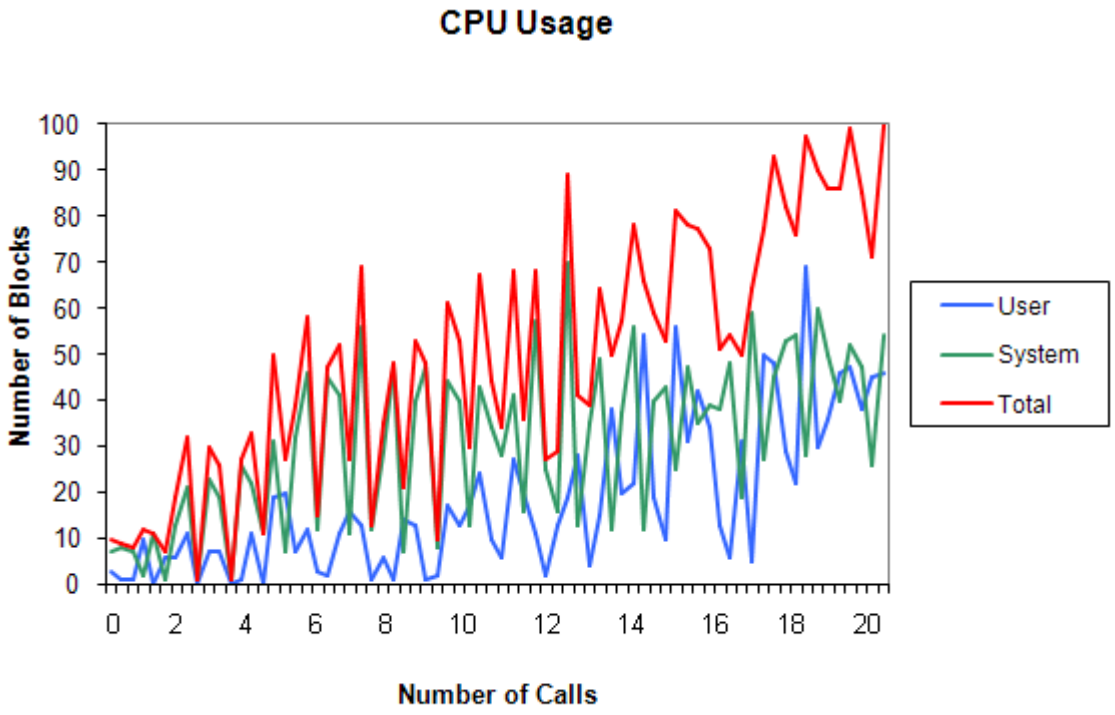
- Average 40 – 50 % CPU usage
- Peak 98 % CPU usage
- Average 120 MB of memory used
- Almost none of data is read from the DoM
- 50 – 450 blocks written to DoM
- Machine is working without problems

Test 4: Digium TE110P E1 mode and Digium TDM800P

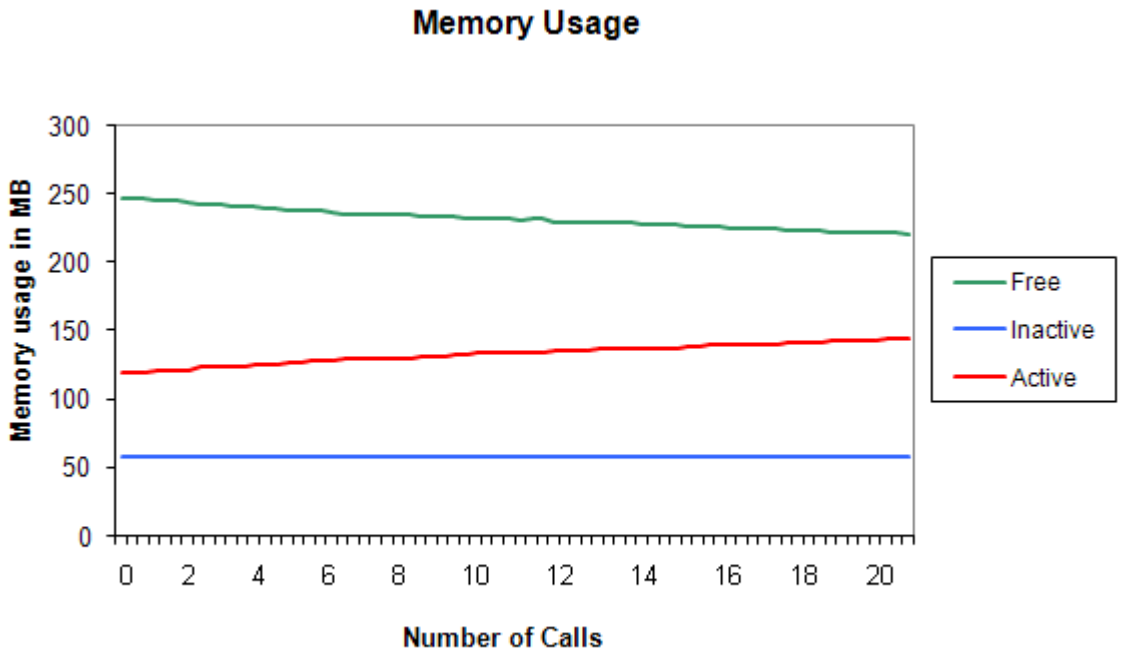
Digium TE110P is a T1/E1 card with 24 lines if in T1 mode and with 32 lines if in E1 mode.

Digium TDM800P analog card has 8 lines thus can be used to create up to 8 calls, but in total we were able to make 20 calls.

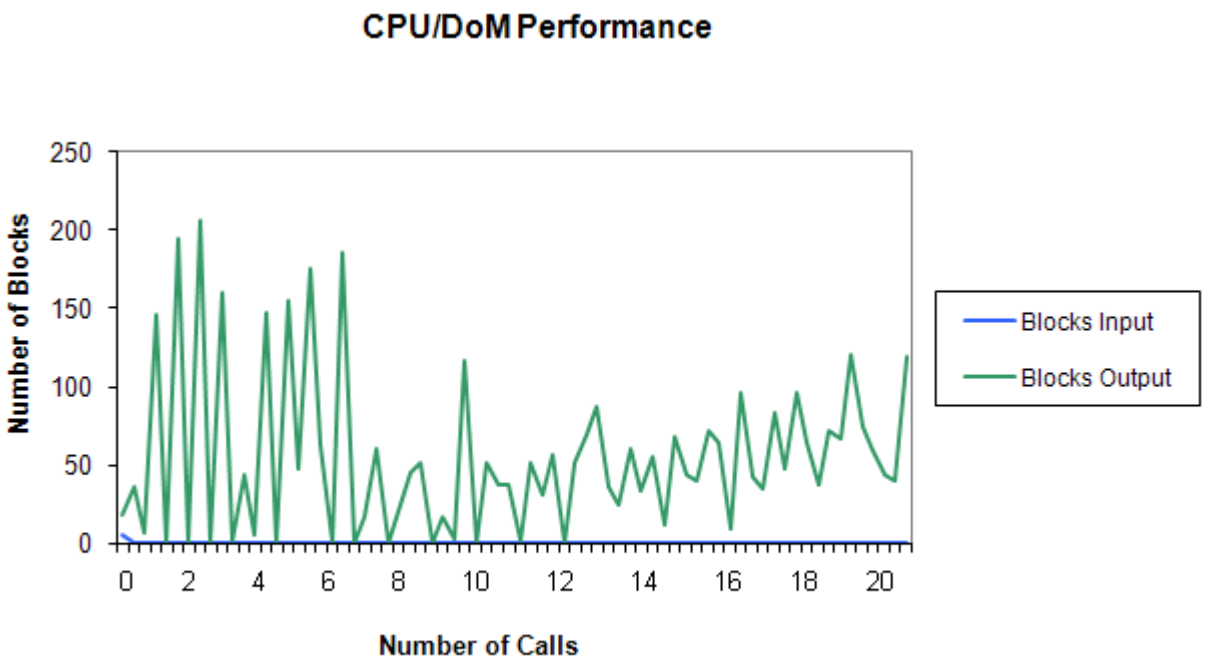
Resulting diagrams are as follows:



Picture 4.1



Picture 4.2



Picture 4.3

Test 4: Conclusion

This is the first test in which we were using the Digium TE110P card. This is a T1/E1 interface card which means it can work either in T1 or E1 mode. When in T1 mode it has 24 lines and in E1 mode it has 32 lines. Difference between the modes is insignificant, considering our usage statistics. This fact is seen in our tests where the mode doesn't really matter in the number of calls that are being made in all the further tests.

So in this tests we had 8 analog and made 12 E1 calls, accompanied with the same number of SIP calls which in total gave 40 calls.

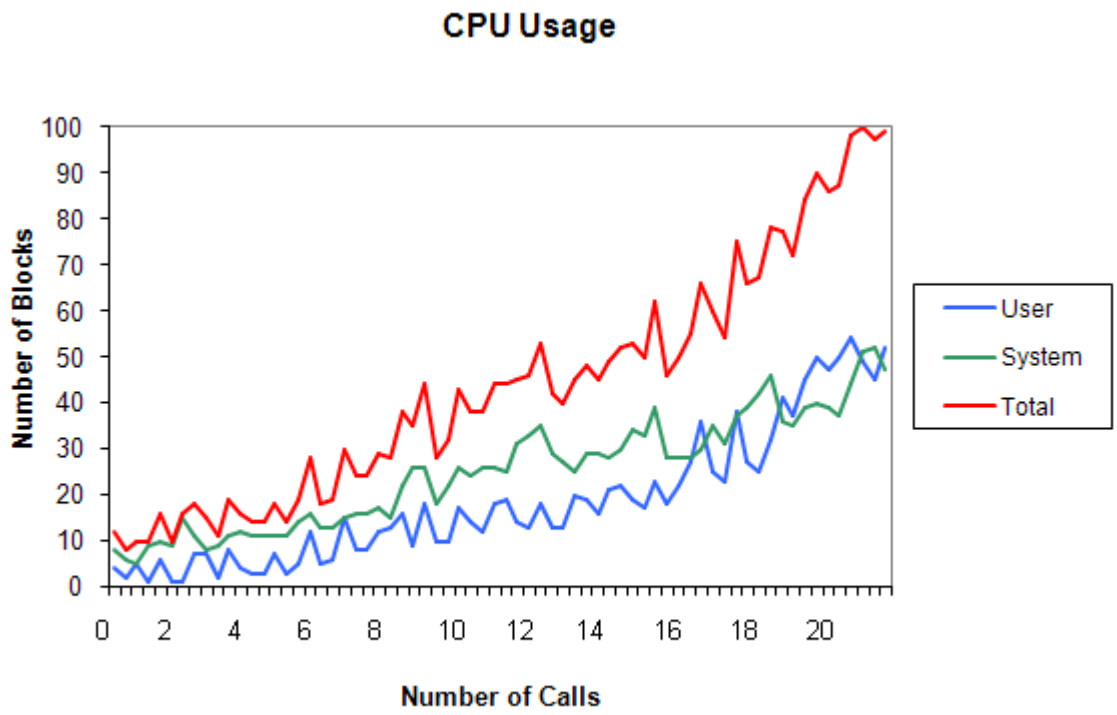
40 statistics:

- Average 78 % CPU usage
- Peak 98 % CPU usage
- Average 130 MB of memory used
- Almost none of data is read from the DoM
- 75 – 200 blocks written to DoM
- Machine is working without any problems as long as the 12 E1 calls are not exceeded

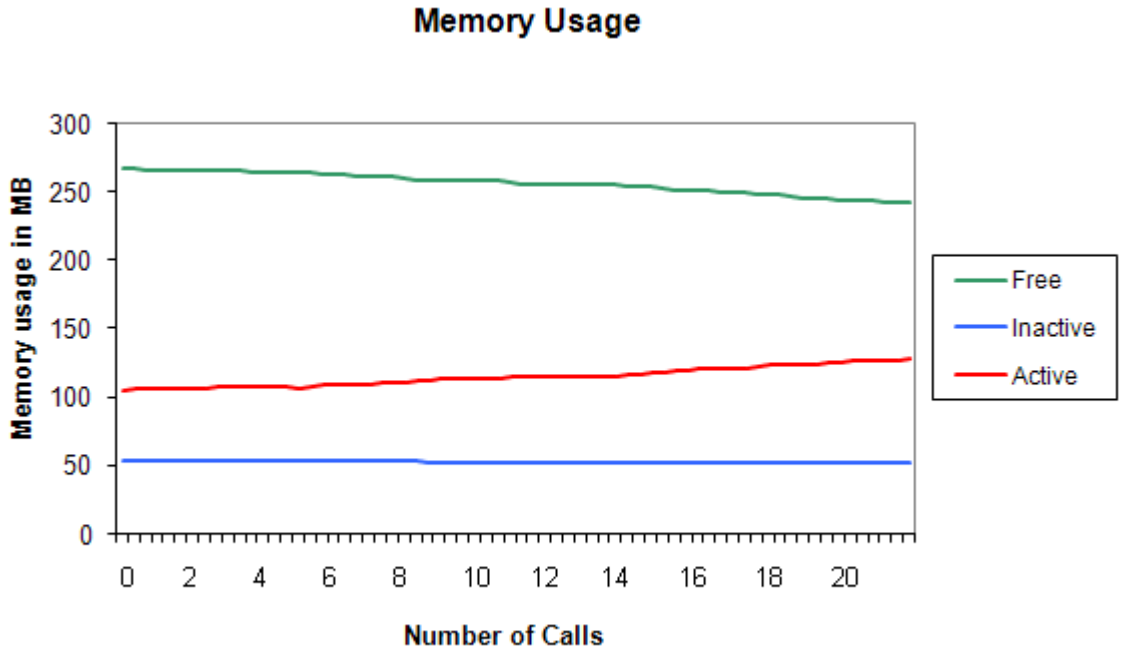
Test 5: Digium TE110P T1 mode and Digium TDM800P

In this test, we had the same setup as the previous test, only here Digium TE110P was working in the T1 mode with 24 lines. But like stated before, there isn't any difference concerning the usage statistics so like in previous test we were able to make 12 calls through the T1 lines.

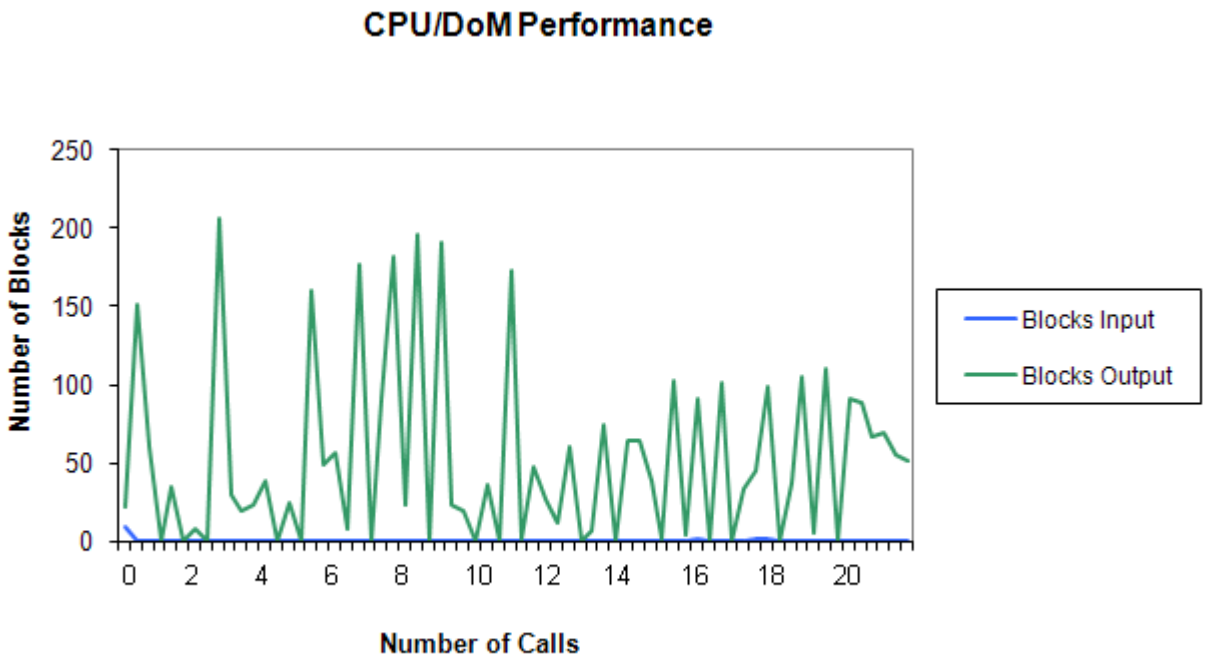
Resulting diagrams are as follows:



Picture 5.1



Picture 5.2



Picture 5.3

Test 5: Conclusion

T1 is using the u-law codec as opposed to the E1 a-law. Although the a-law codec provides more dynamic range then the u-law codec does, there is little difference between them which can be seen in our tests. Like the previous test where the card was in E1 mode, we were able to make 12 calls through the TE110P card in T1 mode.

We had 8 analog and 12 calls through T1 lines, but accompanied with 20 SIP calls that was a total of 40 calls.

40 calls statistics:

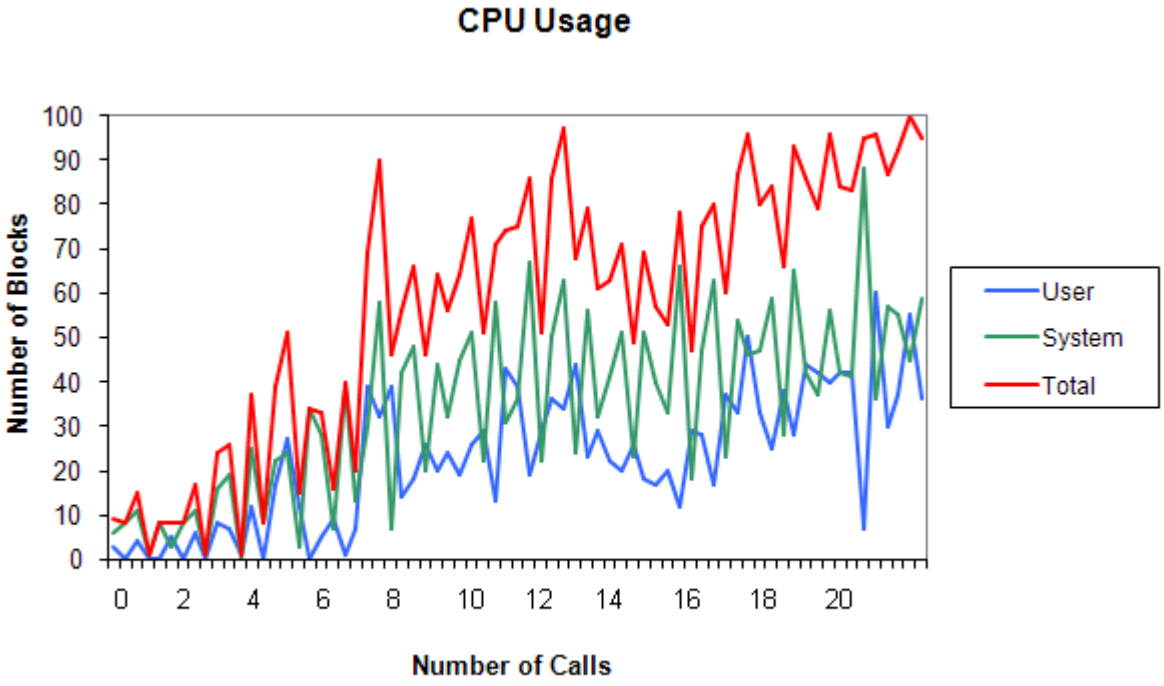
- Average 78 % CPU usage
- Peak 99 % CPU usage
- Average 120 MB of memory used
- Almost none read from the DoM
- 50 – 200 blocks written to DoM
- Machine is working without any problems as long as the 12 T1 calls are not exceeded

Test 6: Digium TE110P E1 mode, Digium TDM800P and Trust MD-2100P

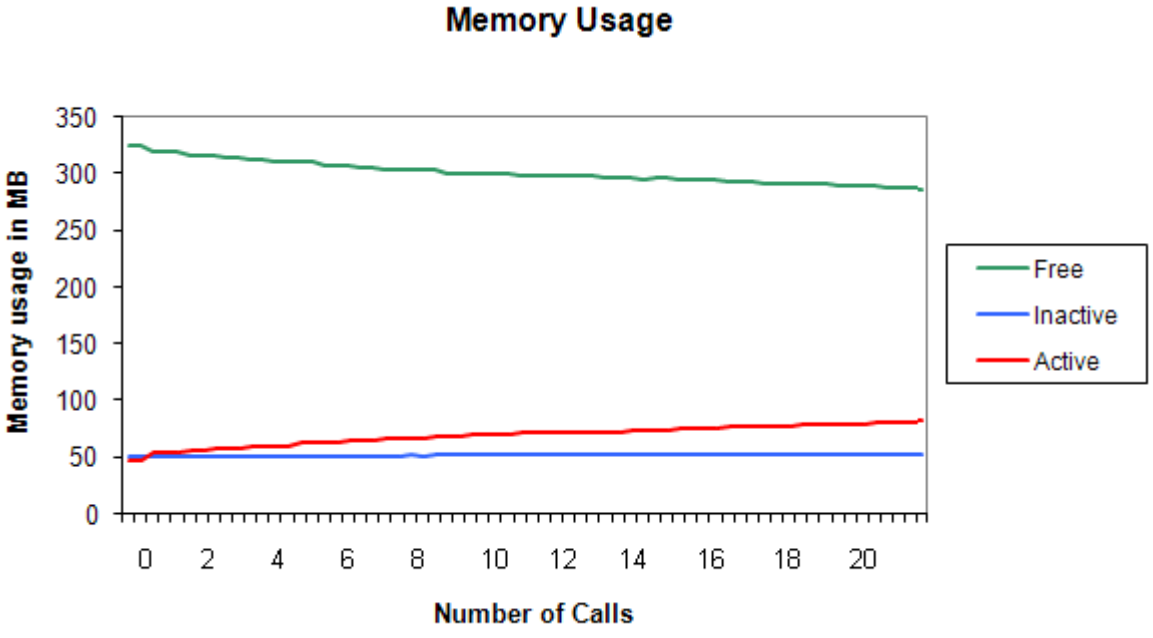
Here we had combination of Digium TE110P in the E1 mode, Digium TDM800P analog card with 8 calls being made, two MD-2100P USB ISDN devices which we used to make 4 calls with.

In this test we managed, besides using the full potential of TDM800P and MD-2100P, to make 8 calls through E1 lines.

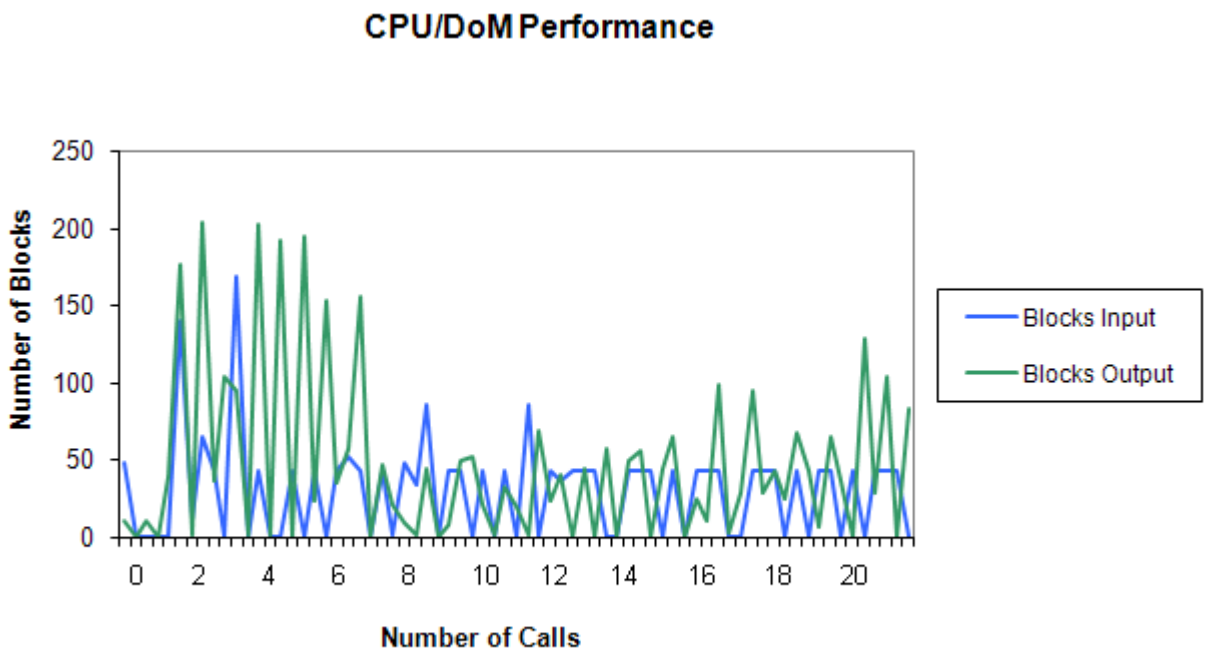
Resulting diagrams are as follows:



Picture 6.1



Picture 6.2



Picture 6.3

Test 6: Conclusion

The two MD-2100P devices had one port on them which means that we had 4 ISDN calls (2 per channel). With TDM800P we made 8 analog calls, and after them we managed to make another 8 calls through the E1 lines.

Of course, all these tests were done with as many calls possible but within the 80% CPU usage boundary.

We had 8 analog, 4 ISDN and 8 E1 calls and with 20 SIP calls that is a total of 40 calls.

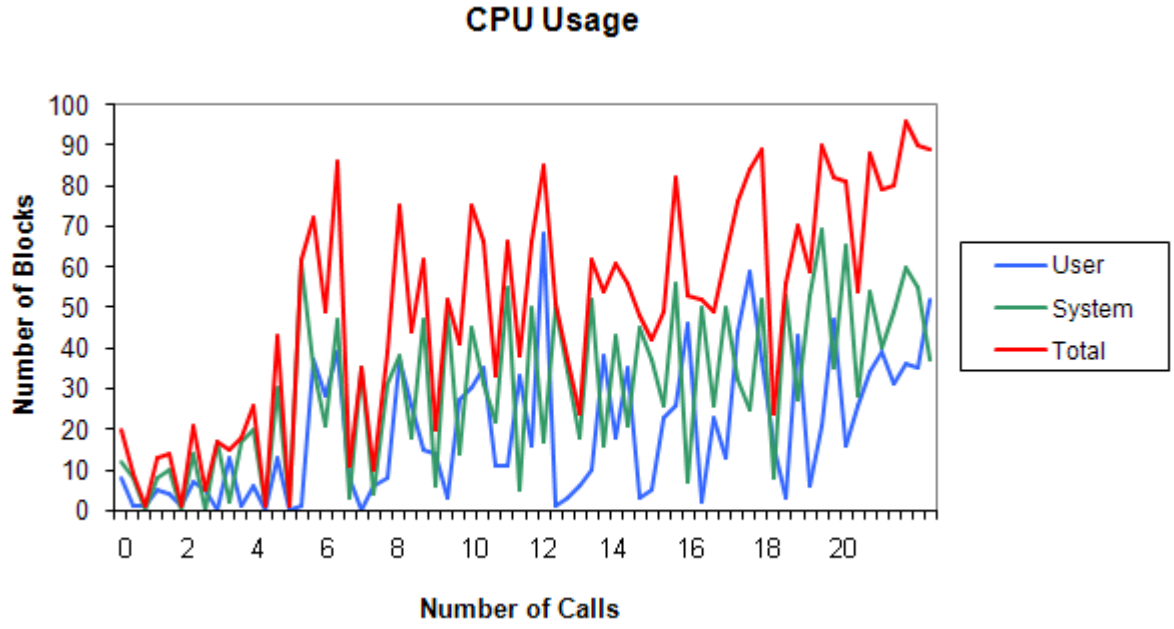
40 calls statistics:

- Average 80 % CPU usage
- Peak 99 % CPU usage
- Average 75 MB of memory used
- Up to 160 blocks read from the DoM
- 50 – 200 blocks written to DoM
- Machine is working without any problems as long as the 8 E1 calls are not exceeded

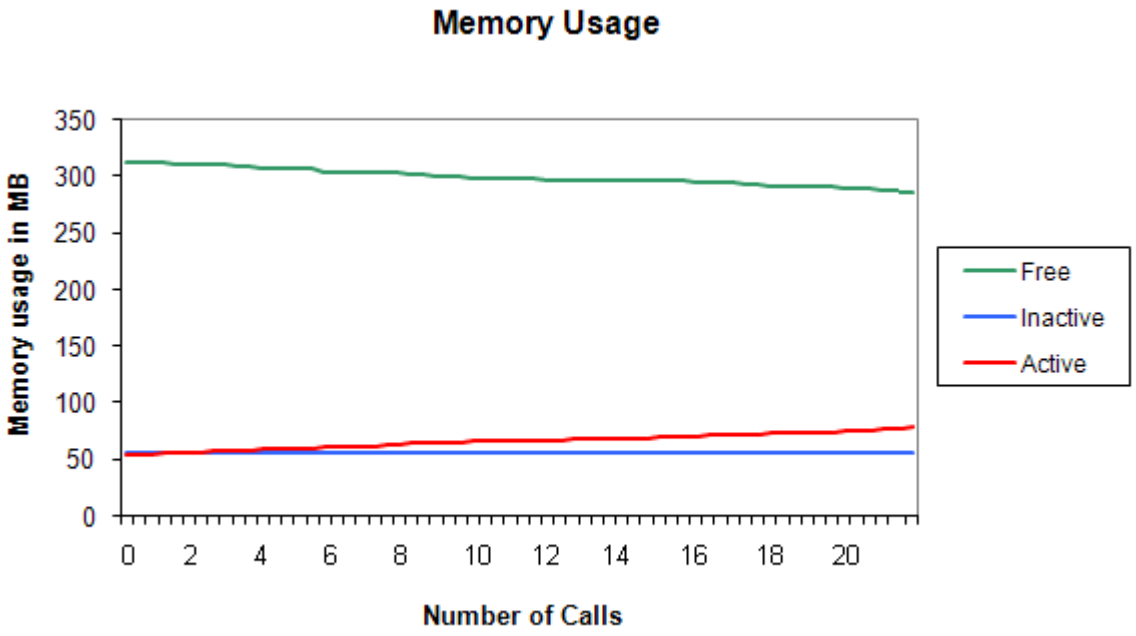
Test 7: Digium TE110P T1 mode, Digium TDM800P and Trust MD-2100P

In this test we have the same setup as in Test 6, but here Digium TE110P card is working in T1 mode and like in previous test we managed to make 8 calls through T1 lines.

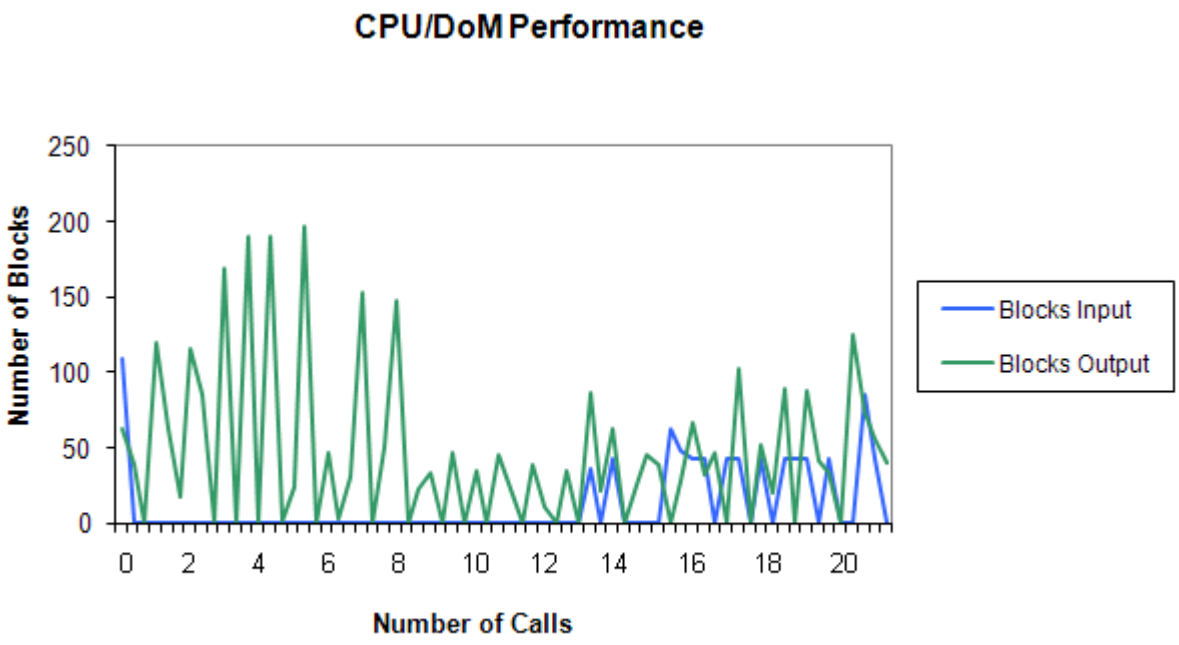
Resulting diagrams are as follows:



Picture 7.1



Picture 7.2



Picture 7.3

Test 7: Conclusion

TDM800P card gave us the ability to make 8 analog calls, MD-2100P devices gave us 4 ISDN calls and with them we managed to make 8 T1 calls.
With 8 analog, 4 ISDN we had 8 T1 and with 20 SIP calls that is a total of 40 calls.

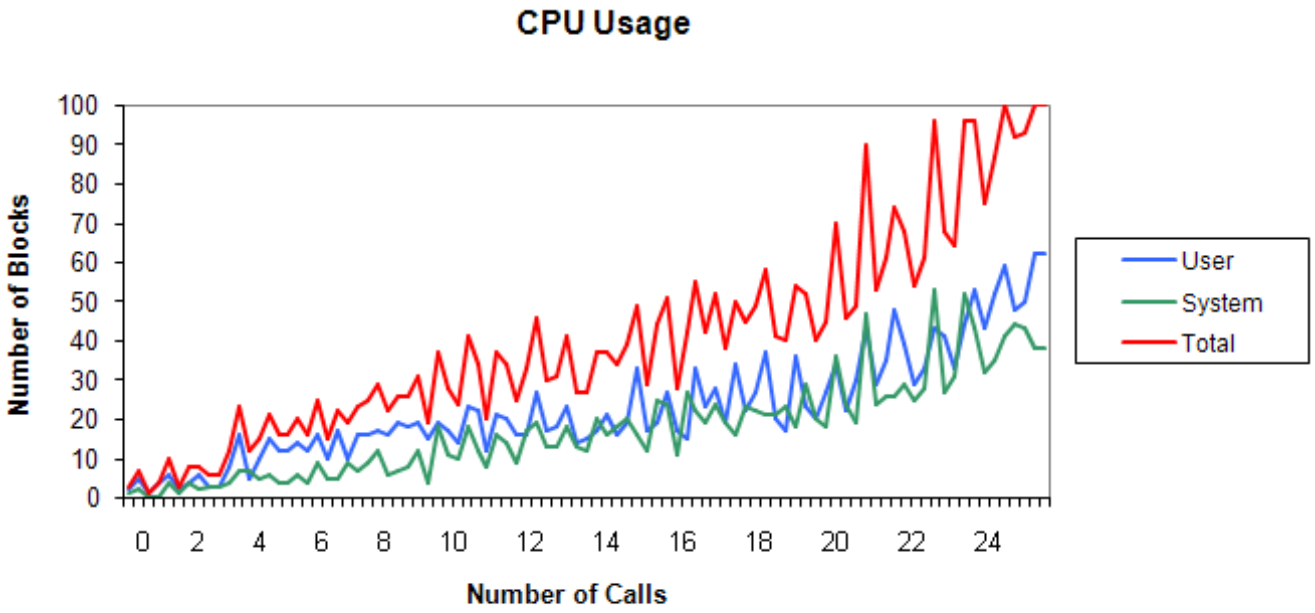
40 calls statistics:

- Average 80 % CPU usage
- Peak 96 % CPU usage
- Average 68 MB of memory used
- Up to 100 blocks read from the DoM
- 50 – 200 blocks written to DoM
- Machine is working without any problems as long as the 8 T1 calls are not exceeded

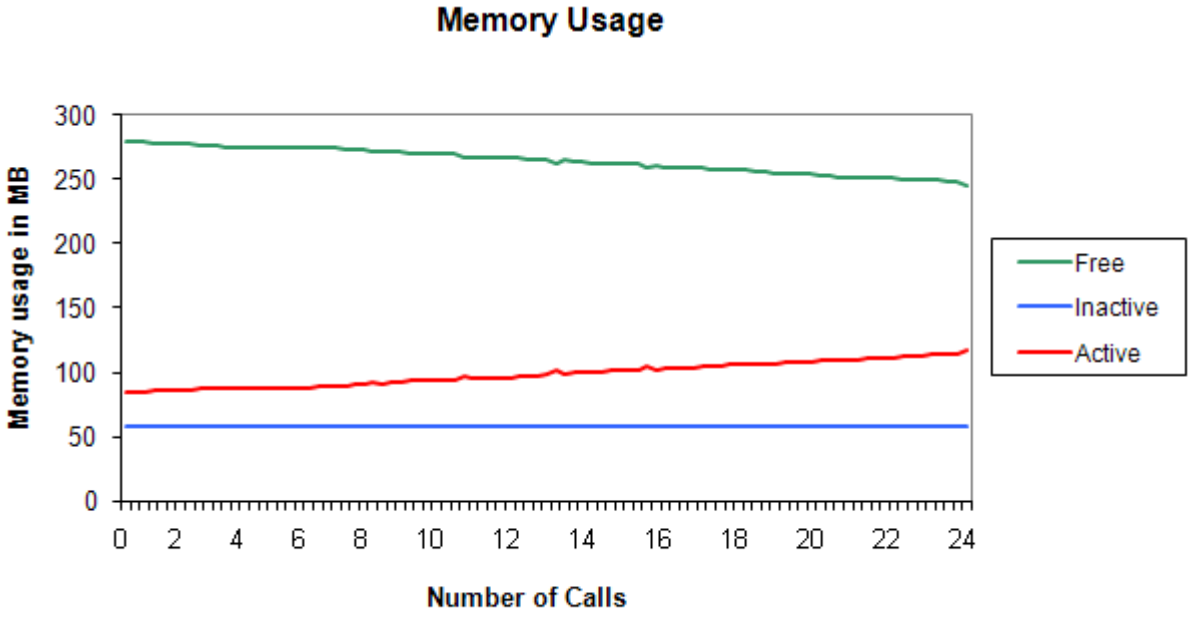
Test 8: Digium TE110P E1 mode and Trust MD-2100P

In this test we combined Digium TE110P in E1 mode with the Trust MD-2100P which gave us 4 ISDN calls. With such configuration we made 20 calls through E1 lines.

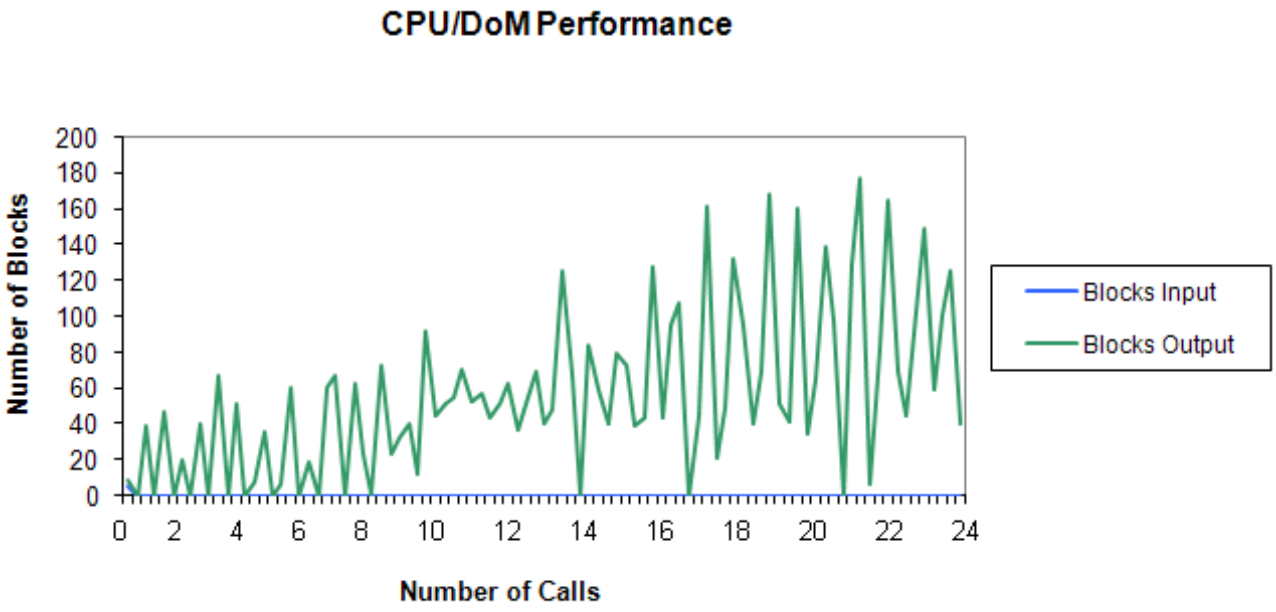
Resulting diagrams are as follows:



Picture 8.1



Picture 8.2



Picture 8.3

Test 8: Conclusion

Like stated, here we have two MD-2100P ISDN devices which gave us the ability to make 4 ISDN calls and Digium TE110P in E1 mode which we used to make 20 calls and everything within 80% boundary.

With 4 ISDN and 20 E1 calls, we had total of 48 calls – including the same number of accompanying SIP calls.

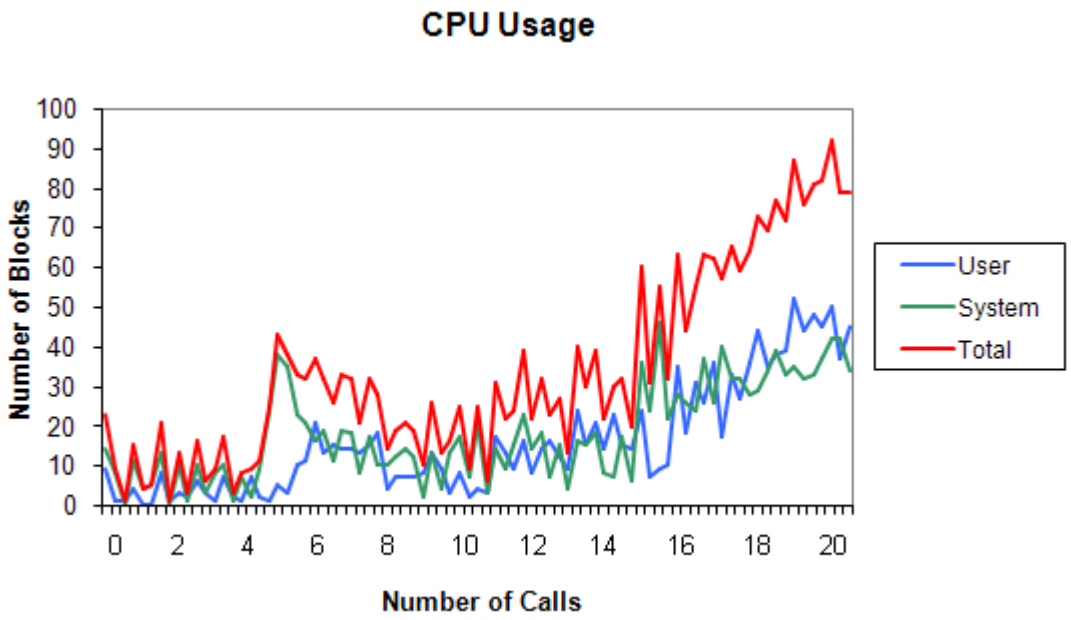
48 calls statistics:

- Average 80 % CPU usage
- Peak 100 % CPU usage
- Average 85 MB of memory used
- Almost none of data read from the DoM
- 20 – 180 blocks written to DoM
- Machine is working without any problems as long as the 20 E1 calls are not exceeded

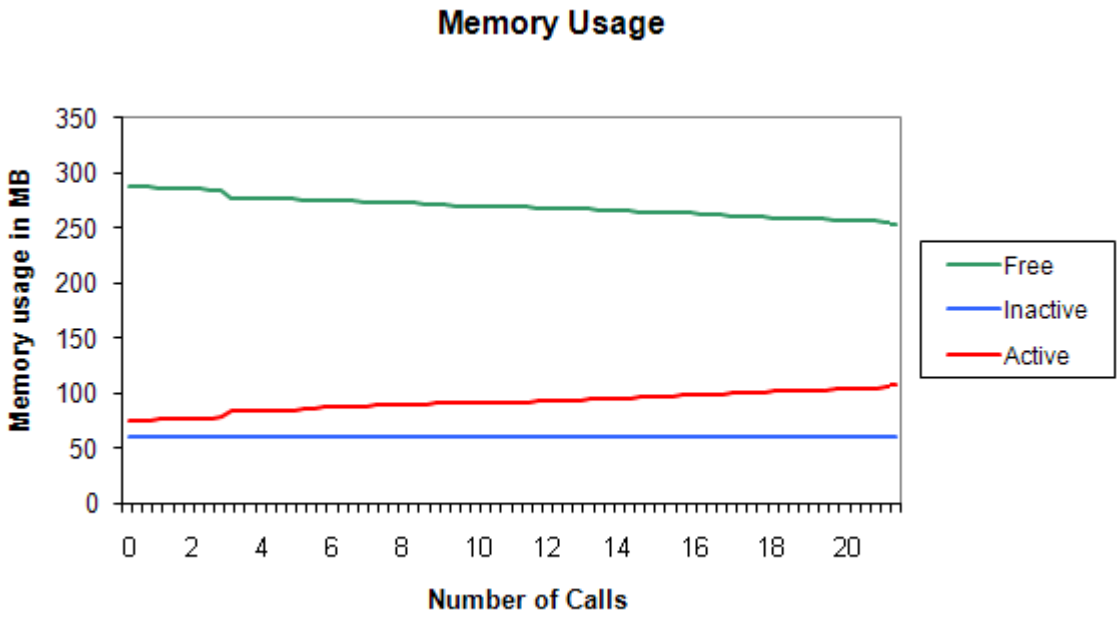
Test 9: Digium TE110P T1 mode and Trust MD-2100P

In this test we had the same stup as in previous test, and as in previous test we were able to make 20 calls through the T1 lines.

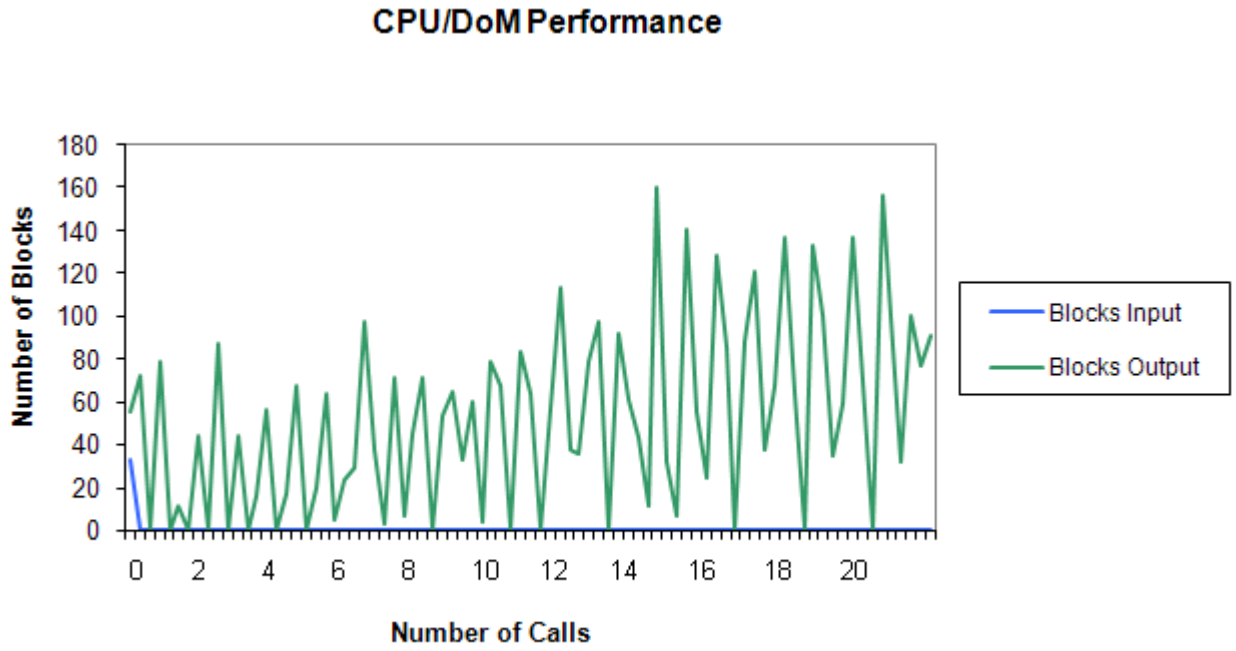
Resulting diagrams are as follows:



Picture 9.1



Picture 9.2



Picture 9.3

Test 9: Conclusion

Here we managed to make 20 calls through T1 lines, just like in previous test, and two MD-2100P provided us with 4 ISDN calls.
When we count in the 24 SIP calls we have the total of 48 calls being made on the machine.

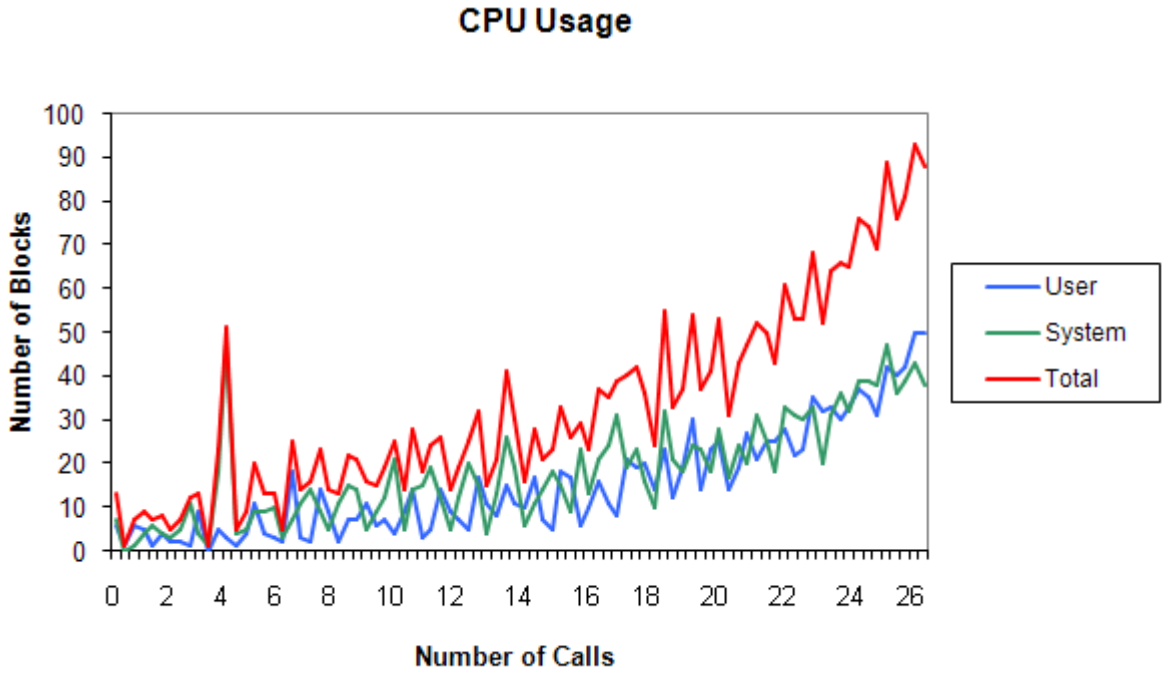
48 calls statistics:

- Average 81 % CPU usage
- Peak 92 % CPU usage
- Average 85 MB of memory used
- Almost none of the data is read from the DoM
- 40 – 160 blocks written to DoM
- Machine is working without any problems as long as the 20 T1 calls are not exceeded

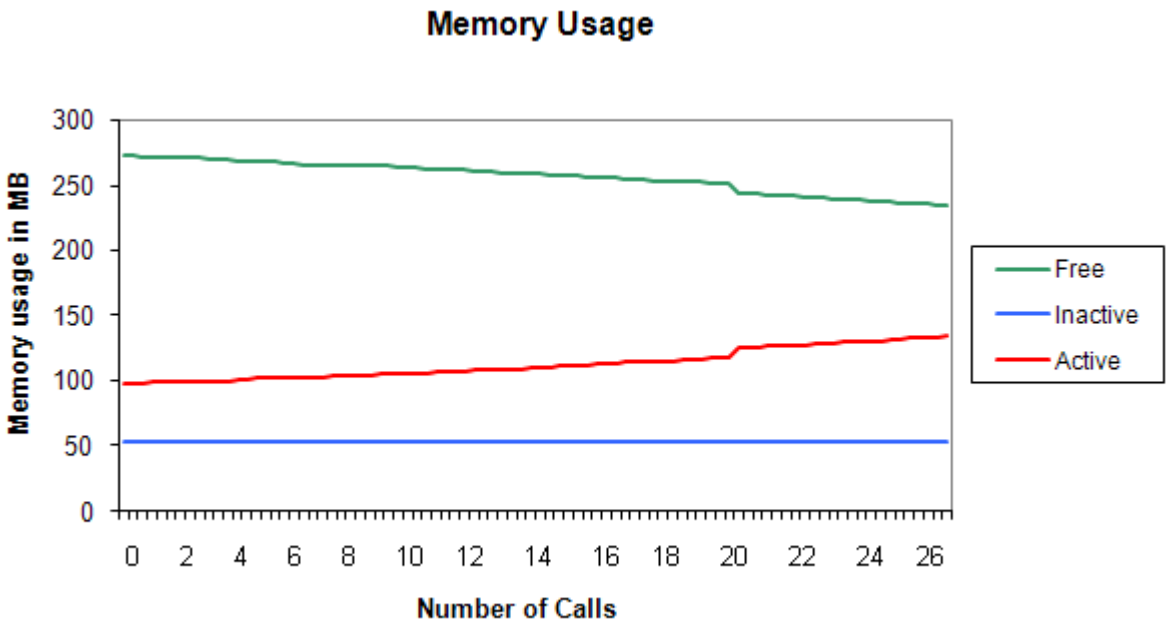
Test 10: Digium TE110P E1 mode and Digium B410P

Here we combined Digium TE110P card in E1 mode and Digium B410P ISDN card with 4 lines which allowed us to make 8 calls.

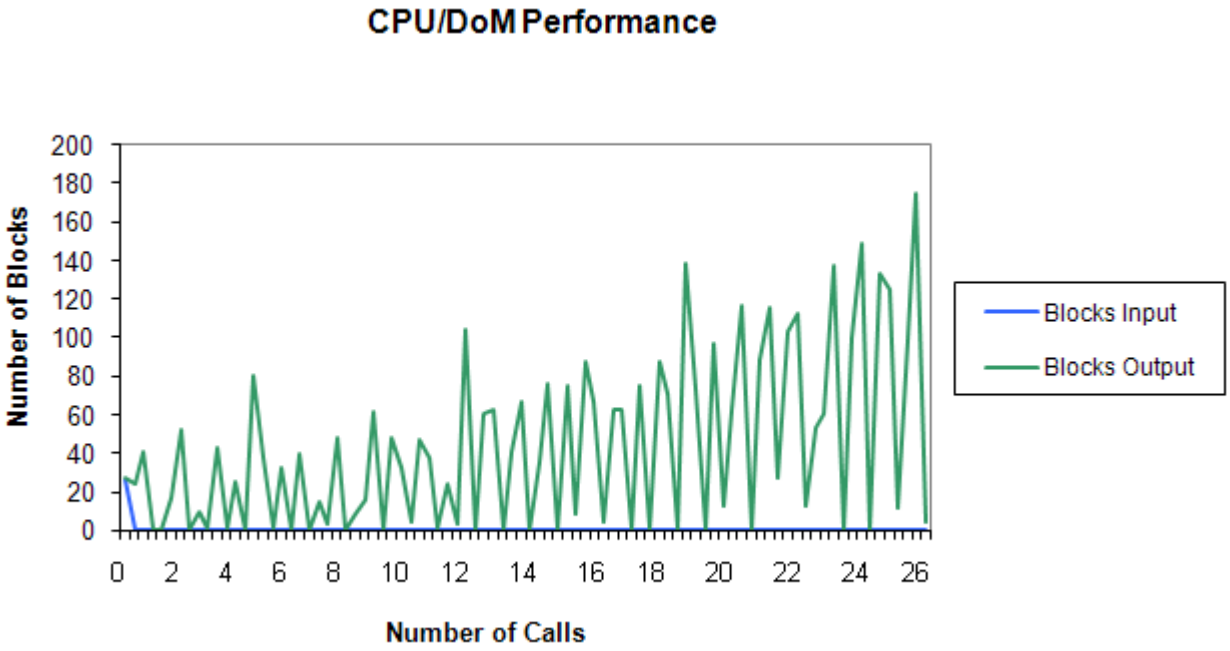
Resulting diagrams are as follows:



Picture 10.1



Picture 10.2



Picture 10.3

Test 10: Conclusion

Digium B410P ISDN 4-port card allowed 8 calls to be made. And with this setup we made 18 calls through the E1 lines. There weren't any compatibility issues and the system was working as it was expected.

So, with 8 ISDN calls and 18 calls through E1 lines we made 26 calls and with the same number of SIP calls that's a total of 52 calls.

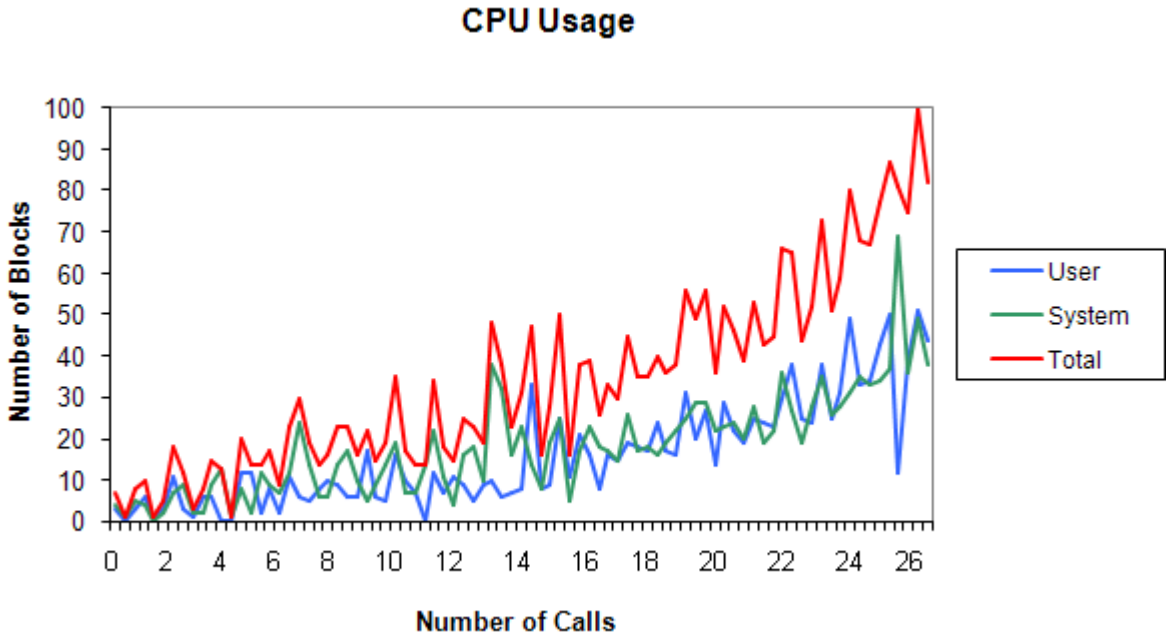
52 calls statistics:

- Average 82 % CPU usage
- Peak 93 % CPU usage
- Average 115 MB of memory used
- Almost none data is read from the DoM
- 40 – 180 blocks written to DoM
- Machine is working without any problems as long as the 18 E1 calls are not exceeded

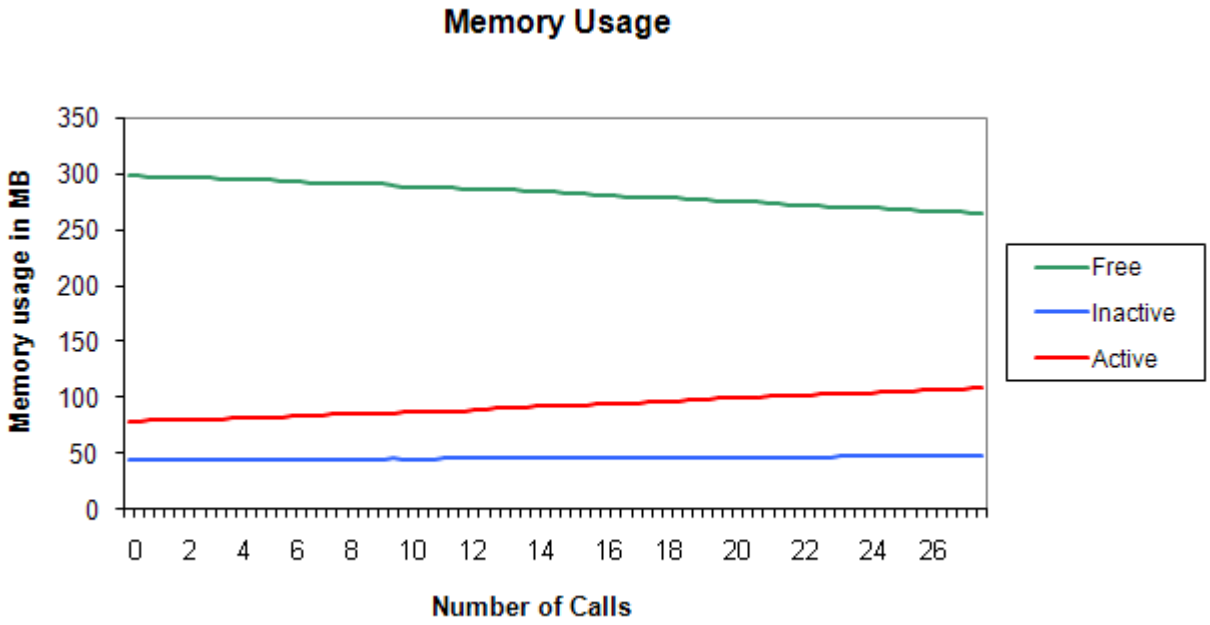
Test 11: Digium TE110P T1 mode and Digium B410P

This test had the same setup as the previous one except the Digium TE110P card was working in T1 mode.

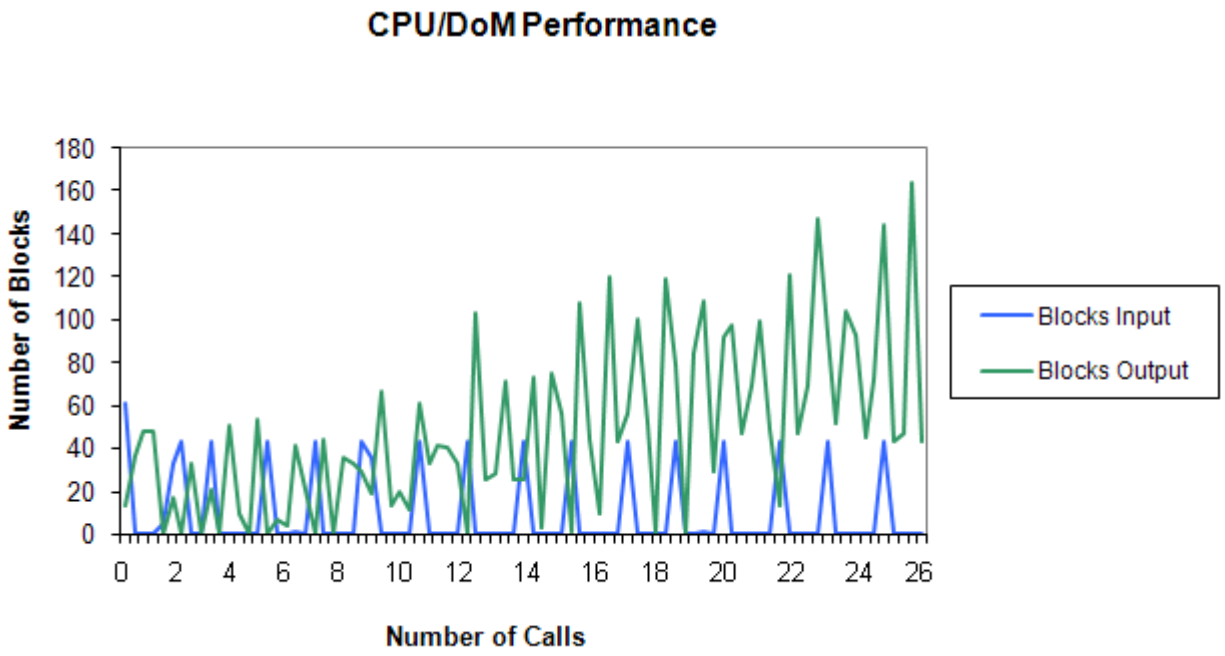
Resulting diagrams are as follows:



Picture 11.1



Picture 11.2



Picture 11.3

Test 11: Conclusion

As in the previous test, where the Digium TE110P card was working in E1 mode, here we have the same results although the card was in T1 mode.

That means that we had 8 ISDN calls and 18 calls through T1 lines, and with 26 accompanying calls we have a total of 52 calls.

52 calls statistics:

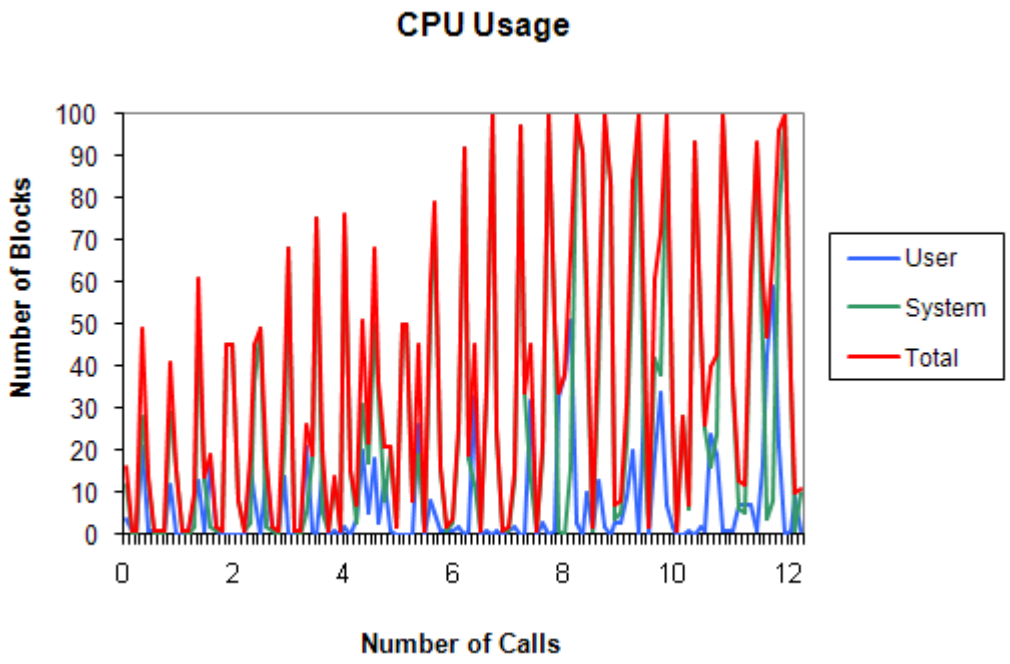
- Average 85 % CPU usage
- Peak 99 % CPU usage
- Average 85 MB of memory used
- Up to 60 blocks read from the DoM
- 40 – 160 blocks written to DoM
- Machine is working without any problems as long as the 18 T1 calls are not exceeded

Test 12: Digium TDM04B and Digium TDM800P

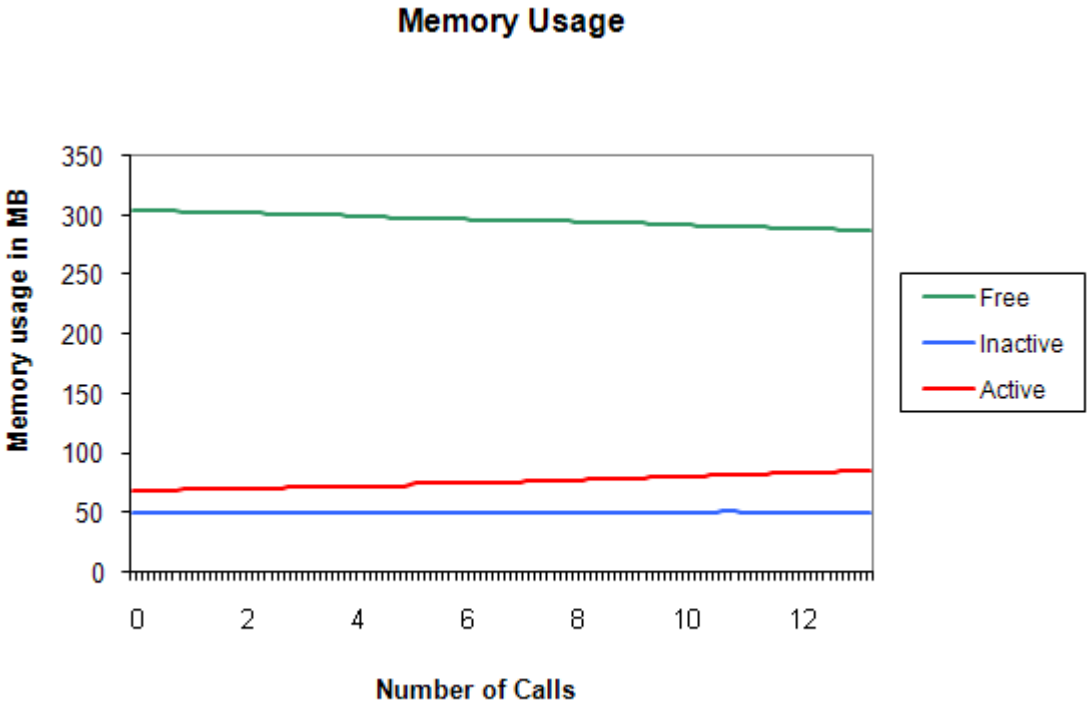
Digium TDM04B is an 4 port analog card which, like TDM800P, can be used with FXS or FXO modules depending on the desired usage.

We wanted to use it just like TDM800P to trunk calls to another machine so they are both using FXO modules. With both cards we made 12 analog calls.

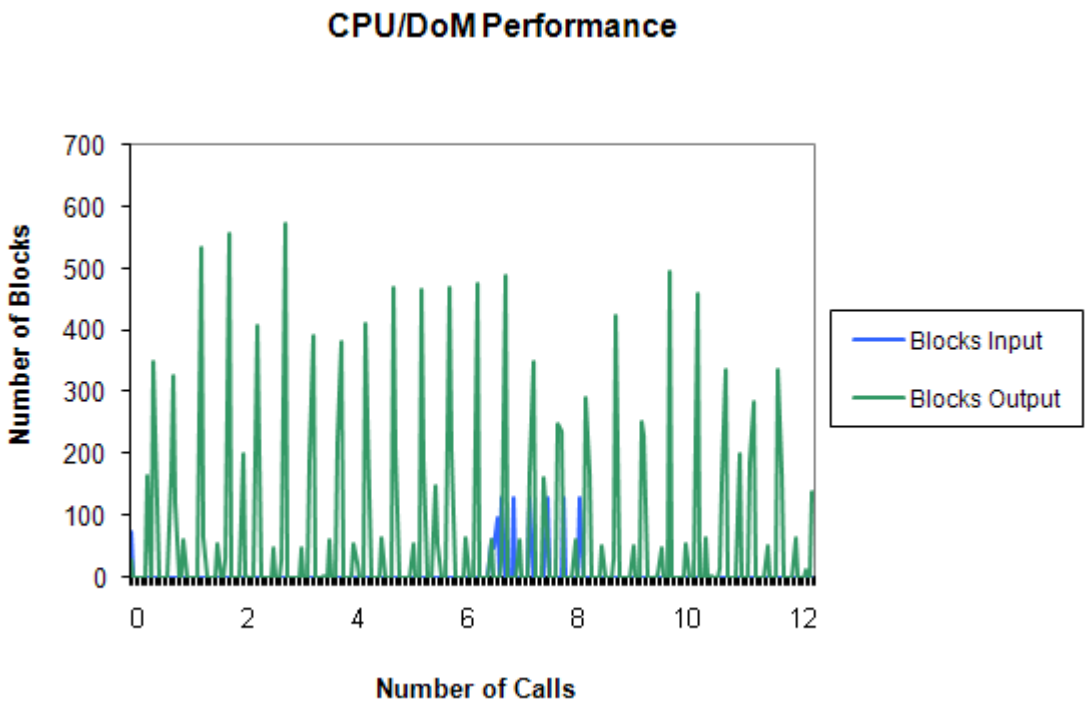
Resulting diagrams are as follows:



Picture 12.1



Picture 12.2



Picture 12.3

Test 12: Conclusion

This test proved the easiest, because two Digiums analog cards were working with no problems at all. After they were inserted and the machine booted, they were recognised from the system and the PBXware configures them properly.

When user decides the purpose of each card and their ports and sets it up, the cards are working immediately.

Because we have 12 analog calls and 12 SIP calls that is a total of 24 calls.

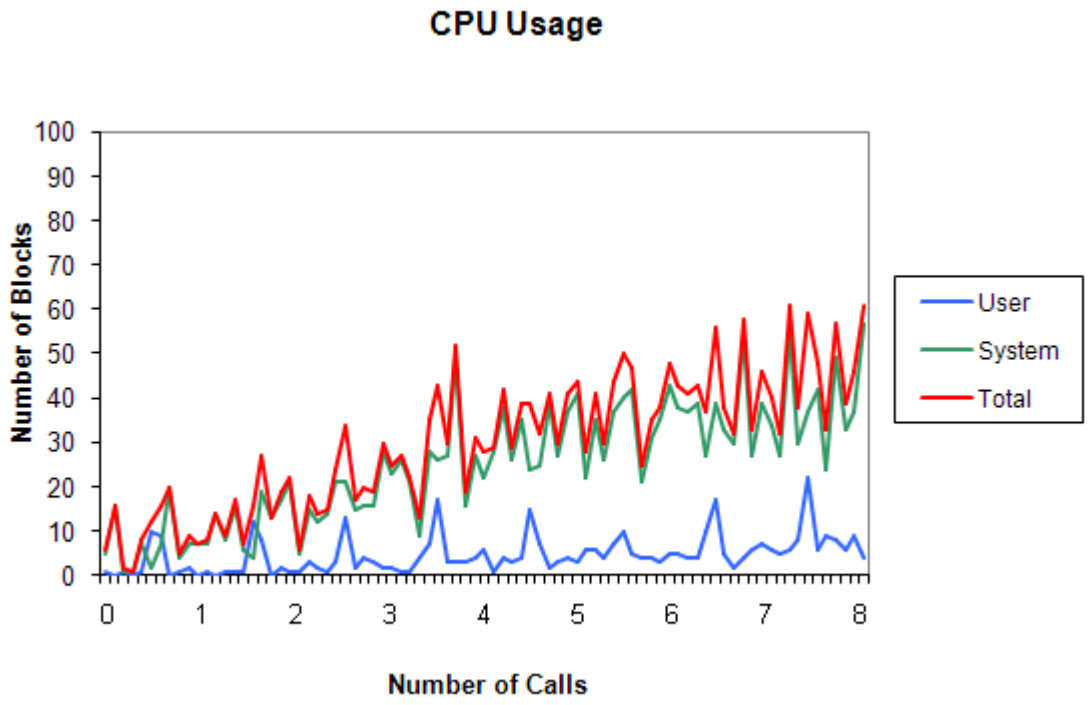
24 calls statistics:

- Average 50 – 60 % CPU usage
- Peak 99 % CPU usage
- Average 70 MB of memory used
- Up to 100 blocks read from the DoM
- 50 – 550 blocks written to DoM
- Machine is working

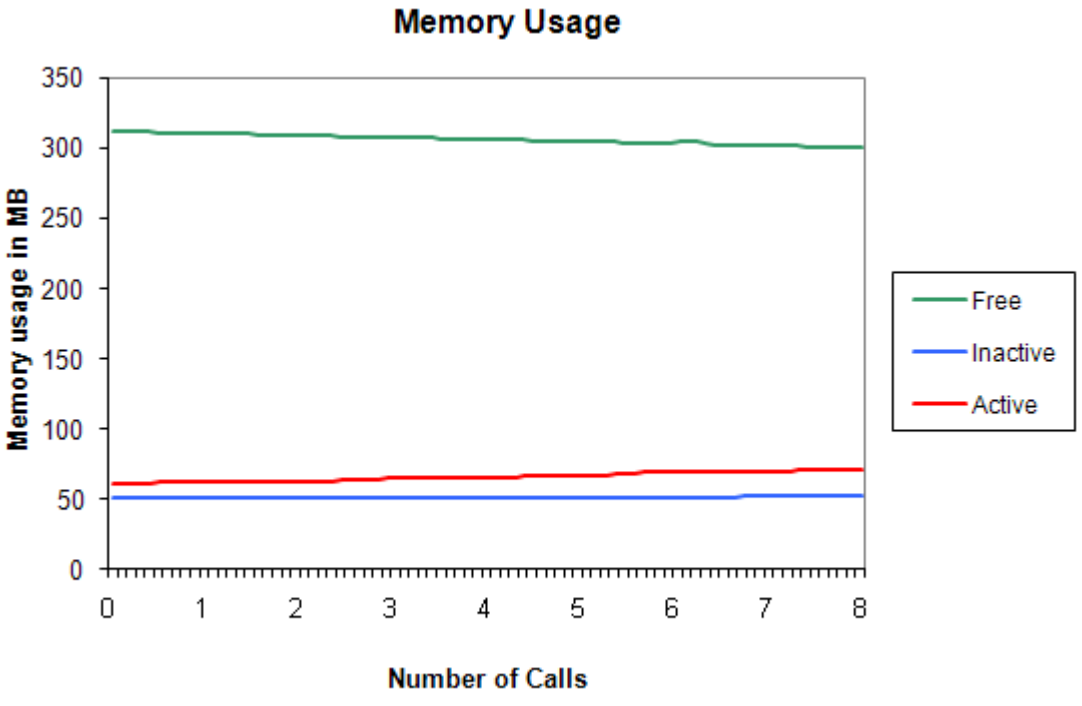
Test 13: Digium TDM04B and Trust MD-2100P

This test is similar to the one with TDM800P and MD-2100P, but in this case instead of 8 port card we are using 4 port TDM04B card. That is 4 analog calls and we have 4 ISDN calls through the two MD-2100P devices and that's 8 calls going out of the machine.

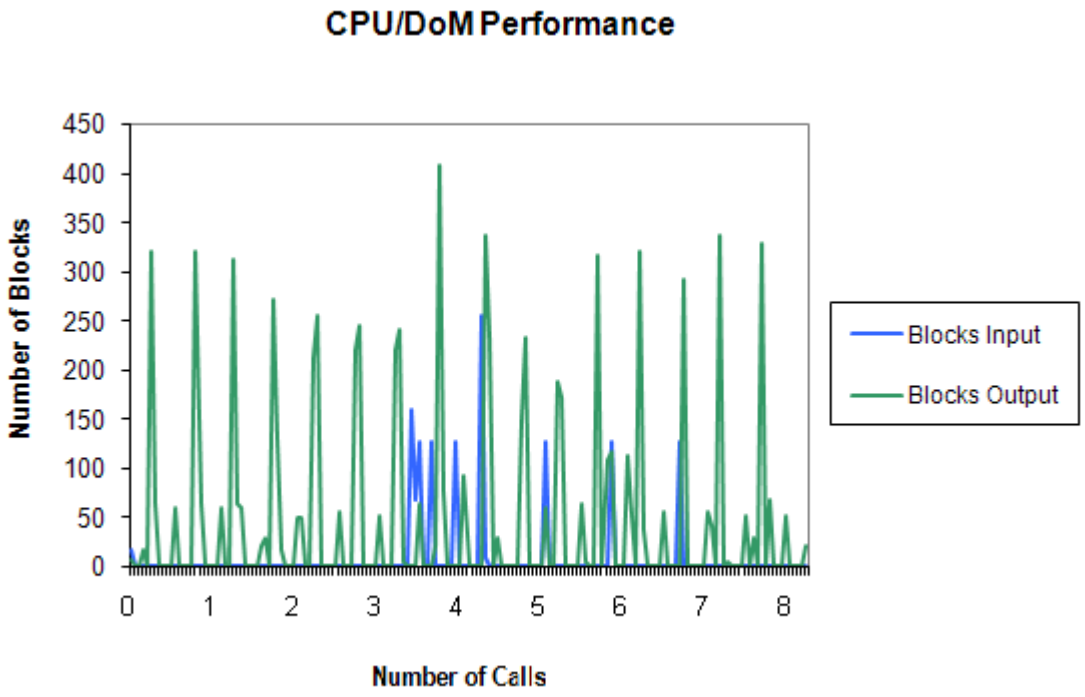
Resulting diagrams are as follows:



Picture 13.1



Picture 13.2



Picture 13.3

Test 13: Conclusion

This test was similar to the TDM800P and MD-2100P but here instead 8 ports we had a card with 4 analog ports.

We had 4 analog calls and 4 ISDN calls and the machine was working without any problem. Also there weren't any compatibility issues so we got our 16 calls total (incl. 8 SIP calls).

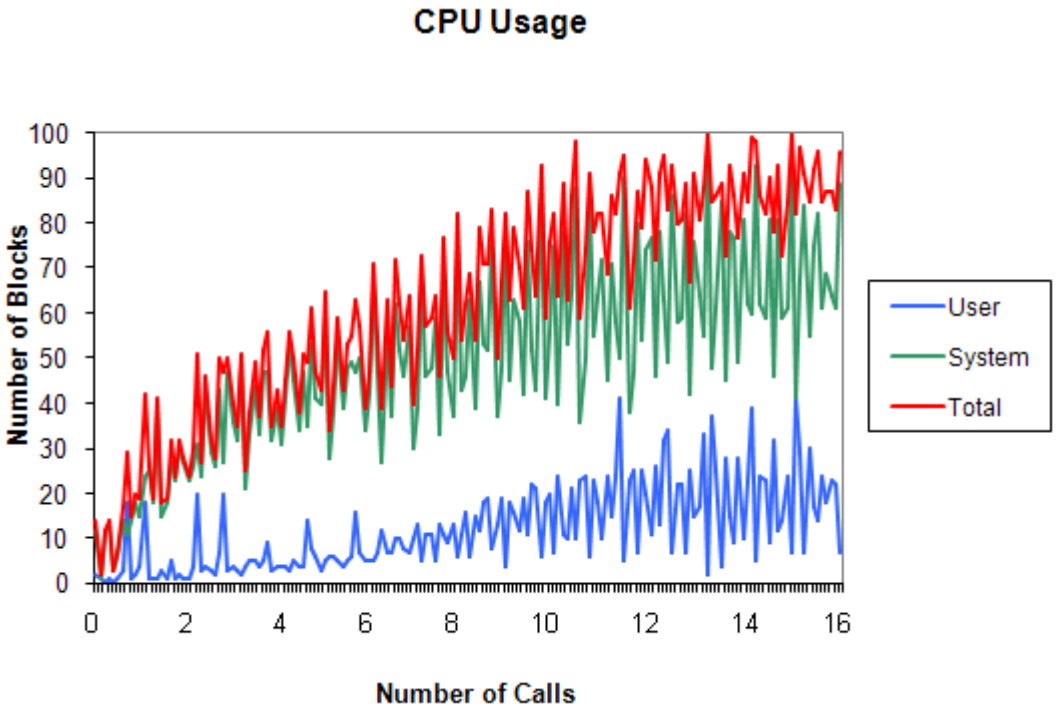
16 calls statistics:

- Average 35 % CPU usage
- Peak 55 % CPU usage
- Average 60 MB of memory used
- Up to 250 blocks read from the DoM
- 50 – 400 blocks written to DoM
- Machine is working without any problem

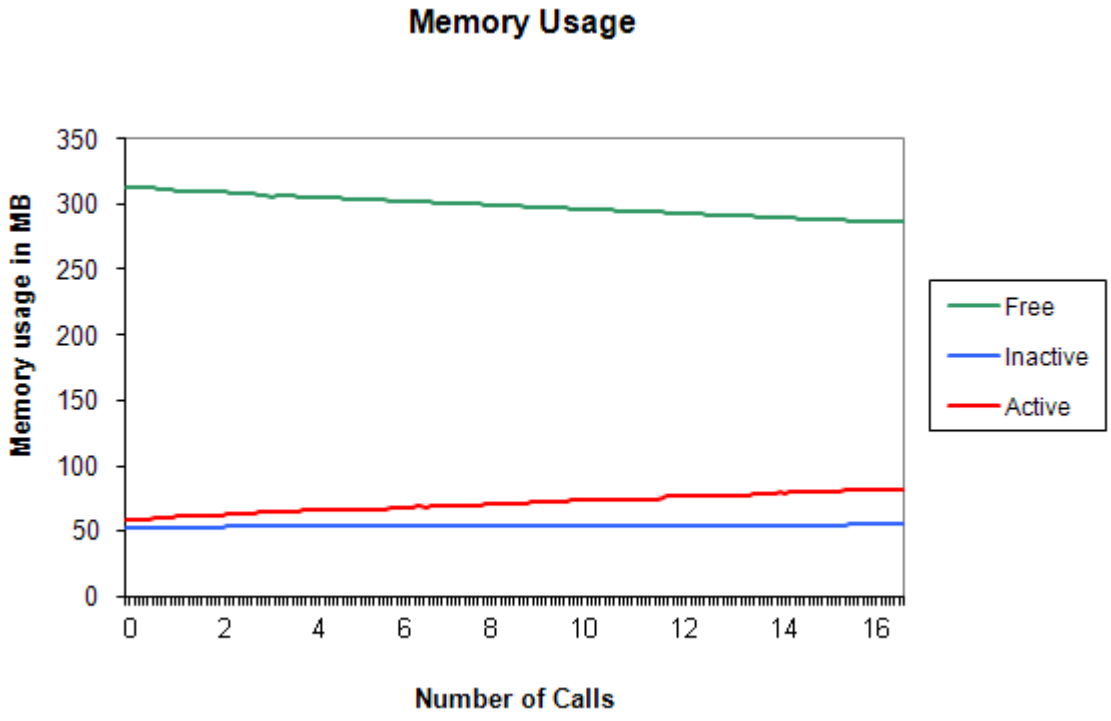
Test 14: Digium TDM04B, Digium TDM800P and Trust MD-2100P

Digium TDM04B is an analog card with 4 ports which can be used as FXS and/or FXO ports. Digium TDM800P is an analog card with 8 ports which can be used as FXS and/or FXO but only in groups. First four ports are using one quad module and last four are using quad module too so they are the same when connecting FXS or FXO quad module. Trust MD-2100P is a USB ISDN device with one port, therefore allowing 2 calls.

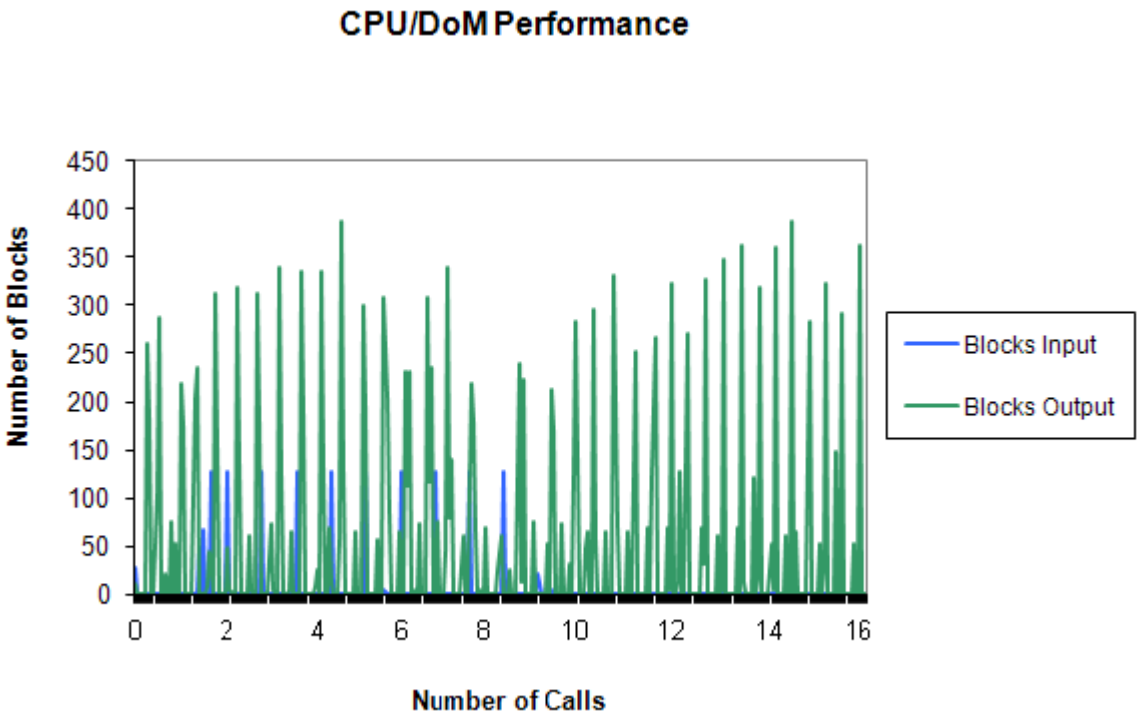
Resulting diagrams are as follows:



Picture 14.1



Picture 14.2



Picture 14.3

Test 14: Conclusion

Here we had one analog card with 4 ports and one with 8 ports which gave us 12 analog calls at the same time. Also we had two USB ISDN devices which provided us with 4 ISDN calls.

This was 16 calls and counting those 16 SIP calls, that was a total of 32 calls with which the machine dealt with no problem. Cards were working perfectly without any conflict and the autodetection in PBXware was working as advertised.

Ofcourse, this thing has to be said once again, in order for cards to work properly user input is expected. End users must decide what the ports are going to be used for and then set them to FXS/FXO if analog and TE/NT if ISDN device.

32 calls statistics:

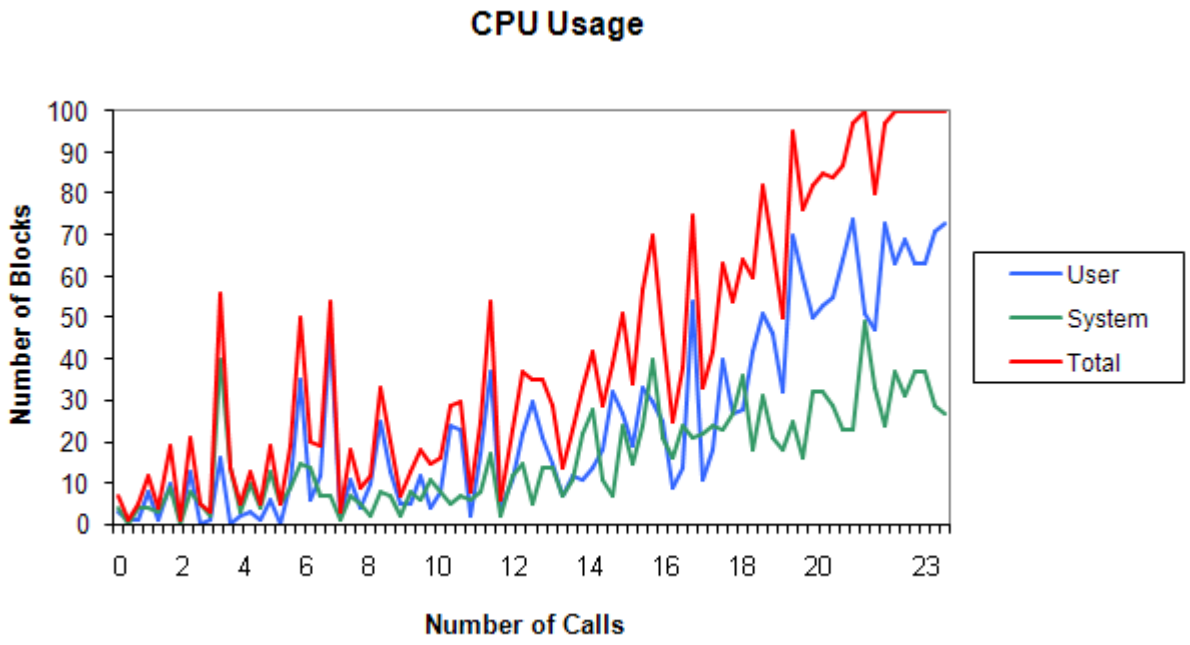
- Average 60 – 80 % CPU usage
- Peak 98 % CPU usage
- Average 80 MB of memory used
- Up to 125 blocks read from the DoM
- 75 – 370 blocks written to DoM
- Machine is working

Test 15: Digium TDM04B and Digium TE110P E1 mode

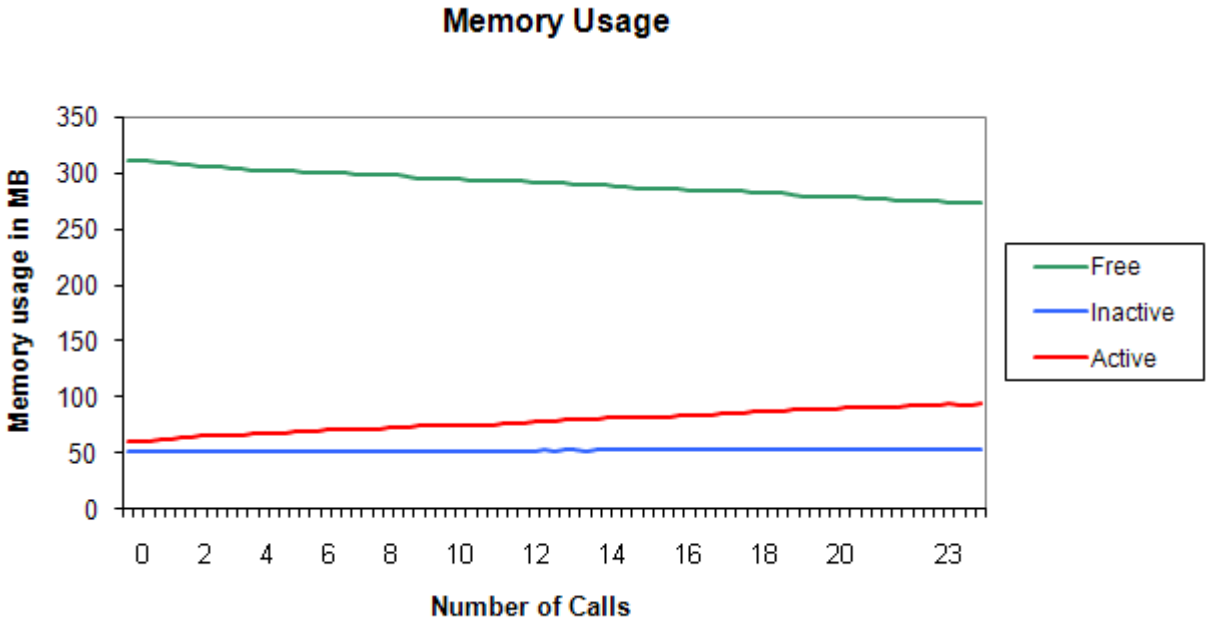
This test is similar to the one with the Digium TDM800P except here we have Digium TDM04B analog card with 4 ports which can be used as FXS and/or FXO ports.

Digium TE110P is working in E1 mode and we managed to make 19 calls.

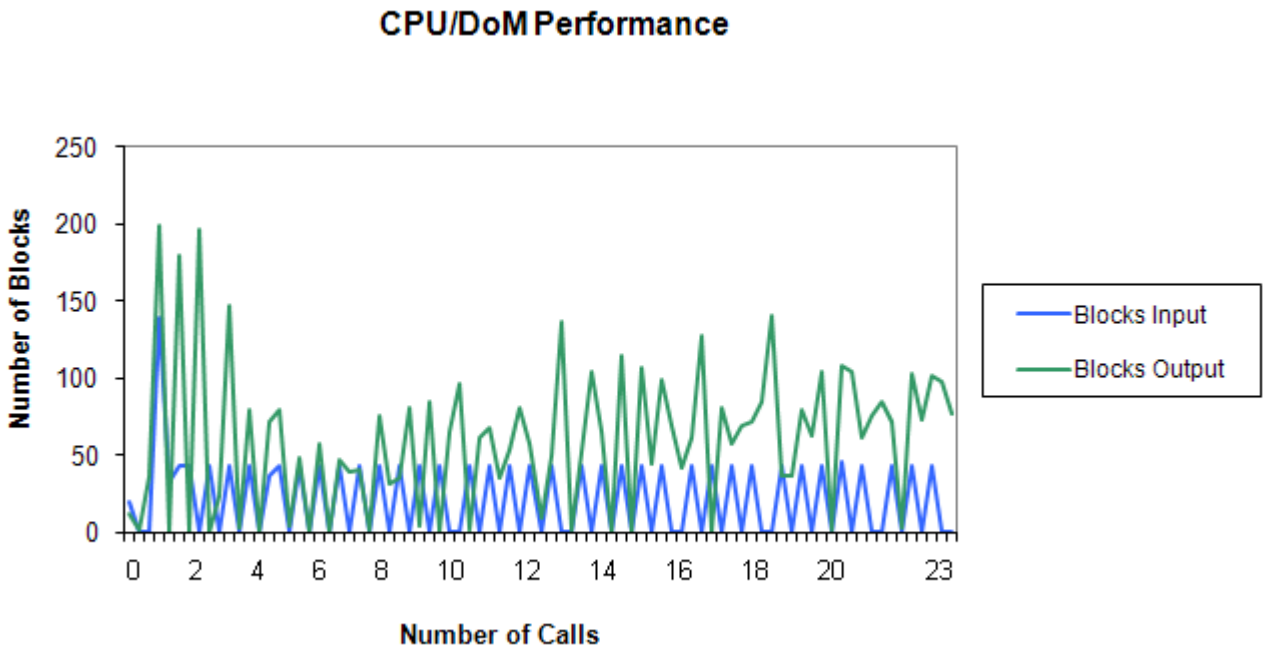
Resulting diagrams are as follows:



Picture 15.1



Picture 15.2



Picture 15.3

Test 15: Conclusion

We used Digium TDM04B to make 4 analog calls and in such setup we managed to make 19 calls through E1 lines.

With accompanying 23 SIP calls that's a total of 46 calls.

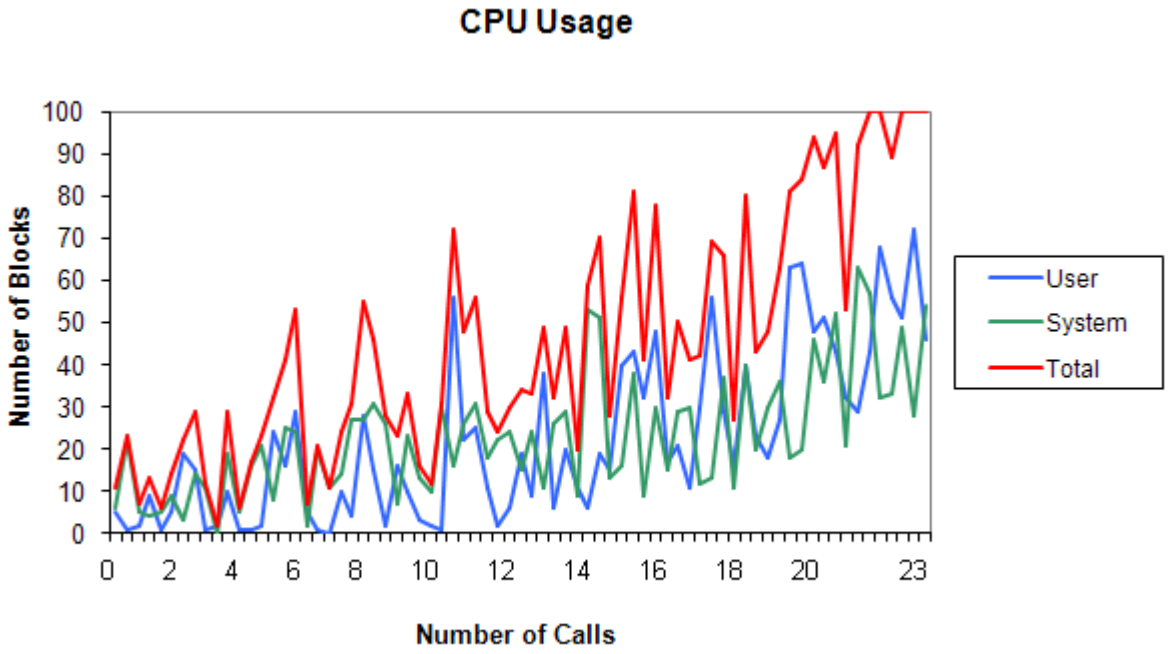
46 calls statistics:

- Average 85 % CPU usage
- Peak 99 % CPU usage
- Average 85 MB of memory used
- Up to 50 blocks of data is read from the DoM
- 50 – 200 blocks written to DoM
- Machine is working without any problems as long as the 19 E1 calls are not exceeded

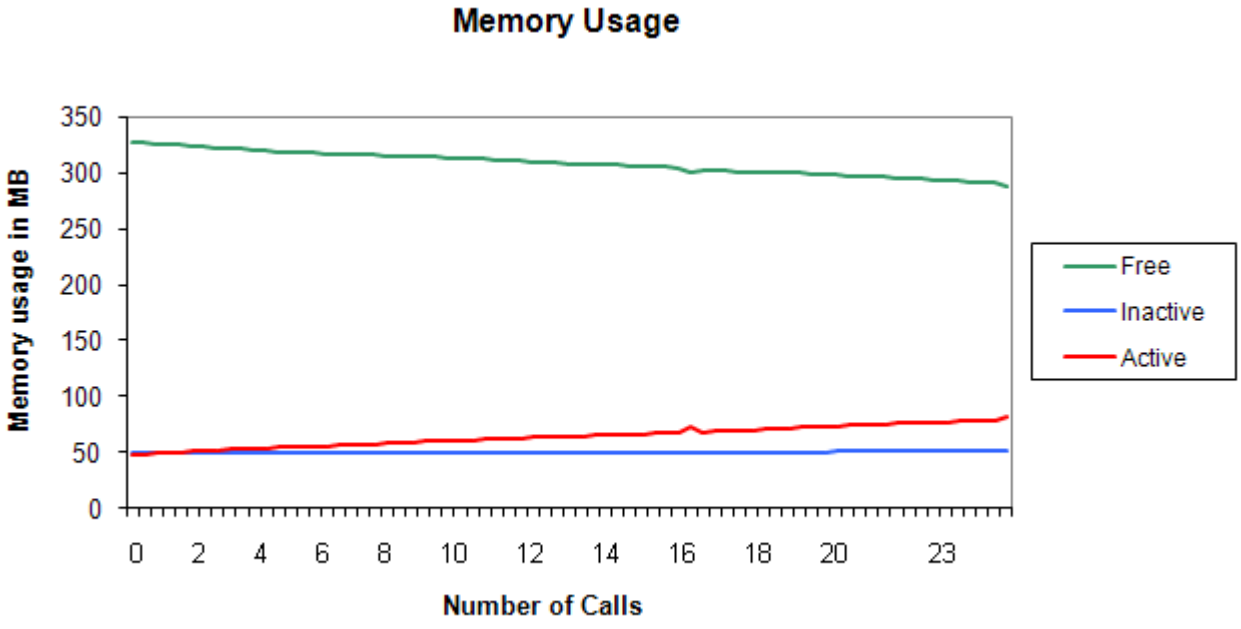
Test 16: Digium TDM04B and Digium TE110P T1 mode

This is the same test as previous one except Digium TE110P was working in T1 mode.

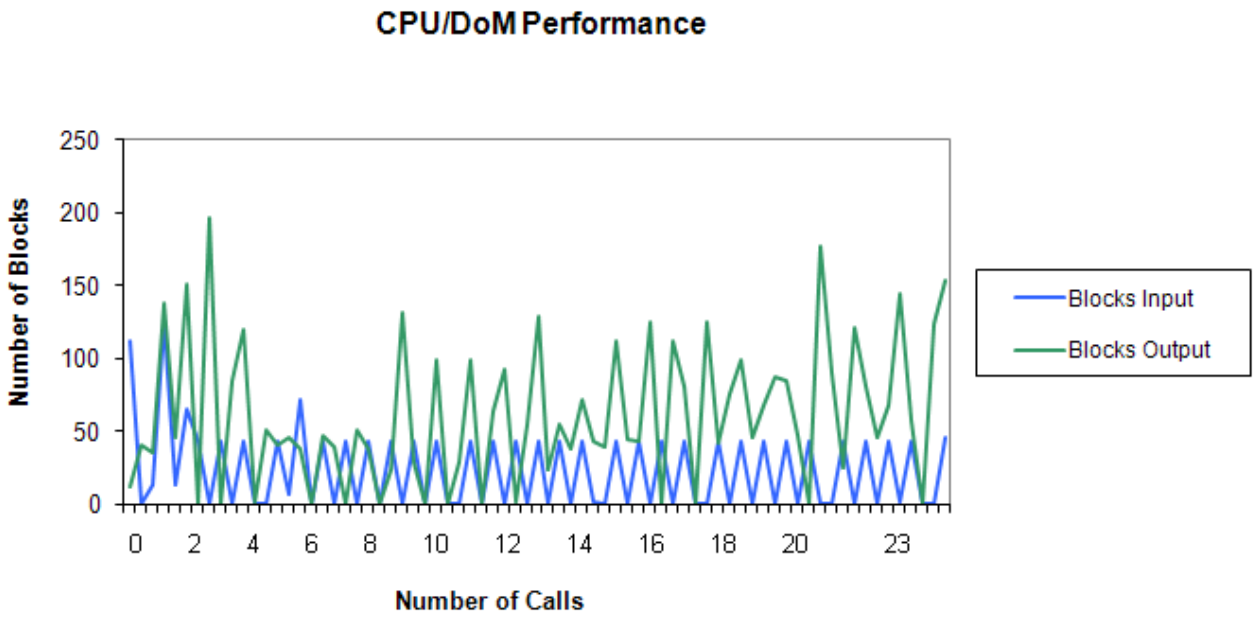
Resulting diagrams are as follows:



Picture 16.1



Picture 16.2



Picture 16.3

Test 16: Conclusion

Like in previous test we have made 19 calls through the T1 lines and we had additional 4 ISDN calls. Together with 23 SIP calls we had 46 calls in total.

Also everything is measured to match our 80% maximum, and there weren't any compatibility issues regarding the two cards.

46 calls statistics:

- Average 83 % CPU usage
- Peak 99 % CPU usage
- Average 75 MB of memory used
- Up to 100 blocks read from the DoM
- 50 – 200 blocks written to DoM
- Machine is working without any problems as long as the 19 T1 calls are not exceeded

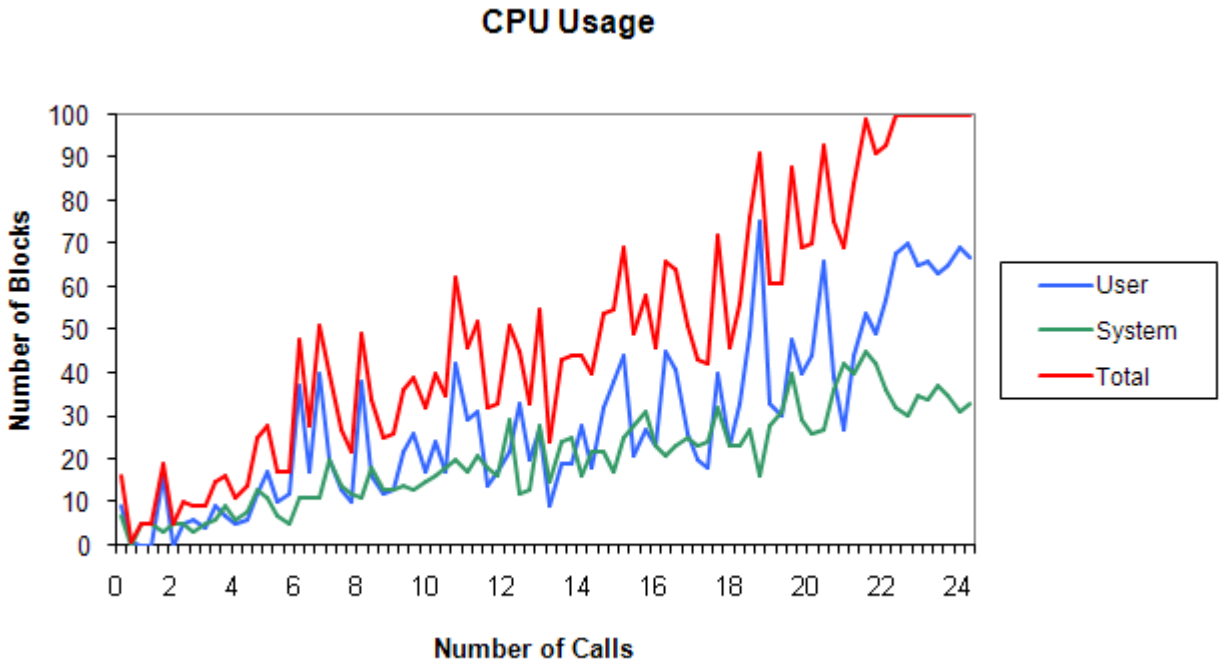
Test 17: Digium TDM04B, Digium TE110P E1 mode and Trust MD-2100P

Digium TDM04B is an analog card with 4 ports which can be used as FXS and/or FXO ports.

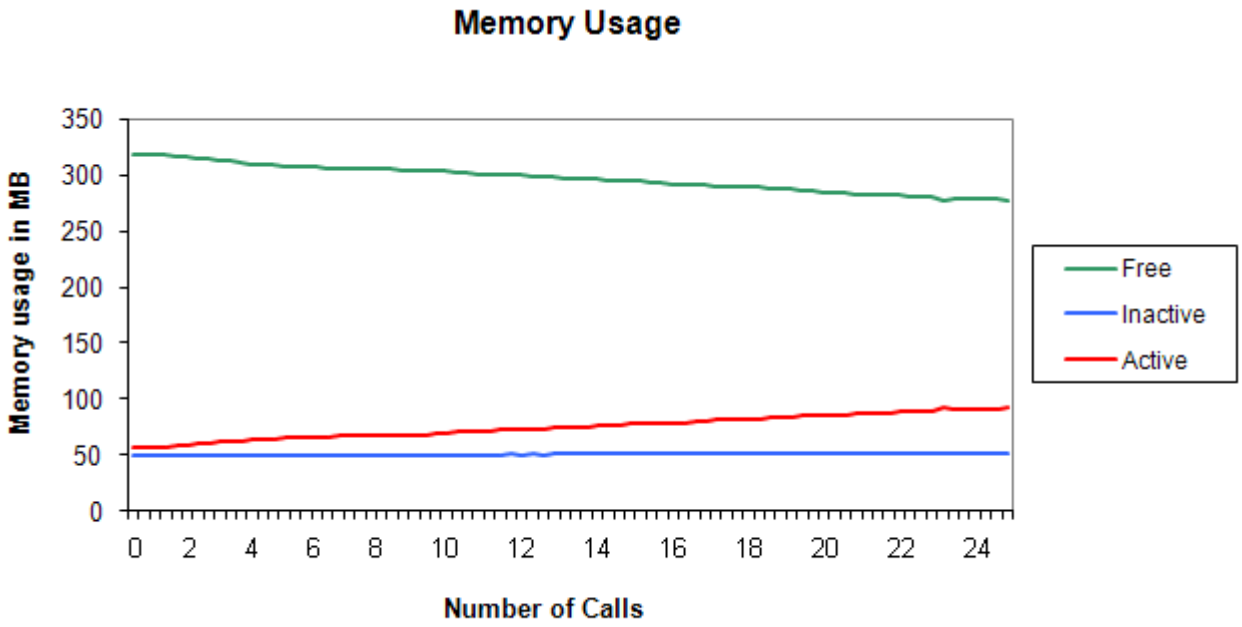
Digium TE110P is a T1/E1 card with 24 lines in T1 mode and 32 lines in E1 mode. Trust MD-2100P is a USB ISDN device with one BRI port which enables us to make two ISDN calls. As we used two of MD-2100P we could make 4 calls.

With this configuration we managed to make 16 calls through E1 lines.

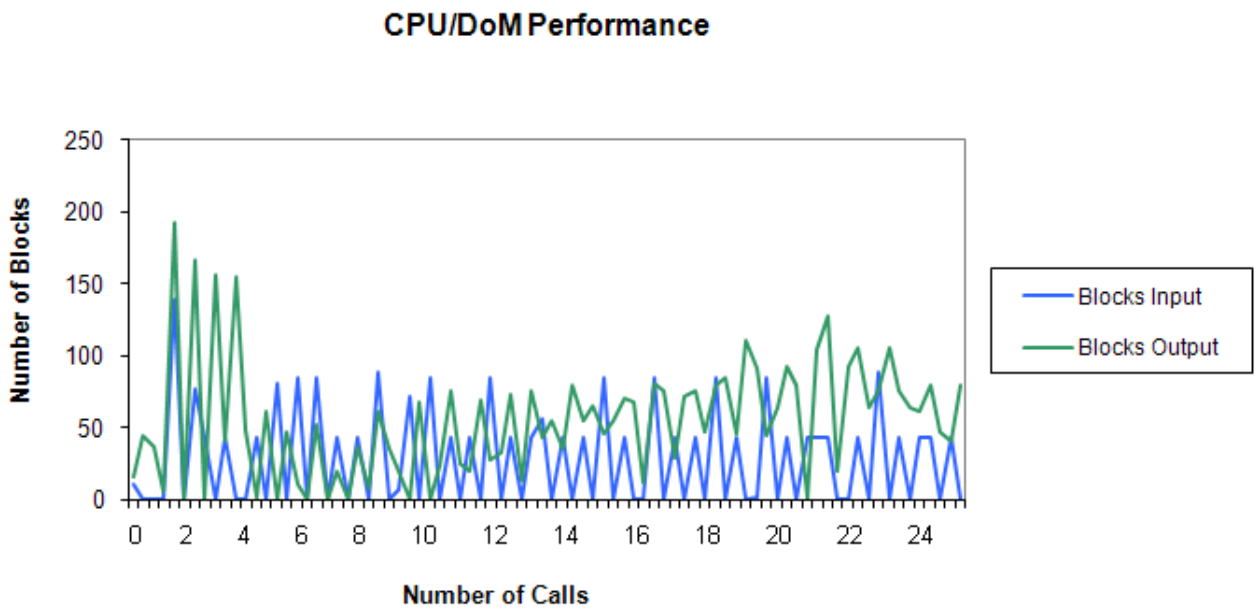
Resulting diagrams are as follows:



Picture 17.1



Picture 17.2



Picture 17.3

Test 17: Conclusion

With such a setup with two cards and an USB device one would expect compatibility issues to rise, but in our case there weren't any. Everything was working without any problem, TDM04B gave us 4 analog calls, two MD-2100P 4 ISDN calls, and we managed to make 16 calls through the E1 lines.

Taking in account the same number of accompanying SIP calls we had a total of 48 calls.

48 calls statistics:

- Average 82 % CPU usage
- Peak 100 % CPU usage
- Average 75 MB of memory used
- Up to 150 blocks read from the DoM
- 50 – 200 blocks written to DoM
- Machine is working without any problems as long as the 16 E1 calls are not exceeded

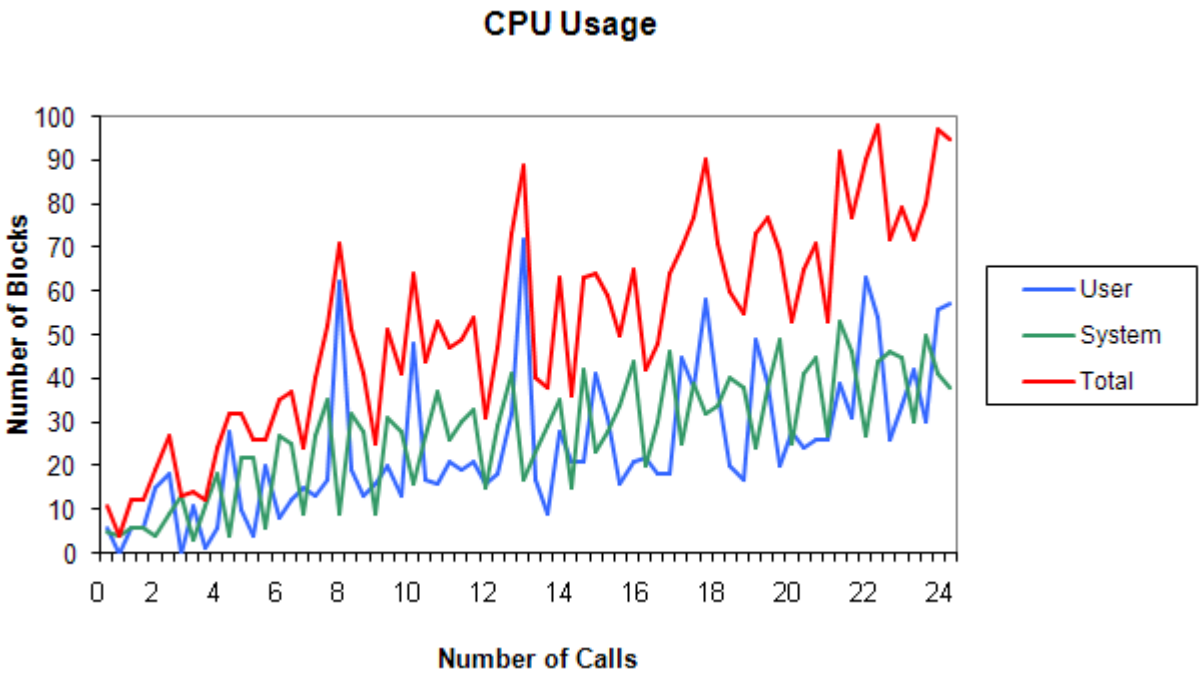
Test 18: Digium TDM04B, Digium TE110P T1 mode and Trust MD-2100P

Digium TDM04B is an analog card with 4 ports which can be used as FXS and/or FXO ports.

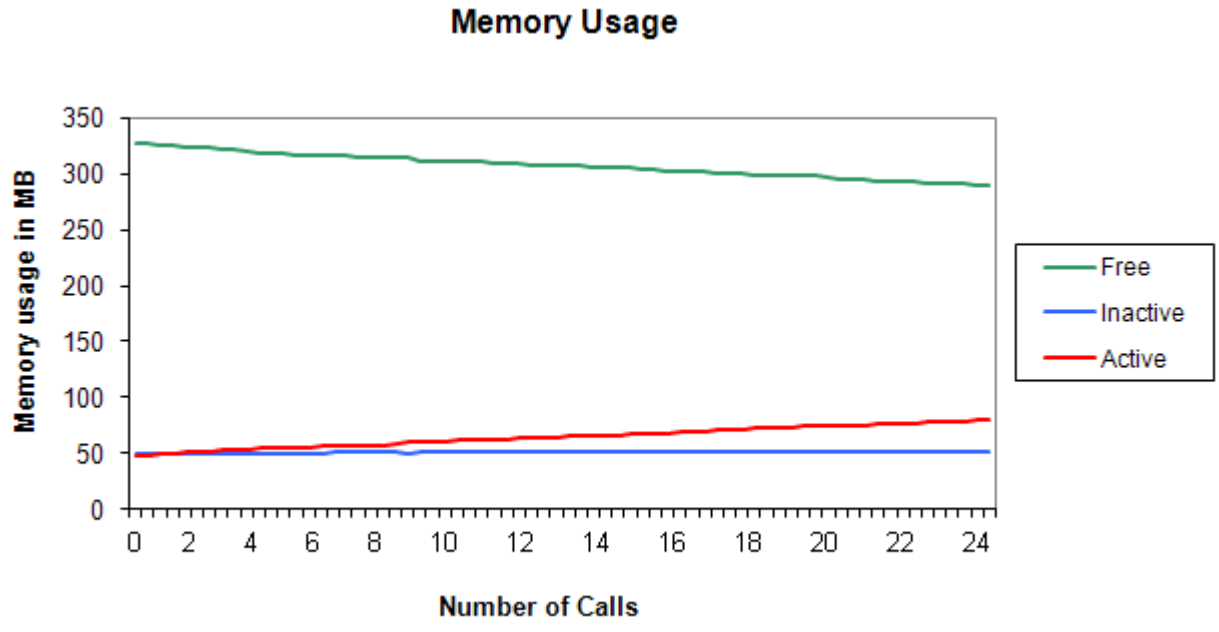
Digium TE110P is a T1/E1 card with 24 lines in T1 mode and 32 lines in E1 mode.Trust MD-2100P is a USB ISDN device with one BRI port which enables us to make two ISDN calls.

Digium TE110P is not working so this is the test of TDM04B an MD-2100P and their compatibility.

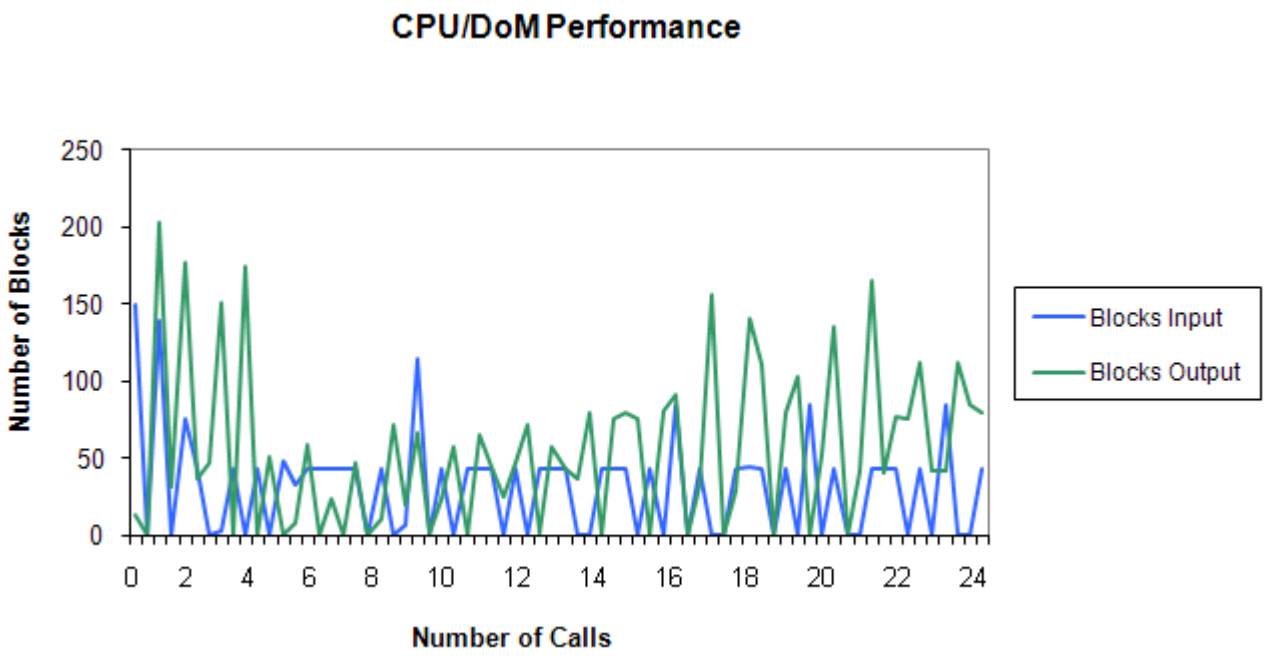
Resulting diagrams are as follows:



Picture 18.1



Picture 18.2



Picture 18.3

Test 18: Conclusion

This test is similar to the previous one because we had Digium TDM04B analog card with 4 ports, two Trust MD-2100P with 4 ISDN calls total, and of course Digium TE110P with which we made 16 T1 calls.

When we add same number of SIP calls we have a total of 48 calls.

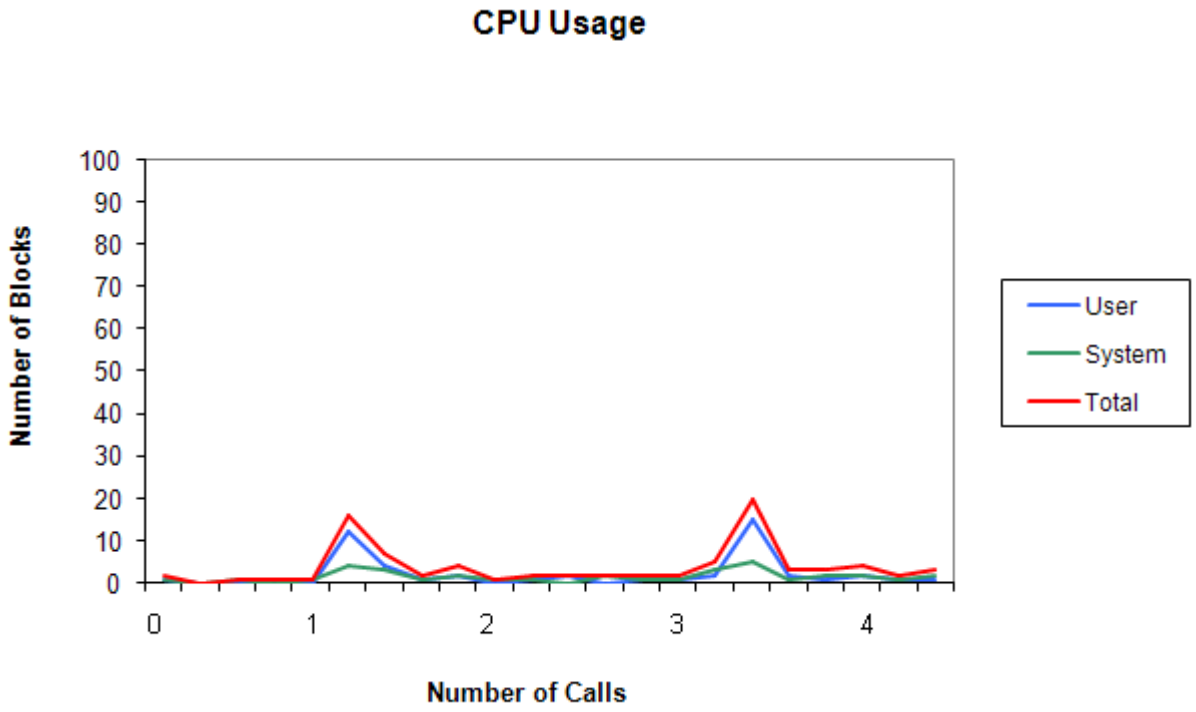
48 calls statistics:

- Average 80 % CPU usage
- Peak 98 % CPU usage
- Average 65 MB of memory used
- Up to 150 blocks read from the DoM
- 50 – 200 blocks written to DoM
- Machine is working without any problems as long as the 16 T1 calls are not exceeded

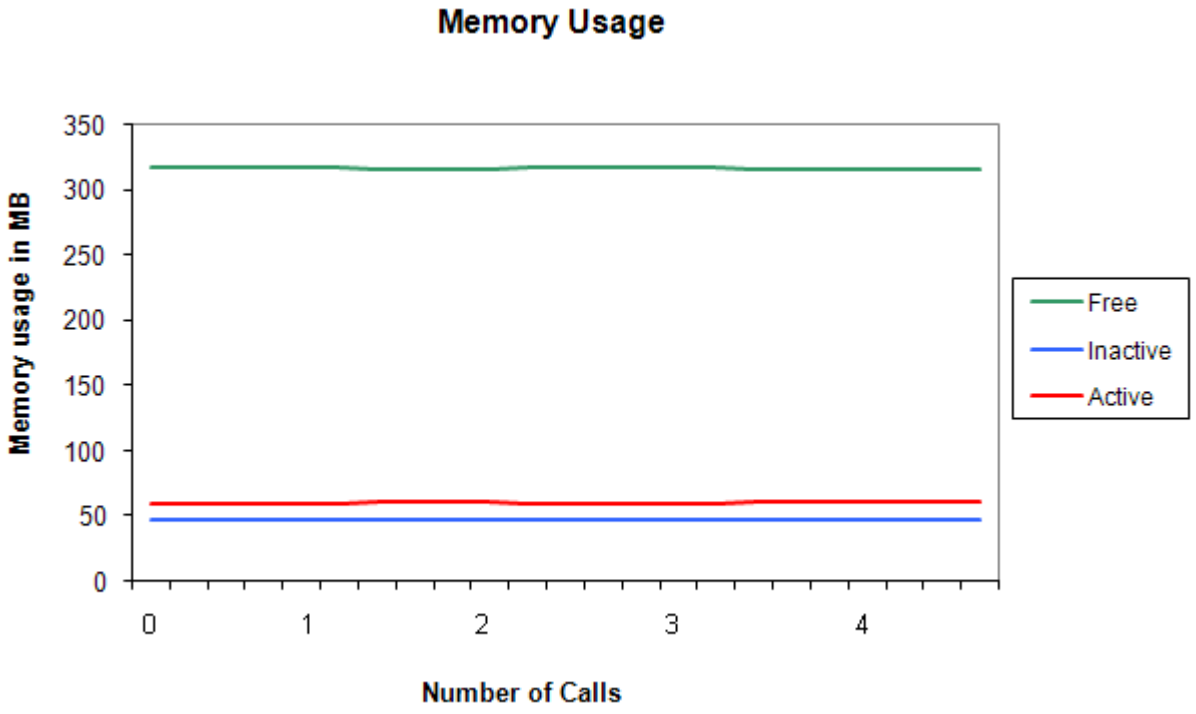
Test 19: BiPAC PCI V.3.0

Billion BiPAC PCI V.3.0 ISDN cards are the ones which produced most of the compatibility issues. They have one port which means that they can be used for just two ISDN calls.

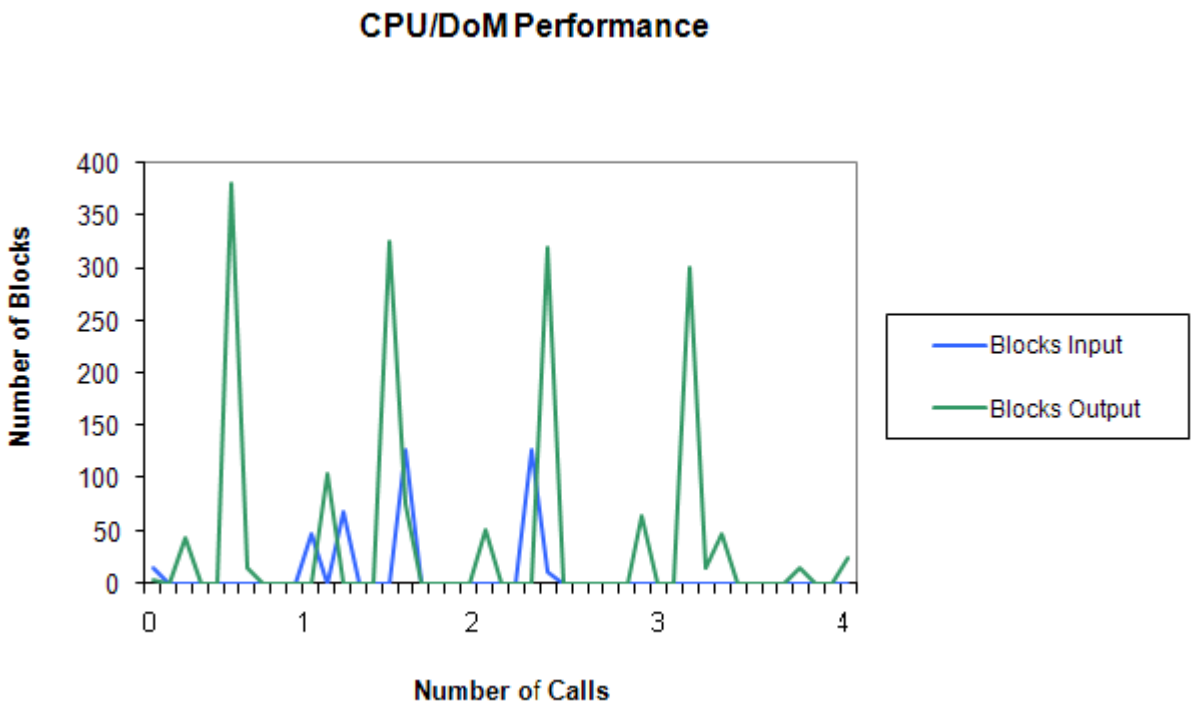
Resulting diagrams are as follows:



Picture 19.1



Picture 19.2



Picture 19.3

Test 19: Conclusion

BiPAC card made the most problems of all. It can work on our system but it requires modifications inside the PBXware so the system can see it as a Digium B410P ISDN card.

First of all you must edit **/home/servers/pbxware/pw/tmp/lspci.out** file.
You will see something like this in the first line:
00:00.0 0600: 1106:0314
Change the **1106:0314** with **d161:b410** and save the file.
Now go to **/home/servers/pbxware/pw/usr/lib/asterisk/modules/**.
Execute **ln –s ../chan_misdn.so**
Go inside the asterisk with **/home/servers/pbxware/sh/asterisk –rv** and execute the **stop now** command.
Now issue the restart to the misdn drivers with **/home/servers/pbxware/sh/misdn-init restart**
After this start the asterisk **/home/servers/pbxware/sh/asterisk**

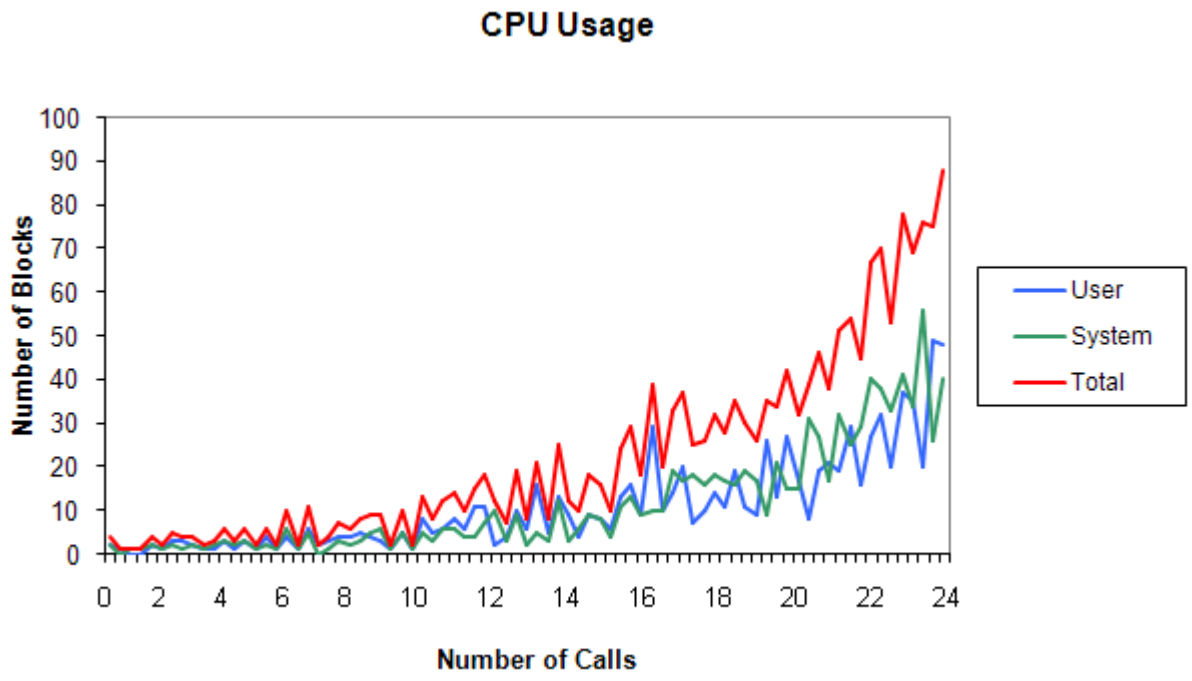
When the previous steps are done the card should be recognised as Digium B410P inside the PBXware, only difference is that only first port could be used.
Results of this test are insignificant regarding the small CPU utilization. We had total of 4 calls, 2 ISDN and 2 SIP that are trunked, but all the small changes on the CPU and memory graph are there even if we don't do this calls. Only on DoM performance graph we can see spikes because PBXware logs all the calls to the DoM.

Test 20: BiPAC PCI V.3.0 and Digium TE110P E1 mode

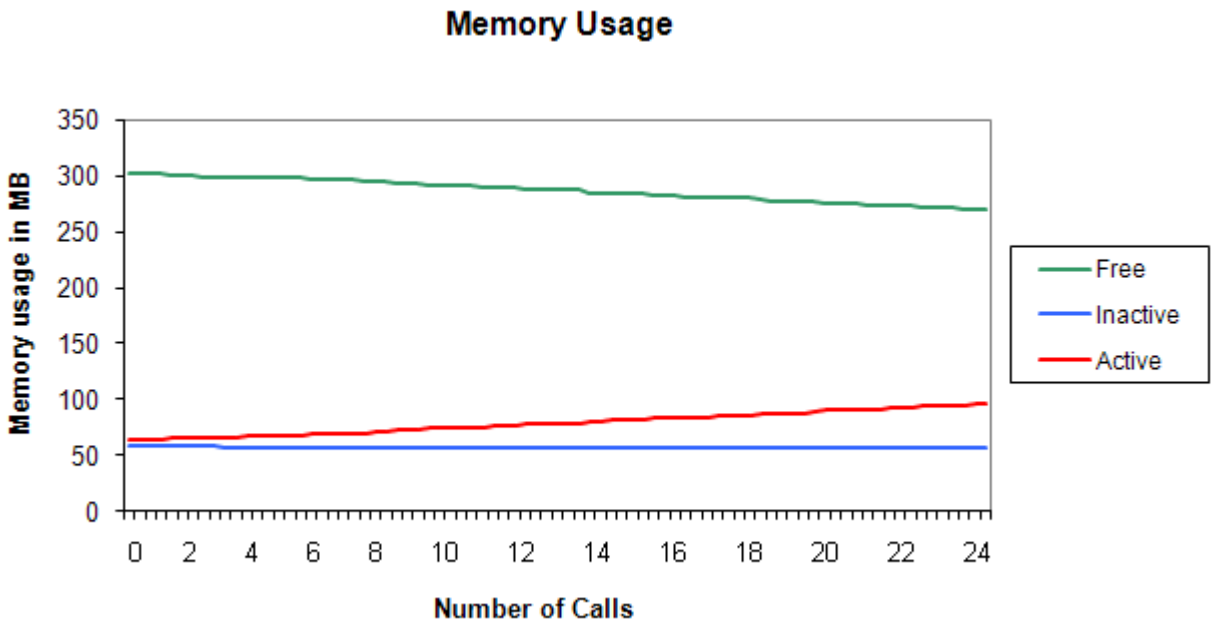
Billion BiPAC PCI V.3.0 ISDN cards have one port on them and two calls can be made.

Digium TE110P T1/E1 cards have 24 lines in T1 mode and 32 lines in E1 mode. In this test where the card was in E1 mode we managed to make 22 calls.

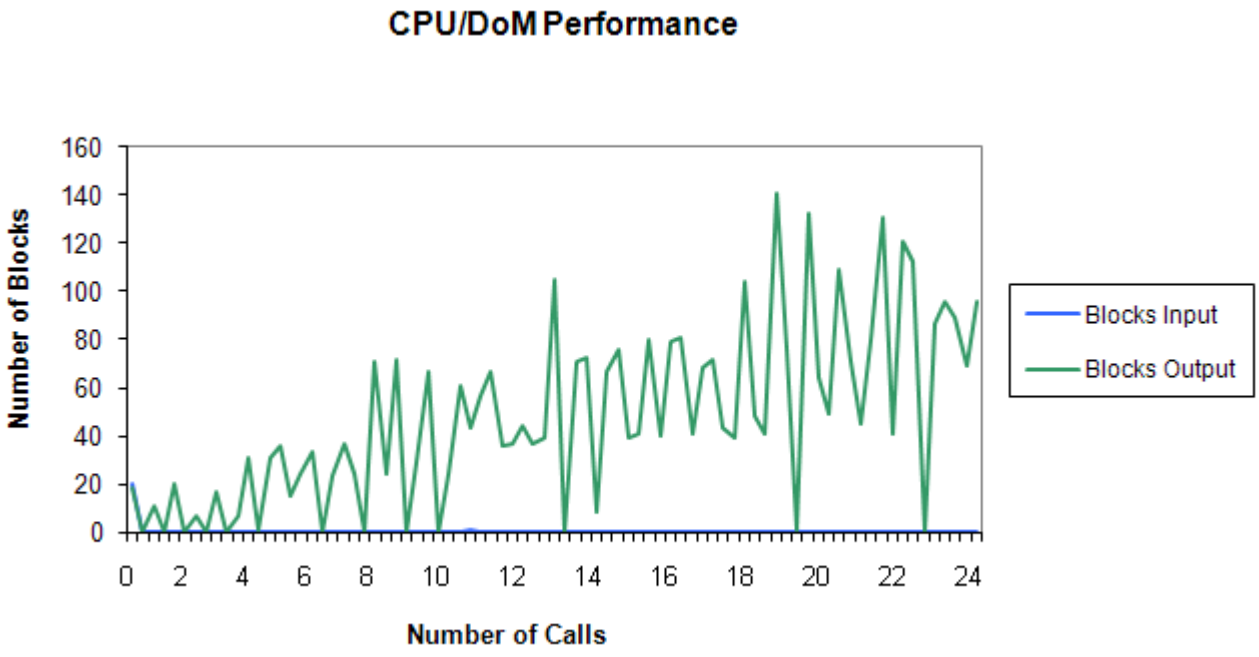
Resulting diagrams are as follows:



Picture 20.1



Picture 20.2



Picture 20.3

Test 20: Conclusion

BiPAC card has only one port thus allowing 2 ISDN calls to be made. Like stated before this card needed some modifications in the PBXware system so it can work properly. When that part is over it can work with the Digium TE110P, and in this case where the card is in E1 mode we managed to make 22 calls.

Adding the same number of SIP calls, in this case 24, we have total of 48 calls.

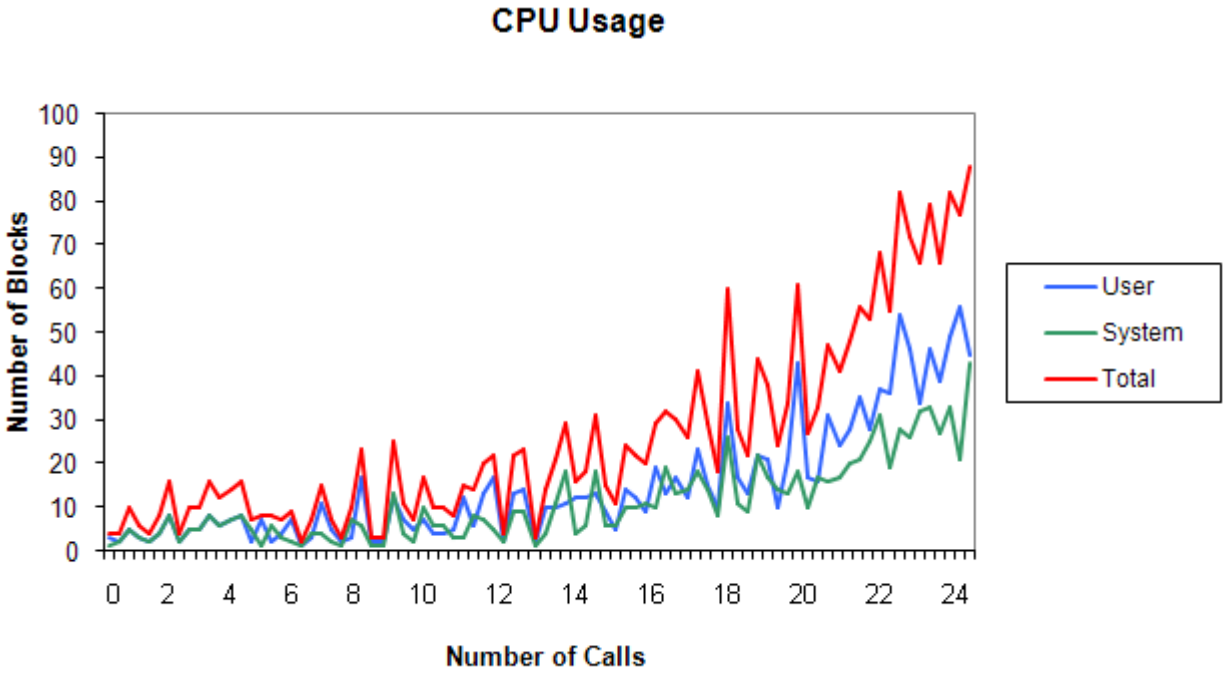
48 calls statistics:

- Average 80 % CPU usage
- Peak 90 % CPU usage
- Average 80 MB of memory used
- Almost none data read from the DoM
- 20 – 140 blocks written to DoM
- Machine is working without any problems only after the system has been modified so the BiPAC card can work and as long as the 22 E1 calls are not exceeded

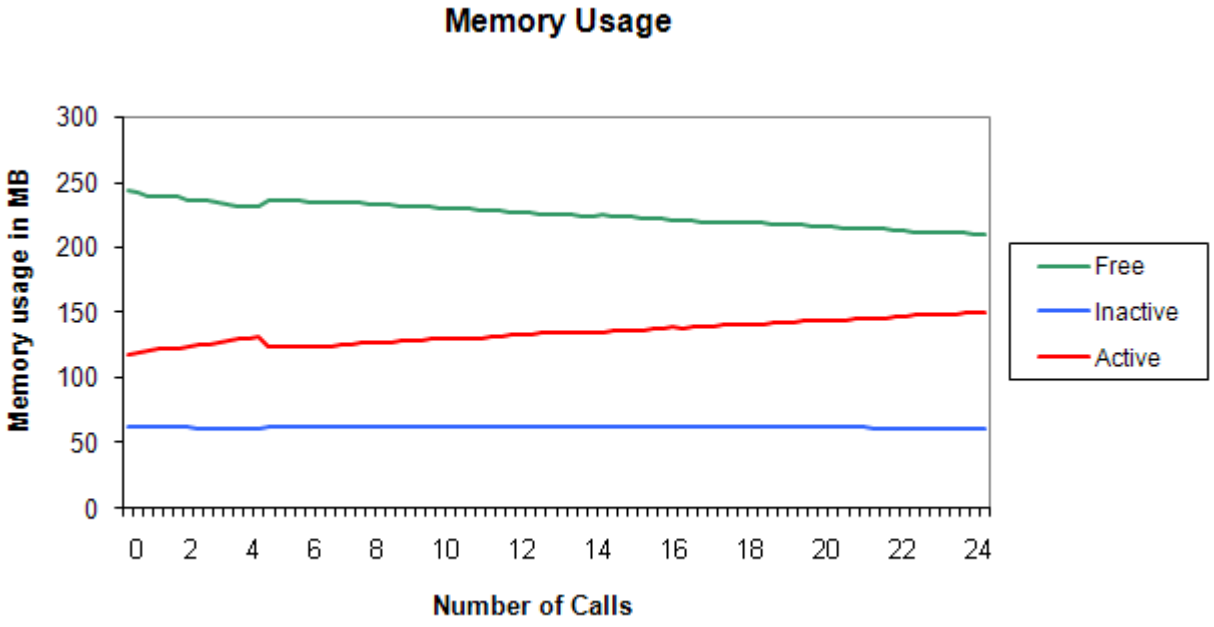
Test 21: BiPAC PCI V.3.0 and Digium TE110P T1 mode

Like in previous test, Billion BiPAC PCI V.3.0 ISDN card has one port which means it allows us to make 2 ISDN calls. TE110P was working in T1 mode and we made 22 calls with it.

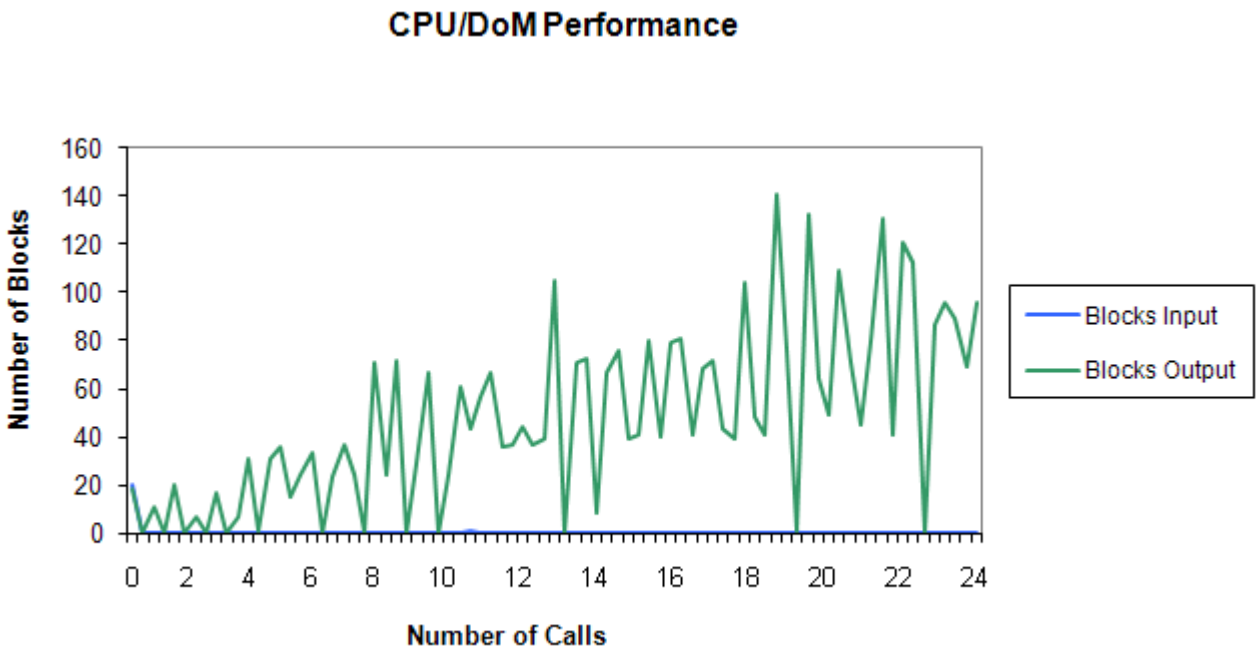
Resulting diagrams are as follows:



Picture 21.1



Picture 21.2



Picture 21.3

Test 21: Conclusion

This test is the same like previous one, because we used the BiPAC with TE110P card. After setting the BiPAC card like stated before, we managed to make 22 calls through T1 lines.

With 24 additional SIP calls we had 48 calls total.

48 calls statistics:

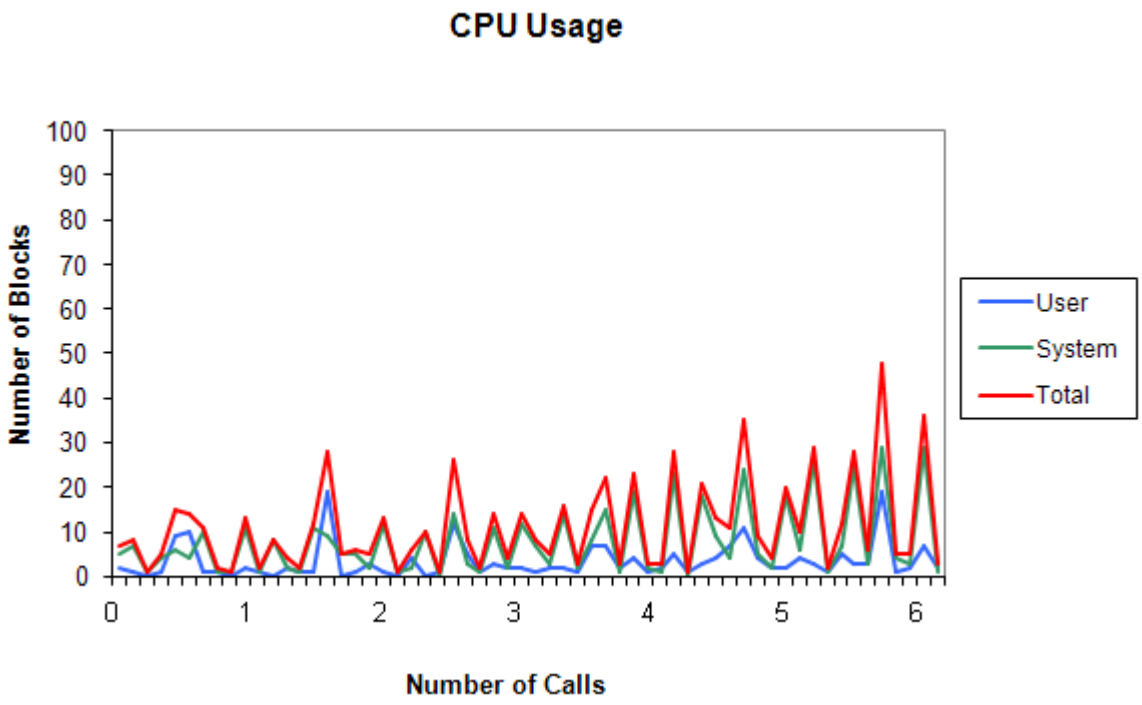
- Average 80 % CPU usage
- Peak 90 % CPU usage
- Average 135 MB of memory used
- Almost none data read from the DoM
- 20 – 140 blocks written to DoM
- Machine is working without any problems only after the system has been modified so the BiPAC card can work and as long as the 22 T1 calls are not exceeded

Test 22: BiPAC PCI V.3.0 and Digium TDM04B

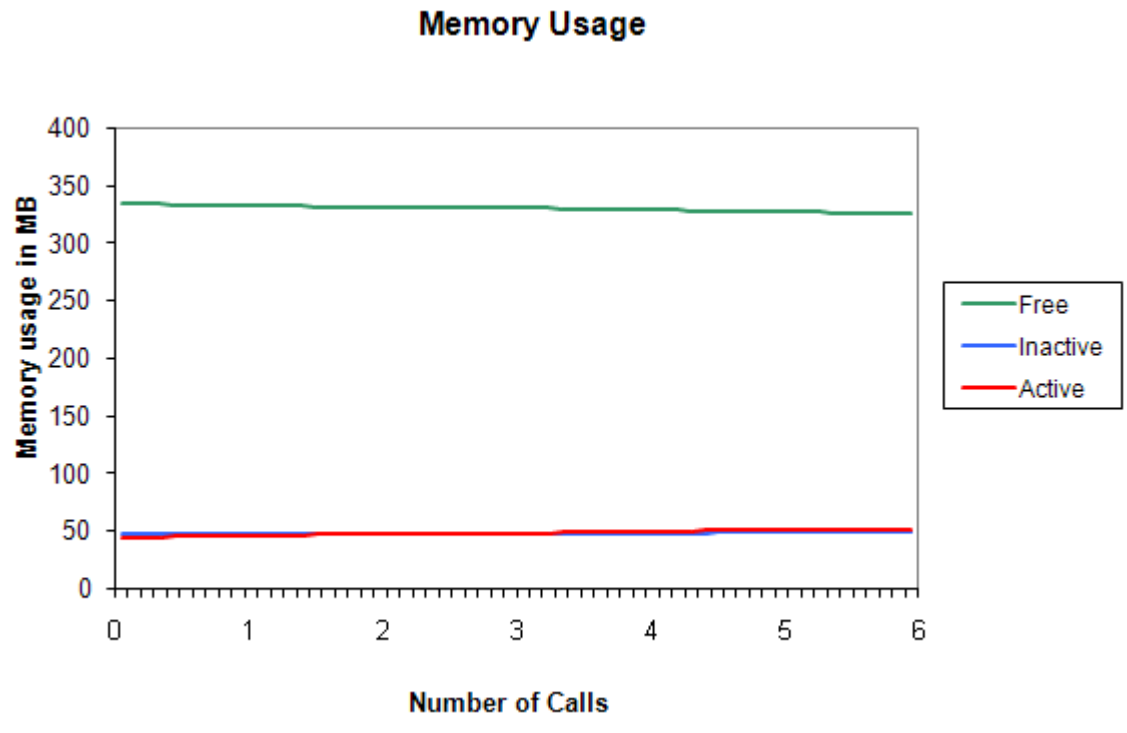
Billion BiPAC PCI V.3.0 ISDN cards have only one port on them and two calls can be made.

Digium TDM04B analog card has 4 ports which can be used as FXS or FXO depending on the designated usage.

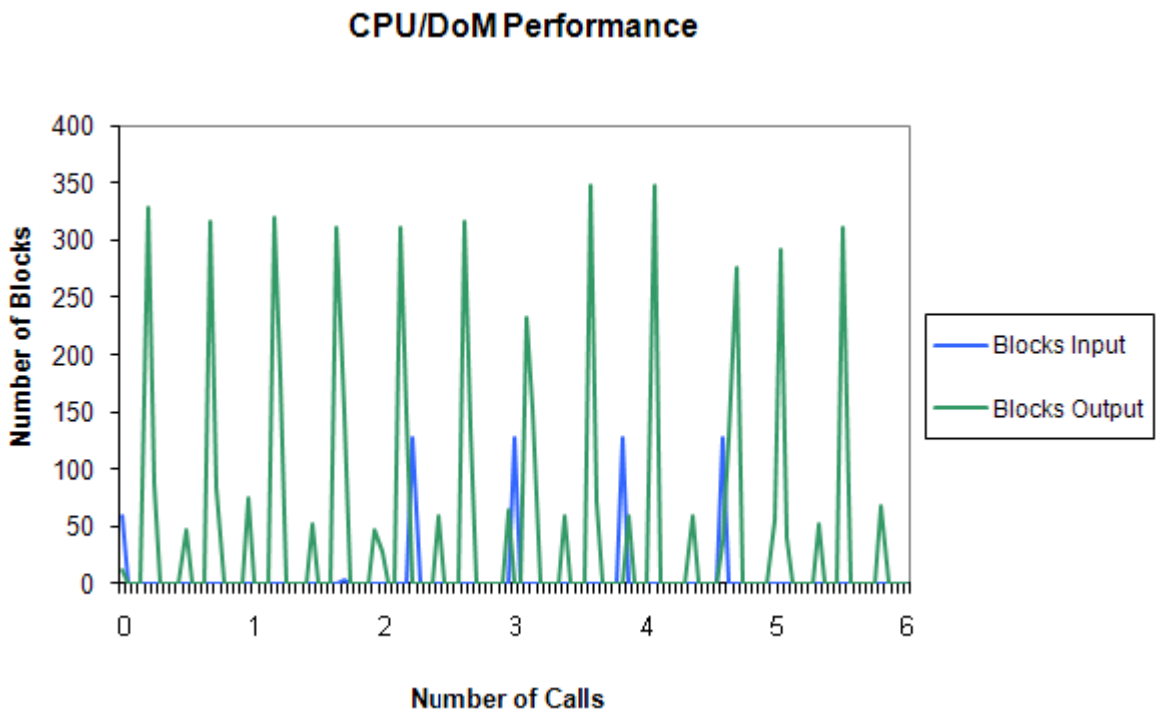
Resulting diagrams are as follows:



Picture 22.1



Picture 22.2



Picture 22.3

Test 22: Conclusion

Besides the required modifications, the BiPAC card was working fine with its two ISDN calls. Digium TDM04B with its 4 calls also so with 6 starting SIP calls we had a total of 12 calls. If it wasn't clear up until now, analog calls are requiring more CPU time then the ISDN calls.

So for this test we got the following results.

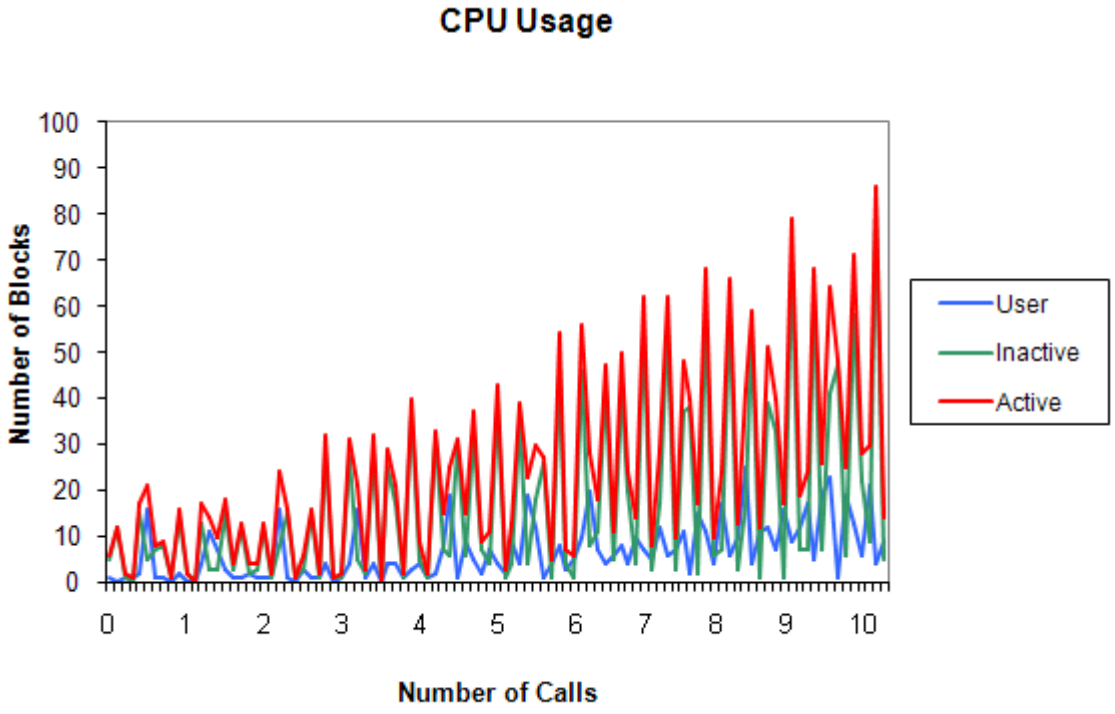
12 calls statistics:

- Average 25 % CPU usage
- Peak 40 % CPU usage
- Average 45 MB of memory used
- Up to 125 blocks read from the DoM
- 50 – 325 blocks written to DoM
- Machine is working but manual configuration for BiPAC card is required

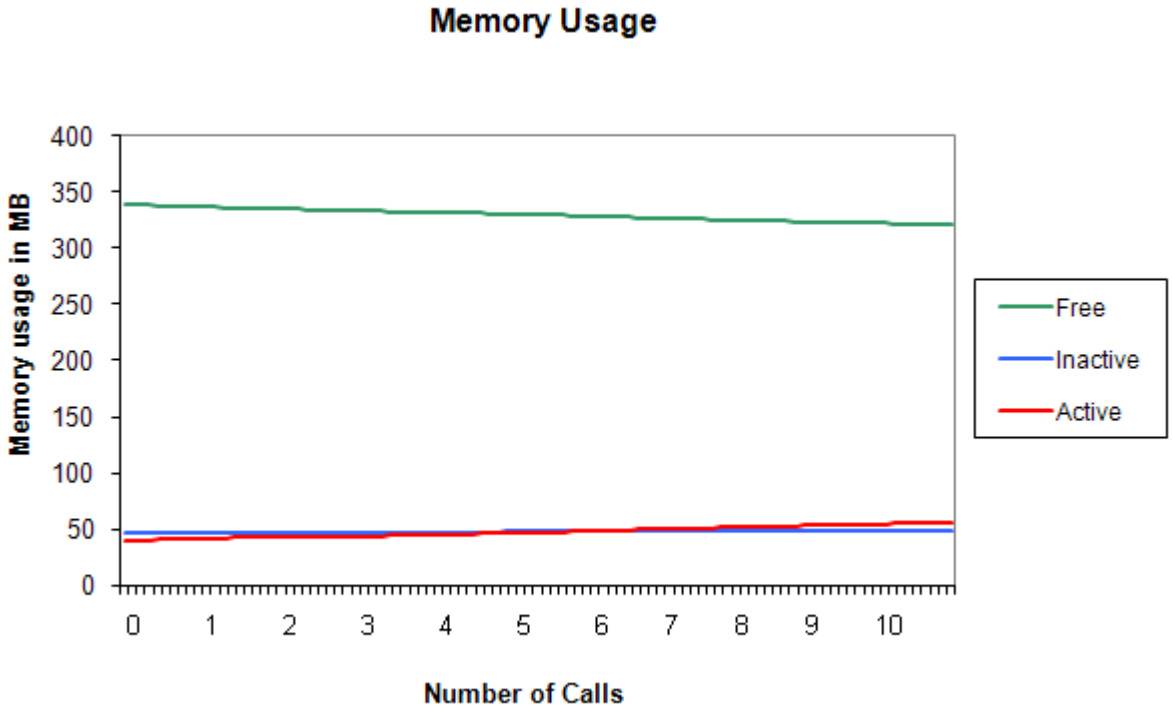
Test 23: BiPAC PCI V.3.0 and Digium TDM800P

This test is similar to the previous one, only here we have 8 analog calls from the TDM800P card and 2 ISDN calls from BiPAC card which still requires the manual configuration so it can be seen as a B410P card by the PBXware.

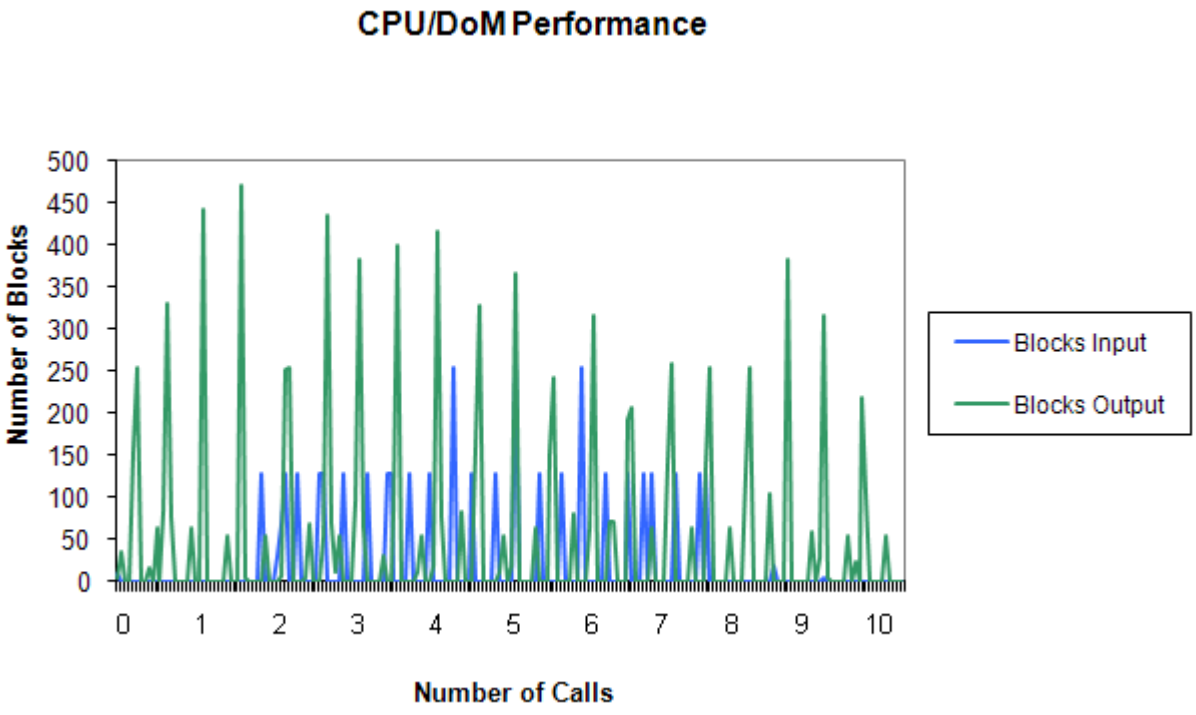
Resulting diagrams are as follows:



Picture 23.1



Picture 23.2



Picture 23.3

Test 23: Conclusion

Last test in this second group of tests was a combination of BiPAC card which needs a lot of inside system tweaking and the Digium TDM800P card which is an excellent example of how the good addon card should be working. It is recognised by the system and automatically configured inside PBXware. User input for designating the usage to the cards ports is still required, but the card was working without any problems. With 2 ISDN calls, 8 analog calls and 10 starting SIP calls, we had total of 20 calls, and here are the statistics.

20 calls statistics:

- Average 35 – 40 % CPU usage
- Peak 80 % CPU usage
- Average 50 MB of memory used
- Up to 125 blocks read from the DoM
- 50 – 450 blocks written to DoM
- Machine is working but manual configuration for BiPAC card is required

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