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**Assignment Title:**

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**Submitted To:**

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**Softwarica College in collaboration with**

**Coventry University**

Assessment Submission and Declaration Form

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**Acknowledgement**

For any kind of research and report, some specific type of knowledge is required to perform the research and make its report in correct format. But every researcher cannot have full knowledge of how to perform the research and make its report in correct way. For this, the researcher should be helped by another person like teacher, friends and other people related to the same field.

In the same way, I would like to express my deepest appreciation to all the teachers and to all the friends who helped me performing this research and formatting the report in correct way. I would also like to thank heartily to Nabin Acharya and Ram Krishan Pariyar teachers because without their guide and coordination, this project would never be completed in a correct way. Furthermore, I also like to express the coordination of my friends Anuragh Timasina, Aakash Karmacharya who also helped me completing my report.

Finally, I would like to tell that I am grateful to all the teachers and students of my class.

**Abstract**

In this report, there is mainly two parts in which the first part refers to task 1 which explains about the difference between the capacity and performance of HDD and SSD from different manufactures and the second part refers to task 2 which explains about the designing of network for students and staffs of the Fountain college. For task 1, laptops from same brand having same processor and DRR4 RAM was taken and then their SSD and HDD were compared. For task 2, a network was divided into different sub-networks with subnetting and assigned to the students and staffs, then a topology diagram was designed for the network system and cost of the project was calculated.

Word count of

1. cover page to list of figures and tables without Turnitin Report = 761
2. Total of task 1, task 2, findings and recommendation = 1,716

* task 1 = 727 (630<x<770)
* task 2 = 779 (720<x<880)
* Findings and Recommendation = 210

1. References = 140

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**Task 1**

# **Introduction**

The goal of this task is to differentiate HDD and SSD capacity and performance from different manufacturers integrated with DDR4 RAM and Processor. For this, their sequential, 4K, 4K-64Thrd read/write speed and access time, power consumption and cost will be compared.

# **Objectives**

* To select HDD and SSD from different manufacturers
* To compare their performance and capacity
* To determine the better one between HDD and SSD
* To compare the better one (HDD/SSD) of each manufacture again

# **Design**

Figure 2: Comparison Concept Chart

Four laptops having same 9th Gen. i7 processor with DDR4 RAM will be selected in which each two laptops will be from same brand. HDD and SSD of the laptops from same brand will be compared separately in tables. Then HDD/SSD of the different manufacturers from comparison results will be again compared in table, bar-diagram and pie-chart.

# **Description**

Now days better quality of HDD and SSD are being manufactured each year and the price of SSD is decreasing because of the competition between different manufacturers. IBM invented the first HDD to be sold commercially in 1956 (Writer, 2013). SanDisk Corporation created the first commercial 20 MB SSD to be sold for $1,000 in 1991 (Vanessa, 2016).Western Digital, Seagate, Toshiba, Hitachi and SanDisk are the best HDD manufacturers (Ranker, 2020). Samsung, Crucial, Intel, Western Digital and Kingstone Technology are the best SSD manufacturers (Ranker, 2020).

## **CPI**

We have,

T = I x ACPI x C and Performance = 1 / T where

ACPI = Average Cycles Per Instruction,

T = Execution Time,

I = No. of instructions executed,

C = CPU Clock Cycle = (1 / Clock Rate(f))

For a faster secondary memory, performance is high and the execution time is less. That means the ACPI will be low for faster secondary memory and high for slower secondary memory (SlidePlayer, 2020).

## **Comparison**

**Western Digital**

“WD10SPZX-24Z10” module of HDD of my own laptop and “WDS100T2B0C-00PXH0” module of SSD have been selected.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attributes | HDD | | SSD | |
| Read | Write | Read | Write |
| Seq. | 114.96 MB/s | 104.56 MB/s | 2221.19 MB/s | 1844.39 MB/s |
| 4K | 0.30 MB/s | 0.43 MB/s | 32.95 MB/s | 119.10 MB/s |
| 4K-64Thrd | 0.50 MB/s | 0.46 MB/s | 1160.42 MB/s | 905.16 MB/s |
| Access Time | 4.899 ms | 23.153 ms | 0.114 ms | 0.073 ms |
| Capacity | 1 TB | | 1 TB | |
| Power Draw | 1.5 W | | 3.5 W | |
| Cost | NPR 3,950 | | NPR 11,300 | |

Table 1: Comparison of WD HDD and SSD performance (Kirsch, 2019)

**Seagate**

“ST1000LM014-1EJ164” module of HDD and “ZP1000GM30011” module of SSD have been selected.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attributes | HDD | | SSD | |
| Read | Write | Read | Write |
| Seq. | 50.11 MB/s | 51.81 MB/s | 3017.50 MB/s | 2823.90 MB/s |
| 4K | 0.09 MB/s | 0.11 MB/s | 62.29 MB/s | 151.46 MB/s |
| 4K-64Thrd | 0.76 MB/s | 0.22 MB/s | 1802.68 MB/s | 1778.16 MB/s |
| Access Time | 19.675 ms | 16.820 ms | 0.027 ms | 0.022 ms |
| Capacity | 1 TB | | 1 TB | |
| Power Draw | 2.7 W | | 5.3 W | |
| Cost | NPR 7,900 | | NPR 18,150 | |

Table 2: Comparison of Seagate HDD and SSD performance (scawthon, 2018; Crisp, 2019)

**Western Digital VS Seagate**

From above comparison results, SSD are found to have high performance than HDD. So, SDD from both manufacturers is again selected and compared which is given below

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attributes | Western Digital | | Seagate | |
| Read | Write | Read | Write |
| Seq. | 2221.19 MB/s | 1844.39 MB/s | 3017.50 MB/s | 2823.90 MB/s |
| 4K | 32.95 MB/s | 119.10 MB/s | 62.29 MB/s | 151.46 MB/s |
| 4K-64Thrd | 1160.42 MB/s | 905.16 MB/s | 1802.68 MB/s | 1778.16 MB/s |
| Access Time | 0.114 ms | 0.073 ms | 0.027 ms | 0.022 ms |
| Capacity | 1 TB | | 1 TB | |
| Power Draw | 3.5 W | | 5.3 W | |
| Cost | NPR 11,300 | | NPR 18,150 | |

Table 3: Comparison of WD and Seagate SSD performance

**Bar Diagram**

Figure 2: WD and Seagate speed comparison

The read/write speed of Seagate SSD is higher and has low access time than that of WD SSD which has high access time. The overall read/write performance of Seagate SSD is 65-68 % faster than that of WD SSD respectively. Therefore, Seagate FireCuda 510 is better than WD Blue SN550.

**Pie Chart**

Figure 3: WD and Seagate power consumption comparison

WD SSD seems to be power hungrier than that of Seagate SSD. WD and Seagate SSD has 3.5 W and 5.3 W power consumption respectively. That means WD Blue SN550 and Seagate Firecuda 510 consumes 39.77 % and 60.23 % of total power which is the sum of their power consumption.

# **Conclusion**

SSD is better secondary memory than HDD because the sequential, 4K, 4K-64 Thread read/write speed, read/write access time and processor’s CPI is better for SSD.

**Task 2**

# **Introduction**

The main purpose of this task is to design and setup a small business network for an organization. For this, a network system will be designed with connection in which a part of the network will be given to the students and other parts will be given to different departments followed by Exam, Operation, IT, Faculty and Admin for the staffs for better maintenance.

# **Objectives**

* To select a network with a specific subnet mask
* To divide the selected network into different sub-networks for students and staffs
* To assign IP addresses to students and different departments of staffs
* To design topology diagram
* To determine the total cost of this project

# **Subnetting**

A process of dividing a single big network into two or more smaller sub-networks is called subnetting. The reasons behind using subnetting are given below

* Helps conserving IP addresses
* Reduces network traffic
* Simplifies the network system

If subnetting is not used then, all the hosts will be on the same subnet which causes many disadvantages like unnecessary network traffic, security problems, organizational problems etc. (Antoniou, 2007; Anon., 2020).

A class B private network 172.23.0.0 is selected as the main network with subnet mask 255.255.240.0 that is /20.

Dividing 172.23.0.0/20 with /21, we get 172.23.0.0/21, 172.23.8.0/21, 172.23.16.0/21, ……………, 172.23.248.0/21. 172.23.0.0/21 is given to the students and 172.23.8.0/21 is given to the staffs which will be again used for subnetting for different departments.

Suppose 41, 28, 13, 11 and 7 are the number of staffs working on Exam, Operation, IT, Faculty and Admin departments respectively. Then, 172.23.8.0/21 is divided with /26 and we get 172.23.8.0/26, 172.23.8.64/26, 172.23.8.128/26 and 172.23.8.192/26. 172.23.8.0/26 is given to Exam department.

Again 172.23.8.64/26 is divided with /27 and we get 172.23.8.64/27 and 172.23.8.96/27. 172.23.8.64/27 is given to Operation department.

Again 172.23.8.128/26 is divided with /28 and we get 172.23.8.128/28, 172.23.8.144/28, 172.23.8.160/28 and 172.23.8.176/28. The first three /28 are given to IT, Faculty and Admin departments respectively.

A full detail information of the above subnetting is mentioned in a table which is given below.

Table 4: Assigning IP Addresses

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Attributes | | No. of  hosts | Network  Blocks | Network Address | Broadcast Address | Total Usable Addresses | First Usable Address | Last Usable Address |
| Students | | 1200 | 172.23.0.0/21 | 172.23.0.0 | 172.23.7.255 | 2,046 | 172.23.0.1 | 172.23.7.254 |
| Staffs | Exam | 41 | 172.23.8.0/26 | 172.23.8.0 | 172.23.8.63 | 62 | 172.23.8.1 | 172.23.8.62 |
| Operation | 28 | 172.23.8.64/27 | 172.23.8.64 | 172.23.8.95 | 30 | 172.23.8.65 | 172.23.8.94 |
| IT | 13 | 172.23.8.128/28 | 172.23.8.128 | 172.23.8.143 | 14 | 172.23.8.129 | 172.23.8.142 |
| Faculty | 11 | 172.23.8.144/28 | 172.23.8.144 | 172.23.8.159 | 14 | 172.23.8.145 | 172.23.8.158 |
| Admin | 7 | 172.23.8.160/28 | 172.23.8.160 | 172.23.8.175 | 14 | 172.23.8.161 | 172.23.8.174 |

# **Design**



Figure 4: Network Topology Diagram

# **Analysis**

A star topology is used to represent the whole network system because star topology is easier to setup and modify, easier to troubleshoot, upgradable, have low network traffic, have faster performance and even a node is affected, the others nodes can work smoothly (Tutorials, 2020).

For this, internet service is brought from cloud and connected to router through WAN cable. Then it is connected to firewall and then to server switch and then to the others six switches with the help of about 1,500 meters of LAN cables. The main purpose of using firewall is to provide security service for the whole network system. Switch 1 is given to students Lab and switch 2, 3, 4, 5, 6 are given to Exam, Operation, IT, Faculty, Admin departments respectively. The student lab contains a laptop and staff’s all departments contain a computer. The IT department also contains the servers to provide services to different department of the staffs which are kept inside DMZ for the protection of the sensitive data from being accessed from the internet. DMZ refers to “Demilitarized Zone” which separates the untrusted networks from the organization’s internal Local area network so that the external facing resources can be only accessed but not the internal servers and the data by the internet. That means it provides additional security layer to LAN (Rouse, 2020).

The pricing of the required intermediary and security devices used in the above topology diagram is given in a table below

Table 5: Price Analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Device Name | Device Module | No. of Devices | Price of Each Device | Total price |
| Router | Cisco ISR 4431 | 1 | NPR 3,76,244.20 | NPR  3,76,244.20 |
| Firewall | Cisco ASA5508-K9 | 1 | NPR  1,25,704.02 | NPR  1,25,704.02 |
| Server witch | Cisco SG550X-24 | 1 | NPR  1,08,901.83 | NPR  1,08,901.83 |
| LAN Switch | WS-C2960+24TC-L | 6 | NPR  42,159.40 | NPR  2,52,956.4 |
| LAN Cable | Cat RJ45 Ethernet Network Internet Patch cable | Length | Price per meter | NPR  30,000 |
| 1,500 meters | NPR  20 per meter |
| Total cost of the project = NPR 8,93,806.45 | | | | |

(Source: Hamrobazar, Kathmandu)

# **Conclusion**

The designing of the network system is done with the help of star topology in as low cost as possible which is considered to be feasible economically and technically for an assigned organization.

# **Findings**

This research has got great significance to the course STW120CT. For example, this research provides practical knowledge about the real-life work and its implementation that means the course provides only theoretical knowledge but this research tells how the theoretical knowledge is applied or actually works in real-life world. From this research, it was found that SSD are invented only after the invention of HDD and SSD are faster, more reliable and better but expensive secondary memory than HDD, a network can be divided into different sub-network with subnetting which will make the network simple, reduce network traffic, conserve the IP addresses and network topology manages a network in systematic way for its smoot functioning. To perform this research effectively and to collect more accurate data, some required physical resources are needed. So, it would have been better and more effective doing above tasks with the availability of required physical resources along with the theoretical research.

# **Recommendation**

SSD is recommended instead of HDD in which Seagate FireCuda 510 is recommended because it has better read/write performance than WD Blue SN550.

A star topology is recommended for designing a network along with the included module of devices for better maintenance, smooth working of network system in as low cost as possible.

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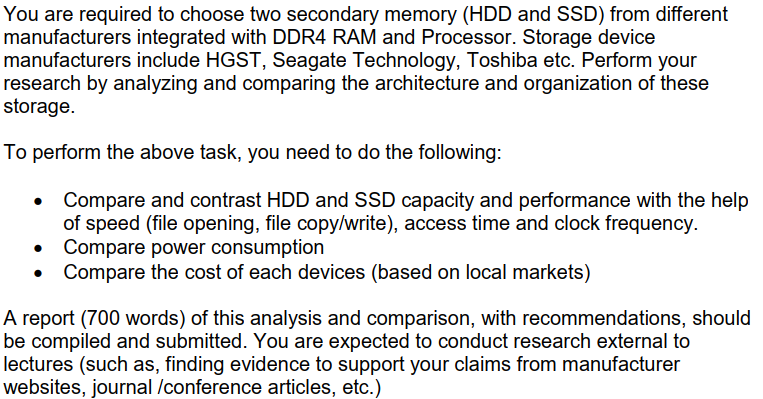
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# **Appendix**

**Task 1**



**Task 2**

