PARAMETERS OF LOAD TESTING MODELS: APPROACHES TO ESTIMATION

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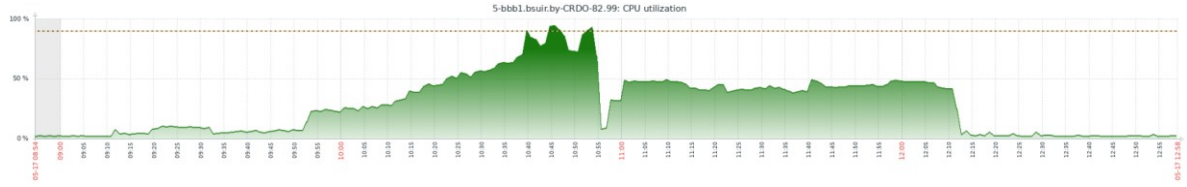
I. INTRODUCTION

The BigBlueButton video conferencing service was introduced to organize distance learning at BSUIR. Since April 2020, as Covid cases increased, the whole system load has increased drastically. During the testing phase, it turned out that increasing the capacity of the BigBlueButton server (BBB) relative to the initial parameters did not significantly increase the performance of the system. There were some problems with the translation of images and connections to the system. The problems started at video conferences with more than 50 participants. Also, there were time synchronization errors, new user login errors, errors adding a video stream. It became necessary to combine several computing facilities (servers and server clones) into a single cluster. A load balancing service was implemented on the video conferencing system to distribute load flows. By combining multiple servers into a single information space, the service allows you to access more resources and distribute the load between the connected servers, depending on the number of users (Round Robin algorithm). After load testing of servers with different configuration in the cluster, the output parameters were obtained to analyze the performance of the cluster and the balancer.

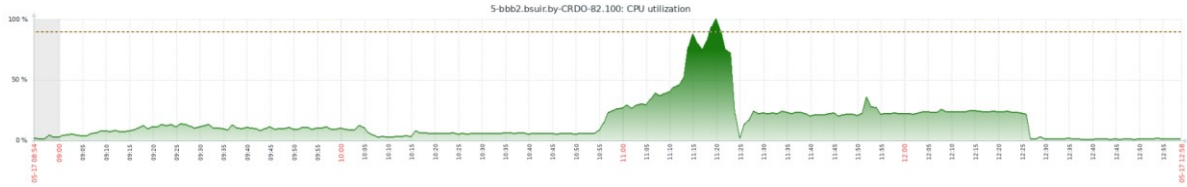
II. RESULTS

Estimating the time graphs of the load testing model at the three stages, we can note a smooth increase in the number of users per time unit. Increase in the number of users per time unit proportionally loads computing power. So, for the cluster BBB1 (4 core CPU, 12 Gb RAM) with more than 200 users connected the load on the CPU increased and exceeded 100%. See on the Figure 1-a. Load growth above 100% is caused by execution of balancing algorithm on VCS entry point. Load above 100% can also be seen on BBB2 (8 core CPU, 14 Gb RAM) with increased parameters on CPU power. See on the Figure 1-b. Number of users with 200% load on BBB2. However, at the same time expanding the capacity of BBB3 cluster to 12 cores, the load at the connection moment exceeding 100% (Figure 1-c) did not affect the system performance. In this case, the number of users exceeded 300.

a)



b)



c)

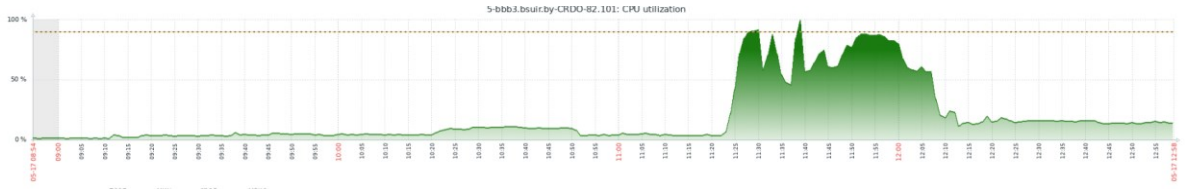
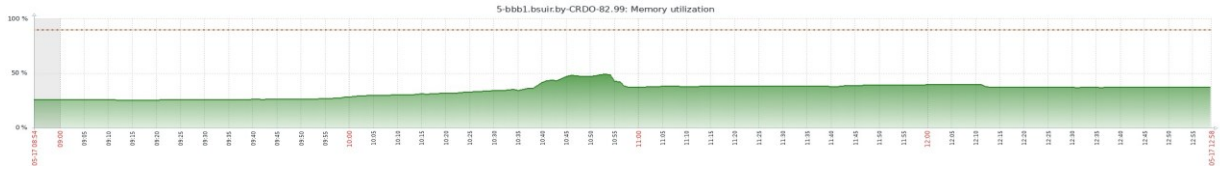


Figure 1. Load testing of the servers: a) BBB1, b) BBB2, c) BBB3

Regarding RAM load on the cluster, it can be noted that exceeding the 50% load mark is related only to the process of caching intermediate user data. However, given such an insignificant load on all tested clusters BBB1 and BBB2, the load can be considered minimal. At BBB1 and BBB2 testing stages multimedia flow from users` webcams was not tested. During the testing phases, a stream from user's webcams was added to the multimedia stream. Load percentage increase on RAM BBB3 – peaked at 65% of 12 Gb (about 8 Gb). See on the Figure 2.

a)



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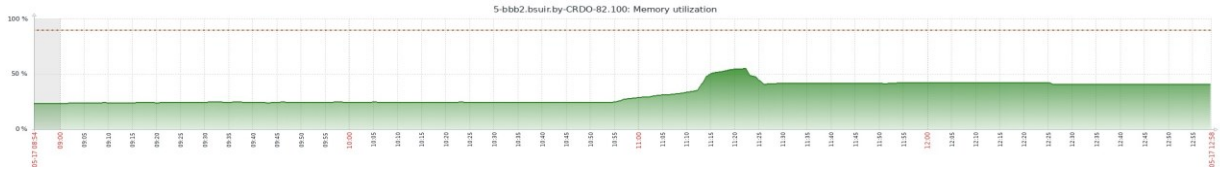

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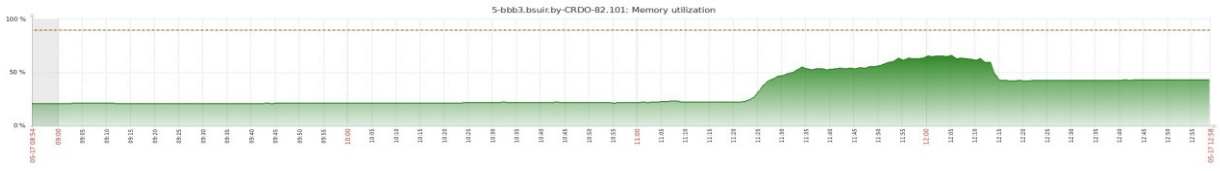

Figure 2. Load of RAM servers: a) BBB1, b) BBB2, c) BBB3

The network load when streaming video from users' webcams goes through the 192 interfaces to the internal bus. 160 interfaces are an external ISP bus. The video stream in case of the internal network reaches a network load about 150 Mbps, which is critical when building a network on unmanaged switches because of the bandwidth of the matrix and the aggregation channel. In case of access to the external network of the provider (as well as input from the external network) the load in the average values does not exceed 7 Mbit/s, which is enough even with a limited channel connection with speed up to 20 Mbit/s. The significant network load graph peaks (Figure 3 and 4) are related to the connection of an external video storage service (YouTube) to video broadcasting in VCS. It is also worth noting that video from a third-party service is cached in the stream, but doesn't have a critical effect on RAM, and works as a webcast, thereby not overloading the stream.

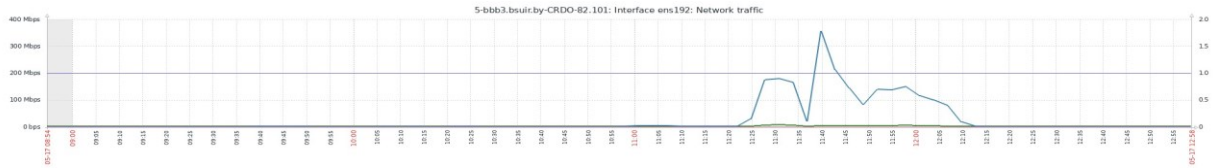

Figure 3. Internal network bus loading

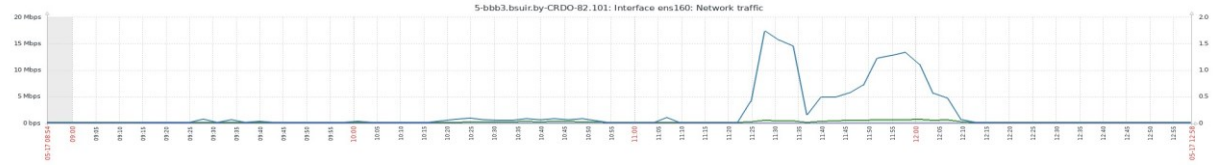

Figure 4. Loading the external network bus to the provider

III. CONCLUSIONS

Test methodology consisted of estimation of performance parameters both by control points – delays and response time of user connection to the room, control of CPU load, memory, network load (as well as in general and by interfaces of local network and provider), cache usage with unloading to disk array, and in visual quality control of system performance – control of audio and video stream desynchronization at the moment of video conference, delays during decoding of the final multimedia flow on endpoint users` devices, control over the package throughput on multimedia flow transfer step in real time. Quality characteristics, in this case, cannot be neglected as at the testing stage of cluster 3 with the use of web cameras on endpoints stable operation mode of VCS was achieved for up to 250 users. Cluster handled further load increase, but the quality of the conference deteriorated.

REFERENCES

[1] BigBlueButton documentation Available at: https://docs.bigbluebutton.org/ (accessed 6 October 2021).

[2] Round Robin Load Balancing Definition. Available at: https://avinetworks.com/glossary/round-robin-load-balancing/ (accessed 6 October 2021).