

Figure 7 shows the decrease in the ability to handle http request per seconds by virtual server of educloud as much as 4.45% against the physical server of educloud, namely: from 484 requests per second to 465 requests per second. The time required to deal with each http request on the virtual server of educloud per second increases up to 5.70% on average toward the physical server of educloud, namely: from 1736 milliseconds for each request on average to 1841 milliseconds. The average number of the total requests for one minute of test to compare the two different servers is 29.752 http requests for the physical server and 28.620 http requests for the virtual server respectively. Thus, the ability to handle the entire http request for 60 seconds between the virtual server of educloud and the physical server of educloud decreases as much as 3.80%.

4.2 The Calculation of the Server Cost and the Network Cost

Table 1: Data Center with Physical Server

Data Center with Physical Server			
Variant	Quantity	Cost (IDR)	Amortization (IDR)
IBM System X3550 M2 7946 - Dual-Core Xeon E5502 1.86 Ghz	5	84.013.845	42.006.922,5
HP PROLIANT ML 150G6-131 Intel Xeon E5502-1.86 GHz	2	22.500.000	11.250.000
IBM 3650 M4 Express X Server System X Intel Xeon 1.8GHz	3	44.654.100	16.745.287,5
IBM System x3650 M2 7947 - Xeon E5520 2,26 GHz	2	39.640.362	14.865.135,75
HP DX2710 Tower Core 2 Quad Q9400	1	8.200.000	3.075.000
HP Proliant ML110G7 Intel Core i3 2100-3.1 Ghz	1	11.338.651	4.251.994,125
DELL POWER EDGE T110 II-E3 1230 Intel XEON E3 1220 - 3.1Ghz	1	11.225.151	2806287,75
POWEREDGE R710 E5520 2.26GHz	3	117.179.094	14.647.386
Quantity		338.751.203	109.648.013,625
SERVER COST			448.399.216,6

Table 2: Data Center with Virtual Server

Data Center with Virtual Server			
Variant	Quantity	Cost (IDR)	Amortization (IDR)
POWEREDGE R710 E5520 2.26 GHz	3	117.179.094	14.647.386,75
Ibm System X3550 M2 7946 - Dual-Core Xeon E5502 1.86 Ghz	4	67.211.076	33605538
Quantity		184.390.170	48.252.924,75
Server Cost			232.643.094,8

Table 1 and Table 2 show the comparison of the server ownership cost, which indicates that the implementation of data center virtualization at the ICT Center of the Faculty of Teacher Training and Education, Sebelas Maret University, can reduce the cost for servers up to 8.11 %, or can also be

interpreted that the ICT Center of the Faculty of Teacher Training and Education, can save as much as Rp215, 756, 121.8

Table 3: Data Center with Physical Network

Data Center with Physical Network			
Variant	Quantity	Cost (IDR)	Amortization (IDR)
NETGEAR Prosafe Plus Switch 24-port	3	8.421.600	10.105.920
Mikrotik Routerboard 1100 AH	1	5.554.500	3.332.700
Switch TP-LINK TL-SG1024 24 ports	2	2.479.400	1.983.520
TP-LINK SL2218WEB 16-ports 10/100Mbps	2	1.887.600	1.887.600
Quantity		18.343.100	17.309.740
Network Cost			35.652.840

Table 4: Data Center with Virtual Network

Data Center with Virtual Network			
Variant	Quantity	Cost (IDR)	Amortization (IDR)
NETGEAR Prosafe Plus Switch 24-port Gigabit Ethernet [JGS524E]	2	5.614.400	6.737.280
Mikrotik Routerboard 1100 AH	1	5.554.500	3.332.700
TP-LINK TL-SL2218WEB 16-ports 10/100Mbps + 2-ports Gigabit	1	943.800	943.800
Quantity		12.112.700	11.013.780
Network Cost (Harga Total + Amortisasi Total)			23.126.480

Tables 3 and 4 show the comparison of network ownership cost, indicating that the implementation of the virtualization of the data center of the ITC Center of the Faculty of the Teacher Training and Education, Sebelas Maret University can reduce the cost for the network up to 35.134%, or it can be interpreted that the ICT Center of the Faculty of the Teacher Training and Education, Sebelas Maret University can save as much as Rp12,526,630.

5. Conclusion

The implementation of server virtualization can be done in the unit of the ICT Center of the Faculty of Teacher Training and Education, Sebelas Maret University by using the open source-based virtualization software, Proxmox VE. The limitation in the server hardware specification is not a problem for the implementation this virtualization as long as the processor used is 64 bit basis and supports the virtualization and hyperthreading technology.

Web server operating within the virtual environment is still able to serve its users as similarly as the one operating within the physical server is. Several results of the statistical analysis show the performance decreases as follows: (1) the average of the whole server performance decrease analyzed for request per seconds is 7.8%; (2) the whole server performance decrease analyzed in term of the time required to serve each http request is 10.11 %; and (3) the average of the whole virtual server performance decrease in handling the http request for 60 seconds of test is 7.56%.

The ICT Center of the Faculty of Teacher Training and Education, Sebelas Maret University can save the costs for the server and the network up to 48.11 % and 35.134 % respectively.

6. Future Works

The scope of research on the server virtualization can still be developed into several domains such as discussing about the safety of server virtualization environment, disaster recovery, service level agreement, and reliability of virtual server which operates in the hypervisor environment.

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